Ethnoecology, Resource Use, Conservation And Development In A Wapishana Community In the South Rupununi, Guyana

Thesis submitted for the degree of Ph.D. in Environmental Anthropology

by

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ABSTRACT

Anthropological work in human ecology and ethnobiology supports the greater involvement of indigenous and other non-western peoples in development and conservation. However, there is still a shortage of data that can form the basis of practical action in these respects. A case study of Guyana confirms this, showing that debate over indigenous involvement in national development is largely rhetorical. Field research on Wapishana ethnoecology and cultural ecology was undertaken in Guyana over twenty-two months in 1997-1998 and 1999-2000. Wapishana people in Guyana collectively occupy a variety of habitat types within the forest-savannah ecotone, mostly maintaining subsistence based lifestyles which entail high levels of dependence on local biodiversity and ecological processes. There is evidence for regulation of human exploitation of the natural environment via symbolically encoded restrictions on behaviour. Wapishana hunters collectively demonstrated a broad and detailed knowledge of the ecology of several animal species and other aspects of the local ecology. Comparison of ethnoecological data with the ecological literature showed them to be largely compatible and correspond closely in detail. Limitations of the ethnoecological data set included incomplete lists of food species for particular animals, and a shortage of useful information in subject areas such as population dynamics and social behaviour. Ethnoecology thus can complement, but not replace, conventional scientific approaches to the study of ecology. Ethnoecology has current applications in subsistence, can generate hypotheses concerning human effects on local ecology relevant to management planning and amenable to testing by scientific methods, and also incorporates practical skills that can be applied to the collection of biological data. Wapishana thus have an interest in, and possess a body of skills and knowledge that may be applied to, biological conservation. Ethnoecology provides a methodology whereby equitable and mutually beneficial relationships may be formed between indigenous groups and the scientific community.

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CHAPTER ONE: INTRODUCTION

1.1 Introduction and Definitions

This thesis is broadly concerned with the practical utility, potential and realised, of the ethnoecological knowledge of one indigenous group resident in Guyana, members of the Wapishana people. Its theoretical orientation derives from the work of several writers. The focus on and practical assessment of ethnoecology is inspired largely by Darrell Posey and his co-workers, who offer a broad definition of ethnoecology as, 'indigenous perceptions of "natural" divisions in the biological world and plant-animal-human relationships within each division'. This, in various aspects, is argued to have applications in development (Posey et al. 1984: 97). I prefer to use the term 'ethnoecological knowledge' rather than 'ethnoecology', restricting the meaning of the latter to the academic study of ethnoecological knowledge. Under the definition given, ethnoecological knowledge can be considered a subset of 'indigenous knowledge', defined by Purcell as, 'the body of historically constituted (emic) knowledge instrumental in the long-term adaptation of human groups to the biophysical environment' (Purcell 1998: 260). This definition deviates from that of 'indigenous people' in that the criterion of long-term historical association with a particular point in space is absent. The emphasis is rather on the retention of some measure of political, economic and cultural autonomy relative to the state and, consequently, a perspective on planned change different from that of extra-local actors (Purcell 1998). Of the various terms used more or less interchangeably to refer to what Purcell has defined as 'indigenous knowledge' (Ellen and Harris 1997), my preference is for 'local knowledge'. I believe this adequately to emphasise the autochthonous character of such knowledge without the historical implications of the term 'indigenous'. In this work, I use the terms more or less interchangeably, such that 'indigenous knowledge' is employed to refer to the local knowledge of, specifically, groups conventionally considered to be indigenous.

1.2 Thesis Statement and Research Questions

The core of the research data presented takes up an argument advanced most clearly by Townsend (1995), who assessed specific information on animal ecology provided by a Murui leader and naturalist within a framework derived from scientific ecology. Here I explore further Townsend's idea that data on the local ecology such as can be provided by local experts on natural history forms a body of information of potential use in the context of formal investigation of the ecology of an area. Key to my

analysis is DeWalt's thesis concerning the complementary nature of scientific and local knowledge systems. This maintains that the site-specificity and theoretical flexibility of local knowledge contrast productively with the general applicability and theoretical rigidity of western science, such that a synergistic combination of the two is possible (DeWalt 1994). The context within which this assessment takes place is that of the cultural ecology of the host community, of which a fairly extensive qualitative description is given. A systems perspective is employed consistent with the analytical framework provided by Berkes and Folke (1998a), in which the focus is on the interactions among ecosystem, people and technology, property rights institutions, and local knowledge. By making current subsistence activities and their ecological effects its central focus, this thesis thus aligns itself with the trend towards increasingly grass roots approaches in development. The perspective differs from the conventional one in that the major agents of planned social and environmental change - whether political, financial, industrial, social or environmentalist in orientation - are considered as external actors affecting the context within which the focal population seek to maintain their livelihoods. The particular research questions I seek to address are all concerned, ultimately, with these people's prospects for continuing to maintain control over their lifestyles and livelihoods in the face of changes they will inevitably encounter in the near future.

1.2.1 Is the conservation of biodiversity and ecosystem function of importance to the people of the South Rupununi?

A major positive change in the global political landscape over the past thirty years has been the rise in attention given to the causes of indigenous peoples. Direct representatives and non-indigenous advocates have achieved unprecedented levels of influence within both the UN and the NGO sector, and the issues they promote are finally being given due attention in many of the higher echelons of power (Wilmer 1993; but also see critique of Wilmer's thesis in Benjamin and Tiessen 1993). A key factor in this has been an alliance with western environmentalists based on a perceived common interest in the conservation of natural ecosystems. Environmentalist causes seem able to inspire far greater levels of concern and action among first world publics than purely humanitarian ones, a point which indigenous activists have been quick to appreciate and act upon (Posey 1990: 48-9; Conklin and Graham 1995: 698; Fisher 1994).

The major point of unison has been the support that has been available for indigenous land claims: environmentalists have often considered indigenous

subsistence strategies to exemplify wise custody and usage of lands. Examples of cases where the reformation of land tenure systems in ways that strengthen control by indigenous communities has resulted in tangible conservation benefits have been reported from Bolivia (Kaimowitz et al. 2000) and Mexico (Alcorn and Toledo 1998). In 1976, the designation by UNESCO of the first biosphere reserves expressed in concrete terms a formal recognition, at the highest levels of decision-making, of the connection between cultural and biological conservation (Droste zu Hulshoff and Gregg 1985). However, much environmentalist rhetoric in the support of indigenous peoples is founded upon perceptions of indigenous worldviews and lifestyles that are often highly idealised, resting upon severe - if well-meaning - distortions of ethnographic reality (Ellen 1986; Brosius 1997). The alliance thus formed may be highly fragile - environmentalists have in the past been quick to abandon their partnerships with indigenes when the latter have failed to live up to their romanticised images - and may provide an unstable base for the advancement of indigenous interests (Conklin and Graham 1995). This can amount, in effect, to the imposition of western notions of environmentalism upon people for whom, while it may represent a better alternative than the imposition of neoliberalism, it nevertheless represents a loss of control over their own destiny. The qualified fashion in which the World Wide Fund for Nature words its statement of support for indigenous rights is testimony for this - clearly, should they conflict with the organisation's purported conservationist goals, the latter will hold greater sway (WWF n.d.). Examples of dispossession of indigenous peoples and other violations of their rights on the grounds of conservation are numerous, and in some cases ongoing (Oviedo 2001; for a current example see Survival International press releases on the Ogiek). On the other hand, at times a mutually beneficial alliance has arisen, perhaps the most spectacular example being the opposition of the Kayapó to planned hydroelectric projects along the Xingú River (Fisher 1994). In other circumstances, indigenous groups such as the Kuna and Kayapó have found it expedient to adopt western notions and methods of conservation and apply them on their own lands (Clay 1988: 66-67, Zimmerman et al. 2001). There are also many cases where conservationists have assisted indigenous groups in developing programmes for sustainable exploitation of natural resources (Clay 1988: 64-66).

The relationship between western environmentalism and indigenous causes is complex, and its terms are still developing. This point is a key one for the present thesis, the core of which is concerned with the practical value of local expertise relevant to the management of natural resources, particularly in hypothetical

circumstances of collaboration with external actors with interests in conservation. Shared interests in the conservation of local biodiversity and ecological integrity can not be assumed *a priori*, and some empirical demonstration is required that they actually exist. Two different aspects of this were addressed - the actual usage by people of local biodiversity, and local opinions and ideas concerning possible threats to the integrity of the natural environment.

1.2.2 Does the Wapishana subsistence system exhibit features which can be considered habitat/resource management?

Parallel with the rise in prominence of indigenous issues has been a change in perspective in applied anthropology, supporting local autonomy with respect to planned social change, or 'development'. That development should be locally determined and based upon local knowledge is now accepted as both a moral imperative and a practical necessity (e.g., Posey 1990: 56-7). This position appears to have emerged largely from a critique from within anthropology of the process of westernisation and its effects on culturally distinct peoples (Purcell 1998). As such, it represents the latest manifestation of the discomfort that has traditionally befallen anthropology in attempting to reconcile its roots in the colonial endeavour with its obligations to the people who have traditionally provided its subject matter (Ervin 2000: 14-26). Unfortunately, there is a case to be made that many anthropologists have been culpable in assisting the maintenance of economic and political relations essentially continuous with colonialism, via their work as development professionals (Escobar 1991). On the other hand, anthropology has provided the intellectual basis for changes in attitude, in the form of an increasingly sophisticated theoretical framework, backed up by a rapidly expanding body of data, within which the practical basis for making local knowledge the foundation of social change is being evaluated with ever greater rigour.

This academic interest in indigenous knowledge systems has its roots in anthropological work dating back around half a century to the earliest studies in ethnobiology and human ecology. In more recent times each of these disciplines has transcended its roots on the fringes of anthropology and attracted the interest of researchers from a broad variety of intellectual backgrounds and theoretical traditions. Several of the currents of research thus generated, both within and beyond Amazonia, are of relevance to the present study. While the major focus is ethnoecological knowledge, substantial research effort was devoted to establishing the context within which its practical utility is to be assessed. Specifically, this

context is provided by Wapishana cultural ecology, of which a broad overview is thus provided. Particular attention is given to the ecological effects of existing patterns of resource use. The major theoretical influences on the approach used are summarised below. A comprehensive review of Amazonian cultural ecology is provided by Sponsel (1986); a more recent general overview of Amazonian ethnography includes a section on human ecology and thus updates this somewhat (Viveiros de Castro 1996).

The modern discipline of ethnobiology dates back to the pioneering work of Conklin (1954), whose description of Hanunoo plant nomenclature and classification represented the academic community's first recognition of the accuracy and complexity of non-western biological knowledge systems, and of the cognitive underpinning they provide to human exploitation of the natural environment. Since then, a substantial body of data has accumulated on the classificatory systems underlying perception of and engagement with the natural world. Best known of this is the work of Brent Berlin and his associates, from which has emerged a description of a complex psychological basis to botanical and zoological classification among the Tzeltal Maya, forming the basis of a model which Berlin considers to be generally applicable to folk systems of biological classification (Berlin et al. 1974; Hunn 1977; Berlin 1992). Following in Berlin's footsteps, researchers have documented elaborate systems of folk classification of biological kinds among many other tribal groups (e.g., Taylor 1990). Many of these studies are somewhat limited by their use of linguistic data recorded in interview settings highly abstracted from its usage in everyday practical situations. Study of folk classification within its broader cultural context has revealed dimensions of complexity obscure to studies with a narrower psychological focus (Ellen 1975, 1993; Randall 1976; Gardner 1976; Kay 1975). Similarly, several ethnobiological studies have focused on the employment of conceptual knowledge within the practice of various subsistence activities, including swidden agriculture (Johnson 1974), hunting (Hyndman 1984), and collection of wild plants (Alcorn 1981). Such studies have illuminated complex and sophisticated cognitive foundations of subsistence practices among geographically and culturally diverse groups of people. Over the same time period, a variety of approaches in the study of human ecology has demonstrated the practical complexity of traditional strategies of resource use.

The pioneering work of Julian Steward and Betty Meggers on Amazonian human ecology was closely focused on the nature of environmental constraints on culture (Steward and Murphy 1977; Meggers 1954, 1996). The emphasis of these studies on

the role of ecological factors in limiting the size, permanence and cultural complexity of human societies set a trend for much important subsequent work in this field. Meggers' interest in the limits of agricultural productivity became discredited, and considerations of protein availability came to dominate the subject (Hames and Vickers 1983a: 10). One landmark paper argued that many features of the traditional social organisation of Amazonian societies can be regarded as adaptations to protein scarcity (Gross 1975). Although this argument has been shown to be suspect in many respects (Beckerman 1979), the questions raised have continued to impact significantly on the nature of research in Amazonian human ecology (Moran 1993a: 19). The continuing utility of such an approach depends upon a recognition of the fact that scarcity may be manifest along several ecological dimensions, and affected by structural elements that do not have any ecological basis (Johnson 1982).

The adoption from ethology of optimal foraging theory (Smith 1983) is another approach concerned ultimately with responses to environmental constraints that has achieved some measure of success. The simplest form, in which the energetic costs and benefits of various activities are assessed, has been successfully applied to data on, amongst others, the hunting behaviour of the Siona-Secoya of Ecuador and Yanomamö and Ye'kawana of Venezuela (Hames and Vickers 1982), and the hunting and gathering of the Aché of eastern Paraguay (Hawkes et al. 1982). Sponsel (1986: 83) noted the limitations of a purely energetic approach; and urged a broader approach in which all nutritional factors were taken into account. More accurate models must also consider non-food resources crucial to subsistence - the Machiguenga of the Peruvian Amazon, for example, are reported to abandon settlements in response to a scarcity of firewood (Johnson 1982: 415-6). Although some studies have adapted the methods to incorporate other aspects of nutrition (e.g., Behrens 1981), realistically, the level of resources and logistics that development of comprehensive optimality models would entail far surpass those available to any anthropological study.

A more fundamental weakness is that optimality models in the biological sciences are concerned with lifetime reproductive success. The relationship between the data collected in these studies and reproductive success is obscure, and rarely explicitly addressed. Among the Aché, for example, it is reported that successful hunters are more frequently involved in extra-marital affairs, and an assumption that evolutionary outcomes can be inferred from a treatment of nutritional factors alone may in such a case be misleading (Hawkes et al. 1982). Further, cultural and biological adaptations may take markedly different forms. For example, many Amazonian people will express

a 'need' for meat even if their physiological requirements for protein are abundantly satisfied (Johnson 1978; Carneiro 1982). This demonstrates that cultural factors unrelated to physiology may affect the perceived dietary needs, and hence behaviour, of people, which may have important implications for the nature of their adaptation to their environment.

Cultural adaptations may also be manifest at different levels of organisation — culture traits, however these may be defined, individuals, and social groups of various sizes – and the form of adaptation at these different levels may be contradictory. A case in point is Alvard's argument that the compatibility of the prey choice strategy of Piro hunters with an optimal foraging model demonstrates the absence of any strategy for conservation of game populations (Alvard 1993, 1995). In fact, in several ethnographic accounts which evince culturally determined strategies for natural resource conservation, they are manifest not at the level of individual decision-making, but emergent at analytical levels corresponding to social groups (Reichel-Dolmatoff 1971, 1976; Balée 1994; Descola 1994). This is what might be expected: while game conservation might well be maladaptive from the perspective of the individual hunter, it can be to the long-term advantage of the group as a whole. Alvard's failure to recognise the complexity of cultural adaptation leads to a misconception on his part that conservation can not take place without explicit intent on the part of the individual actor. In determining the ecological implications of human behaviour, it is concrete actions and their effects rather than the ideas behind them that are of ultimate importance (Vayda 1993: 64-66). To make a distinction between 'true' and 'epiphenomenal' conservation on the basis of intent, as Alvard suggests, is thus somewhat misleading when the issue of most relevance is the ecological effects of human activity. It may, however, be relevant to the question of the resilience of cultural adaptations for conservation in the face of changing external circumstances, which I consider in more detail in the next section.

The interaction between ideas, action and ecology was more competently addressed by Ross [1978] in his consideration of the adaptive significance of food taboos. Although this paper ultimately promised more than it delivered, it did indicate a clear path towards a unification of structuralist and functionalist approaches to cultural ecology. The ethnographies of Balée, Reichel-Dolmatoff and Descola cited above develop this perspective somewhat, though the theoretical implications have yet to be fully explored.

Bodies of work which investigate cultural ecology from a systems perspective have perhaps provided more telling insights into its adaptive nature. Key early studies

of shifting agriculture systems revealed them not to be the crude efforts of people severely constrained by limitations of environment, technology and intellect, but complex and effective systems of resource exploitation well adapted to the ecological realities of their environment (Conklin 1957; Dove 1983). A substantial body of work now exists which employs a more explicitly systemic perspective, initially based upon another analytical tool derived from the biological sciences, the concept of the ecosystem.

The ecosystem approach was the foundation of a number of important studies, generally focused on energy flows and exchanges (e.g., Geertz 1963; Rappaport 1968, 1971), and has achieved substantial theoretical development within anthropology (Ellen 1982; Moran 1984, 1990). Recent criticisms have pointed to excessive levels of attention to systems, which had come to be regarded as entities in their own right with teleological properties, rather than analytical tools to be employed in the understanding of human behaviour (Vayda 1996). Vayda advocates the use of actor-oriented models, in which system models are not constructed *a priori* but pragmatically according to the outcome of research focused initially on human actors and actions. Such an approach has proven successful in, for example, describing the systemic operation of networks of water temples in Bali, which serve to co-ordinate the activities of rice growers over a wide area (Lansing and Kremer 1993).

Another problem with the ecosystem approach, which is shared by the evolutionary models discussed above, has been a lack of attention to the dialectical relationship between culture and environment. The notion that the environment is not a fixed constraint within which culture operates, but is better considered to be, to a certain extent, a product of culture, was implicit even in some earlier studies. An explicit recognition of a dialectical relationship between nature and culture is now a central feature of studies of human adaptation (Viveiros de Castro 1996). The more integrated approach which has emerged has been most clearly articulated within the discipline of historical ecology (Crumley 1993; Balée 1998). This has been the perspective within which the practical value of traditional systems of engagement with and usage of nature has become most clearly apparent. Balée (1989) employed this approach in arguing that substantial areas of Amazonian forest, previously considered to be primordial ecosystems on which human influence had little effect, in fact show evidence of significant anthropic manipulation over historical time scales. Sponsel (1995a) takes a more theoretical line, pointing out that large-scale destruction and degradation of Amazonian ecosystems is largely a post-contact

phenomenon and thus arguing that indigenous knowledge, practices and world-views could provide the basis for a change in the attitudes within the dominant world system responsible for its destructive nature. Specific case studies of traditional systems of natural resource use and management indicate the existence of diverse systems successfully reconciling the satisfaction of subsistence needs with the maintenance of local biodiversity and ecosystem integrity.

Long-term studies of Kayapó human ecology have shown their subsistence practices to involve extensive manipulation of local ecosystems, markedly increasing the availability of useful species in a manner which enhances biodiversity, does not disrupt ecosystem function, and may even extend the range of forest cover (Posey 1985). Clay (1988) provides a review of numerous traditional systems of management of forest resources in South America. Outside Amazonia, agroforestry practices of the Ara of Nigeria have proved resilient in the face of the changes of the past century, having maintained productivity in the face of massive population growth and profound political change (Warren and Pinkerton 1998). Non-crop biodiversity has thus far been maintained, although the need for increased production has necessitated the conversion of substantial areas to more intensive agricultural usage and populations of most species have therefore declined substantially.

The study of cultural ecology has generated a variety of theoretical perspectives, some of which are, in one way or another, relevant to the treatment of Wapishana cultural ecology undertaken in this thesis. A broad qualitative overview of the subsistence practices documented in the host village is presented in chapter four. From this, evidence of features which can be considered to have conservation or management functions is sought. Much of the latter was found not to be based upon direct individual intentionality, but rather vested in symbolically encoded prescriptions relating to subsistence practices. Chapter five is for this reason concerned with research findings related to symbolism, those features which may have resource management functions being discussed in particular detail.

1.2.3 Does the existing social-ecological system have properties which could promote its stability in the face of anticipated changes in the circumstances in which it operates?

As I will describe in chapter two, Guyana's Wapishana population is currently facing the prospect that exogenous influences on their society will make themselves felt with unprecedented force. This is largely a result of pressures upon the natural resources of the area in which they live. The implications of this for their future

prospects are a matter of the gravest concern to many among them. This situation is similar to that faced by a number of marginal societies throughout the world, and is also of great importance to those concerned with the applied aspects of research in cultural ecology. The prospect that indigenous and other traditional systems of resource management, and the knowledge systems associated with them, might be of practical value in addressing the environmental problems arising from the changing human relationship with ecological systems on both global and local scales, has therefore been a major preoccupation of researchers.

Two distinct orientations evident in this field appear to reflect different political positions. One essentially assumes, whether for reasons of ideology or pragmatism, the persistence of existing social and economic structures. Indigenous knowledge is seen as a tool for the greening of a global society which would continue to operate according to the economic principles already employed as the major basis of decision-making (Escobar 1995: 192-211; Stirrat 1998). This forms the basis of the treatment of indigenous knowledge in international agreements such as the Convention on Biological Diversity (Posey 1998: 114-115), and is an unchallenged assumption that pervades much of the literature on extractivism (Assies 1997: 75-6). Acknowledging that there is an undeniable pragmatic value in this, I discuss some of the relevant literature shortly. First I will consider the other, more radical of the orientations I have identified. Largely arising from the systems approach, this explicitly incorporates the critique of western cultural hegemony that Purcell (1998) considers characteristic of anthropological interest in indigenous knowledge. Study of the traditional knowledge of non-western populations is considered an approach which can provide the basis for fundamentally different ways to organise the social and ecological relations of human societies (Berkes 1999).

The greater part of the research effort devoted to the applications of traditional knowledge has focused, sensibly enough, on agriculture. Alcorn (1995) provides a general summary of the diverse contributions that ethnobotanical knowledge can make to agricultural development. A growing number of studies are concerned with investigating such potential in other areas of subsistence. Among pastoralists in various parts of sub-Saharan Africa, for example, management of grazing lands is strongly dependent on local knowledge of water cycles and pasture growth, and regulated via traditional systems of ownership of and access to water sources and grazing lands (Niamir 1995). Over the time scale encompassed by their written history, resource use practices among the Cree appear to have evolved so as to incorporate systems for the sustainable exploitation of lake fisheries and wild

populations of beaver and caribou (Berkes 1998, 1999). Beaver hunting appears to operate so as to maintain populations at their maximum levels of production, while fishing practices seem to have succeeded in finding solutions to the problem of maintaining viable populations in conditions in which conventional approaches to fisheries management have been manifestly unsuccessful. A summary of fisheries management practices among coastal peoples of North America highlights their success in maintaining harvests in sustainable limits, in stark contrast to the outcomes of conventional fisheries management strategies informed by scientific methodologies (Hipwell 1998).

Hipwell (1998) points out the highly detailed specificity of traditional systems to local conditions, and their sensitivity to, and flexibility in the face of, micro-level fluctuations in conditions. He argues that the adoption of a new paradigm in fisheries management, based upon an integration of these methods and their associated knowledge systems with scientific approaches, is long overdue. Moran (1993b) presents a similar argument in relation to Amazonia: a massive diversity of traditional systems for natural resource management exists, each adapted in a detailed fashion to the specific ecological context within which it operates. He asserts that this site-specificity of local systems makes them the most appropriate starting point for devising strategies for increased food production in Amazonia, given the problems encountered by conventional approaches in the face of the extreme environmental heterogeneity that exists. A more detailed account assembles data on Amazonian cultural ecology in order to specify the contributions that the traditional knowledge of Amazonian populations can make to development in the region (Posey et al. 1984). Areas given particular attention are agriculture, aquaculture, game harvesting, gathering plant foods, use of both anthropically-modified and 'natural' environments, and cosmology. The authors of this paper note the artificial nature of this categorisation, and emphasise the interrelations among all aspects of the environmental relations of indigenous populations and the cultural systems within which they are embedded.

The essentially holistic nature of traditional resource management systems is further elucidated by Alcorn (1989), with the perspicacious observation that they tend to be based upon the regulation and maintenance of ecological processes. This is in contrast to conventional management strategies, whose focus is typically a single ecological variable (Berkes and Folke 1998a: 11-12). Thus the dynamism and interconnectedness of the ecological systems being managed is generally ignored, with consequences that may be catastrophic. Among researchers, in contrast, the

holistic context within which traditional systems of resource management operate has become a major preoccupation. Berkes and Folke (1998a) advance the analytical value of systems theories as tools for the analytical integration of social and ecological systems. An explicit multidisciplinary framework for investigating their co-evolutionary relationship formalises concepts implicit in much of the work cited above under the terms social-ecological system and social-ecological linkages Four major fields of investigation are identified, interactions among which are suggested to be the key factors contributing to the resilience of local social-ecological systems, both traditional and non-traditional in the face of change: ecological systems, technology, local knowledge and property rights systems.

Within this framework, the reasons for the success of many local resource management strategies in situations where scientifically informed approaches have failed becomes clear. Traditional systems are process oriented, and based on the accumulation of knowledge over time within the unfolding of a co-evolutionary relationship between culture and environment. These features compare closely to those that are distinctive in adaptive management, a modern policy trend in forestry and fisheries management. The latter, they continue, has the advantage of being able to incorporate scientific information obtained by systematic experimentation, either within the management project itself or incorporated from elsewhere. Logically, it might be expected that potential for improvement in this manner might also exist in traditional strategies.

Specific case studies exist of management systems based on the incorporation of scientific methods and data thus acquired into systems based on traditional methods of exploitation and access to resources operating within the local cultural context. These include "wholistic" (as the author terms it) systems of management of British Columbian forests (Pinkerton 1998), and the exploitation of clam beds by residents of coastal communities of Maine (Hanna 1998). These indicate that the efficacy of integrating traditional and scientific approaches to resource management extends beyond theory, and offer positive indications that the promise of such an approach may well be realised when it is put into practice. These are exceptional cases, however, where the combined approach emerged without conscious planning towards this specific end from particular sets of local conditions. In reality, as far as most situations are concerned, the theoretical basis for such an integrative approach is still being explored.

Although the need for a holistic approach in the study and application of traditional knowledge is well recognised by theoreticians, it is less well observed in

practice (Sillitoe 1998: 228-9). Throughout the 1990's, a far more effective driving force was an interest in the direct economic potential of extractive industries, and the potential this has to provide an economic rationale for the conservation of forests. It is nowadays widely considered that the sustainable harvesting of non-timber forest products such as fruits and nuts (Clement 1993) or palm products (Kahn 1993) can form part of a multi-faceted production system which reconciles use of the forest as an economic resource with the long-term maintenance of biodiversity and ecological functions (Lescure and Pinton 1993; Clement 1993: 140). The economic importance of extractivism is already vast - it was estimated in 1982 to employ 1.5 million people in the Brazilian Amazon alone, producing an annual income of around 100 million dollars (Anderson and Ioris 1992: 178).

To give one local example, the island of Combu in the Guamá river near Belém supports over 600 people, at a population density of 43 per km^2, 92 of whom rely on extractive industries for the majority of their income (Anderson and Ioris 1992: 184-5). Calculations of the potential market value of products that may be harvested on an ongoing basis from particular forests in Amazonia suggest that the economic basis for extractive industries may exist over substantial areas (Peters et al. 1989; Peters 1992). The economic viability of extractivism compared to alternative land uses – specifically permanent agriculture and livestock raising - has been investigated by Susanna Hecht. She found that, although the alternatives were more lucrative over a single short-term cycle of 10-15 years, if the cost of land degradation was incorporated into her models extractivism was the only economically viable option. In other words, the potential for sustainable practice makes extractivism a more economically sound long-term management option than the alternatives (Hecht 1992). A historical study of the dynamics of extractive economies has shown that its sustainable operation can not be assumed, and in particular depends on the continued provision of economic benefits as well as the maintenance of harvests within sustainable limits (Homma 1992). Trends in marketing extracted products in first world countries as a form of environmentally and socially responsible consumerism have also been heavily criticised, both on the grounds of the ideological contradiction and questions as to whether the type of relationships with corporate interests that are involved are likely to be of long-term benefit to producers (Corry 1993). These reservations notwithstanding, extractivism has come to occupy a central position in mainstream discourse on the reconciliation of economical, social and conservationalist needs. Several cases exist where the practice of extractivism appears to be fulfilling

its assumed potential to provide socially and environmentally benign means to fulfil local financial needs.

The best developed example of extractivism in practice is the extractive reserve, which has its social and political roots in the rubber-tapping industry of the Brazilian Amazon. The concept has ultimately proved politically acceptable in this country, where numerous such reserves now exist, and is being widely adopted in conservation and development circles elsewhere (Murrieta and Rueda 1995). Market-directed extraction of forest products has also been incorporated into the economies of some indigenous groups. The Siona and Secoya of Ecuador are successfully adapting to the economic realities of modern times, along lines firmly based in their own culture and traditional activities, by the use of a system of resource exploitation in which extractivism is a major and vital part (Vickers 1993). Maya people resident in the Uaxactún-Carmelita multiple-use reserve in the Petén of northern Guatemala benefit financially from a management regime based upon the extraction of palm leaves *(Chamadorea oblongata* and *C. elegans)*, allspice *(Pimenta dioica* and *P. officinalis)*, and chicle gum, in combination with nature/archaeology tourism (Nations 1992).

The use of faunal resources has been relatively underattended in the literature, despite its nutritional importance in subsistence economies (Redford 1993: 227), though there now exist two volumes collecting papers on this topic (Redford and Robinson 1991; Robinson and Bennett 2000). The incorporation of hunting and trapping into sustainable forestry programmes has often been considered to be neither straightforward nor desirable. In recent times, however, biologists have been rising to the challenges involved and developed extensive collaborative relationships with groups for whom hunting is an important part of subsistence (see Mazzucchelli and Ortiz von Halle (2000) for a review of such initiatives in South America). Probably the best developed example is in the Reserva Comuna Tamshiyacu-Tahuayo of north-eastern Peru (Bodmer and Puertas 2000). Employing conventional approaches to sustainable harvesting requires a great deal of background data on the population dynamics and carrying capacities of the species concerned (Feer 1993: 692-699). The possibility that the study of indigenous knowledge can provide a way towards more advanced collaboration between scientists and local populations that enhance the prospects of achieving biologically informed solutions to the problems of maintaining sustainable limits to human use of wild resources is a major preoccupation of this thesis.

1.2.4 Does the nature of ethnoecological knowledge provide the basis for its integration with scientific approaches in ecology?

The complementary nature of scientific and indigenous knowledge systems is discussed by DeWalt (1994). DeWalt's distinction between the 'immutable mobiles' of science and the 'mutable immobiles' of traditional knowledge emphasise the site-specificity of the latter. Unlike scientific knowledge, indigenous knowledge is highly local in its scope, but flexible with respect to changes in the context within which it operates. DeWalt presents three case studies, each of which illustrates the synergism that can result from the combination of the two approaches. Other analyses have stressed the methodological difference: Posey (1990: 54-55) suggests that hypothesis testing can serve as a linkage between the two systems: ethnobiological information provides hypotheses that can be tested by scientists, thus advancing scientific understanding of the phenomena under investigation. Such an approach is being applied in agricultural development, and is reported to have successfully aided the communication and interaction of rural farmers and development staff (Warren and Rajasekaran 1993). More advanced investigations, centred around the harvesting of particular species of forest plants, attest its efficacy in enhancing the economic and conservational potential of local systems for the management of these resources (Donovan and Puri n.d.; Puri 2001).

In a similar vein, Sillitoe (1998: 226-7) advocates the use of scientific methods in evaluating indigenous knowledge, identifying gaps in knowledge and instances of maladaptation caused by rapid change. I would like to give greater emphasis to the political implications: local empowerment and self-determination are implicit in schemes whose primary basis is the local body of capacities, rather than the esoteric knowledge of an outsider. Scientific knowledge and practice can offer people a greater range of intellectual tools and experimental methods than are available in the traditional setting, and offer insights that might be difficult to achieve within the constraints of traditional knowledge systems (Puri 2001). Ortiz (1999) describes how the incorporation of novel scientific information can successfully effect adaptive modifications of agricultural techniques, but emphasises that the information content and the manner of its presentation must be compatible with pre-existing belief structures if this is to be achieved. Agrawal (1995) argues that the notion that there are inherent differences between scientific and non-scientific systems of knowledge can not be sustained. This argument largely rests on a lack of attention to the sort of empirical detail that would show that DeWalt's conclusions, for example, are largely borne out by the facts. It does, however, raise the important point that scientific and

indigenous knowledge systems can not be rigidly distinguished on the basis of differences in substance, methodology, epistemology or contextuality. This does not undermine the validity of the conclusions presented above: substantial bodies of scientific and indigenous knowledge do in fact exhibit profound qualitative differences in one or more of these areas, and these differences generate a potential for their combination in a complementary fashion (Kalland 1997). Rather, it raises the prospect that the synthesis of indigenous and scientific thought could be more intimate than has previously been considered possible, a prospect which is being actively investigated in a range of research settings.

The employment of local knowledge directly as a source of data for scientific studies concerned with ecology may have a long history, perhaps dating back to the roots of the biological sciences in folk biology and natural history (Atran 1990), and has persisted in modern biology (e.g., Peres 1991: 636; Salas and Fuller 1996: 1446). However, only a small number of studies have so far made a serious contribution towards the formalisation of methods of data collection and analysis. So far the relationship between scientific and ethnoecological data on ecology has not been thoroughly investigated, although such studies as have been conducted in this area clearly indicate the promise of such an approach. Inuit hunters in Russia and Alaska contributed information on the distribution, movement patterns, feeding ecology, reproductive behaviour, social behaviour and response to human disturbances of Beluga whales *(Delphinapterus leucas)* that was consistent with and substantially enhanced the scientific database (Myrmin et al. 1999; Huntington et al. 1999). Groups of Inuit hunters on Baffin Island were able to give detailed accounts of changes in abundance and distribution of caribou over a period of 80 years. This information also proved consistent with, and greatly enhanced, existing historical records (Ferguson et al. 1998). Warao people of the Orinoco Delta were able to provide detailed information on fish diversity and microhabitat use (Ponte Johansons 1995). Interviews with a single Murui expert on natural history generated substantial quantities of data on many aspects of the ecology of all ten primate species found in his area, consistent in almost all cases with data presented in the scientific literature (Townsend 1995). The core of this thesis is concerned with a similar analysis of the ethnoecological knowledge of Wapishana hunters, which forms the content of chapters six and seven. A detailed comparison of ethnoecological data on various animal species with ecological data from the published literature is presented, and the implications of this for the development of an integrated approach are discussed. An evaluation of ethnoecological knowledge is also undertaken in relation to the data

presented on cultural ecology. This considers existing applications of ethnoecological knowledge in subsistence (chapter 8.1), and the use of ethnoecological data to generate hypotheses concerning human effects on local ecosystems of relevance to local management (chapter 8.2).

Research projects based on scientific methodologies have also found local skills related to ethnoecology to be of great value, one example being the employment of indigenous skills in botanical identification in a study of spider monkey *(Ateles paniscus)* ecology in Surinam (Roosmalen 1985b: 42-3). Aché skills in tracking and identifying the signs of animals greatly contributed to zoological surveys within the forests inhabited by them (Hill et al. 1997). Local hunters in the Luangwa valley in Zambia were employed in conducting monitoring of populations of wildlife in their area (Marks 1994, 1996). Ecological surveys based upon the knowledge of local people have been an extensive component of planning and design of the protected areas network in Laos (Steinmetz 2000). This relatively new approach holds much promise: it has been argued that it could form the basis for a paradigm shift in the science of ecology and in the whole manner in which technological solutions to the current environmental and social crises are sought (Berkes 1999). The present study included a pilot project on the local ecology in which Wapishana hunters were asked to apply their forest skills to the collection of biological data, and the outcome of this is reported in chapter 8.3.

These four research questions determine the academic context of this dissertation. Its content is based largely upon field data collected over two year-long stays in Guyana in 1997-1998 and 1999-2000. Most of the research time was spent among the Wapishana people of south-western Guyana, and the data presented largely relates to these people. The next section provides a brief introduction to the Wapishana, prior to a more detailed account of their history and present circumstances in chapter three.

1.3 The Wapishana people

Guyana's Wapishana population has been the subject of very little previous ethnographic study, and information on the group is fairly sparse. The earliest available information dates back to the visits of the Schomburgk brothers in the first part of the 19th century, accounts of which include various ethnographic observations (Schomburgk 1923; Schomburgk 1931). Later explorers Everard Im Thurn and William Brett also make reference to the Wapishana, although the latter's work is too blighted by Victorian bigotry to be of any value (Im Thurn 1883; Brett

1868). In both cases their accounts of their travels suggests that they did not reach as far south as the South Rupununi, and their observations may be borrowed from the Schomburgks. The first ethnographic expedition was undertaken by Curtis Farabee in the second decade of the twentieth century, and produced a book-length ethnography mostly concerned with the Wapishana (Farabee 1918). Walter Roth also made research visits to the Wapishana in the course of his nationwide surveys on the material culture of Guianese Amerindian peoples (Roth 1924, 1929). No ethnographic data on the Wapishana people was recorded for over four decades subsequent to Roth's visit, and the only available information from the intervening period is contained in a survey of the conditions of indigenous people throughout the country undertaken by a representative of the colonial government (Peberdy 1948). The Savannah Research Programme of McGill University did some work in the South Rupununi, and produced one publication about Wapishana agriculture, which appears to be based upon a fairly brief period in the field (Salisbury et al. 1968). More recent information comes almost entirely from the work of the Amerindian Research Unit (ARU) of the University of Guyana, most notable among which is a broad overview of Wapishana material culture based upon research undertaken in 1989 (ARU 1992). Several other ARU publications also provide background data on the Wapishana (ARU 1993, 1995; Forte and Pierre 1994). A doctoral dissertation on Wapishana identity, based upon research in Brazil, contains a little ethnographic data (Foster 1990), and another dissertation on development in the South Rupununi also provides some useful information (Tang 1995).

The modern Wapishana language is an amalgamation of Wapishana and Atorad (ARU 1992: 4), both of which are members of the Rio Branco group in the Arawakan language family (Mason 1950: 210-214). I observed Wapishana to be the language of communication in all villages visited, although on a small number of occasions I met Wapishana people resident outside their home area who could not speak the language. Almost all people attend government primary schools, and as a result most are conversant in English, the very young and very old excepted. Owing to the proximity with Brazil, Portuguese is also widely known.

General models of social organisation of tribes of the Guiana culture area are, due to limitations of available ethnographic data, based largely upon data about Carib tribes (Riviere 1984; Butt Colson 1984). However, these appear to be largely consistent with the findings of the present study and what information is available from earlier studies about social organisation of the Wapishana, although certain features have changed over time.

Riviere identifies cognatic descent, two-line prescriptive relationship terminology, preference for either settlement endogamy and/or uxorilocal residence, the importance of co-residence as a factor in ordering relationships, and the small size and short duration of settlements as the key common features (Riviere 1984: 4). Butt-Colson's emphasis is on the ideal of cross-cousin marriage and matrilocality, the outcome of which is a paradigmatic extended family based around a 3-generation line of female consanguines with both vertical and horizontal kinship relationships who, although not forming a corporate group in the strict sense of the word, act as an informal collaborative matriline about which men circulate. This model is accepted as being representative of Guianese indigenous societies, and comprises a suite of features found widely throughout Amazonia (Viveiros de Castro 1996: 188).

Results obtained in the present study showed that owing to the intervention of missionaries, cross-cousin marriage, although a historical convention, is nowadays very rare in practice. No clear pattern of post-marital settlement was evident, and I found no clear indication of any historical convention. Settlements is nowadays more concentrated and permanent, another outcome of missionary activities, since consolidated by the provision of government infrastructure at the centre of nucleated settlements (see chapter 3.2.4).

Wapishana settlement in Guyana is spread over a wide area of the savannah-forest ecotone in the South Rupununi savannahs (chapter 3.2.3). Both savannah and forest habitats are crucial for subsistence, which is based around long-fallow swidden agriculture. Fishing, hunting, rearing domestic livestock, gathering animal and plant foods, and the cultivation of fruit trees and keeping of house gardens on the savannah are all important aspects of subsistence (chapter 4). Economically, former sources of income generation in the trade in wild animals and 'balata' (dried latex of the tree *Manilkara bidentata)* have, respectively, declined and disappeared. A few people have employment in the ranching industry, in general income-generating opportunities are very scarce and the vast majority of people are concerned overwhelmingly with subsistence pursuits (chapter 3.2.4).

1.4 Methods

The study employed a variety of methods in collecting data on the various subjects of interest. The majority of data, and that of greatest importance, was recorded in interviews. Observation and to a lesser extent participation were also important, and GPS equipment was employed in mapping land use.

A broad overview of cultural ecology was constructed via the employment of several methods to collect data on subsistence activities. 54 households in the village participated in a survey covering various topics, but dominated by questions relating to subsistence. One or more adult representatives of each household participated in an interview conducted in Wapishana by a local assistant, and translated into English by the latter. The identity of the interviewees from each participating household was determined by availability at the time an interview was arranged; and may have been either the male or female household head, or both.

GPS was employed to map the locations of the major sites of subsistence activity: current farms, farm houses, major hunting lines, fishing pools and hunting and fishing camps. Over the course of this, much additional information was obtained from the comments of companions and by observation. Direct observation of subsistence activities was undertaken in accompanying excursions to the forest, visiting people at their farms or camps, and opportunistically on any occasion I spent time with people in the forest or on the savannahs.

The bulk of ethnoecological data was collected in a series of semi-structured interviews. Some collaborators in this area of the study also recorded observations in writing in their own time, prior to interviews on the subject area in question. Data was also collected opportunistically, when information was offered by companions on trips to the forest or savannah on the basis of their observations, or in my observations of how people went about subsistence activities. A more detailed account, and evaluation, of the methods used in ethnoecology is given in chapter 6.2.1.

Prior to the commencement of the ethnoecological component of the study, a certain amount of information was collected on ethnozoological nomenclature and classification. This involved a combination of eliciting written lists of animal names from informants, and subsequently interviewing them about their content. Corroboration of names was achieved by soliciting names for animals which could be identified when spotted in the field. A detailed account of ethnozoological methods used is in chapter 6.1.1.

Information on Wapishana cosmology, within which particular attention was paid to symbolic factors affecting resource use, came from a variety of sources. Symbolic considerations often arose over the course of interviews on ethnoecology, and informants sometimes reported their relevance to subsistence in the course of research on cultural ecology. Much information was collected on an *ad hoc* basis, increasingly as people came to appreciate my interest in and respect for this subject area, and in a variety of the different social contexts in which I found myself both in

the village and out in the forest. Some village elders were interviewed by local assistants, who translated the results into English. I also solicited translations of some myths and stories relating to the natural world, some translated and written by Wapishana collaborators, some translated either by the teller or an intermediary and recorded by me.

Many Wapishana stories, both traditional and anecdotal, have been recorded in writing in Wapishana, and in a few cases English, thanks to the ongoing programme in Wapishana literacy of the WWA **(Wapichan Wadauniinao Ati'o**, for which the group suggests the translation 'Wapishana for our descendants') and the Wapishana Language Project of the Unevangelised field mission. The same collaboration has also recently produced a dictionary and grammar of the Wapishana language, which proved a very useful aid. Mr. Adrian Gomes of the WWA kindly provided transcriptions of a large number of the Wapishana botanical terms recorded in this study. Many other biological terms are included in the dictionary, and I have used the spellings therein in these cases. Terms not included in the dictionary and not recorded in the session with Mr. Gomes I have transcribed myself, and are preliminary.

A variety of methods provided data concerning local views on conservation. During the reconnaissance period of the research, I visited several villages in the South Rupununi to determine which had an interest in hosting the research. On most such occasions, informal meetings were held to discuss my research plans in particular, and local interest in conservation more generally. The input of participants in these meetings - usually consisting mainly of village councillors, teachers, and informal leaders - provided a broad range of local opinions and ideas concerning conservation. Within Maruranau, regular meetings were held over the course of the research in order to discuss its implications. In the initial stages these were public meetings with large attendances, in which much local opinion about conservation was raised. In the second year of field research, meetings centred around a focal group of those most actively participating, although open to all who wished to attend. The opinions of core participants may by that stage have been substantially influenced by our collaboration, but other attendees such as village councillors often raised additional points reflecting other local perspectives. Finally, a few key individuals in Maruranau and elsewhere participated in one-to-one interviews concerning the local importance of conservation.

1.5 Overview of Thesis

The remainder of the thesis is organised as follows. Chapters two and three are mainly based upon literature research, and address the situation of indigenous peoples in relation to the current pace and nature of economic development in the interior of Guyana. Chapter two takes a national perspective, and considers the various factors that bear upon decision-making concerning land use at the national level and the effects upon indigenous communities of their relationship with the national economy. Chapter three continues this theme, but narrows the focus to that of the region and tribal group that are the major subjects of this thesis. It is thus focused upon development interest in the South Rupununi region of Guyana, the effects this has upon the Wapishana people that are its majority inhabitants, and local attitudes and responses to this situation.

The next five chapters report, analyse and evaluate the field data. The subject of chapter four is Wapishana cultural ecology: the various methods by which people in the host village make a living from the forest and the ecological implications of these activities. Chapter five examines the regulation of human use of natural resources by means of symbolically encoded restrictions on consumption and usage, placing this in the context of a general account of Wapishana symbolism. These two thus provide the cultural context for the subject matter of chapters six to eight, which are concerned with the main body of field data, that on Wapishana ethnoecology. Chapter six reports the results of a course of interviews with Wapishana hunters on the ecology of animal species found in forest. Chapter seven compares this data systematically with data from the published ecological literature in order to assess its strengths and limitations. Chapter eight considers a variety of practical applications of ethnoecological knowledge and the associated body of practical skills relating to the usage of wild resources.

The final two chapters re-assess the themes of this opening chapter in the light of the research findings. Chapter nine reviews the research questions introduced in this chapter, each of which is basically answered with a qualified 'yes'. In conclusion, in chapter ten it is argued that ethnoecology is an approach that can contribute to both biological and cultural conservation, but that this is dependent on the circumstances in which it is employed. Suggestions are made as to how this might be achieved in practice.

CHAPTER 2: INDIGENOUS PEOPLES AND DEVELOPMENT IN GUYANA

This chapter provides an overview of the situation currently faced by indigenous people in Guyana as a whole. The emphasis is on relationships with the state and the impacts that the activities of various actors, national and transnational, in government, industry, development and conservation are having or might have on the situation of members of the indigenous population. This provides essential context for subsequent chapters of the thesis. The local systems of knowledge and praxis with which this thesis is concerned are embedded in social, political and economic systems operating on larger scales. A full understanding of the local situation can not be achieved without reference to this broader context and the linkages between the two. As I will demonstrate, events on regional, national and international levels have been important factors in the history of Guyana's indigenous population, not least the Wapishana people with whom this thesis is largely concerned. At the current time, the prospect exists that the effects of exogenous forces on these people might shortly come to be felt with greater force than ever before.

2.1 Indigenous populations in Guyana

Members of Guyana's indigenous population are locally referred to as "Amerindians", distinguishing them from the numerically dominant Indo-Guyanese. Guyanese Amerindians are conventionally considered to comprise members of nine distinct tribal groups. However, some of these include descendants of people formerly belonging to linguistically distinct groups and incorporate remnant groupings still conversant in these minority languages. This is most notable in the cases of the Waiwai (Yde 1960: 84; Dagon 1967b: 9; Mentore 1995: 20) and the Wapishana (Farabee 1918: 4; ARU 1992). Formally recognised tribes include six speaking Carib languages: Karinya or "true Caribs", Akawaio, Arekuna, Patamona, Makushi and Waiwai; two speaking Arawakan languages: Lokono or "coastal Arawaks" and Wapishana and, in the Warao, a single member of the Warao linguistic branch. Additionally, I have met Trio people at least temporarily resident on the Guyanese bank of the Correntyne River, although the traditional homelands for this tribe are across the river in Suriname.

The most recent nation-wide census of Guyanese Amerindians estimated their number, on the basis of data of variable quality and accuracy, at around 47,000 people, or around 8 percent of the national population (Forte 1990a). However, the

concentration of the vast majority of the non-Amerindian population in a relatively small area of land along Guyana's coastal strip means that Amerindians are in a numerical majority in many of the country's sparsely-settled interior regions.

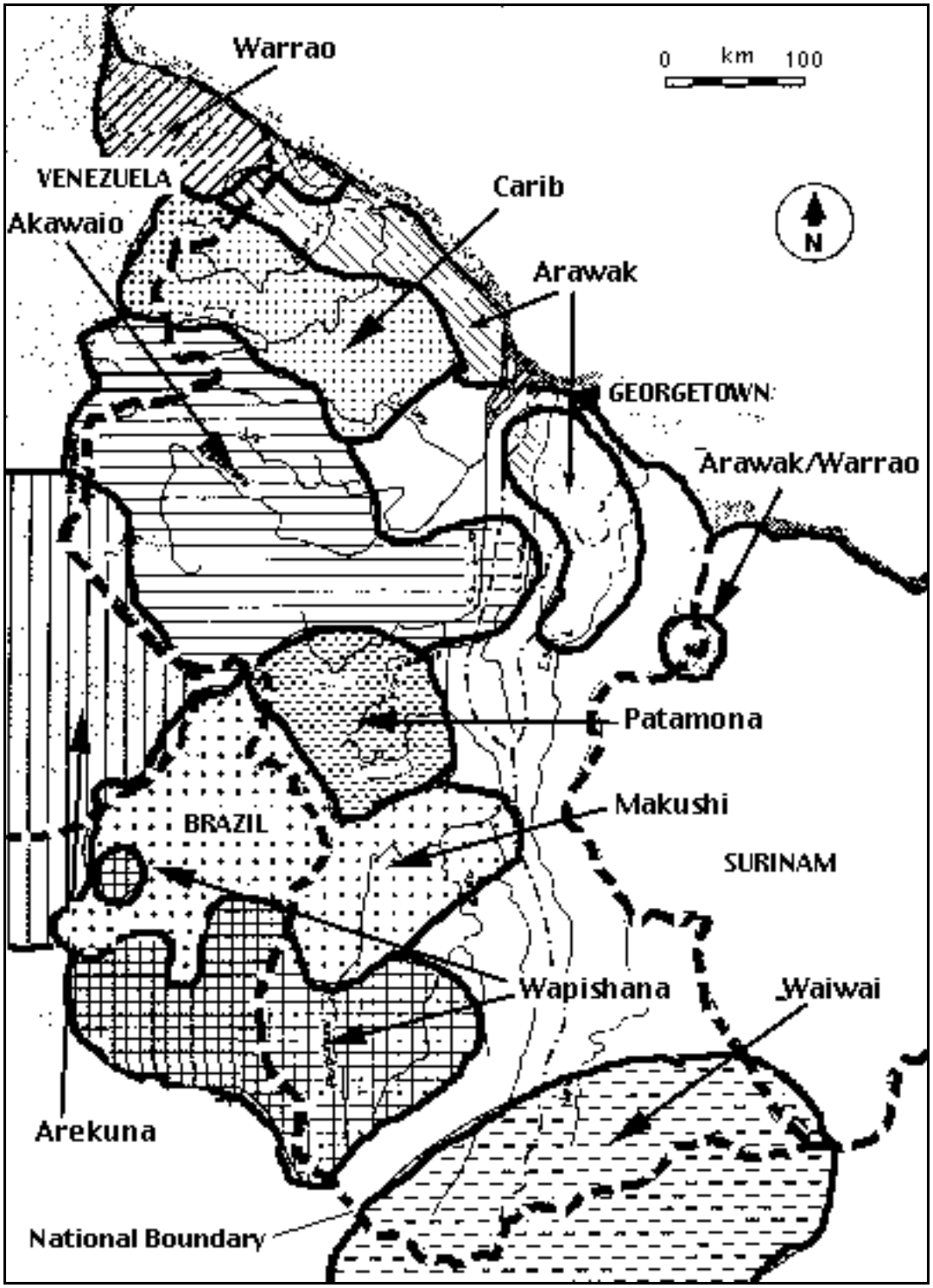

Figure 2.1. Map of Amerindian settlement within Guyana. (Reproduced from Colchester 1997).

Three tribes are resident in large numbers on the coastal plain, in the forested areas that lie between the main settlement and agricultural zone on the lower reaches of Guyana's major rivers and the falls that mark the intersection of these rivers with the edge of the Guyana shield massif. These are the Lokono, Karinya and Warao. These

groups also comprise the majority indigenous population in the country's more remote Northwest District. Akawaio settlement overlaps Lokono settlement in the case of a single community on the lower Demerara river, but is otherwise concentrated in the west of the country along the Mazaruni rivers. Guyana's only Arekuna village is also located in this region, adjacent to the Venezuelan border. Further south, Patamona settlement is concentrated in the Pakaraima mountains. These descend south into the Rupununi savannahs, whose northern part is populated mainly by Makushi people, the south savannahs being dominated by the Wapishana. Finally, the Sierra Acarai range in the extreme south of the country is home to a single village of Waiwai, who include descendants of remnant groups of survivors of several tribes otherwise thought to be extinct. Two isolated Amerindian groups have been located in Guyana (Bahuchet 1995: 111). One is resident in the New River triangle in the southeast of the country, and is thought to be affiliated to the Waiwai (Anselmo and Mackay 1999: 20). Another is located in a remote part of Waiwai territory, and was apparently founded by a group of Wapishana who, disillusioned with the changes they observed around them, decided to live in a self-imposed isolation from the national society.

2.2 Amerindian Relations With Wider Guyanese Society

The geographical remoteness of most of Guyana's Amerindian population is mirrored in their status as people socially, culturally and economically peripheral within a nation state dominated by other ethnic groups. As is the case elsewhere in the English-speaking Caribbean, indigenous contributions to national identity and cultural diversity have rarely been acknowledged in the mainstream of national consciousness (Palacio 1995). There have been concerted efforts to remedy this situation in recent years, most notably in the government's designation of September as Amerindian heritage month and the organisation of associated events concerned with celebrating and raising awareness of Amerindian culture. However, it remains the case that the attention of most coastal Guyanese is focused north towards the Caribbean islands and North America. Few have visited the interior regions, levels of ignorance and prevalence of misconceptions about which remain high among the general public.

Economic activity is also focused overwhelmingly on the coast, and most Amerindian communities are affected by a severe lack of income-generating opportunities. Although the use of conventional economic indicators can be somewhat misleading in communities in which the greater part of the economy is based upon subsistence or barter (Fox and Danns 1993: 99-100), high levels of

material poverty remain the norm in most of these locations (Forte 1993: 6-8). Little prospect for remedy exists within the conventional public education system, which conforms with a pan-Caribbean curriculum with little relevance to the realities of interior life. Success in this system is more likely to alienate the most able students from their home areas than help to equip them to contribute to solving the problems there (Forte 1993: 9; Lea 1968: 17-18). In 1995, a UN-sponsored consultation with Amerindian representatives produced an extensive series of recommendations as to how education at all levels could be reformed so as to cater more effectively for the needs of Amerindian students and enable them to employ their education effectively within their home communities (Forte 1995b: 15-24).

The system of local government ensures that Amerindian communities have a good measure of political autonomy. Village captains and councils, elected biennially, are responsible for village administration, enactment of public decisions, and political representation of their constituencies at the regional and national levels. On the other hand, this can result in isolation from state and other central sources of technical advice, assistance and support. Captains and councillors may find themselves ill equipped to deal with the problems of office, and vulnerable to exploitation and manipulation by relatively powerful outside interests (Forte 1995c: 10). Central governmental representation, in the form of the Ministry of Amerindian Affairs, was introduced in 1992. However, this office has not been allocated sufficient staff or funding to allow it to fulfil its myriad obligations in respect of the people it ostensibly represents. Amerindian groups in Guyana have also criticised the fact that the Minister of Amerindian Affairs is a political appointee rather than a representative elected by Amerindian people themselves (APA 1998).

Over the same period, endogenous movements for the broader representation of Guyana's Amerindians have markedly increased their prominence and influence, both nationally and internationally. Guyana now has several indigenous NGO's: the Amerindian Peoples' Association (APA), Guyana Organisation of Indigenous Peoples (GOIP), The Amerindian Action Movement of Guyana (TAAMOG) and the National Amerindian Council, while the non-Amerindian Guyana Human Rights Association (GHRA) has also played an important role in promoting indigenous issues. Of these organisations, the APA has in recent years emerged as the most dynamic and influential, and can also lay the greatest claim to grass-roots representation via its mode of organisation. Membership is based around more or less autonomous cells organised at the level of the individual village, and an elected executive committee is responsible for activities at the central office in Georgetown. The central organisation

provides national-level representation in respect of particular problems faced by member communities, and also lobbies at a national and international level on key issues.

Particular attention has been given to two issues of major importance: reform of Guyana's Amerindian Act and pressing for the full recognition of indigenous land rights. The Amerindian Act, chapter 29 of the former constitution of the Republic of Guyana, was condemned by the APA as a piece of outdated legislation based directly upon colonial perceptions of indigenous peoples, which failed to live up to international standards on indigenous rights in numerous respects (APA 1998). An opportunity for much-needed revision of this act came with the complete reform of Guyana's constitution, an outcome of disagreements between Guyana's major political parties over the conduct of the 1998 general election. Amerindian representatives took a major role in the reform process and achieved a substantial proportion of their objectives (APA 1999b). The experiences of the head of the constitutional reform committee provide an instructive insight into the perceptions of Amerindian people and their political campaigns among Guyana's coastal community. They seem to me to provide a microcosm of the process of awareness raising necessary if these struggles are ever to gain widespread popular support. Most of the non-Amerindian members of the committee were initially unsympathetic to the concerns of the Amerindian contingent, and apparently somewhat ignorant as to their bases. As a dialogue developed and a greater appreciation of the culturally specific needs of Amerindian peoples was achieved, many of these people were persuaded to change their views considerably (LaRose 1999b). Could a similar process be effected more broadly within the national population this would be a major step towards achieving equal status for Amerindians within the national society. Another notable achievement of the APA was its collaboration with Guyanese environmental lawyer Melinda Janki in the establishment of the Centre for Amerindian Rights and Environmental Law (CAREL) in Georgetown. This facility will provide legal advice and training to Amerindian people and address environmental issues (APA 2000a). Despite these successes, little progress appears to have been achieved in initiating a productive dialogue between Amerindian organisations, particularly the APA, and central government. The major sticking point appears to be the central issue of Amerindian land settlement, and there appears to be little common ground on the subject of how the government should go about discharging its responsibilities in this respect (APA 2000b).

2.3 Amerindian land rights and land security in Guyana.

A recent APA-sponsored publication draws attention to several ways in which obligations concerning Amerindian Land Rights, which were among the legal conditions of Guyana's independence from Britain, have not been met. Via the Amerindian Lands Commission, which formed in 1966 and presented its report to the national government in 1969, 116 Amerindian communities laid claim to a total of 43,000 square miles (about 110,000 km^2). The commission recommended the granting of title to 24,000 square miles (a little over 60,000 km^2) of this (Amerindian Lands Commission 1969). The 1976 Amerindian Act and its 1991 amendments designated a total of only 6,000 square miles (15,400 km^2)as titled Amerindian land. Many communities were designated land holdings inadequate for their subsistence needs, many others have experienced population growth and now require land extension, areas that were formerly contiguous Amerindian lands have been fragmented, and around 50 settlements have no form of title whatsoever.

Moreover, the security of indigenous land tenure afforded by the 1976 act is severely undermined by the inclusion of several discriminatory conditions. Most notable are the exclusion from the title of sub-surface rights and of rivers and riverbanks up to 66 feet inland, and provision for the alienation of lands from Amerindian ownership via the unilateral action of an unspecified minister (Anselmo and Mackay 1999: 13-25). The borders of titled lands are often specified ambiguously or inaccurately, and few borders have been demarcated. Up to the mid-1990's only a single village had had its boundaries demarcated (Forte 1995c: 9). The government attempted to rectify this situation in the late 1990's by introducing a programme of demarcation, but did not include any element of consultation. The programme was subsequently rejected by the majority of the communities involved, who were dissatisfied with both the demarcation process in general and the attitude and work of the surveyors in particular (LaRose 1999a). Consequent ambiguities over the exact location of reservation boundaries mean that titled as well as untitled communities may be vulnerable to encroachment upon their land by outsiders.

Several Amerindian groups have begun to take direct action to rectify this situation. The most advanced Amerindian land claim is being exercised by the Akawaio and Arekuna communities of the Upper Mazaruni, who are seeking to exercise their historical right to around 11,000 km^2 of land formerly comprising the Upper Mazaruni Amerindian District. Much of this area was dereserved (i.e., its status as an Amerindian territory was revoked) in colonial times to facilitate the entry of miners, and the villages currently hold title to non-contiguous areas of land totalling

around 4,000 km^2 and excluding many areas vital for subsistence. In 1994 the communities commenced a land use mapping project to substantiate their claims, presenting the maps thus produced to the government in 1997. Facing a lack of response on the part of the government, the communities decided to resort to legal action, which was filed by their legal representatives late in 1998 (Anselmo and Mackay 1999: 25-36). The outcome of the action in the Guyanese courts is still pending, and meanwhile other Amerindian groups in Guyana have begun to follow similar courses of action. Several communities in the Moruca sub-region in the Northwest District have recently completed a joint land use mapping project undertaken for the purposes of land use planning and claiming land extension (APA 2000c), and a similar project is now underway in the 'Deep South' district of Region 9. (See chapter 3.3.1).

Despite the uncertainty of the indigenous land situation, for many years violations of Amerindian territories were minimal. Owing to the economic stagnation that afflicted the country under the Burnham regime during the 1970's and 1980's, very little attention was directed towards the remote and undeveloped interior areas of the country. Timber and mineral extraction, the major industrial activities in the interior, both dwindled almost to extinction (Thomas 1993: 142-6). Guyana's Amerindians for the most part avoided the atrocities inflicted upon their counterparts elsewhere in the Americas in the name of development over this period, and can currently be considered better off than many in neighbouring Brazil and Venezuela (e.g., Foster 1990; Cleary 1990; MacMillan 1995: 122-126). It is clear that this was not due to any measure of government benevolence. A plan for a major hydro-electric power project on the Mazaruni river, whose expediency was questionable but which would have seen the Akawaio residents of the region forcibly removed from their lands (Bennett and Colson 1981) failed to materialise only because the requisite funds could not be secured. However, in many areas Amerindian communities received little outside attention other than from missionaries, and were left more or less free to maintain their lifestyles as they chose, within the constraints already observed.

In the years since the death of former dictator Forbes Burnham in 1985, the national situation has changed markedly. The highly despotic and bureaucratic command economy constructed by Burnham has been transformed as a result of a series of interventions led by the World Bank and the International Monetary Fund. One consequence of this is unprecedented levels of pressure upon the natural resources of Guyana's interior and new risks to its inhabitants, particularly as a result

of industrial logging and mining. A statement issued by the UNHCR in March 2000 drew attention to the failure of Guyana's government to provide legal equality for Amerindian people. It also expressed concerns about continuing threats to Amerindian culture entailed by the failure to adequately provide for Amerindian land requirements and the effects of logging and mining operations in the interior (U.S. Department of State 2001). The relationship of the logging and mining industries to Guyana's Amerindian population is the subject of the next section.

2.4 Amerindian people and development in the interior of Guyana: the impacts of industrial logging and mining.

The dominant factor in Guyana's economic transformation has been the terms of a second structural adjustment loan granted by the International Monetary Fund as part of a rescue package for the country's crippled economy in 1989. A similar rescue package earlier in the 1980's had not adequately accounted for the peculiarities of Guyana's situation, emphasising economic recovery based upon increasing diversity and volume of exports, rather than directly addressing the crisis in domestic production that was at the root of the problem (Harrigan 1991). This failure notwithstanding, the World Bank proceeded to base their second programme for economic reform on the liberalisation and vast expansion of the forestry and mining industries (World Bank 1991), despite warnings from other quarters of the folly of such an approach (Commonwealth Advisory Group 1989). This expansion of extractive industries was to be financed by the private sector, necessarily - owing to the dearth of investment capacity within Guyana – from overseas sources, and the terms of foreign investment in Guyana were rapidly and radically altered to become highly favourable to potential investors.

Since the late 1980's, both the timber and mining industries have expanded at phenomenal rates, far outstripping the government's capacity to monitor or control them and enhancing the marginalisation of the people resident in the areas where these developments were taking place (Colchester 1997). Development in the interior of Guyana came to be largely under the control of foreign-owned commercial enterprises under no compulsion to consider the interests and rights of local residents. The latter were thus left in a position of alarming vulnerability (La Rose 1994), particularly those dependent on native ecosystems for subsistence. In 1999, it was estimated that 18 percent of Guyana's original forest cover had been either cleared or (probably the majority) converted to secondary forest, and that 41 percent of the rest was under threat (Cotton 1999: 63). The timber and mineral

industries have been identified as the main causes of degradation and destruction of Guyana's forests (Colchester 1998).

2.4.1 Amerindians and the Mineral Industry in Guyana

Mining for gold and diamonds has a long history in Guyana, archaeological evidence suggesting that gold was mined in the Upper Mazaruni in pre-Colombian times. Gold was important to both colonial and national economies from the mid-19th century until the decline of the industry in the 1980's. The 1990's saw a huge increase in mining both by small scale independent miners, locally referred to as pork-knockers, and non-Guyanese multinationals, which has brought the industry into conflict with Amerindian people in many areas of Guyana (Anselmo and Mackay 1999: 46-47). This has been most thoroughly studied in the Upper Mazaruni, where large numbers of pork-knockers operate close to, and often upon, Amerindian lands. Multinationals operating in the area have also intruded on titled village land without permission, damaging farms in at least one area. Mining operations are reported to have caused extensive environmental damage, making the river useless for all domestic purposes. Fish stocks have almost disappeared, and populations of game animals are also highly depleted as a result of hunting by and on behalf of miners and the noise associated with mining operations. Subsistence activities such as maintaining a farm have been neglected by many local residents drawn to the mines in search of cash, and dependence on imported foods and malnutrition are now common in formerly self-sufficient communities. Social effects include increased economic inequality, the breakdown of traditional family systems, involvement of Amerindian women in prostitution and an increase in schoolgirl pregnancy (Forte 1997: 77-81, Anselmo and Mackay 1999: 61-64).

Despite these reported negative impacts of small-scale mining upon Amerindian communities in its vicinity, it is simpistic to regard these communities as in simple confrontation with the industry. Large numbers of Amerindian people are themselves involved in small-scale mining activities, and for many it is their only means of access to the cash economy. A study of mining communities close to the Guyana-Brazil border suggested that the presence of non-Amerindian miners in these areas increases the potential economic output of the Amerindian segment of the workforce. The presence of Brazilian miners, usually working illegally, was considered to be particularly important in effecting infrastructural improvements and increasing the availability of petrol and other goods. This, it was concluded, financial benefits Amerindian miners, whose potential income from mining is elevated (Roopnaraine

1995, 1996). Certainly, many Amerindians are willing and enthusiastic participants in small-scale mining, and the overall pattern of costs and benefits to Amerindian communities is as complex as the morass of social and economic relations described in the multi-ethnic and multi-national mining communities described in these studies.

Industrial scale mining has also had significant negative effects upon Guyana's interior and its people. The most dramatic example of this is the collapse of a tailings dam at the Omai gold mine in central Guyana on August 19, 1995. This led to the discharge of 3.2 billion litres of cyanide-laced water into the Essequibo River system. Legal action has been filed against the majority owners of Omai – the Canadian-owned company Cambior – on behalf of 23,000 people affected by the spill and by other pollution connected with the mine, and is currently in process in the Guyanese courts. Compensation worth USD 100 million is being claimed for damage to property and the natural environment, pollution of supplies of drinking water, and a variety of ailments including skin diseases, vomiting, diarrhoea and headaches (Langdon 1999, also see article in Guyana Chronicle, August 18, 1999). Regulation of mining appears to be the major current preoccupation of Guyana's Environmental Protection Agency (EPA). The Stabroek News of the 10th of March 1999 reported Guyana was to receive funding and technical assistance from the Canadian International Development Agency for a large-scale programme aimed at developing technical capacity and reforming legislation with respect to regulation of the mining industry. The EPA has since been working on a set of regulations designed to curtail the environmental damage associated with the industry. An editorial in the Stabroek News of the 28th of June 1999 applauded these measures, but also noted that the Guyana Gold and Diamond Miners Association had expressed concern that their implementation would put 90 percent of small scale miners out of business. These recent developments are promising, but ameliorating the environmental and social impacts of mining without causing hardship to the large numbers of Guyanese economically dependent upon it promises to be a supremely difficult task.

2.4.2 Amerindians and the Logging Industry in Guyana

Expansion of the logging industry occurred at such a rate that by the mid 1990's Guyana's assistant commissioner of forests was able to report that, 'almost the entire area of the Permanent Forest Estate described as State Forests has been allocated', and, 'it is difficult to find virgin forest areas that have not been allocated to anyone'. This was despite the fact that this area was beyond the capacity of the Guyana Forestry Commission (GFC) to monitor (Marshall 1994: 85, 84). This turn of

events was the subject of much concern, particularly as logging concessions covering vast areas of forest were awarded to enterprises connected with Asian companies, many of which had histories of wreaking environmental, social and political havoc in other countries in which they had operated (Colchester 1991).

Almost seventeen thousand square kilometres of forest awarded to the joint Malaysian-Korean Barama company was estimated to have incorporated the lands of around 1,200 Amerindian people, including four titled communities and numerous untitled settlements (Colchester 1994; Forte 1995a: 5). While the presence of the company brought a much-needed source of employment, some of which went to local Amerindians, it has also had many negative effects. Barama's activities led to pollution of water sources, and the company forcibly relocated the community of Orenoque without providing compensation or adequate replacement housing. By 1997, local objections were sufficient to provoke the lodging with the government of a petition on behalf of around 4,000 people thus affected (Forest Peoples Programme 1997).

Outside its concession, Barama has been the source of widespread hardship in at least one other Amerindian village - Orealla on the Correntyne River – from which it contracted to buy timber to make up shortfalls in production from its concession (Henfrey 1995). This community was systematically manipulated and swindled by Barama, whose practices included claiming to have rejected substantial proportions of timber loaded onto and transported by their barges while providing no evidence of its unsuitability, and persistently recording timber volumes substantially less than those measured by the loggers themselves. As volumes of timber were calculated using a formula according to which the radius of a log was one quarter of its girth, giving a result somewhat less than two-thirds of the actual value, the company clearly paid for only a fraction of the wood it actually received. Foreign timber dealers with whom the community has dealt with since have turned out to be even more crooked. Orealla's village captain told me that one buyer, an agent claiming to represent the notorious Oregon-based timber firm P and S, had defaulted on debts of GYD 20 million for timber purchases, and around GYD 2 million further in unpaid wages. Appeals by the community for government assistance led to the former Minister of Amerindian Affairs abetting the buyer's fraudulent behaviour, the two collaborating in pressuring village officials into accepting the company's non-payment. Other Amerindian communities involved in commercial forestry have reported similar experiences (e.g., Sizer 1996: 208). Overall, a long-standing historical pattern seems to have been perpetuated by the changes in the timber industry over the past decade. Amerindian

involvement in logging has at best resulted in the local extinction of commercially valuable timber species and often exacted more severe environmental and social costs. Meanwhile little or enduring benefit, financial or otherwise, has accrued to the majority of the people involved (Forte 1995a).

Reform of the logging industry has been taking place since the mid-1990's, in the form of an institutional strengthening programme sponsored by Britain's Overseas Development Association (ODA) the government department concerned with implementing development aid programmes which has since become the Department for International Development (DFID). The proposal emphasised institutional strengthening of the Guyana Forestry Commission, and incorporated a substantial social component as well as giving prominence to environmental criteria (ODA 1994). A review conducted at the midway stage of the programme gave stronger emphasis to social factors, calling for interactions with Amerindian communities to become a key feature of central regulation of the logging industry and interior development in general (Hobley 1997). While reform of the industry was clearly needed, the APA has expressed concerns about the lack of Amerindian participation in the programme, and alleged that the draft act fails to recognise Amerindian rights (APA 2000d).

Although one condition of the ODA/DFID programme was a freeze in the handing out of new logging concessions, Guyana's government appeared to continue to promote the expansion of the timber industry over the period this was in force. The area of state forests – those over which the GFC has jurisdiction and which are, therefore, potentially available for timber extraction – was greatly expanded (GHRA 1997). Furthermore, a new legal mechanism for engaging logging interests was introduced in the form of exploratory concessions, under the terms of which companies are allowed access to areas to prospect for lumber, begin to establish infrastructure, and develop management plans prior to a decision being made over whether an actual logging concession is to be awarded (Chandarpal 1997). This step was criticised by environmental and social groups, who expressed fears that this system would not prove an effective component of government regulation of the logging industry (e.g., GHRA 1997). These were realised when one company, the mostly Malaysian-owned CASE-UNAMCO, was shown to have illegally cut timber to an estimated value of USD 7.65 million from an exploratory lease. The government response was to impose a token fine of USD 7,142, exactly USD 30,000 less than the sum the company was at the time reported to owe in arrears on fees relating to its other logging interests in Guyana (Forest Peoples Programme 1998).

Changes in the global economy seem to have tempered the interests in Guyana's timber. In an interview printed in the Stabroek News of March 21, 1999, the managing director of CASE-UNAMCO alluded to the Asian financial crisis and a global recession in the logging industry as factors in the company's scaling down of its operations in Guyana. He did, however, suggest that the main reason was the company's unfair treatment by Guyana's government! However, the Stabroek News of April 18, 2000 reported the arrival of a delegation representing The Jilin Forest Industry Corporation, a Chinese forestry company, for discussions over a proposed investment in the Northwest District. The report indicated that the company had already fulfilled its obligation to produce an environmental impact assessment and forestry management plan, and also that it planned to produce value-added products as well as diversify into other sectors such as aquaculture and commercial agriculture. The Guyana Forestry Commission was reported to be arranging for consultations with Amerindian communities in the area that would be affected by the proposed development. Should these aims be fulfilled in practice, the proposed operation could fulfil many of the criteria for generating greater local economic benefit while, depending on the nature of and adherence to the management plan, reducing environmental damage.

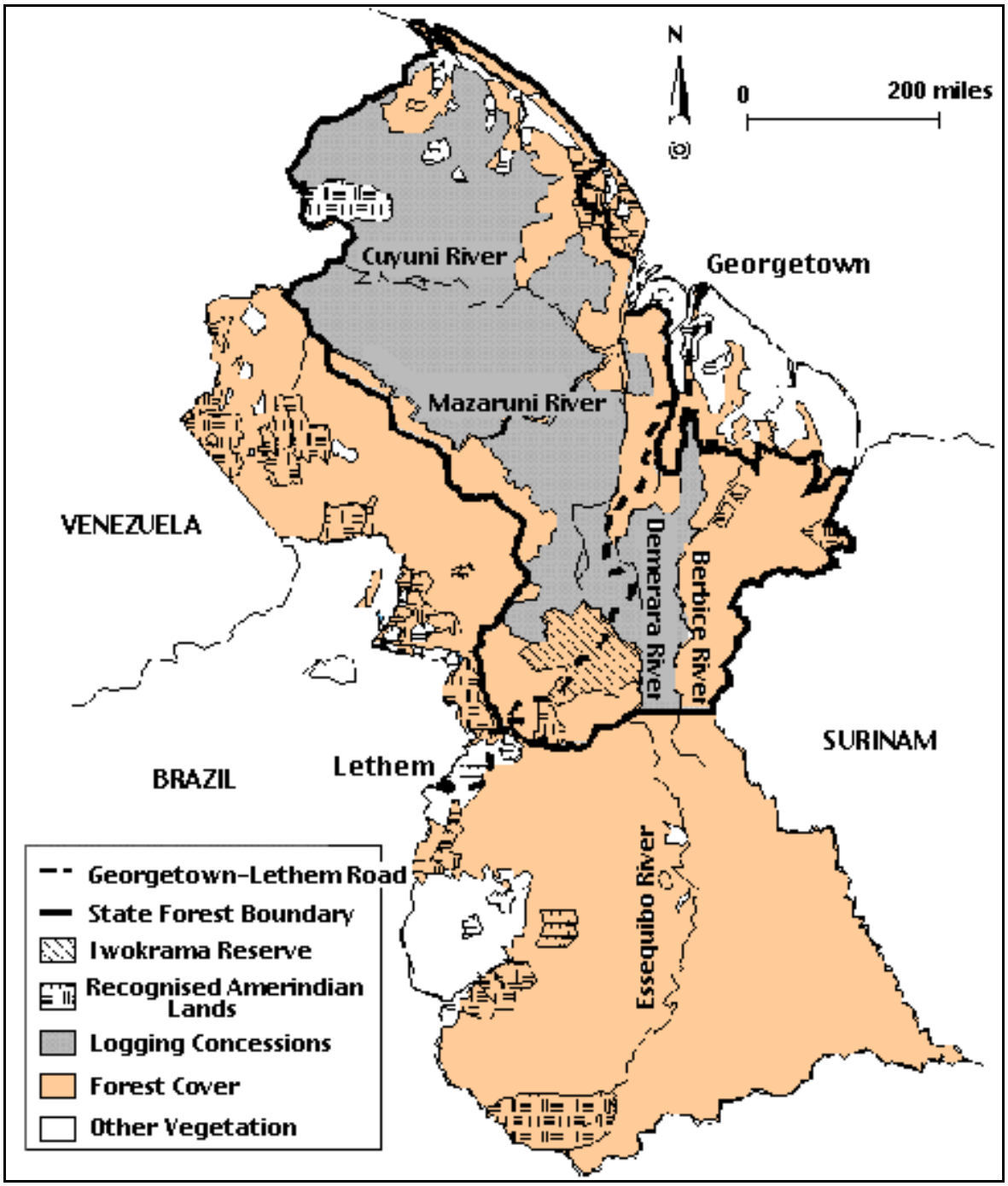

Figure 2.2. Map of Amerindian lands, logging and mining concessions (from Sizer 1996)

2.4.3 Conclusion

Both the logging and mining industry involve large numbers of Amerindian people, both as independent operators and employees of larger enterprises. Possibly a greater number are incidentally affected, in the manners described above. Although in many parts of the interior these industries are the only source of employment, or of any kind of infrastructure, the above account indicates that the overall effects on the Amerindian population are at best dubious. This fact has clearly been recognised both by the Guyanese authorities and some of their major international donors, and current steps to reform and regulate both industries will hopefully realise tangible and

significant improvements in the situation of Amerindian communities adversely affected. Welcome as such steps are, their long-term impact may prove limited if they continue to dominate economic development in Guyana's interior in the current fashion, and the country remains economically dependent on the operations of largely transnational corporate enterprises of dubious integrity.

There are two major avenues to rectifying this situation relevant to the subject matter of this thesis, and possible steps along each have already been taken in Guyana. Operational reform of both industries, firstly, is already underway. Within the logging industry in particular, the potential for Amerindian involvement in monitoring is great, and calls have been made from within both Guyana's academic community and the forestry industry itself for the initiation of large-scale programmes to realise this. From within the industry has come a suggestion for a large-scale programme of monitoring of logging concessions by members of neighbouring Amerindian communities, with the direct financial support of the logging companies themselves (De Freitas 1998). This is in many ways similar to an earlier suggestion for a state-sponsored programme of training for Amerindian Environmental Monitors who could represent state interests in monitoring and regulating industrial activities in the interior, in collaboration with the Forestry Commission and Environmental Protection Agency (Forte 1995a: 8). Forte's point that this could be achieved partly through existing training courses at the Guyana Forestry Commission appears to have been taken up, if not on the scale she advocates. An article in the Stabroek News of July 3, 1999 reported the then-Minister of Amerindian Affairs to have disclosed that, starting in 1998, the government had begun to provide five scholarships annually for the support of Amerindian students training on the Certificate Course in Forestry. The Minister also noted that the GFC at the time employed 23 Amerindian members of staff, most of whom had been recruited on the basis of their botanical knowledge and in particular tree identification skills.

Amerindian knowledge has been a central aspect of Guyana's logging industry since its inception, as evinced by the fact that the vernacular terms for most tree species consist of their Lokono names, some of which have also been incorporated into Creolese (Polak 1992: 12-13). The proposals described above thus incorporate a certain historical logic, as well as great practical merit. I would further advocate that any such programmes incorporate a substantial research effort dedicated to developing methodologies in ecological monitoring based upon Amerindian knowledge, whether intellectual or practical in nature. Biological resource inventories currently in planning or underway, such as the national forest inventory, whose inception was

reported in the Stabroek News of May 16, 1999, could provide an opportunity to take the first steps in this. The assessment of some of the relevant skills provided by the present study will, I hope, prove useful in the planning of any efforts that may be made in this direction.

Indigenous knowledge is even more central to the second of the possible remedial measures to which I referred above, expansion of the range of income-generating activities in the interior. High-level officials of the GFC have expressed their wishes for diversification of the forestry industry, both by expanding the range of timber species from the tiny number that currently supplies the export market (Singh 1997) and by extending into non-timber forest products (Marshall 1994: 86). The latter already has a long history and important economic role in Guyana, and is the subject of the following section.

2.5 Other uses of the forest: commercial extraction of non-timber forest products of plant and animal origin

2.5.1 The commercial extraction of non-timberforest products: history and prospects

The commercial exploitation of non-timber forest products was formerly of great economic importance in Guyana, particularly balata, the latex of the 'bullet tree' *Manilkara bidentata.* When the trade was at its peak in the years immediately following the First World War, the total production from the Rupununi district alone was around one million pounds (about 450,000 kg) annually (Baldwin 1946: 44), and the maximum annual production, 1,595,888 lbs, (725,404 kg) was recorded in 1917 (Forte 1995a: 2). Baldwin estimates a workforce in the Rupununi of around 600 people in 1944, about half of this being Amerindian. Life history data collected in the present study indicates that the majority of Wapishana men were employed in the trade in some capacity, suggesting levels of Amerindian employment in later decades to have exceeded this figure. The distribution of the tree extends throughout the lowland areas of Guyana (Jenman 1885: 171-172), and the reports of former bleeders interviewed in the present study indicate that they reached the furthest reaches of the country. At this time, then, much of the forest area of Guyana was effectively an extractive reserve supporting both extraction and the subsistence pursuits of those involved in it. The replacement of balata with synthetic substitutes had already caused a substantial decline in the volume of production by the 1940's (Baldwin 1946: 44). The export market eventually collapsed in the 1980's, and the

industry rapidly disappeared. A project funded by Conservation International to provide training in carving ornaments from balata and access to export markets for these products has so far proven successful, although it is limited in scope to a single village.

Balata production must certainly have been supported to some extent by the indigenous knowledge of the Amerindian work force, if only to the extent that their skills in living, travelling and procuring food in the forest will have been essential in permitting them to stay in the forest for the extended periods required for the collection of latex. The extent to which ethnoecological knowledge relating to the bullet tree was employed in identifying new areas for exploitation and location of stands or individual trees can now only be a matter for speculation. It is also essential to note at this stage that Afro-Guyanese formed a substantial proportion of workers in the balata industry, and the entire workforce in the early years of the trade in the 1860's (Jenman 1885). The interaction of Amerindian and Afro-Guyanese workers must have provided rich possibilities of intercultural exchange. For many of the older Wapishana people with whom I discussed their experiences as bleeders, this time represented the greater part of their experience of coastal society. Some reported that they had learnt uses of forest trees previously unknown to them via this contact, one being the use of the bark of the locust tree *(Hymenaea courbaril)* to make tea. This knowledge may have originated in Lokono populations — certainly it was by Lokono people that I was first served locust tea - and much of the ethnobiology of this tribe has been assimilated into the general forest lore of the Guyanese coast. Historical patterns of transfer of knowledge among culturally distinct sectors of the Guyanese population must have been complex. The role of past and current interactions as a result of shared involvement in the industries of the interior, including logging and mining, would be a fascinating area of study.

Exports of NTFP's of plant origin are currently dominated by a single product, the canned, edible hearts of the manicole palm, *Euterpe oleracea*. This is based upon the enterprise of a single company, AMCAR, who were awarded a concession of around 50,000 ha in Guyana's Northwest district in 1987, and began commercial operations in 1989. By 1997, over 23,000 palm hearts were being canned in AMCAR's factory daily, an output worth over USD 2 million annually. Over 1000 local people, mainly from neighbouring Amerindian villages, receive a regular income from this, either as direct employees or by cutting palm hearts for sale to the company; many more people cut palms on a more casual basis as their economic needs dictate. Two independent evaluations of the operation concluded that the employment

opportunities provided were of net benefit to the area, although hardship had resulted for some people who had neglected subsistence tasks for the sake of a cash income, but observed that harvesting levels were exceeding the limits of sustainability. Both of these studies included recommendations as to how sustainable harvesting might be achieved, which have since been acted upon by the company (Johnson 1994; Andel et al. 1998).

Export records for 1996 included several other products derived from forest plants, though in far smaller quantities. These are 'nibi' and 'kufa' (the aerial roots of, respectively, *Heteropsis flexuosa* and *Clussia* spp.) to a total value of around USD 130,000, tibisiri (a weaving material derived from the leaf of the etai palm, *Mauritia flexuosa*) to a total value of around USD 10,000, and a tiny volume of 'mokru' *(Ischnosiphon arouma)* (Andel and Reinders 1998: 6). All of these are materials traditionally and widely used for weaving by Amerindians throughout Guyana. The same figures also included several thousand dollars' worth of various medicinal plants. If, as the figure above suggests, the market for these is mostly expatriate Guyanese, it is likely that most are components of coastal pharmacopoeia, although as already noted much of this may be derived from Amerindian ethnopharmacological knowledge (Austin and Bourne 1992: 293). Though barely any research attention was given to Amerindian knowledge of plant-based remedies prior to the 1990's (Austin and Bourne 1992: 293) it was the subject of a great upsurge of interest in that decade. Medicinal plant use among Amerindian population was the major focus of several research projects (Reinders 1993; Forte et al. 1996a; Andel 1998; Riley 1998), although more recently local fears of biopiracy have made this a highly controversial area in which to work.

National uproar was caused when pharmacologically active compounds derived from plants used for medicinal purposes by Makushi and Wapishana people were the subject of a patent by the ethnobiologist Conrad Gorinsky, acting without consent at either the local or national level. Fears of a repeat scenario provided the basis for many of the current regulations governing the activities of foreign researchers in Guyana, in which documentation of ethnomedicine and the export of live plants are closely restricted (EPA n.d.). It has been acknowledged at governmental level that the legislative framework with respect to local and indigenous knowledge does not adequately address the issues of protection and benefit sharing (EPA 1999: 45), but there is a clear impetus towards attempting to rectify that situation. In the meantime, some Amerindian people are taking charge of the situation themselves. Legal action is reportedly being taken against Gorinsky on behalf of several

Wapishana communities in which he worked (Singh 2000). In my own research situation, one of my host villages responded to their fears of biopiracy by requesting that I promise not to pass on any information given to me about medicinal uses of plants. A written agreement was subsequently made to the effect that I remove all references to such information from my fieldnotes prior to allowing them to be read by any third party. This contradicts somewhat one of the regulations concerning the obligations of foreigners conducting research in Guyana: that a full copy of fieldnotes is deposited with the EPA prior to departure from the country. Thus the ironic situation arose that I was unable to discharge, in full, an obligation to the Guyanese authorities imposed largely as a result of legitimate concerns relating to international biopiracy, because of local-level concerns about the prospect of biopiracy within the country. This provides some indication the complexity of the issues faced in relation to the commercialisation of indigenous knowledge. Clearly a great deal of work lies ahead for both national authorities and indigenous representatives, as they work together to devise protocols relating to possible commercial applications that are equitable and satisfactory to all concerned. Until this is achieved the economic, and ideally conservation, potential of this intellectual resource is unlikely to be realised.

Another non-timber forest product whose commercial potential is not currently being realised is the Brazil nut, fruit of the forest tree *Bertholletia excelsa*. Large-scale extractive industries based upon this product are already established in Brazil and Bolivia. The annual commercial production from these countries is estimated to average around 50,000 tonnes. Around 200,000 people are thought to be involved in the commercial harvest, which involves the collection of fruits from approximately 2-3 million trees in an area of 2-3 million hectares (Clay 1997: 246-252). A large-scale conservation programme based in Peru seeks to develop further the value of the Brazil nut harvest as a tool for the protection of vast areas of forest spanning an area shared by Peru, Bolivia and Brazil (Ortiz et al. 1998). The botanical potential, at least, for such an operation also appears to exist in southern Guyana.

Many Wapishana people reported to me the existence of vast stands of Brazil nut trees deep in the forests of the basins of the Rewa, Kwitaro, Essequibo, Kujuwini and Kassikaityu rivers[1], but these are currently exploited only for subsistence purposes.

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1 The existence of these stands could be important in the context of the Wapishana land claim mentioned in chapter 3.3.1. Balée (1989: 9) considers stands of Brazil nut trees, *Bertholletia excelsa*, to be unambiguous indicators of prior human modification of forests. The stands in question therefore exist as a result of the activities of people presumably ancestral to the present-day Wapishana (see chapter 3.2.1), and provide evidence in support of their claim to these areas.

During the 1970's, one or two Wapishana entrepreneurs used to undertake a small-scale commercial harvest, selling the nuts to ranchers. One such former buyer reported that the harvest was exported to Trinidad, but that the collectors had since passed away or grown too old to continue their work and collection had hence ceased. I have occasionally seen Brazil nuts on sale in food shops in Lethem, on the Brazilian border, which shopkeepers told me had been imported from Brazil. In Georgetown they are, as far as I know, available only in a single shop, an outlet for health foods and herbal medicines. The owner of this shop told me that he imported the nuts in small quantities from the USA, and that he was not aware of any source within Guyana.

The major impediment to the trade appears to be the low retail price within Guyana. Traders operating within the South Rupununi told me that during 1999, a group of Waiwai collectors had brought several tonnes of Brazil nuts to the end of a vehicle track on the Kujuwini river in the hope of selling them. This proved impossible, as even at the low price requested by the collectors (GYD 50 per pound, about USD 0.60 per kilo), addition of transportation costs would make the production price exceed what the nuts could be expected to sell for wholesale in either Lethem or Georgetown. However, I have calculated that, given the high retail price commanded by Brazil nuts in wealthier countries such as the U.K., an export trade could be economically viable. What is currently absent is the links between producers and primary buyers at one end, and exporters and importers at the other.

2.5.2 The commercial exploitation of forest animals: the trade in wild animals

In recent times, of far greater magnitude than the commercial extraction of plant-based non-timber forest products has been the capture and export of live animals for the pet trade. A report on this activity was published in 1992, and although the pace of change since that time means it is now quite dated, it is still the most useful summary available. At the time, a representative of the Guyana Wildlife Exporters Association calculated that the industry employed 430 people directly in connection with export, along with 7,540 trappers and domestic traders. Including the families of these people, an estimated 50,000 people would therefore have received direct financial benefits, and a further 2,000 were estimated to benefit indirectly by providing goods or services to those involved. It is estimated that Amerindian people make up 75 percent of these beneficiaries: in particular, the vast majority of trappers are Amerindian men (Edwards 1992: 82-83). If correct, these figures would

correspond to a remarkably high proportion of Guyana's Amerindian population. The total value of registered wildlife exports was calculated to be USD 2,100,000 in 1996 (Andel and Reinders 1999: 6).

The trapping of animals requires indigenous knowledge of their ecology and behaviour to be applied in a highly detailed and precise fashion. In accompanying Arawak and Warao trappers on a collecting expedition for macaws (*Ara* spp.) on the Correntyne, I had an opportunity to observe this in practice. Specific locations are used for trapping on the basis of their fulfilment of strict criteria: trees of species known to be important for feeding at the time of year that trapping takes place, located on routes over which large numbers of birds are known to fly. The trappers I was with were familiar with several such locations spread over a large area, to each of which they had returned repeatedly over the years they had worked as trappers. Trappers work in pairs, one of whom climbs to a position near the top of the tree, where he constructs a hide, while the other waits at the base. He takes with him a tame individual of the species being trapped, which is held on a leash and placed in a location where it will be visible to passing birds. Any bird that lands to join the trapper's 'calling bird' is caught in a net by the trapper in the tree, who quickly docks its wings to prevent flight and drops it to his partner on the ground. Some trappers told me that they employ a different technique for the capture of macaws, involving the application of adhesive to the branch where it is hoped birds will land. The techniques involved in the trapping of different species will obviously vary according to their ecology and behaviour.

The sustainability of the trade is a controversial subject. Species-specific quotas have been in force since 1987, but these were set in the absence of any baseline population data that might have been used, and despite downward revision on advice of the CITES secretariat, are scientifically naïve and may thus exceed sustainable harvesting levels (Edwards 1992: 79; Thomsen and Mulliken 1992: 229). Much of the trade is undocumented and unregulated, being either domestic - assumed to be substantial in size due to the popularity of keeping animals as pets - or illegal exports across the land borders to Brazil, Venezuela and Suriname. Birds - mostly Psittacines and toucans - form the most conspicuous component of the trade, but are actually outnumbered in the documented trade by reptiles; amphibians and some species of mammals are also exported in small numbers (P.E. Williams, pers. comm. 1997). The export of several species is banned, including, all those listed on CITES, to which Guyana has been a signatory since 1977 (Edwards 1992: 77). It is unlikely that any Guyanese species is threatened with national extinction by capture for the licit export

market: exporters interviewed by Edwards suggest that only about 10 percent of available habitat is exploited for live capture (Edwards 1992: 79), although local population decline is a possibility. Illegal export of certain species may be a problem: populations of Arapaima gigas and giant river turtles in the Rewa and Rupununi rivers are reported to be seriously threatened by capture for export to Brazil, despite their CITES-1 listing, as the means are simply not available in Guyana for enforcement of this law.

The effectiveness of CITES in achieving any practical, rather than purely symbolic, successes in conservation has been called into question (Trexler 1990), and the Guyanese case supports this argument. Excessive attention and resources are directed towards an issue of relatively minor importance in terms of national conservation, at the expense of a country with limited means to fulfil the regulatory obligations imposed upon it. Furthermore, there is a danger of the economic value of Guyana's wildlife being reduced by hampering a trade which has the potential to operate sustainably, and provides employment for Amerindian people within their local areas and based upon local knowledge. One specific example is the wish of a north Rupununi community to begin the harvesting of black caimans *(Melanosuchus niger)* for meat and skins. Although the local abundance of this species is such that it has reached pest status and represents a threat to human life, its CITES listing precludes access to an export market for its products while doing nothing to protect less numerous populations in other locations from unsustainable exploitation.

Aside from the trade in wild animals, a few species are also harvested for sale as 'bush meat' in restaurants in Georgetown and other coastal settlements. Species I have noted on the menus in such establishments include laba *(Agouti paca),* lowland tapir *(Tapirus terrestris),* both species of peccary *(Tayassu tajacu* and *T. pecari),* agouti *(Dasyprocta agouti),* waatrash or capybara *(Hydrochaeris hydrochaeris),* and unspecified species of cervid (Most likely *Odocoileus virginianus* and/or *Mazama americana).* Various species of fish found in watercourses in the interior also enter the urban food chain by this route. No data has been collected on the source of these meats, but as the harvest area involved is necessarily restricted to those areas within relatively rapid travel distance of Georgetown the impact on animal populations is likely to be local.

Several animal species native to Guyana have a demonstrated potential for sustainable harvesting, and in some cases semi-domestication or other forms of controlled management, which can under appropriate conditions provide an economic incentive for conservation of their habitats (Werner 1991; Smythe 1991;

Thorbjarnarson 1991; Ojasti 1991; Thomsen and Brautigam 1991; Vaughan and Rodriguez 1991; Hoogesteijn and Chapman 1997). Hunting also has considerable current subsistence value for both Amerindians and non-Amerindians living or working in the forests. Both of these could be important components of future sustainable use programmes in Guyana's forests. Steps towards formalising and effectively regulating animal harvests are being taken. The government plans to embark upon a nationwide programme of wildlife surveys aimed at providing baseline data on wildlife populations, though I am not aware of the extent to which forward planning regarding the implementation of the findings in management programmes has been incorporated into their design. This thesis advances the case for greater involvement of Amerindian populations in both planning and implementation of survey, monitoring and management programmes related to wildlife.

2.5.3 Conclusion

Non-timber forest products of both zoological and botanical origin have a long history of exploitation in Guyana, and continue to make significant contributions to local livelihoods and the national economy. However, the above account suggests economic and conservation potentials far greater than are currently being realised. Many products of commercial potential are, for a variety of reasons, being harvested at levels well below their full potential. Those that are currently exploited are subject to little or no regulation of a nature that is likely to ensure that harvests remain sustainable, leading to apparent local depletion in some instances. Furthermore, the evolution and operation of extractive activities is haphazard and unregulated. No measures are in place at either national or local levels to ensure that possible negative social consequences of the economic disruption that can accompany the introduction of new income-generating possibilities are avoided. While opportunities to earn a cash wage are welcomed in most cash-starved interior villages, they can expose people to dangers such as declines in living standards resulting from a neglect of subsistence activities by wage earners, or the introduction of new dependencies on manufactured goods which can no longer be fulfilled if the source of income vanishes.

On the other hand, in many respects the prospect of a greatly expanded national market in non-timber forest products, based upon small-scale and local operations subject to central monitoring and regulation, could be of great benefit to many sectors of the Guyanese population. Reliable incomes could be provided for independent producers in Amerindian communities, free to choose their own work schedule and hence combine these activities with subsistence tasks. Economic

benefits could also be expected to accrue in regional and coastal settlements involved in transportation and marketing. This idea is nothing new: in the 1940's, it was advocated that the colonial government seek to develop markets for a variety of forest products that could be collected by Amerindians. In conjunction with greater, more equitable involvement in existing interior industries (logging, ranching and balata), in each of which Amerindian skills were already crucial, it was envisaged that this could provide a path towards the economic integration of Amerindian people on their own terms (Peberdy 1948: 8, 30).

The modern state of Guyana has the human capacity to respond to economic possibilities by creating functioning organic linkages between producers in the interior and retailers or exporters in Georgetown and other major coastal towns. This is clearly evinced by, for example, the current nature of the wildlife trade, or the availability of fruits of forest trees on market stalls in Georgetown. In some cases what is missing is information about and access to possible export markets, as is the case with Brazil nuts. In others the deficiencies may be of a different nature, such as a lack of access to start-up capital, limited knowledge of economic potential, absence of reliable and honest intermediaries or, as in the case of medicinal plants, fear of inequitable relations. Many could possibly be overcome by a programme which would systematically identify the reasons why particular marketable products are *not* being exploited, devise and implement mechanisms to overcome these barriers, and work with local authorities at community levels to ensure the social and ecological sustainability of any extractive enterprises.

Local knowledge is central to all aspects of the exploitation of non-timber forest products. Many are ultimately based upon indigenous usage, and the location and appropriation of products in the forest may depend heavily on both intellectual and practical expertise relating to the forest environment. This thesis contributes to some extent to answering the question of whether such skills could contribute to the expansion of extractive industries in Guyana. Data is presented relevant to indigenous contributions to both the production and monitoring aspects of this. The key measure of the success of such a development would be sustainability, in both social and economic terms. Its potential benefits are seen to be that, in contrast to logging and mining, it could enhance the economic value of forests without contributing to environmental, social or cultural degradation. In connection with other approaches, it could form a key component of a national strategy for biodiversity conservation. These other approaches also have strong implications for Amerindian people, and it is this which is the subject of the next section.

2.6 Conservation interest in Guyana

Recent years have seen Guyana assume a position of huge importance in the global forest conservation debate. It is estimated that forest, much of it pristine, still covers 80 percent of the country (Ek 1996: 15). Over 1000 tree species have been recorded, in a total flora in excess of 8000 species, 30 percent of which are estimated to be endemic, and 1063 species of vertebrates (Conservation International 1997). In 1997, Guyana was highlighted as one of only eight countries worldwide in which a realistic potential for large-scale sustainable management of forest resources still exists (WRI 1997). The consequent interest from conservationists has resulted in much external pressure to adopt a development path that is compatible with the maintenance of biodiversity and ecosystem integrity. While this may have served the interests of the Amerindian population to some extent, in terms of support in their conflicts with extractive industries in the interior, it has also created problems of its own. The rhetoric of participatory conservation has rarely transferred into action, and Guyana's nascent conservation enterprise has already come into conflict with Amerindian communities.

2.6.1 The National Protected Areas System Programme

The most high-profile conservation scheme mooted for Guyana has been the National Protected Areas System Programme. Guyana is the only country in South America, and one of very few in the world, without a national system of protected areas. During the 1990's, with no apparent sense of irony, the World Bank initiated a programme to rectify this situation. This included the nowadays-obligatory pretence of consultation with the Amerindian population, when captains of villages from throughout the country were flown in to an expensively assembled meeting at Paramakatoi in 1996 (Government of Guyana 1996). Despite several flying visits to Guyana by World Bank employees and consultants, little progress appeared to be achieved by their collaboration with the government of Guyana. The stop-start process finally ground to a halt after the APA contacted the World Bank to air its complaints about the lack of meaningful Amerindian consultation and the unsatisfactory situation regarding indigenous land rights. The response of the bank was to hold up its funding allocation for the programme. The APA has since contacted both the World Bank and the Guyanese government in efforts to resurrect the programme in a form that incorporates the settlement of outstanding land claims (APA Executive Council 2000).

In the meantime, the government took its own path, and in 1999 then-president Janet Jagan signed an order extending the boundaries of Guyana's single national park at Kaiteur Falls. The neighbouring Patamona community of Chenapou objected to this on the grounds that they had thus been prohibited from using, or even entering, vital hunting, fishing and gathering grounds and their major river transport routes (Chenapou Village Council, 1999). Pressure from the APA on this issue caused President Jagan to agree to amend the act creating the national park in order to rectify this situation (APA 1999a), an promise also made by her successor Bharat Jagdeo (APA 2000b). However, an article in the Stabroek News of 4th March 2002 reported that the community had filed a legal order in the Guyanese courts to arrest the progress of the national park, and was due to hold meetings with President Jagdeo to discuss the matter.

The same article reported that the government was preparing a revamped proposal for submission to the World Bank, and was seeking funding for programmes leading to the designation of protected areas at several key sites. These are the Kanuku Mountains in the southwest of the country, which I discuss more below, Shell Beach, a nesting site for four species of marine turtles located in a remote region of the northwest coast where small-scale research and conservation projects have been underway for some years, and the Guyanese part of Mount Roraima on the borders with Brazil and Venezuela. The proposal is also due to include continuation of work at Kaiteur Falls, and gives substantial emphasis to consultation with Amerindian communities in the vicinity of any proposed protected areas, particularly in Kanuku, where the consultation programme is already well underway. The involvement of local Amerindian communities has also become a key component of what is currently the only functioning protected area in Guyana, the Iwokrama Forest Reserve.

2.6.2 The Iwokrama Rain Forest Programme

The Iwokrama programme has its origins in former president Desmond Hoyte's allocation of 360,000 hectares of forest in central Guyana for conservation purposes, announced at the 1989 meeting of commonwealth heads of state in Malaysia. After a faltering start, the programme of research, conservation, public education and community outreach centred on the forest reserve has become increasingly large and dynamic, and it is nowadays the major focus of conservation efforts in Guyana. Engagement with Amerindian communities in the vicinity of the forest has been a major preoccupation of the programme since visits were first made to two villages in 1992. Particularly since Guyanese NGO Red Thread took on a contract for community

outreach in 1995, links between Iwokrama and its neighbours have strengthened, and local levels of confidence and interest increased (Scherl 1998: 5-14). The relationship was institutionalised when twelve mainly Makushi communities within its catchment area formed the North Rupununi District Development Board. Though its mandate is broader, a major function of this is to act as a representative organ for these communities in dealings with Iwokrama.

One of the NRDDB's earliest activities was its participation in the documentation of local biodiversity use and ethnopharmacological knowledge (Forte et al. 1996a, 1996b), and it has since continued to be actively involved in Iwokrama-related research activities relevant to its member communities. Iwokrama has continued to dedicate much attention to its relationship with NRDDB communities, and sponsored numerous local initiatives related to awareness raising and capacity building (Watkins et al. 1999: 15-20). The programme's resident wildlife biologist has been engaged in an extensive and ongoing investigation into local knowledge of forest ecology, and is now seeking to develop community-driven programmes in wildlife research and management (Iwokrama 2000). A conference on wildlife management organised by Iwokrama during the year 2000 numbered Guyanese Amerindians among its speakers and other participants. Iwokrama has also hosted a predoctoral research programme concerned with human-forest relationships, involving several NRDDB member villages (Allan 2002). The need for Iwokrama to extend its outreach activities beyond its immediate geographical area, and beyond the scope of the NRDDB, has been noted (Scherl 1998: ix). First steps towards this have been taken, in the form of a workshop held during 1999 to which representatives of all Rupununi communities were invited (Iwokrama 1999).

Iwokrama has thus demonstrated a progressive attitude towards local Amerindian communities, devoting a great deal of time and human resources towards both political relations with its neighbours and the documentation of various aspects of indigenous knowledge. Certainly the programme has to be applauded for the creative and sincere way in which it has addressed these subjects, although I feel that it could go somewhat further. Research attention to indigenous knowledge appears to be quite decontextualised, concerned solely with its practical utility within what are nowadays fairly conventional practices related to the management of the reserve. While this is probably no bad thing in itself, I feel that the organisation could go further, and seek to investigate the potential that a broader treatment of indigenous knowledge, as a set of knowledge and praxis that is embedded in a particular social-ecological system, might have for its overall management and institutional structure.

In short, a more in-depth treatment of indigenous knowledge might lead to results that would challenge and help to transcend the management and institutional contexts within which the programme currently operates. The high profile, organisational strength, and access to human, technical and financial resources, combined with the commendable level of dialogue that it has already established with indigenous communities, means that Iwokrama is ideally placed to become a true innovator in the field of applications of indigenous knowledge in biological conservation.

Iwokrama's potential role in cultural conservation should also be stressed, and may already be developing as a consequence of the employment within the programme of significant numbers of residents of neighbouring Amerindian communities, mainly as rangers. The provision of opportunities for people to earn a living largely based in the forest may functionally replace many of the traditional arenas in which knowledge relating to the use of the forest is acquired, in cases where the latter are in decline. Certainly such opportunities would for this reason be welcomed in the communities in which I was working. Concern was expressed in these locations that the tendency of young people to shun traditional activities at home in favour of emigration from their home region in search of wage labour could lead to loss of knowledge, and ultimately, of the basis for economic self-sufficiency. In this respect, employment as rangers could functionally replace the balata trade, thanks to which many interviewees in the ethnoecological component of this study had spent far more extensive periods in the forest than they might otherwise have, over the course of which much of the knowledge documented in this study was acquired. Such would also apply to potential employment in relation to such further protected areas as will eventually be established, as well as in the realisation of the scenarios relating to extractive industries and their monitoring described above. Ongoing training and educational programmes such as are currently undertaken by Iwokrama rangers may also contribute to the effective advancement of indigenous knowledge systems. Such competence as may thus be attained in formal, scientifically-based systems of understanding may, as the present study explores, be complementary to what many of these people already know. The contribution that people competent in both traditional and scientific knowledge of biology may be able to make their integration may be formidable.

2.6.3 Other Activities Relating to Conservation in Guyana

Most notable of many government initiatives in conservation over recent years has been the passing of the national environment act in 1996 (EPA 1999: 27), the major outcome of which was the founding of the Environmental Protection Agency (EPA). The EPA is the first government department in Guyana to be concerned primarily with environmental issues, and unifies several functions formerly dispersed among numerous ministries and departments. The National Biodiversity Action Plan, produced by the EPA, does not give particular prominence to indigenous matters. It does, however, mention numerous issues of relevance to Amerindians and highlights the need for a concerted programme of research on traditional resource use and ethnobiological knowledge (EPA 1999: 47).

Guyana is also signatory to a number of international agreements with potential implications for indigenous people, including the Amazon Cooperation Treaty, Rio Declaration, Convention on Biological Diversity, Agenda 21, and CITES (Sizer 1996: 212). Government rhetoric has increasingly reflected the global increase in levels of concern with indigenous issues, but how this may translate into practice without conflicting with short-term economic goals remains to be seen.

Numerous local and international NGO's are, or have in recent years been, active in Amerindian communities, with greater or lesser measures of effectiveness (Forte and Pierre (1994) give a list of examples from the Rupununi region). In addition, several international conservation NGO's are now active in Guyana, and many of their activities impact in some way on Amerindian communities. Conservation International (CI) has a long-standing interest in the Kanuku Mountains, and initiated a programme to add fiscal value to the forest in their vicinity by developing a market for balata carvings made by artisans in the village of Nappi. CI has also recently established a 'conservation concession' in a remote area of forest in central Guyana, where they have purchased logging rights with the intention of preventing logging and investigating alternative land-use practices. The World Wide Fund for Nature established its Guyana office in 2000, and has taken an interest in Shell Beach, an important nesting area for marine turtles on Guyana's north-western coast. A project has operated in the area for a number of years, concerned with reducing hunting and egg collection by local populations via developing economic alternatives to the harvest and raising public awareness within the villages.

2.7 Summary and conclusion

Over the past decade or so, rapid change in Guyana has affected its Amerindian population, many of whom now find themselves in conflict with logging, mining, conservationist and other interests over access to land and other natural resources. The existing system of land tenure is inadequate to provide protection from these intrusions. Many Amerindian people in Guyana regard their freedom to choose their lifestyle and maintain their cultural distinctiveness, and in some cases their very livelihood, to be under serious threat.

However, Amerindian representation at the national level is becoming increasingly strong via several indigenous organisations, and indigenous participation in national politics is also becoming more significant. Increasing levels of awareness of the need for indigenous consultation among all groups interested in Guyana's interior are becoming manifest in practice, with varying degrees of sincerity and success. Guyana's government is also taking steps towards fully addressing the needs of its indigenous constituents, though these efforts are hampered by the need to reconcile this with other economic and political goals. There is still some way to go before the government achieves common ground with indigenous representatives, but progress does at least appear to be taking place. New government initiatives concerned with environmental protection are coming into effect, and promise to help improve the situation of Amerindian communities negatively affected by mining and forestry.

While all these developments are surely welcome, Amerindian leaders do not regard them as sufficient. A joint statement issued by **toushaos**[2] of Amerindian villages from all over Guyana in 2000 expressed continuing dissatisfaction with the effects on their communities, and lack of adequate consultation and participation, with respect to several areas. These included forestry, mining, road building, designation of protected areas, and resolution of land rights (APA General Assembly, 2000).

A further weakness of all development interest in Guyana's interior is the relative lack of attention to the particular intellectual contribution its indigenous population may make towards achieving the goal of environmental sustainability. It is well recognised that Guyana faces an extreme shortage of human capacity with respect to resolving the conflict between the need to exploit the resources of interior for the

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2 '**Toushao'** is a Wapishana term for the leader of a village, which in recent years has been adopted by Amerindian groups elsewhere in Guyana in the place of the term 'village captain', previously employed to refer to the elected political head of the village.

benefit of the entire national population and to ensure the maintenance of the myriad ecological services they provide (EPA 1999: 37). While some attention has been given to indigenous knowledge of potential commercial value, the broader contribution of Amerindian technical skills, knowledge systems and cosmology, has not been given due attention. A lack of information is certainly a factor in this - the Iwokrama studies in ethnoecology aside, there has been little research on these dimensions of indigenous knowledge, and little data upon which to base any initiatives concerned with the practical applications of indigenous knowledge.

In principle, as the above analysis suggests, the indigenous knowledge of Guyana's Amerindian population could have diverse applications in development in the interior. It is important not to overstate the case: the problem of addressing conflicting interests and determining a development strategy of the greatest mutual benefit to Guyana's population as a whole is not one which has any simple solution. While indigenous knowledge may well represent a body of cultural capital whose potential contribution to this process is great, it is not by any means a simple or straightforward solution. Its documentation and application themselves entail complex problems in methodology, analysis, incorporation into planning and benefit sharing, all of which must be carefully addressed. Their resolution within Guyana will require a great deal of co-operative work among Amerindian communities and their representative groups, government departments such as the EPA, Ministry of Amerindian Affairs, Guyana Forestry Commission and Guyana Geology and Mines Commission, The University of Guyana and other relevant research bodies such as the National Agricultural Research Unit and Water Roth Museum, Iwokrama and whatever future bodies are formed with management responsibilities for protected areas, and representatives of commercial interests in the resources of the interior.

This thesis seeks to contribute to that process, being based upon ethnographic research undertaken in collaboration with one of Guyana's least-studied Amerindian peoples and explicitly concerned with the question of indigenous contributions to conservation, resource management and development within and beyond their own lands. The next chapter moves from the national to the regional level, and is concerned with the history and current situation of the Wapishana people. The emphasis is on the increasing influence of exogenous forces, potential ways in which this might threaten local livelihoods, and local responses to these changing circumstances.

CHAPTER 3: THE RUPUNUNI REGION AND THE WAPISHANA PEOPLE

The present study was located within Guyana's Region 9, officially referred to as Upper Takutu-Upper Essequibo but more commonly known as the Rupununi region after the Rupununi River, which flows north through the region, and the adjacent Rupununi savannahs. The savannahs are around 13,000 km^2 in extent, and form an eastward extension of the much larger (41,000 km^2) Rio Branco savannahs in the adjacent northern Brazilian state of Roraima (Hills 1973: 351). The administrative region within Guyana totals roughly 74,000 km^2 in area, the greater part of which is therefore forested (Forte and Pierre 1994: 7).

Figure 3.1. The Rio Branco and Rupununi savannahs (derived from Eden 1986: 256)

The forested Kanuku Mountains almost bisect the Guyanese portion of the savannahs along an east-west axis. To the north lie the South Pakaraima Mountains, and the

forests of the Rupununi River itself form the eastern boundary of the north savannah. The south savannah is bounded on the east by the forests of the Kwitaro river basin, while east of there the Rewa and Upper Essequibo rivers also lie within the region. The southern border of the savannah is formed by the forests of the Rupununi headwaters and the Kujuwini river, south of which lie the Kassikaityu and Upper Takutu, the latter forming part of Guyana's south-western border with Brazil.

The reasons for the existence of the savannah are unclear and it appears not to have any simple explanation, but rather to be the current historical manifestation of a complex interaction of climatic, edaphic, biotic and anthropic factors (Hills 1973: 353-6). Five distinct vegetation types have been recognised, ranging from entirely herbaceous savannah to closed savannah woodland. In terms of area, herbaceous savannah and open savannah woodland are most widespread among these. The dominant species is the grass *Trachypogon plumosus*, which is found in association with numerous less abundant species of grasses, sedges, forbs and herbs. The dominant woody species is the 'sandpaper tree' or **cayambi**, *Curatella americana*, and species of *Byrsonima* of tree, shrub and herbaceous habit are also common (Hills 1973: 359-60).

This chapter provides background information on the Wapishana people, one of the four distinct indigenous groups resident in Region 9 and the tribe of which the people with whom this thesis is concerned are members. I will first relate significant aspects of the situation regarding economic development in the region. The next section gives an account of the recorded history and present-day circumstances of the Wapishana people in Guyana. These two themes are integrated in the final section, which is concerned with local attitudes and responses to the changing situation in which these people find themselves.

3.1 Environment and Economics in the Rupununi

3.1.1 Environmental constraints on economic development in the Rupununi

The economic potential of the savannahs is severely limited by both climatic and edaphic characteristics. In both savannahs and the adjacent forests the annual rainfall cycle is strongly unimodal, up to 80 percent of a fairly variable annual total, averaging around 1800 mm., falling at the height of the rainy season between May and August. The result of this is a severe hydrological imbalance, typical years alternating between extensive flooding, particularly of the southern savannahs, and widespread desiccation and local water shortages at the height of the dry season (Loxton 1958:

5-9). The hardship that this entails for the human, animal and plant populations of the region was greatly exacerbated by the particularly severe El Niño-induced climatic disruptions of the late 1990's. Droughts during 1998 led to widespread crop failure, forest fires, and death of livestock, game and fish populations. During 1999 and 2000, heavy unseasonable rains caused flooding of many low-lying fields, disrupted the annual migration patterns of fish, and caused severe difficulties with transportation at unusual times of year.

Most savannah soils are highly infertile and unsuitable for agriculture, which is possible in most areas only when the soil is enriched either by the concentration of nutrients in corrals or the use of long-fallow swidden techniques (Rutherford 1956). Commercial activity, such as it is, is dominated by cattle ranching, but this too is highly constrained by the hydrological cycle and the limited availability of grasses of high nutritive value. Periodic burning of the savannahs, which destroys humus and exposes the soil to further degradation, overgrazing and lack of pasture management further reduce the availability of palatable forage. Profitability is generally marginal at best, which has been an impediment to capital investment and a disincentive to experiment with methods for improving returns (Daniel 1985).

A period of relative prosperity in the cattle industry resulting from the introduction of air transport to take beef to the coast (Rutherford 1956: 5) was somewhat brief. Economic stagnation, caused by persistent transportation and marketing difficulties, has led to a decline in herds to an estimated 15 percent of their size in the 1970's, and the Rupununi Livestock Producers Association is seeking to initiate projects to rejuvenate the livestock industry (RLPA n.d.). Attention has also been given to agricultural development at the village level. A meeting of farmers and leaders from all Region 9 communities held in 1999 identified the difficulty of transportation and restricted market access as the major impediments to agricultural development in the region. Priority crops identified for commercial development were peanuts, cashew nuts, cassava and mangoes. Projects in food security, sheep and goat rearing, aquaculture, handicrafts and solar drying of fruits and nuts were also mooted (Regional Democratic Council of Region 9, 1999).

3.1.2 The Georgetown-Lethem Road

Historically, the Rupununi has been something of a backwater, its remoteness and inaccessibility from Georgetown conspiring with its minor contribution to the national economy to preclude any major development initiatives. This may have been exacerbated by the Rupununi uprising of 1969, when an insurrection led by a group of

ranchers narrowly failed in their alleged aim of securing political autonomy from Guyana for the region (Ridgwell 1972: 221-2). While the indigenous and ranching communities have conflicted in various ways, particularly in the north, the region has received little attention from other quarters. In recent years, however, Guyana's decreasing isolation has manifest locally and brought a variety of interests to bear on the lands of the Rupununi.

The most apt demonstration of the decreasing isolation of the Rupununi is the fact that the region now has a road link with the rest of Guyana. This unpaved road, completed in the early 1990's, traverses the north savannahs from Lethem to the major Makushi settlement of Annai, bisects the Iwokrama reserve, and further north connects with the national network at the town of Linden on the Demerara River. The greater proportion of traffic on the road is composed of ex-British-army Bedford trucks, which are about the only vehicles capable of making the journey at the wettest times of year, although access by less powerful vehicles is possible during the dry season. The road has substantially reduced the costs of both passenger and freight travel between Lethem and Georgetown, and facilitated local travel in some areas of the north savannahs. Residents of Annai are reported to have welcomed the project, and had previously attempted to clear trails along the present route northwards on their own initiative (Forte 1990b: 7).

Problems resulting from the difficulty and expense of transportation throughout the Rupununi are a source of great hardship to many of its residents. A thesis concerned with development in the South Rupununi, written prior to the completion of the road, makes repeated reference to this issue and calls for the improvement of road facilities within and beyond the region to be given the highest priority (Tang 1995: 93, 97, 109-110, 119, 132). However, concerns have been raised that Guyanese interests are being overlooked in a project whose ultimate driving force is the economic benefits that will accrue to Brazil once it has a road link to South America's northern Atlantic coast. The brunt of the social and environmental costs generally associated with road building in Amazonia will be borne by Guyana, and measures have not been put in place to safeguard against these (Forte 1990b; Forte and Benjamin 1993).

I am not aware that, thus far, many of these fears have been realised, although I did on occasion hear reports of game depletion on the northern savannahs as a result of sport hunters travelling from Georgetown. Lethem grew in size conspicuously over the course of this study as a result of increased migration from the coast, though no immediate effects of this upon the villages of the region were manifest.

Infrastructural improvements such as the introduction of a telephone service and a reliable, 24-hour electricity supply may have as much to do with this as the presence of the road, though the latter is certainly contributing, and continued road improvements will only accelerate this process.

Following a diplomatic visit to Brazil by President Janet Jagan in May 1999, she and the Brazilian president released a joint communiqué stressing improvement of the road, including construction of a bridge across the Takutu, as a key component of the improvement of communication between the two countries. An article in the Stabroek News of 22nd August 1999 indicated that EU financing may be forthcoming for the upgrading of the current road to an all-weather surface. Although environmental and social impact assessments are being undertaken, regardless of their results it must only be a matter of time before the project goes ahead. The encounter between the Rupununi and the outside world which will inevitably result could prove traumatic. The conflicts of interest and dangers to the security of indigenous populations that will result from this are already starting to manifest. As is the case elsewhere in Guyana, Amerindian populations in the Rupununi are increasingly facing the prospect that their lives may be affected by the activities of outsiders from both commercial and conservation sectors.

3.1.3 The timber industry in the Rupununi

There is not currently any industrial logging in the Rupununi region, though timber is extracted on a small scale for house building both within indigenous communities and for sale to Lethem. The toushao of Parikwarawaunau, the closest Wapishana village to Lethem, which does not have any titled land, reported occasional problems with outsiders from both Lethem and Brazil cutting timber from lands used by the village without permission. Extension of the state forest boundaries brought the area available for industrial logging to within the area of use of Rupununi villages. Four large exploratory leases were reportedly made available to Asian companies, extending south to areas within the Rewa river encompassed by the local land claims and greatly beyond the existing national transport network (GHRA 1997). The prospect that this might lead to the onset of large-scale timber extraction in the region was one about which many people in the Rupununi were greatly concerned on my arrival. However, perhaps because of financial constraints exacerbated by the lack of existing infrastructure, no concrete activity ever came about in relation to these concessions and the proposed investments never materialised. Maps have not been

released, but it may well be that Conservation International's concession is located in one of the areas made available at that time.

3.1.4 The mining industry in the Rupununi

The mineral extraction industry is more firmly established in the region, and gold has been mined at Marudi and Bat Mountains since the 1920's (Grantham 1939). A study conducted in 1989 observed the presence in the area of large numbers of small-scale miners, including Amerindians from the Rupununi and elsewhere in Guyana but dominated in number by non-Amerindian Guyanese. Visible detrimental effects on populations in the local villages included rising food prices, long-term absenteeism of male heads of households, and the consequent neglect of farming activities (ARU 1992: 29). During the 1990's, a clampdown on illegal mining in Roraima state was reported to have led to increased illegal activity on the part of garimpeiros - self-employed Brazilian miners – in both Marudi and the Kanuku Mountains (Forte 1997: 73).

More recently, corporate mining interests based in Canada have held concessions in the area, first Romanex (Colchester 1997: 89) and, currently, Vannessa Ventures. According to the company's website, Vannessa was awarded licenses for mineral prospecting over huge areas of land within various parts of Guyana, a total of around 1.5 million hectares, in 1998 (Vannessa Ventures Limited 2001). The initial prospecting license covered a major proportion of the forests around the South Rupununi, and within this several sites have been identified as being of potential value for mining. News of the awarding of this license caused uproar among Rupununi communities when it first reached them. The company has responded to local fears somewhat, and was reported in the Stabroek News of 24th June 1999 to have organised a meeting with toushaos of Region 9 villages. At this meeting, Vannessa agreed not to work on Amerindian lands without permission, and to operate any mines that might result from its activities in accordance with the wishes of local communities. The same meeting resulted in the formation of a committee comprised of village leaders and officials of local and central government offices, to represent the interests of the region in logging and mining operations. No new mines have as yet been opened as a result of Vannessa's activities, and only time will tell what the long-term effects of their work might be for the people of the region.

Further mineral interest in the South Rupununi was manifest in the form of discussions between Guyana's government and an Australian mining company, Hardman Resources Limited, towards the awarding of a license to prospect for

petroleum reserves over 10,000 km^2 of the Takutu river basin. Although the opening of discussions was reported in the Stabroek News of 15th. February 1999, I have seen no subsequent reports, and the license appears never to have been awarded. Exploration activities seem not to have commenced, and the company's web site gives no mention of an interest in Guyana. Another proposed mining operation that the region appears to have been spared is a gold option on slightly more than 100 km^2 around the source of the Kwitaro river. This river is an essential resource for the major study village in this project and its neighbours, but a mining concession there was nonetheless taken up by Guyanese company AMPA, and later optioned to foreign mining interests (Canarc Resource Corporation 1997). AMPA's owner told me that gold deposits on the river were insufficient to support a commercial mining operation, and to date no mining operations have commenced, although the option remains open.

3.1.5 Conservation Interest in the South Rupununi

Aside from Iwokrama and the Conservation International concession, several other sites have at one time or another attracted attention as potential protected areas. Of these, most concerted and active attention has been given to the Kanuku Mountains. The first documented activity in this regard was a European Commission sponsored consultancy, which unfortunately exemplified a notional and cosmetic approach to community consultation. Boundaries suggested for this park encompassed much land which, although not within Amerindian titles, provides important subsistence services for the villages in the foothills of the mountains. While token reference was made to the participation of local people, it was suggested that the same people be kept out of these areas by armed patrols, but that local favour should be curried by naming the project 'Kanuku Amerindian National Park'! (Agriconsulting 1993). Since this, biological background data collected on expeditions sponsored by Conservation International has confirmed the biotic richness of this area (Parker et al. 1993). During 2000, following a request by Guyana's government, CI organised a series of consultations with communities in the vicinity of the mountains, a first step in establishing the compatibility of a reserve with the needs of these people (Forte 2000). This process is ongoing, according to an article about developments in the NPAS programme published in the Stabroek News of 4th March 2002.

Various other areas in and around the South Rupununi have been suggested as possible conservation sites of various types (Ramdass and Hanif 1990), though I have not observed any evidence of local consultation in relation to these proposals.

Information collected over the course of this study indicated that a great deal of interest in conservation does exist in the region, particularly among community leaders who consider the health of natural resources to be vital to the continued self-sufficiency and cultural distinctiveness of their people (see chapter 3.3 below). Among the ranching community there are many advocating conservation practices. This may also reflect economic self-interest, as many ranching operations are nowadays turning to ecotourism as an alternative source of income. Karanambau ranch in the North Rupununi, one of the area's better established ecotourism operations, has for many years been seeking to achieve protected area status. Initial plans were considered by an independent analyst not to be in the best interests of local Makushi residents. An appropriately modified initiative is now underway in the form of a nature reserve geared towards the facilitation of ecotourism, scientific research and wildlife ranching (Shackley 1998).

Within Region 9, then, conflicting outside interests relating to use of natural resources are beginning to manifest themselves. This situation in many respects mirrors that at the national level as described in the previous chapter. As within the country as a whole, this has serious implications for indigenous residents of the region, and thus provides the dominant socio-political context for the subject matter of this thesis. The next section provides an account of the known history and present-day circumstances of one of these indigenous populations, the Wapishana people.

3.2 The Wapishana people in Guyana

3.2.1 Early recorded history of the Wapishana

Riviere (1963) provides a summary of the information available on the Wapishana from the early colonial period, prior to sustained European contact. Several sources suggest the Wapishana to have originated in the vicinity of the Rio Uapes, a tributary of the Rio Negro, in which case the Spanish were aware of their existence as far back as the late 16th. century (Riviere 1963: 115-6). The modern-day Wapishana language supports this conclusion, the suffix 'san' denoting origin. Riviere contends that Wapishana residence in the South Rupununi results from an eastwards migration from this area, and makes a convincing case that this is the best interpretation of the available historical evidence. It must be noted, however, that owing to the fragmentary nature of this evidence, his argument is far from irrefutable. Even today, many Wapishana retain historical memories of ancestors who migrated from Brazil to

Guyana. Such accounts as I was given can date back no more than four or five generations, and it seems that migration has been an ongoing process. At present, movement is mainly to the west, as economic factors encourage migration from the Rupununi to the adjacent Brazilian state of Roraima.

Riviere suggests that the major impetus behind the initial eastward movement may have been a series of unsuccessful attempts on the part of the Portuguese to settle Amerindians of the Rio Negro basin in permanent settlements known as 'descimentos', towards the end of the 18th century (Riviere 1963: 127-8). Chernela (1998: 316-321) describes the forced resettlement of people of various tribes resident in the Uapes river system to the mission fort at Sao Gabriel de Cachoeira in the years following its establishment in 1761. Although she does not mention the Wapishana by name, the timing and location implies that they would have been among the victims of this policy. This is also consistent with Riviere's suggested dating of the migration, although the earliest indications in the colonial records of a Wapishana presence in Essequibo predate this.

A colonial despatch dating from 1753 blames Wapishana people for the murder of three colonists on a trading expedition up the Essequibo, and indicates that the colonial authorities were aware of their presence prior to this date. Notably, the wording indicates a Wapishana presence as far east as the Essequibo River itself at this time (Harris and de Villiers 1911: 302-3). The same despatch makes reference to ongoing hostilities between Wapishana, Makushi and Caribs, which were apparently protracted as there is a later report of warfare between Wapishana and Makushi on the Rupununi in 1765 (Harris and de Villiers 1911: 485-6). However, by the time of Schomburgk's visit several decades later, the two tribes were reported to be co-existing peacefully in the north savannahs, living in at least one mixed village and intermarrying (Schomburgk 1923: 229, 308)

Riviere (1966) builds upon these observations in a reinterpretation of archaeological data reported by Evans and Meggers (1960), whose analysis he considers to have been misled by the use of ethnographic data of dubious accuracy. Evans and Meggers suggested that Makushi settlement extended over both north and south savannahs prior to the Wapishana immigration, but that they were driven north by the newcomers. This scenario appears to have become accepted as standard in the historical literature (e.g., Thompson 1987: 195-197). Riviere, however, contends that the initial Wapishana incursion was to the north savannahs, where after an initial period of warfare the two tribes intermingled for a period prior to a further and final Wapishana relocation to the south savannahs (Riviere 1966: 309). Several reports

from the early 19th century unambiguously indicate that by this time Wapishana settlement extended throughout the South Rupununi (Riviere 1963: 62-4, 114-128). However they reached there, the immigration of the Wapishana refugees to the South Rupununi brought them into contact with several other tribal groups. As many of these came to be ancestors of the present-day Wapishana, a history of the latter requires them to be considered.

Best known of the other tribes ancestral to the Wapishana are the Atorais or Atorads, whose assimilation by the Wapishana was in its final stages by the time of Farabee's visit in the second decade of the twentieth century. He reported the presence of a little over a hundred Atorad speakers, mostly of mixed ancestry, living among and culturally barely distinguishable from the Wapishana (Farabee 1916: 428; Farabee 1918: 131-134). Im Thurn (1883: 170-171) had previously reported that Atorai, along with another group called Amaripa, lived in settlements shared with the Wapishana, although as I have already mentioned (chapter 1.3) it is highly probable that this is a second hand observation. Farabee also claimed that the homelands of the Atorad tribe had previously encompassed all of Guyana south of the Kanukus, but gives no source for this observation. However, it is also consistent with a testimony given by an Atorad witness in the border dispute between Brazil and British Guiana at the turn of the century (Riviere 1963: 22). Nowadays, the Atorad language has been incorporated into modern Wapishana (ARU 1992: 1-2) and is still spoken by small numbers of individuals in the South Rupununi. One resident of Katoonarib mentions the presence of Atorad speakers in her village (Forte and Melville 1992), and informants have told me that a few Atorad speakers still reside in the Rupununi, notably in Karaudanawa.

Farabee also observed what he considered to be the last stages of a similar process of assimilation on the part of the Taruma people (Farabee 1918: 135-136). Along with the Atorad, this tribe was by the 1940's reported to be extinct as a distinct group (Peberdy 1948: 18). The Taruma appear to have inhabited the forests of the Upper Essequibo, to the south and southeast of the south savannahs, an area visited by the Jesuit missionary Cary-Elwes in 1919 and 1922. His account suggests extensive contact with the Wapishana, locations in the area having names in both languages (Butt Colson and Morton 1982: 221). Should the conjecture of Evans and Meggers (1958: 121-4) - that Guyana was a refuge area populated only in post-Colombian times and in response to dislocations caused by European activities - be correct, then the Taruma may have been among the earliest inhabitants of this region.

Cary Elwes considered Taruma residents of the village of Wanawanatûk, where he had a church built in 1922, to have been generally unhealthy (Butt Colson and Morton 1982: 240), and they appear to have been decimated by a 'flu epidemic in the years following his visit. Roth reports that by 1925 the population there had declined to eight adult men, all of whom were married to Waiwai women (Roth 1929: IX). The only other Taruma population known to Roth at this time was a group of nine adults resident in the Wapishana village of Baidannao. Peberdy later confirmed the postulated fate of these tribes, reporting that by the late 1940's both the Taruma and Atorads had ceased to exist as distinct groups, but that survivors had intermarried with the Wapishana (Peberdy 1948: 18). More recent accounts have reported the presence of people who consider themselves Taruma resident among the Waiwai (Guppy 1958: 57; Yde 1960: 84). Results obtained in the present study show that to this day their extinction is not quite complete: one family in Maruranau is reported to be of Taruma descent, and a small number of individuals in this lineage identify themselves as Taruma speakers.

Archaeological evidence of the close connection between Taruma, Waiwai and Wapishana histories is provided by the analysis of petroglyphs located on the Upper Essequibo and Kassikaityu rivers. These are presumed to be of Taruma origin, and in connection with contemporary observations of the use of fish trap technology represented therein among Waiwai and Wapishana people, suggest shared cultural traits related to fish exploitation among all these groups (Williams 1979a: 136, 1979b: 146).

Riviere provides evidence that, although too sketchy to be definitive, suggests the assimilation of several other tribal groups by the Wapishana, including the Amaripa and Paravilhana (Riviere 1963: 260-1). The latter are known from only a few reports, having apparently been the major victims of the descimentos, but are reported to have originally been settled over a huge area stretching from the Rio Negro as far east as the Essequibo (Riviere 1963: 199-202). Farabee suggests the Parauien, presumably the same people, to be an extinct sub-tribe of the Taruma (Farabee 1918: 135-136). A colonial representative visiting the Rupununi region in 1769 reported 'Parhavianes' and Wapishana to be settled in close proximity in the vicinities of the Kanuku Mountains and Maho River (Harris and de Villiers 1911: 616-9). This occasion, incidentally, appears to be the first recorded instance of direct contact between Wapishana people and any representative of the British colonial government. The extent of Atorad settlement, similarly, is impossible to determine exactly, but populations were reported in Guyana from the Brazilian border as far

south as Kujuwini (Riviere 1963: 130-2), and one Atorad giving evidence in the Brazilian-British Guiana border dispute described Atorad country as having been bordered by the Takutu, Kujuwini and Kwitaro rivers, and the Kanuku mountains (Riviere 1963: 122).

Present-day Wapishana speakers in Guyana, then, are the descendants of a group of eastward migrants from the Wapishana homeland in the Uapes basin, along with several peoples encountered by these people in the areas they moved into. The latter include people originating from a wide area, whose minimum extent was between the Takutu and Essequibo Rivers west to east, and the Kanuku Mountains and Kujuwini River north to south.

3.2.2 Twentieth century history: cattle ranching, balata and missionaries

Initially as a result of obscurity, later controversy, the location of the border between British Guiana and Brazil was not determined to the satisfaction of both governments until the 20th century following legal arbitration (Riviere 1995). Wapishana people resident on what was to become the Guyanese side of the border had very little direct contact with the colonial society until this century. The first recorded European attempt at settlement in the South Rupununi is that of a Dutchman, DeRooy, who set up as a trader at Rurwau, near Dadanawa, in 1860, having purchased a bull and cow from Brazil. Several decades later John Ogilvie was told of two or three other Europeans settled in the region at around the same time, and two escaped African slaves are known to have married into Wapishana villages during this period (Baldwin 1946: 36-7). Connections with the wider world during the pre-independence years of the 20th. century were almost entirely the product of three factors: the cattle and balata industries, and missionisation.

The cattle industry in the South Rupununi began in earnest in the last decade of the 19th century following the purchase of DeRooy's herd, now numbering close to 200 head, by H.P.C. Melville, a Scot who had married two daughters of an Atorad chief and settled on the Rupununi river at Dadanawa. Along with John Ogilvie, a European prospector and explorer who settled in the South Rupununi a few years later, he was to play a crucial mediating role in the integration of the South Rupununi peoples into the colonial society. The major beneficiary of a short period during which freehold titles to savannah lands were being issued by the government, Melville pioneered ranching in the south savannahs with great success, and by 1920 was able to sell out a vastly enlarged herd to the Rupununi Development Company (RDC), which occupies his former homestead at Dadanawa and the surrounding ranch lands

to this day (Baldwin 1946: 38-9). It appears that Melville's genuinely beneficent relationships with the savannah peoples were maintained by the RDC, with which they established labour and trading links vital to the functioning of the company (Turner 1972: 32). Melville and Ogilvie were also instrumental in the establishment of the balata trade in the South Rupununi (Turner 1972: 19).

To the present day, the ranching industry remains a key feature of life in the Rupununi. Dadanawa ranch still occupies a huge area of land, despite having given up some of its grazing lease to neighbouring Wapishana villages (Colchester 1997: 48-9), and the ranch headquarters are a major focal point for travellers to the deep south villages. As well as being one of the major employers in the region (although its permanent staff is no more than a few dozen people), the ranch provides essential infrastructureservices in terms of transportation - its pontoon across the Rupununi is the only means by which vehicles can cross the river during the rainy seasons – communication and trade. There are several other, smaller ranches in the South Rupununi, which along with the indigenous settlements form the major landmarks in the region. Perhaps the most profound impact of the livestock industry has been the adoption by the Rupununi's indigenous inhabitants of the practise of animal husbandry (see chapter 4.6), processes of change resulting from which are still evident today.

Although there are inevitably conflicts between the native populations and the ranching community — most dramatically illustrated by the Wapishana fence, which separates, or separated, the RDC lease from reservation lands, and which some people considered an offensive intrusion (Peberdy 1948: 18, 31) — the relationship on the whole seems to have been beneficent. Baldwin observed that aside from the changes inevitably caused by people's access to the cash economy, non-Amerindian presence in the South Rupununi seemed to have caused little disruption of the traditional way of life (Baldwin 1946: 54). This appears in part to have been due to the small number and size of ranching settlements and their distance from indigenous settlements. The personalities of those involved in the ranching industry have also contributed. Melville and Ogilvie appear to have interacted with local populations in a culturally sensitive and respectful manner, and their successors to have continued in a similar vein (Peberdy 1948: 9, 31; Brock 1972).

Nowadays, connections between the livestock industry and the Wapishana people are increasingly strong as ties with and dependence upon the outside world increases and their involvement in the industry, as employees and ranchers, increases. The Rupununi Livestock Producers Association, originally founded by the manager of

Dadanawa in 1977, has a Wapishana membership that is growing in both numbers and activity. It may be that this alliance will become crucial if the increasing intrusion of the outside world starts to threaten the culture and way of life of the people of the South Rupununi. The history of the Makushi in the north savannahs demonstrates a stark contrast: their lifestyle and culture were reported to have been tragically undermined by the relationship with the ranching industry (Baldwin 1946: 55-56; Myers 1944).

The balata industry appears to have been the major source of wage labour for Wapishana people for much of the 20th century (Baldwin 1946: 44; Amerindian Lands Commission 1969: 75). Even in the earliest years of the century, surveyors working on the demarcation of the Brazilian border reported difficulty in finding sufficient workers, due to the number of people away working balata (Anderson 1907: 21). More recently, informants in Maruranau report the vast majority of men in the village to have been employed in the industry, either as bleeders or in providing support services, in the years prior to the closure of the balata company. Former balata bleeders report this work to have been easily reconcilable with the maintenance of subsistence activities, particularly agriculture, partly because of its seasonal nature (also see Baldwin 1946: 45; Amerindian Lands Commission 1969: 75), and the closure of the industry is much lamented. Many Wapishana, in fact, lobbied politicians visiting their villages prior to the 1997 general election for the re-opening of the industry.

The earliest missionary work among the Wapishana was that of the Jesuit Priest, father Cuthbert Cary-Elwes, whose diaries have been published and form an invaluable historical record of the South Rupununi in the early decades of the twentieth century. Following an initial visit to the South Rupununi in 1909, he began evangelising in the villages of Potarinau and Sand Creek during the following two years (Bridges 1985: 4-6, 21-23). Undeterred by the dismay with which his presence was initially received, he eventually managed to gain converts, and succeeded in persuading these two villages to build churches by 1918. By 1919, he had baptised children in the more remote villages of Shea and Sawaramanirnao, in both of which churches would later be built under his instruction, and the first Christian marriages among the Wapishana were conducted in 1922 (Bridges 1985: 114-6, 134-7, 140, 157, 162).

Cary-Elwes' legacy in the South Rupununi is huge: of the major settlements, in all but one the vast majority of the population is Roman Catholic. The exception is Awarewaunau, where Seventh-Day Adventists form a numerical majority. In more recent times, Christian missionaries representing US-based churches have made their

presence felt in the South Rupununi. In Maruranau, for example, one sub-settlement is made up of an extended family who are all members of the Christian Brethren Church, and who have their own small church in their hamlet in the southern part of the village, and one other family belongs to a US-based Sabbitarian church. It is probably fair to say, however, that the typical modern-day Wapishana person considers herself or himself a Roman Catholic.

3.2.3 Modern patterns of settlement

A survey conducted in 1993 found there to be a total of 6,780 Wapishana people resident in the South Rupununi, reflecting a steady increase in numbers over the course of the century (Forte and Pierre 1994: 11-12). Table 3.1 summarises data on population sizes in South Rupununi villages as collected in various censuses over the past twenty years. Much of the variation in the figures is methodological, arising from differences in the sources of data and the definitions of village boundaries employed. Probably the most reliable data is based on the results of surveys conducted in 1998, and kindly provided to me by the Office of the Regional Democratic Council of Region 9. However, continuous migration of people between villages and into and out of the region means that these figures are at best approximate. Figure 3.2 is based upon the same data, and breaks down population figures for the villages into age and gender classes.

Table 3.1. Changes in populations of South Rupununi Villages

Year of survey:	1986 (1)	1989 (2)	1993 (3)	1998 (4)
Shea	452	345	367	312
Maruranau	455	726	675	645
Awarewaunau	498	650	535	578
Aishalton	1144	1500	1142	1040
Karaudanawa	890	489	965	995
Achiwuib	412	255	544	518
Sand Creek	829	728	771	1158
Parikwarawaunau	119	nd	152	172
Potarinau	504	304	676	386
Rupunau	nd	nd	244	223
Shulinab	457	nd	494	504
Katoonarib	238	nd	296	308
Sawariwau	174	nd	525	774
Shiriri	nd	nd	nd	78
Baitoon	nd	nd	nd	227
Small Sand Creek	nd	nd	nd	190

(1) Data collected by ARU during 1986 and 1987, in collaboration with various village representatives and workers in villages, and reported in Forte 1990a.

(2) Data from records of Ministry of Regional Development or some other, unspecified source, from Forte 1990a.

(3) Data from ARU survey, reported in Forte and Pierre 1994.

(4) Data provided by the Office of the Regional Democratic Council, Region no. 9.

Beyond the borders of Guyana, a substantial Wapishana population remains in rural areas of the Brazilian state of Roraima. The total population of Makushi and

Wapishana resident in indigenous settlements in Roraima numbers around 6,000 (Forte and Pierre 1994: 11-12). There has also been substantial emigration from the traditional homelands. Many Wapishana from both sides of the border are resident in Boa Vista, state capital of Roraima, and Guyanese Wapishana appear to be resident throughout the country and beyond. Elsewhere in Region 9, many Wapishana people are resident in Lethem, in Apoteri, the village located at the site of the former balata depot at the confluence of the Rupununi and Essequibo rivers, and an ethnobotanical study of the small settlement of Kurukupari on the Essequibo reported a Wapishana presence there (Johnston and Colquhoun 1996: 183). I also met a Wapishana woman who has married into and settled in Oreal la village on the Correntyne River. In the present study, many people reported relatives to be working in the mining areas of western Guyana (see also ARU 1992: 29), or resident in Georgetown and other coastal towns, and some also told of relatives who have emigrated to Venezuela, Canada and the United States.

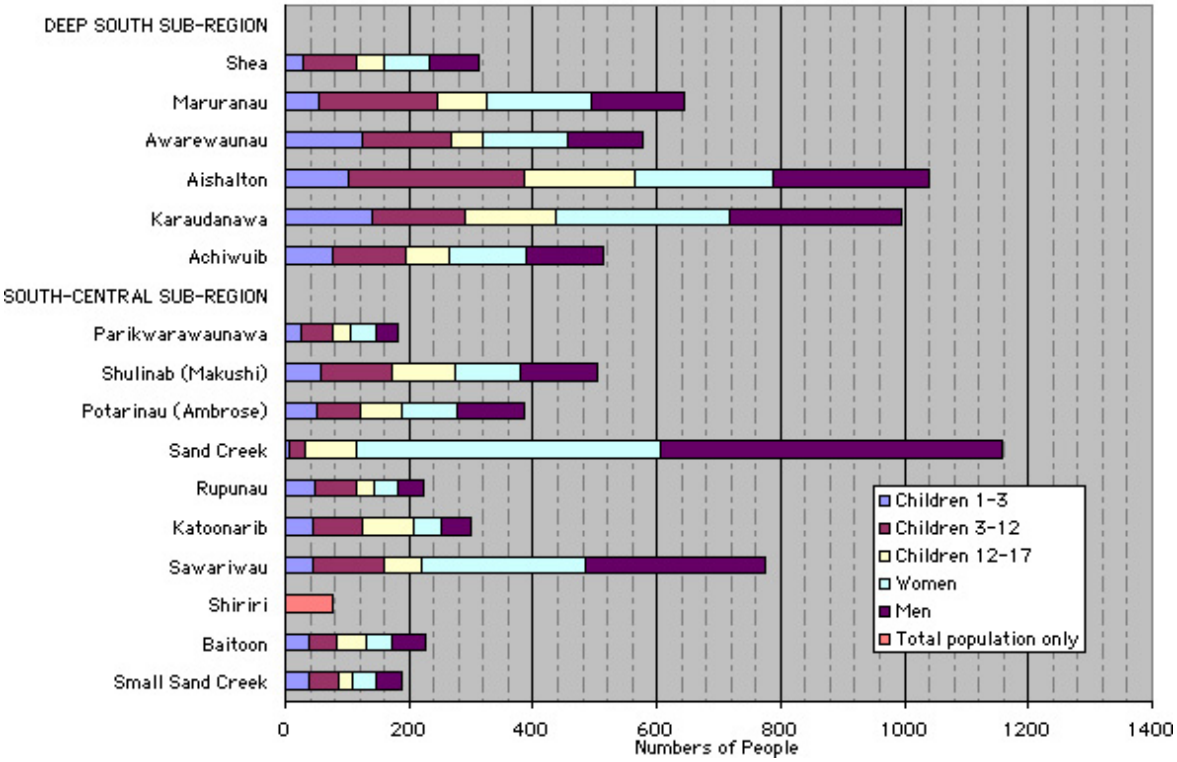

Figure 3.2. Population structure in South Rupununi villages in 1998

Within the South Rupununi, the majority of people are resident in twelve major nucleated settlements (see figure 3.3), whose locations are determined by access to forests for farming, and to a lesser extent hunting, and to year-round water sources. All but one of these are numerically dominated by Wapishana people. The exception is Shulinab (often referred to locally as Makushi village), whose residents are mostly

Makushi, although I met Wapishana people there who have married in from other villages.

Shulinab and its satellite settlements, including Baitoon, are situated close to Saruwa'o creek and next to the main Dadanawa-Lethem road. The fairly small Wapishana village of Parikwarawaunau is situated several miles away, also close to Saruwa'o. People of these villages farm in the gallery forests lining this creek or on small mountains forming part of the foothills of the Kanukus. Fairly nearby, to the south, is Potarinau, often referred to as Ambrose, which was the name of its first toushao. Residents of this village farm in bush islands, which are common in this area and fairly extensive. Also dependent on bush islands for access to forests are residents of two villages on the Sawariwau creek, Sawariwau and Katoonarib, which latter name in fact derives from the Wapishana term for these formations. While each has its own council, Katoonarib apparently falls within the official boundaries of Sawariwau reservation, while Sawariwau itself lies outside these (ARU 1992: 4). Also in this area is the small village of Shiriri, in the heart of the savannahs close to the mountain of the same name. This village was founded within the last few decades, and is not officially recognised by central government. The most populous Wapishana village is Sand Creek, located at the mouth of Sand Creek River (Katuwa'o) where it meets the Rupununi. Farms are located either in the nearby foothills of the Kanuku Mountains or in riparian forest along the banks of the Rupununi. Many of these farms are located at considerable distances from the village, and large numbers are outside the boundaries of the reservation, the majority of which is savannah land and which incorporates insufficient forest to meet local needs. Sand Creek also administers the satellite settlements of Small Sand Creek and Santa Cruz, an Amerindian-owned ranching settlement whose grazing lease adjoins the reservation to the south. Also outside the boundaries and without official recognition or land title are several small and reportedly fairly insular settlements on the Maparri creek in the Kanuku mountains (see Anselmo and Mackay 1999: 20). To the east of Sand Creek village lies the village of Rupunau, which consists of four main settlements under the administration of a single council. This village is not officially recognised and has no title. These communities, along with Dadanawa and other ranches in the vicinity, collectively form the South-Central sub-district, one of five major administrative divisions of Region 9. The indigenous population has organised along the lines suggested by this political division in the form of the South-Central Indigenous Peoples Association (SCIPA) which elects a chief of chiefs for the sub-district. It is

through this body that the member villages are pursuing the joint claim for land extension mentioned above.

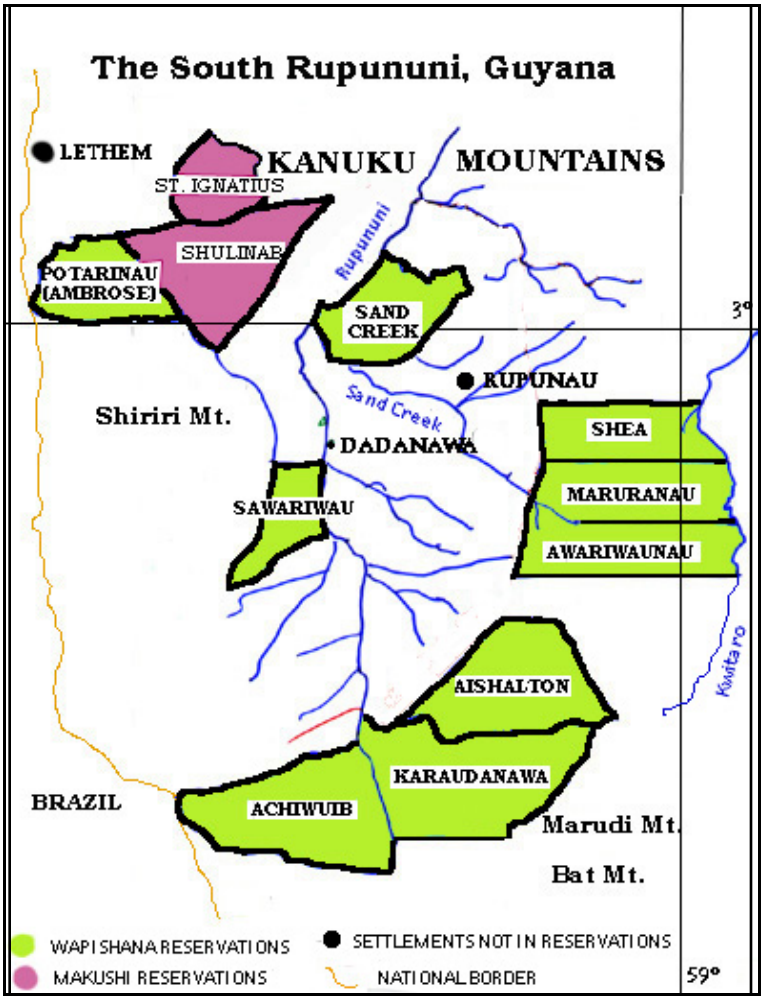

Figure 3.3. Map of South Rupununi Communities.

The remaining six major Wapishana settlements are in the Aishalton sub-district, or Deep South, and complete an arc of villages stretching from Sand Creek, through Rupunau and on around the eastern and southern border of the savannahs. The three villages of, from north to south, Shea, Maruranau and Awarewaunau, form a contiguous block of reservation lands along the west bank of the Kwitaro river. Most of the farming lands are found in the forests of the Kwitaro basin, while some people in the outlying settlements of Palmylco and Diniad use forests in the Kanuku foothills to the north. Two Wapishana-staffed outstations of Dadanawa are in the vicinity, at the eastern edge of the lease close to its boundary with the east end reservations: Katilernau a few miles west of Shea, close to Katilerwao creek, and Arakwoi, close to the Arakwoi creek southwest of Awarewaunau. The remaining Deep South villages are situated along the southern edge of the savannah, several miles from its border with forests of the Kujuwini river system. Aishalton is the sub-district capital, where are

located the district offices and the only hospital and police station in the South Rupununi. A secondary school was opened in this village in 1999, but although the provision of secondary education in the area is welcomed the headmaster has complained about a chronic shortage of appropriately trained staff. Karaudanawa to the west is situated on the upper reaches of the Rupununi river, and Achiwuib lies still further west, its reservation boundary abutting the Brazilian border. Several smaller settlements are administered by these villages, and villagers of both Achiwuib and Karaudanawa have established separate farming settlements to the south of the villages, close to the forest-savannah boundary, as the farming areas are at considerable distances from the villages themselves.

Wapishana settlement in Guyana thus encompasses almost the entire forest-savannah boundary in the South Rupununi, and the range of habitat types found within this. Analysis of changes in the forest-savannah boundary over the period 1952-1983 shows it to have remained stable over time, despite increases in population and permanence of settlements and hence apparent agricultural intensification. In fact, in one uncultivated area north of Shea the forest appears to be advancing into the savannah (Eden 1986). Preliminary research findings based on a study of genetic variation of bird species across savannah-forest ecotones in Cameroon suggest that such transitional habitats may be of great importance in generating biodiversity over evolutionary time-scales, via the promotion of intraspecific genetic diversity and hence speciation events (Smith et al. 1997). Should these findings be confirmed, and should they also apply to such habitats in South America, this would have great implications for the conservation importance of the area occupied by the Wapishana in Guyana. As a major part of an ecotone of the world's largest intact area of tropical forest, it would represent an area whose biodiversity is of global importance. Human use of and effects upon this habitat is thus a subject of key interest to those concerned with global conservation, and comprises the subject matter of the next chapter.

3.2.4 Maruranauas an example of a modern Wapishana village

The major site of field research in this study was Maruranau village, which was founded in 1922 after converts of Fr. Cary-Elwes resident in the village of Sawaramanirnao decided to relocate to a previously uninhabited site on the banks of Marora wa'o creek, owing to a shortage of water at the former location. Work started on the church in 1922, and Cary-Elwes reported the village to have relocated following its completion by the time of his visit in 1923 (Bridges 1985: 146, 158,

162). Extensive changes in the overall settlement pattern appear to have occurred since that time.

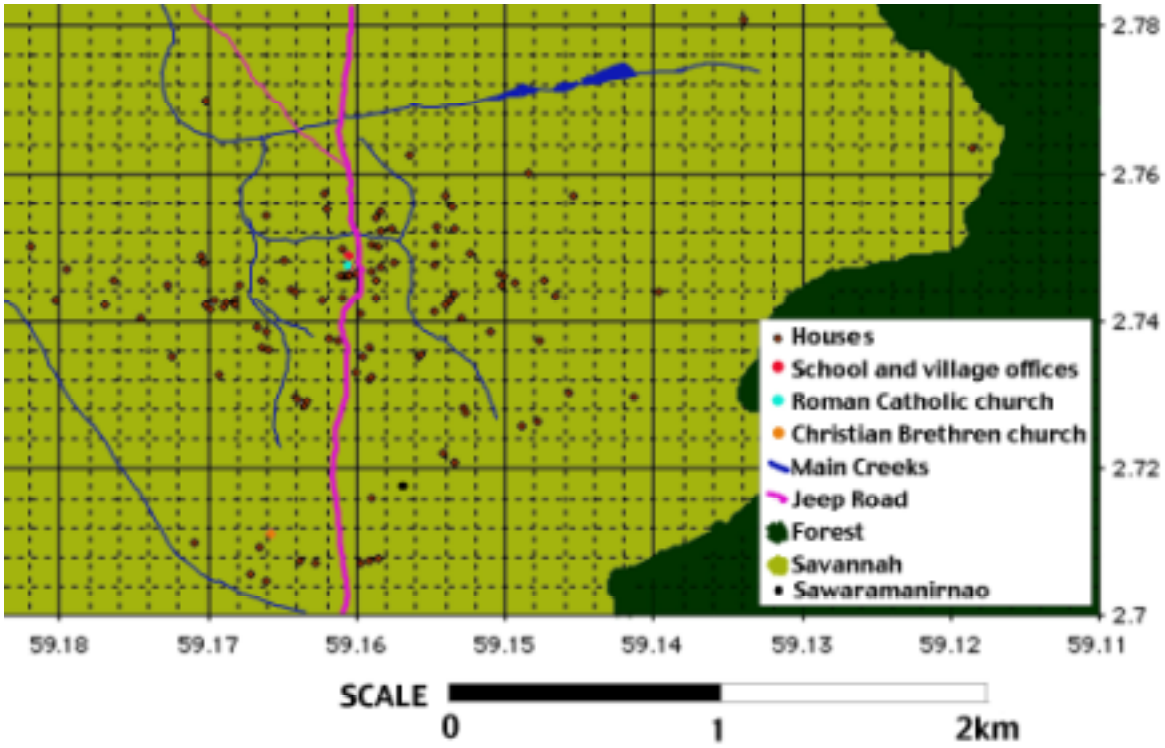

Figure 3.4. Village map of Maruranau

Present-day residents recall when settlements were mostly dispersed along the forest-savannah boundary, and archaeobotanical evidence of this is still visible in the form of fruit trees planted at these sites. The present-day settlement pattern in Maruranau is fairly typical, consisting of a number of small hamlets fairly widely dispersed around the village centre, on the savannah several miles from the edge of the forest. Hamlets mostly correspond to various developmental stages of the basic unit of residence among Amerindians of the Guiana shield described by Riviere (1984: 15-41). As such, they range from single households occupied by a recently married couple, or at the other end of the scale, by an old widow or widower, to clusters of several closely related households representing three (in some cases four) generations of an extended family.

The traditional pattern of cross-cousin marriage is explicitly recalled by few people, but remains encoded in kinship terminology. This is also apparent in the manner in which kinship referents are often used in English: Wapishana speakers will regularly confound and use interchangeably the terms 'uncle' and 'father-in-law', 'aunt' and 'mother-in-law', 'brother-in-law' or 'sister-in-law' and 'cousin'. Cross-cousin marriages are nowadays very rare, as people tend to marry more in accordance with Christian than Wapishana custom, and were strongly discouraged in the earliest days

of missionisation (Bridges 1985: 80-81). Polygyny - another early target of the missionaries (Bridges 1985: 67-68) - has long since been abandoned, and is one custom of the 'old-time people' which nowadays appears to be a source of some amusement to their descendants. Post-marital residence is cognatic and appears to be determined mostly by social factors. A hamlet may thus be composed of any combination of members of an extended family; geographically each tends to be located on a single hill, and hamlets are thus distributed largely according to the availability of suitable sites.

The village functions as a corporate group mostly with respect to infrastructure and local politics. Village councils and senior positions thereon, are appointed via public elections in which all adult members of the village are eligible to stand or nominate others for office, and to vote. The council has responsibilities in administration, representation of villagers at the regional and national levels, and, when called upon, resolution of conflicts and enforcement of social norms. Infrastructure is shared in that all villagers use the same school, clinic, market, playing field and — for most individuals — church. The council plays a role in this, via its organisation of village work, a voluntary system in which individuals give one day's free labour per week to the maintenance of the village compound and other communal facilities.

The village also functions as a corporate entity with respect to land use, in that reservation land is held under a communal title vested in the council. However, as the next chapter will clarify, the functional groups involved in resource appropriation are far smaller, comprising groups of individuals regularly making use of the same area of land. Actual decisions concerning land use are occasionally made on this level, but more commonly by the smaller groupings in individual hunting parties or at the level of the individual family or household head.

Villages are generally equipped with a basic infrastructure. In the case of Maruranau, this is mostly located within the village compound, and consists of the primary school, nursery school, a home economics centre associated with the primary school, village health centre, village rest house, library, council office, the village bond where council property such as agricultural tools is stored, village market and a playing field. Adjacent is the Roman Catholic church, which has attached a house to provide accommodation for visiting priests, and a sewing centre that is under construction. Most of the above was built by the villagers, large-scale projects such as the school with the support of donor agencies to provide funds for materials and labour, much of the rest by village work. One extended family follows the Christian

Brethren faith, and has constructed a separate church in the south of the village. A windmill-powered water system in the compound formerly supplied water to both schools and to the health centre, as well as a hand pump for general use but is nowadays broken down, only the well remains functional. A new well was being dug at the time of my departure from the village.

Four villagers nowadays run shops, two of which opened during the course of the research. These supply a variety of basic essentials: mostly foods such as salt, rice, sugar, flour, cooking oil, matches, soap, pens, notebooks, and in one case clothes. Other goods such as sweets and both sweet and alcoholic drinks are also often available. Supply can be sporadic due to the difficulty of transport from Lethem: especially during the rainy season, even basic goods can be in short supply. The supply of commercial goods is periodically augmented by the visits of traders from Awarewaunau and Aishalton, and more rarely Lethem, who may come weekly during the dry season, but far less frequently when the weather is poor. Village markets, in which a variety of local and manufactured goods are sold, are held on an irregular basis. These are often organised for the purpose of raising funds for the council, school, or health centre.

Economic opportunities are very scarce in the village. Apart from the handful of government employees — the teachers and community health worker — nobody holds a regular salaried position. The most reliable source of income is the sale of peanuts. Peanut farming was introduced under the encouragement of an agricultural extension worker in the late 1960's, and many families supplement their subsistence agricultural activities with the cultivation of a field of peanuts. For a market outlet they are dependent on a small number of traders who bring vehicles to the villages either to buy peanuts or to exchange them for commercial goods.

The sale of livestock is another important source of money for some people. Individual buyers will occasionally travel in vehicles from Brazil to take advantage of the relatively cheap prices of meat in the Rupununi, but their visits are inevitably restricted to the less remote villages. Those in Maruranau and other outlying areas must take their livestock to the market, which involves a walk of several days to Lethem. Aside from the arduous and time-consuming nature of the drive itself, these people are at a severe disadvantage to livestock producers living closer to Lethem. Animals suffer loss of weight and are occasionally lost or die en route. The traders themselves are out of touch with current market information and vulnerable to exploitation by buyers because of their need to make a quick sale or face the cost and inconvenience of an extended stay away from home. The growing involvement of

small-scale Amerindian ranchers in the Rupununi Livestock Producers' Association is providing a forum for these and other problems to be expressed and discussed, and may ultimately help to improve the lot of the small rancher.

Table 3.2. Sources of income for households in Maruranau

Activity	Percentage of respondents reporting activity to be a source of household income
Sale of farm produce within village	72
Manufacture and sale of Handicrafts	22
Sale of fish (within village)	20
Wage labour outside village	20
Sale of wild game (within village)	18
Wage labour within village	18
Sale of livestock within village	14
Commercial farming of peanuts	10
Sale of garden produce within village	8
Sale of livestock outside village	8
Sale of cotton	6
Government salary	4
Government Pension	4
Support from relatives working outside	2

In the Rupununi area, some people find work in the ranching industry as 'vaqueiros' ('cowboys'), ranch hands, drivers and mechanics, though the total labour force is small relative to the size of the local population. The majority of people interested in wage labour must depend on migration out of the Rupununi region. In some cases this is to other parts of Guyana - Georgetown or the gold mining areas of the Upper Mazaruni and Pakaraimas in western Guyana. The vast majority of people, however, are drawn west to the neighbouring Brazilian state of Roraima (also see ARU 1992: 52-3). Such migration may be seasonal, long-term but temporary, or permanent. Some young people will spend the majority of their time working in Brazil, returning for special occasions such as Christmas and Easter; others will cycle between working for money and living back in their home village off money saved, returning to work when the money runs out. In both cases, the return of these people provides cash injections into the normally impoverished local economy. Some young men migrate seasonally according to the agricultural cycle, travelling to Brazil after cutting and planting their farms at the onset of the rainy season. In this pattern they are replicating the cycle between subsistence and wage labour adopted by balata bleeders.

Many labour emigrants spend several years out of the region working, eventually returning to settle and raise a family in their home village and resuming a lifestyle largely based upon traditional subsistence activities. In other cases the emigration is permanent, young people or entire families relocating entirely in favour of the greater economic opportunities available elsewhere. Many families have extensive cross-border connections, in particular when young adults with children leave the children in the care of their grandparents while they are working in Brazil. However, only a single household participating in surveys conducted in the present study reported the provision of money by relatives working outside the village to be a source of income.

In Maruranau, as is typical in the villages of the South Rupununi, people are severely materially disadvantaged by the low level of basic services, especially health and education, and the low cash flow locally. Although the cash economy is an important part of modern life, certain shop-bought goods having become essential, means by which people can earn money are very limited. Labour migration is a common response to this, and often results in social disruption and the break-up of families via the absence of one or both parents or the emigration of young people out of their home area (ARU 1993: 103-4, 110-111). Some people expressed their concerns to me that this could result in cultural degradation and loss of self-sufficiency, as young people failed to acquire basic subsistence skills.

Within the South Rupununi, whether through choice or lack of alternative, subsistence activities are dominant in most people's lives. The possible changes with which the first section of this chapter was concerned have major implications for this. On the one hand, initiatives that may improve the local economic situation and provide means of generating income locally would be welcomed in most quarters. One the other hand, people in the area generally gave me the impression of being more concerned with the possible threats these changes may hold for their existing livelihoods.

3.3 Local Perspectives on changing circumstances

3.3.1 Indigenous land claims in the South Rupununi

It appears that the people of the South Rupununi have long been aware that their continued existence as a culturally distinct people would one day come under threat. The most vivid demonstration of this is their long-standing claim to areas of land far beyond the present boundaries of their titles, dating back to the time of the Amerindian Lands Commission. Officials of the commission were somewhat taken aback when toushaos of the six Deep South Villages each submitted an identical

letter, making a detailed and specific claim to an area of savannah and forest of which it was requested the villages be given joint ownership (Amerindian Lands Commission 1969: 213). The commission rejected the claim as excessive, and beyond the management capabilities of the communities, and recommended the designation of discrete, but contiguous, reservations over a far smaller area. (Amerindian Lands Commission 1969: 71-93).

The land actually awarded covered most of this recommendation, but excluded the area of land between the reservations of Aishalton and Awarewaunau. The present-day leaders of these villages have decided to continue to assert their claim to the entire area originally requested, and over the course of this study this translated into action. Following the example of the Upper Mazaruni communities, they requested the assistance of the APA in securing funding and technical assistance for the undertaking of a land-use mapping project over the area in question. I have since heard from the region that this has been achieved and the mapping project is underway. The Lands Commission also received, and also rejected, a less precisely defined claim for joint ownership of lands from the villages of Sand Creek, Shulinab and Potarinau (Amerindian Lands Commission 1969). I have been told that these communities, along with the other villages of the South-Central District, including the untitled villages of Rupunau, Parikwarawaunau, Katoonarib and Shiriri, have since joined forces to pursue a joint land claim. The claim has apparently been submitted to the government but has not so far progressed any further.

3.3.2 Local attitudes to conservation

The various data collected on local attitudes to conservation reflected a diverse range of local opinion, both within and between villages. With a small number of exceptions, formal and informal village leaders considered conservation of biological resources to be of great importance. This was mainly expressed in utilitarian terms, emphasising the need to ensure continued supplies of natural resources upon which people depend for subsistence. Many people also emphasised the importance of cultural conservation in these terms, clearly demonstrating that they considered this subject to be inseparable from that of biological conservation. The concept of independence was often mentioned, both in terms of an ideology emphasising self-sufficiency and as a practical necessity. For example, some people pointed out the value of local knowledge of medicinal plants, given the limited nature of formal health care facilities available in most parts of the region. More abstract considerations were also mentioned by some, including the importance of conservation for maintaining the

freedom and independence of local people, and the amenity value of nature. One toushao, for instance, told me how he lamented the decline in songbirds around his village, and that he was now trying to regulate their trapping for sale to outsiders, which he considered to be the cause.

Some people also raised the issues of conflicts between conservation goals and human needs. Predation upon livestock by big cats, especially jaguar and puma, and the possible danger these animals present to people, were the most commonly raised of these. Several tales of life-threatening encounters between people and big cats appear to be in circulation among the villages, and in one village it was reported that a puma had on one occasion attacked and killed a child travelling to school. Farm predation by white-lipped peccaries *(Tayassu pecari)* was an issue of concern for some people, especially in Sand Creek, where hunting of this species appears to be of somewhat less importance than elsewhere.

Negative attitudes to conservation were also expressed by some people concerned that it could amount to restrictions on their activities imposed from outside. Clearly this is a somewhat different definition of conservation to that employed by those whose opinions are cited above. In conversation with people who expressed this opinion, I found they generally agreed with the type of utilitarian perspective described above, although not everyone considered that existing subsistence practices could cause damage to or depletion of natural resources. The notion of outsiders intervening to impose limits, geographical or otherwise, upon local subsistence activities was one which was, in my experience, universally rejected by people in the South Rupununi. However, many people also opined that the provision of technical assistance by outsiders with expertise related to conservation, in order to assist local decision-making in this respect, could be valuable and welcome.

The local reaction to the dispute concerning Kaiteur National Park is instructive in this respect. News of this, circulated by national indigenous organisations, reached Maruranau at a time when I was away from the village for an extended period between my two main fieldwork sessions in Guyana. The situation in Chenepau was obviously one for which there was much local sympathy, and some people started to raise concerns that I would advocate or otherwise somehow try to introduce a similar measure there. On my return to the village, I was obliged to address this issue at one of the regular public meetings organised by the council. The outcome was ultimately favourable, as it provided me with a useful opportunity to contrast former approaches to top-down conservation to the community-led approach based in human resource use with which my work is broadly concerned.

An outreach workshop held in Lethem by Iwokrama in early 1999 and attended by representatives of all Rupununi communities, surveyed local opinions as to conservation problems and their possible solutions. In the South Rupununi, problems identified included overhunting of peccaries, iguanas, armadillos and anteaters, reduction of fish populations by poisoning and trapping, burning of savannahs, raiding of crops and livestock by wild animals, felling of fruit trees, and the reduction of fish stocks in Kwitaro River following mining activities there. Solutions suggested were education and awareness raising among both children and adults, development and enforcement of regulations regarding use of wildlife, rearing of livestock and fish to reduce pressure on wild animals, replanting of fruit trees and various forms of income-generating initiatives (Iwokrama 1999). The issues of fish poisoning and felling of fruit trees arose frequently in my discussions with people throughout the South Rupununi. In Maruranau, the village council is sufficiently concerned about the negative impacts of these activities that it is attempting to introduce rules to restrict them.

3.3.3 Conclusion and Summary

A case study of development in Region 9 conducted during the early 1990's was highly critical, and drew attention to an absence of Amerindian involvement in planning and decision-making, typical of approaches to development worldwide at the time (Tang 1995: 29, 42-44). It appears that this situation is improving, the need for Amerindian participation having been recognised by all major actors — central and local government, industry, development organisations and conservationists — as well as being strongly asserted by the Amerindian populations themselves. The different interest groups involved all have very different agendas, and their reconciliation over the years to come will strongly affect the nature of life in the Rupununi and the welfare of its indigenous population.

CHAPTER 4: WAPISHANA CULTURAL ECOLOGY

This chapter presents a broad view of Wapishana usage of, and ecological relationships with, the natural environment, particularly with respect to the use of forest resources. This is necessary both for the immediate aims of the thesis and the broader issue of development in the South Rupununi: any initiatives directed towards improvement of the conditions of its people must necessarily be based in the first instance on the existing economy. Subsistence practices are considered to be the primary location in which ethnoecological knowledge is applied in practice. This argument is based upon the assumption that ethnoecological knowledge is acquired, retained and transmitted because of its adaptive value in subsistence. For people who are dependent upon local ecosystems for the provision of food and the other essentials of life on a day-to-day basis, it logically transpires that knowledge of these ecosystems is of immense practical utility. This chapter seeks both to outline the human relationship with the forest/savannah ecosystem, and to begin to establish how this is predicated upon local knowledge of the functioning of the ecosystem, whether individual and explicit or encoded in customary norms of behaviour. Following an overview of subsistence, various categories of subsistence pursuit are described in turn.

4.1 Overview of subsistence

For most Wapishana people, subsistence forms the major preoccupation in day-to-day life. A variety of strategies are employed on an ongoing basis in exploiting forest, savannah, riparian and lacustrine habitats for food and the other necessities of life. Most people rely overwhelmingly on locally produced foods, though shop-bought goods are consumed when available and some — especially salt and, to a lesser extent, sugar — deemed close to essential. Manufactured implements are also employed in all aspects of subsistence: agricultural, building and woodworking tools, nylon fishing lines and metal hooks, matches and kerosene are all integral to the modern subsistence strategy. The body of skills employed prior to the availability of these items is retained, though their labour saving qualities are greatly appreciated: it is probably fair to say that many Wapishana retain the ability to survive without these goods if necessary, but none would voluntarily choose to do so.

Agriculture is central to subsistence activities in terms of dietary importance, allocation of time and the extent of intervention in ecological processes, particularly in the forest. The strategy of exploitation of forest resources may best be

characterised as a multiple use system based around long-fallow swidden agriculture, recognising that the value of this label is somewhat limited by the fact that it characterises a great diversity of agricultural systems worldwide (Brookfield and Padoch 1994). Forests are used for agriculture, hunting, lumbering, fishing, and gathering of foods, medicines, firewood, and the raw materials for building and crafts. Savannahs provide the major sites of permanent settlement, and are also used for fishing, livestock rearing, hunting, gathering of plant and animal foods and non-food items such as building materials, firewood, craft materials and medicines. The Wapishana subsistence strategy is thus adapted to the exploitation of the resources offered by both forest and savannah habitats, reflected in a pattern of settlement that spans the ecotone between the two (Potter 1993: 2).

Within this broad picture there is much variation, both within and between villages. Some can be ascribed to differences in availability of resources. Sand Creek village, for example, is situated close to the confluence of two major rivers, has a long history of involvement in the livestock trade, is fairly close to a number of important ranches, and suffers a shortage of forest lands within its reservation boundaries. In contrast, Maruranau is amply supplied with forest land but is situated some distance from the nearest sizeable watercourses; opportunities for involvement in the livestock industry are less readily available and people generally focus to a greater extent on forest-based activities. This is manifest in a much lower level of hunting in Sand Creek than Maruranau: whereas 73 percent of Maruranau households interviewed in the present study reported hunting to be an important subsistence activity, a socio-economic survey in Sand Creek found there to be only six recognised hunters among the 118 households in this village (Forte 2000: 64). My impression from visits to Sand Creek is that hunting is focused much more strongly on the savannah deer *(Odocoileus virginianus)* than is the case in Maruranau. In contrast, in the same survey, all households in Sand Creek reported that they engage in fishing, as opposed to 85 percent of those in Maruranau interviewed in the present study.

People will on occasion travel widely to procure particular resources unavailable in their home village. Villagers from Maruranau and the neighbouring villages make seasonal fishing trips to large rivers and lakes in the vicinity of Rupunau and Sand Creek. During the course of this study Rupunau village council approached Maruranau to request permission to send a group to visit and collect **mokoro**, a forest vine *(Ischnosiphon arouma)* used to make a variety of household utensils and reported to be extremely scarce in the vicinity of Rupunau.

Table 4.1. Percentage of households interviewed in Maruranau to report participation in various categories of subsistence activity.

Activity	Percentage of respondents reporting participation
Rearing Domestic Livestock	95
Swidden Agriculture	91
Fishing	85
Gathering of wild fruit	85
Hunting	73
Gathering of Animal Products	62
Keeping a House Garden	24

Intravillage variation is evident at the level of the hamlet or individual household. Different people or groups concentrate to different degrees on different subsistence activities depending on their skills, inclination, and other commitments, and also to some extent according to the distribution of resources within the areas known to them. Table 4.1 indicates the percentage of households interviewed during this study reporting involvement in various broad categories of subsistence activities. This indicates a certain level of variation in overall subsistence strategy, in that there is no single activity in which all households interviewed claim to participate. However, four of the seven categories of activity involve over 85 percent of households interviewed, and two others well over half. These figures mask a great deal of variation in the relative importance of different activities to different households, some of which is detailed in the sections that follow. For example, a household reporting involvement in hunting, fishing and livestock rearing may emphasise and be mostly reliant on any one of these three as a source of protein, engaging in the others only rarely. Specialisation among and within the categories employed in this study may take a variety of forms. An individual will generally employ a combination of techniques in subsistence, determined by their particular skills, knowledge and access to tools, the range of natural resources available within the particular areas of forest and savannah known to and exploited by them, and of course personal inclination and taste. Illustrative examples include the powerful fish poison haiari *(Lonchocarpus* sp.), whose trees are so rare that very few people know their location, and the need for specially trained hunting dogs (and hence knowledge of the training techniques, access to 'binas' — magical plants employed in training — and so on) for the pursuit of certain game animals. Partly as a consequence of this specialisation,

there is a good deal of interhousehold exchange, barter and, less commonly, sale of goods and services, broadening the spectrum of local resources and techniques of appropriation effectively available to any individual or household.

4.2 Agriculture

4.2.1 Spatial and social relations of agriculture

Maruranau's agricultural zone spans the breadth of the reservation along the western edge of the forest. Every household has at least one farm, and often several, except on rare occasions when adverse circumstances prevent this. These may include a shortage of cassava sticks and other planting materials owing to estrangement from the agricultural cycle following a period of emigration or damage of the farm by predation, drought or flood, ill-health or injury at a crucial time in the agricultural cycle, or - especially in the highly disrupted climate of the late 1990's – disruption of the agricultural cycle by unusual patterns of rainfall. Local networks of mutual aid, especially - but not exclusively - among kin and affines, generally seem to operate in such circumstances. Other families may supply planting materials or labour, or provide someone without a farm an opportunity to work co-operatively on theirs. Two households participating in the survey reported that they had no farm, but each is exceptional in its own way: one an unmarried female teacher, the other an aged widow. Both remain highly dependent on local agricultural produce obtained through trade, barter, or the assistance of relatives.

The farms are located along a number of 'farm roads', trails into the forest along each of which several families typically have their farms and fallow fields, which form the basis of the socio-spatial organisation of agriculture. Each road is nominally owned by a particular individual, whose permission must, strictly, be sought by any other individual seeking to cut a farm along it. This status is initially conferred upon the person who first cut the trail; in practice most of the active roads were first cut by previous generations, and their custody inherited by its current bearers via a variety of cognatic patterns. A young man[3] may thus have a choice between the roads used by his father, father-in-law, andperhaps uncles if they farmed in different places. Immigrants without close sanguinal or affinal connections in their village must either approach the 'boss man' for the road along which they wish to farm, or (much less commonly) cut their own road in a new location.

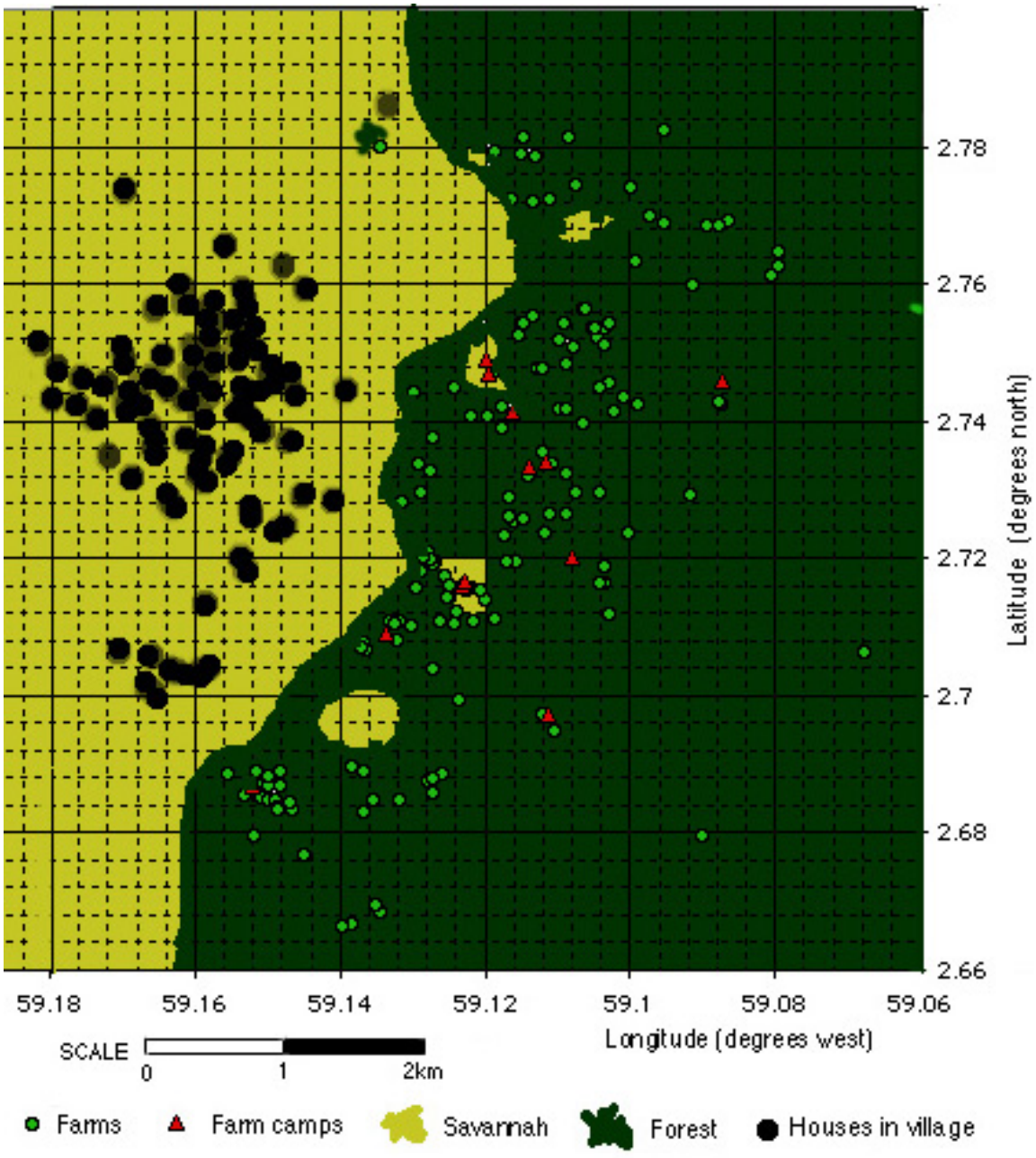

Figure 4.1. Map of Maruranau's farming area

In practice it appears that permission to cut a farm along a particular road, when sought, is rarely refused. However, this may be largely a result of the general abundance of farming land in the village, as people report that the only circumstance in which permission might be refused would be a shortage of available land. One individual reported to me that he had encountered such a situation. For social reasons, he would have preferred to farm along his father-in-law's road, but a shortage of suitable sites there forced him to relocate to his father's. Although I did not witness this directly, I strongly suspect that he made the choice to move on his

[3] Men are considered responsible for selecting the sites of their farms, though in practice the input of wives and other female relatives is, of course, likely to have an influence

own initiative rather than as a response to any overt social pressure, as in Wapishana society people tend to speak out about such things only as a last resort. One notable exception to the apparently relaxed operation of this system concerns a farming road in Maruranau along which one man cut a short cut. Since he did this job alone, it is reported, he enforced his rights of ownership to the fullest extent by refusing permission to anyone else even to walk along this trail, which was thus used only by his family up until the time of his death. Conversely, those farming in isolated locations will sometimes encourage a neighbour or relative to cut a farm nearby, for the sake of company and mutual assistance.

Social and ecological factors thus interact in the choice of location, or locations, used by any particular family for farming. The system of ownership and permission outlined above operates in a low-key fashion such as to disperse people away from areas of high local agricultural pressure and maintain farms at a suitably low density. The social consequence is that each farming road will be occupied by a number of families connected sanguinely, affinaly or in some cases by friendship. These farming communities effectively operate as forest-based sub-settlements, which owing to the variety possible in the cognatic systems of allocation of both residential and farming location, will correspond to varying degrees with the hamlets forming the residential units in the village.

In general, agricultural activities are the major feature of day-to-day life in a Wapishana village. Adults generally spend most of their days at the farm, occupied with the ongoing tasks of weeding, replanting and harvesting and processing crops. Children are expected to assist — as they are with domestic and subsistence tasks in general — as soon as they are old enough to be able. Children of school age are thus able to supplement their school teachings with a traditional education. This may help to counterbalance the cultural degradation resulting from the adoption of formal education that has been observed amongst Amerindian communities elsewhere in Guyana (Forte 1993: 8-9). During term-time, Saturday is a weekly peak of agricultural activity, being the only day when schoolchildren are available for a full day's work at the farm. Many families take advantage of the opportunity provided by the long school holidays of July and August to spend extended periods at the farm. Periods of extended residence in the forest are such a common feature of Wapishana life that a realistic concept of Wapishana settlement must encompass the farming area (cf. Ellen 1978: 26).

Consistent with the findings of previous studies among the Wapishana, many families in Maruranau have a second dwelling, either in the forest, at the savannah

edge, or in patch of savannah within the forest, within or near the farming area, in which they reside on extended stays at the farm (Riviere 1984: 24; Foster 1990: 130; Tang 1995: 29). Those which I visited were generally furnished with all the equipment necessary to perform the basic tasks of subsistence, in particular the manufacture of **farina** and **parakari** (see chapter 4.2.3 for definitions of these terms). Some are shared by several families, and the group of secondary dwellings down any particular farm road provides a physical basis for its status as an effective agricultural subsettlement. Often these groupings form the basis of collective labour at the farm, an essential feature of agricultural activities without which many of the most arduous tasks involved in the annual agricultural would be far more difficult.

Two main institutions of collective work exist. **Manorin**, is a non-reciprocal form of collective labour, in which one household invites neighbours, relatives, and friends to come and assist with a job. The host provides as an incentive a large quantity of alcoholic drink and usually a cooked meal as well. An invitation to a **manora** is one of the strongest social obligations possible in Wapishana society, to which people will respond positively in all but the most adverse circumstances. **Manorin** is commonly employed as a strategy for completing the most arduous tasks involved in agriculture, such as felling large trees in field clearance, and in other areas such as house-building. In contrast, I only observed the reciprocal form of collective labour, **kamiinkaiwakau**, translated as 'self-help', to be employed in agricultural contexts, though I do not believe it is necessarily limited to these. Groups of around four or more people will work collectively on the farm of each group member in turn.

Many farm houses, particularly those deeper into the forest, also act as bases for extended hunting trips of several days or weeks, which may or may not coincide with an extended period of family residence at the farm. Most of the regular hunting roads are extensions of or branches from the farm roads, and the latter are themselves subject to heavy hunting pressure as most men habitually carry bows and arrows, and are accompanied by dogs, as they travel to and from the farm.

4.2.2 Agricultural techniques.

The annual cycle of agriculture is determined largely by the pattern of rainfall. Farms are usually cut in January, just after the short rainy season. This provides several months of sunny weather to dry out the cut materials before the farm is burned in April, just before the long rainy season. Planting of most crops normally takes place shortly after burning. Occasionally people cut a farm at the end of the rains in early September, burning it in late November before the short rains. In Maruranau, many

people prepare a second field dedicated mostly to peanuts, a cash crop. This task is given lower priority than the growth of food for home consumption, in that it is undertaken later. During 2000, the early onset of the rains took many farmers by surprise. Many people reported that they had been unable to burn fields they had begun preparing for peanuts. However, all of these had managed to finish work on their fields of cassava and other subsistence crops. Most crops are harvested on a continuous basis when available. The capacity of cassava to resist spoilage in the soil means it is available year-round; most other crops exhibit seasonality to greater or lesser degrees. The division of labour in agriculture is not rigid: men are responsible for site selection and heavy work such as clearing the undergrowth and felling, while most of the other tasks are done jointly.

Around five years is regarded as the minimum fallow period, with at least nine considered ideal; however in practice many farms are left fallow for far longer. Individuals or families retain rights of ownership over their fallows, in that anyone wanting to cut a farm on a site previously farmed by another must obtain the permission of the prior user. These rights are inherited cognatically, and are inevitably asserted because fallows and other areas of secondary growth are preferred to primary forest as sites for new fields. This is because of the high labour input involved in cutting down mature trees, the most arduous and dangerous task involved in clearing a new farm. The retention of ownership rights is important in the long-term agricultural cycle. In a lineage that is expanding in numbers, whose inheritance of old farm sites is therefore insufficient to fulfil their future agricultural needs, men in their youth or prime will cut their farms in primary forest in order to establish an area of old farms within which they will be able to cut fields when they reach old age.

The allocation of agricultural land seems to vary among villages. One village allocates specific areas sufficient to encompass active fields and fallows on a household-by-household basis, and prohibits the cutting of fields in another's designated area. Unlike the traditional system from Maruranau described above, this appears to be the outcome of council regulations which were introduced in recent years as a response to a local shortage of easily accessible farmland. These findings contradict those of previous studies (ARU 1992; Salisbury 1968: 10; Hills 1968: 62-63), which reported that ownership of fallows was not retained, and that there were no restrictions on where a new farm might be located. A similar conclusion was reached in a study of Waiwai land use (Dagon 1967b). Retention of ownership rights over fallows has been reported in studies of other swidden agriculturalists, including the Iban of Sarawak (Horowitz 1998). The contradiction between this finding and

that of previous studies of Wapishana agriculture may reflect differences between the prevailing systems in the study villages, but I suspect it is more likely a consequence of the different duration of past studies. Casual questioning of my part did not reveal the existence of the system of regulation of access to farming land. The latter only became evident to me after I had spent several months in the field, a longer duration than was available in either of the previous studies cited, and started to undertake a period of research dedicated to agriculture.

Farms generally remain at peak productivity for two years. The most common varieties of cassava planted have a maturation period of about nine months: a farm in its second year of life will therefore be actively harvested over the period before the new farm comes to maturity. After two years fields are generally neglected as weeding ceases, although some crops will continue to produce and may be harvested for several years beyond this. The most important examples of this are some tubers, such as yam and sweet potato, and tree crops such as banana *(Musa* spp.) and papaya *(Carica papaya*). Fruit trees are commonly planted in the vicinity of farm camps, most commonly mango *(Mangifera indica)*, cashew *(Anacardium occidentale)* and citrus trees *(Citrus* spp.), and also guava *(Psidium guajava)*, soursop *(Annona* sp.), jamoon *(Syzygium cuminii)* and calabash *(Crescentia cujete)*, grown for technical rather than alimentary purposes. Conscious agroforestry barely extends beyond this: palm trees with edible fruits and other useful products may be left standing when fields are cleared, or when very abundant felled in such a way as to allow the tree to grow back from the stump. This occurs most commonly in the case of the kokerite palm *(Attalea regia)*, which is very common in the farming area; I also observed cases when other palms such as **buru** *(Astrocaryum* sp.) were spared when found in areas being cleared for farms. Apart from this I saw only a single instance of a tree being left standing in an area cleared for agriculture, a food tree for macaws used by the farmer and his relatives for trapping these birds.

Edible fruits of forest trees may be dispersed by people into old farms, or their immediate vicinity, when their fruits are collected and brought to the farm for consumption. Wild guava and wild cashew are reported to have been introduced into the farming area in this way, but this appears to have been an accidental consequence of their consumption rather than any conscious manipulation of succession. Fallows are used to a limited extent for gathering useful products, most important of which from a cultural perspective being **bishawud**, or 'kari mother', whose leaves play an important part in the fermentation of cassava during the manufacture of parakari. Certain popular species of game animal are known to

frequent old farms, and are hunted in these locations, but this seems to be regarded as largely fortuitous. Ethnoecological data on the plant and animal communities associated with old farms is presented in chapter 6.4.2. The use of farms and fallows as hunting areas is discussed more extensively below (chapter 4.2.6). Conscious manipulation of their composition in order to increase the abundance of either game or useful plants appear to take place on only a limited scale: some people reported that they will weed selectively, leaving useful plants such as **bishawud**.

Unintentional manipulations of forest composition may well be of greater importance than the deliberate modifications described. Certainly, the ecological characteristics of anthropogenic secondary forest appear to be important in subsistence (chapter 4.2.6), even if these do not result from any conscious intent on the part of farmers. Such a situation is in many ways comparable to that described among the Guajá and Ka'apor of Maranhão, Brazil. Guajá foraging activities rely extensively on forests whose composition has undergone significant modification as a result of the activities of the agriculturalist ancestors of the present-day Ka'apor (Balée 1993). This does not appear to be the outcome of any intentional habitat enrichment strategy on their part, but as in the Wapishana case, the utilitarian value of the habitat has been enhanced as an incidental consequence of their agricultural activities.

4.2.3 Dietary importance of agriculture

The importance of agriculture in the Wapishana lifestyle reflects its importance in the diet, as it is the source of almost all carbohydrate. The major crop is bitter cassava *(Manihot esculenta)*, of which numerous varieties are grown and whose products are consumed at every meal. Bitter cassava is eaten in a variety of forms, most popular being a coarse meal known as **farina**. Manufacture of farina is similar to that of the cassava bread more familiar among other Amerindan groups in Guyana and elsewhere, except that during the cooking stage it is placed on a lightly greased pan and continually agitated with a paddle, rather than being left to bake into a solid loaf.

A typical Wapishana meal consists of farina and a stew made from meat or fish, seasoned with peppers and **cassreep**, a condiment produced by boiling down the poisonous juice extracted from cassava tubers during their processing until it forms a thick, rich, dark brown sauce. Cassava bread is also commonly eaten, tapioca (cassava porridge) and starch are used, and the crop is also used to make a variety of alcoholic beverages. The most popular of these, **parakari**, is an important social lubricant and generally features in collective work, especially **manurin**, although

other cassava drinks and those made from other sources appear to be considered acceptable substitutes. Other root crops, along with pumpkin, plantain, green banana and papaya, are commonly consumed as porridge or a supplement to stews; sometimes if oil is available they are fried and eaten as chips. They can be used as alternative sources of carbohydrate if cassava is for some reason not available, as was the case during the drought of 1998, but extended periods without cassava are regarded as a hardship, even if another source of carbohydrate such as yam is available. Fruits form a dietary supplement and snack food - especially for children – during season, when some of the surplus that commonly exists may be used to prepare wines. Corn appears not to be of great importance as a source of carbohydrate: it is eaten boiled as a vegetable when fresh, and dried mainly for use as animal feed. Both these products, however, may at times be dried, grated and made into porridge. As in other societies where bitter cassava is the staple food, its processing is a lengthy job which occupies a large proportion of women's time (see also Mentore 1983-4; Riviere 1987). This is not, as Riviere suggests, simply a burden on the female population. Many women do their cassava work in groups based on the farming or residential community, sometimes in the form of a **manora**. These provide important opportunities for women to socialise and are one mechanism by which the skills involved in cassava processing, and other aspects of Wapishana tradition, may be transmitted vertically through female lineages, or horizontally to friends and visitors interested in their documentation.

Table 4.2. Percentage of farmers in Maruranau reporting the cultivation of particular crop species

English name	Latin name	Percentage of respondents reporting cultivation
Bitter Cassava	*Manihot esculenta*	98
Yams	*Dioscorea* spp.	94
Potatoes	*Ipomoea batatas*	92
Banana	*Musa* spp.	88
Eddoes/Dasheen	*Colocasia esculenta*	86
Peppers	*Capiscum frutescens*	84
Pumpkins	*Cucurbita maxima*	76
Corn	*Zea mays*	74
Sugar cane	*Saccharum* sp.	74
Cotton	*Gossypium* sp.	58
Pineapple	*Ananas comosus*	58
Watermelon	*Citrullus lanatus*	54
Blackeye	*Vigna unguiculata*	34

Peanuts	*Arachis hypogea*	18
Rice paddy	*Oryza sativa*	8
Barley	*Hordeum vulgare*	6
Radish	*Raphanus sativus*	2
Pawpaw	*Carica papaya*	2

Table 4.2 indicates the frequency with which interviewees reported the cultivation of particular crop species. In terms of the major foods, the profile is fairly uniform: cassava, yams *(Dioscorea* spp.), sweet potatoes *(Ipomoea batatas)*, eddoes and dasheen *(Colocasia esculenta*, also known outside the Caribbean as taro), and plantain (merged with sweet species of *Musa* in the chart, despite their somewhat different nutritional roles: the exact frequency with which plantain itself was mentioned was 80 percent). Each of these species was reported by over 80 percent of respondents, and this represents a minimum proportion of those who actually grow it. At the varietal level, the pattern is less uniform, as each of these crops is present in several varieties, any one of which may be cultivated by a relatively small number of families. Beyond these major staples, more interhousehold variety in range of crops planted is evident, although most of the other species were reported by more than half of those interviewed: hot peppers *(Capiscum* spp.), watermelon *(Citrullus lanatus)*, pineapple *(Ananas comosus)*, sugar cane *(Saccharum* sp.), corn *(Zea mays)* and pumpkin *(Cucurbita maxima)*. A smaller number of crop species were mentioned at very low frequencies, less than 10 percent, and in these minor crops there evidently exists some variation in agricultural strategy. All of the crops plants reported in interviews and observed growing in the farms appeared to be among those listed in a survey of Rupununi food plants conducted in the late 1960's in both Amerindian and non-Amerindian farms in the vicinity of Lethem (Dagon 1967a), although a number of novel cultivars were observed and reported to be grown in house gardens (see chapter 4.2.5 below).

Two further features of the data are worth pointing out. First is that peanuts *(Arachis hypogea)*, the only crop grown mainly for sale rather than home consumption, was mentioned by only 18 percent of interviewees, which provides a good indication of the extent of priority of subsistence over commercial activities. Second, papaya was mentioned in only a single interview, but was observed to be growing in a far higher number of the farms visited. This may be because this species is rarely planted, but is dispersed into farms and fallows endozoochorously (when the seed is swallowed whole and subsequently defecated, intact and still viable, in another location) by birds such as the crested orondepola *(Psarocolius decumanus)*

and is effectively a volunteer species. It thus may not be considered to be included in the Wapishana segregate **paoriba** – which appears to be the closest translation of crop plants in the language but in whose definition the act of planting appears to be crucial – despite the fact that it commonly grows in farms and produces edible fruits.

4.2.4 Furtherforest-based agriculture

Agriculture is also practiced on a small scale beyond the main farming area, along hunting roads and in the vicinity of hunting and fishing camps deep in the forest. These camps remain at permanent locations, and at most of these a small area will be planted with crops. This may be no more than a few pepper plants, but at more commonly used camps a variety of crops will be found. Those recorded include pumpkin, yams, sweet potatoes, sweet cassava, watermelons and bananas. One or more tree crops, from the same range of species found near farm camps, are also commonly present. A small area around the camp is usually felled in order to minimise the possibility of trees falling and causing injury, and once these have dried out they may be burned and seeds or tubers planted in the ashes. Ashes from campfires may also provide a source of soil nutrients. Trail agriculture does not reach anything remotely approaching the scale practised by the Kayapó (Posey 1985), but rather seems to be a practice undertaken casually, opportunistically and rather infrequently. Dead, fallen trees in the vicinity of the hunting trail, which have dried sufficiently, may be set alight and the area of bare ashy ground that results planted. Owing to the relative infrequency with which their locations are visited, these deep forest crops are highly susceptible to predation by wild animals. However, they may also serve to attract potential prey animals to the area around the camps and trails, especially in the case of perennial crops such as banana, papaya and fruit trees.

4.2.5 Agriculturaluse of the savannah

The exceedingly low fertility of the savannah soil, combined with the need for any edible plant to be protected by a fence from the ravages of voracious domestic cows and pigs, the cultivation of plants is far less extensive on the savannah than in the forest. However, it is of some significance to all residents of Maruranau. Every household interviewed reported the presence of at least one species of cultivated tree at the homestead, and a small number listed ten or more of a total of 23 different species reported (see table 4.3). Inter-household variability is high, with only four species being cultivated by more than a third of the respondents. The fruits are consumed directly as snacks, especially by children, and during seasonal gluts in

availability, often fermented to make wines or left for consumption by foraging animals.

During the course of the study, a representative of a British company trading in dried tropical fruits visited some South Rupununi villages investigating potential supplies. Despite having provided solar dryers, which a group of several women invested large amounts of time in using to dry fairly substantial quantities of fruit, he reportedly failed to fulfil a promise to make a return visit to collect the goods. This outcome is somewhat unfortunate, as the levels of interest shown demonstrate such a project — transforming a perishable surplus that would otherwise be wasted into a more long-lived product with commercial value — to be of potential value in local economic development.

Table 4.3. Percentage of interviewees listing fruit trees grown to indicate the presences of particular species

English name	Latin name	Percentage of respondents reporting presence
Coconuts	*Cocos nucifera*	74
Mango	*Mangifera indica*	63
Guavas	*Psidium guajava*	39
Cashew	*Anacardium occidentale*	39
Jamoon	*Syzygium cuminii*	37
Oranges	*Citrus sinensis*	30
Whitee	*Inga* sp.	24
Dunks	*Zizyphus mauritania*	22
Soursop	*Annona muricata*	17
Lemon	*Citrus limon*	11
Sugar Apple	*Annona squamosa*	9
Locust	*Hymenaea oblongifolia*	7
Lime	*Citrus aurantiifolia*	6
Tamarin	*Tamarindus indica*	6
Cherry	*Malphigia punicifolia*	6
Grape	*Citrus paradisi*	6
'Gooseberry'	Not identified	4
Passion	*Passiflora edulis*	4
Tangerines	*Citrus reticulata*	2
Carambola	*Averrhoa carambola*	2
Breadfruit	*Artocarpus altilis*	2
Pear	*Persea americana*	2
Sapodilla	*Manilkara zapota*	2
Pawpaw	*Carica papaya*	2

When growing in large stands, mango trees especially provide an important source of shade for domestic animals. Stands of fruit trees on the savannah may also form the basis of the formation of 'bush islands' (Salisbury 1968: 12-14), although the botanical composition of these patches of vegetation and the processes involved in their establishment and expansion have not been investigated sufficiently to determine if this is indeed the case. Ethnoecological evidence reported by Salisbury (1968: 8) suggests that at least some of the islands predate Wapishana occupation of the South Rupununi, and the size of some of the larger islands would appear to preclude an anthropogenic origin, via processes akin to those described by Salisbury (also cf. Posey 1985), within the interval since the first Wapishana immigration into the region. These larger islands are the major sites of agriculture in the villages of the central savannahs, Potarinau, Sawariwau and Katoonarib. The name of the latter, in fact, is derived from the Wapishana term for these formations.

Cultivation of staple crops on the savannahs proper is far more limited in extent. In Maruranau, two families practice corral agriculture, growing cassava and other crops in fenced areas fertilised by their previous use as corrals for cows, when they are rounded up for the purposes of milking and branding during the breeding season. This practice is made possible by the fact that both of these families possess relatively large herds of cattle, and it seems unlikely that it could be adopted within the population as whole without large increases in stocking rates. Within Maruranau there are high levels of interest in increasing the use of the savannah for agricultural purposes. In a series of NGO-funded workshops aimed at generating community-determined proposals for development projects, residents of Maruranau devised a project proposal centred around experimental investigations of savannah agriculture. Although a lack of funding has meant that no concrete action has been taken, it demonstrates the interest that exists locally in this type of innovation. A major incentive in this is that people are becoming increasingly aware of the time and labour inputs involved in travel to and from the farm and the transport of crops to the homestead, and in particular the demands imposed upon women by this. The opportunity to locate the household's main farm closer to the homestead on the savannah would thus assist to alleviate the domestic workload.

Elsewhere, workers resident at the outstations of Dadanawa are given strong encouragement to practice corral agriculture by the management. In Sand Creek, the former health worker, a progressive thinker who lived for a number of years outside the Rupununi and is married to a coastlander, has a strong interest in savannah agriculture, and retired her post in order to have free time to dedicate to the pursuit

of this. In Maruranau, the use of the savannah for cultivation is more widely practiced in the form of house gardens, in which a variety of vegetables, fruit and seasonings are grown. This practice is in many cases a recent innovation, most gardeners having started this work in response to the visit of and distribution of seeds by a Canadian NGO. Success has been varied, hampered in some cases by problems of drainage, water shortage, and reserving planting materials as people adapt to the cultivation of unfamiliar crops in novel circumstances. Much work is also involved in maintaining fences around the gardens, essential to prevent their complete destruction by domestic animals. The original conception of the gardening project as an income-generating venture has barely materialised, owing to the lack of cash in circulation within the village and the impossibility of transporting highly perishable goods to distant markets. A relative minority of people have incorporated the novel foods into their diets. However, significant numbers of people have maintained productive house gardens — including 24 percent of respondents in household interviews — in which a fairly wide range of both traditional and exotic crops are cultivated (see table 4.4). In Maruranau, both the nursery and primary schools currently maintain small vegetable gardens, used for educational and fund-raising purposes.

Table 4.4. Percentages of gardeners interviewed in Maruranau reporting the cultivation of particular plants in house gardens

English name	Latin name	Percentage of respondents reporting cultivation
Bora	*Vigna unguiculata/V. sesqipedalis*	92
Squash	*Lagenaria vulgaris*	67
Pepper	*Capiscum frutescens*	58
Eschallot	*Allium cepa var. aggregatum*	58
Sweet Cassava	*Manihot esculenta*	58
Tomatoes	*Lycopersicon esculentum*	50
Eggplant	*Solanum melongena*	33
Okra	*Abelmoschus esculentus*	25
Butter beans	*Phaseolus lunatus*	25
Ornamentals	Various	21
Lettuce	*Lactuca sativa*	17
Melon	*Cucumis melo*	17
Cucumber	*Cucumis sativus*	17
Calooloo	*Amaranthus dubius*	17
Sorrel	*Hibiscus sabdariffa*	17
Celery	*Apium graveolens*	8
Watermelon	*Citrullus lanatus*	8
Pumpkin	*Cucurbita maxima*	8
Coffee	*Coffea arabica*	8

Bananas	*Musa spp.*	8
Thyme	*Lippia micromera*	8
Carrot	*Daucus carota*	8
Snake gourd	*Trichosanthes cucumerina*	8
Beans	*Vigna* sp.	8

4.2.6 The ecological consequences of agriculture

Some insights into the ecological consequences of agricultural activities were obtained by observations made in the farming area, information volunteered by informants, and in certain interviews on ethnoecology. A comprehensive survey of the farming area in Maruranau provided little evidence of forest degradation resulting from agriculture. In two small areas, both of which were farmed by very old men, the forest appeared to have reverted to scrub. Other informants suggested this was caused by intensive agriculture, the areas having been repeatedly cultivated for excessively long periods. However, these were exceptional cases and it appears that fallow periods are not generally being shortened, as people are aware of the importance, in terms of both productivity and long-term ecological effects, of not reusing an area prematurely.

Succession in old farms may be of importance in the ecology of the forest. Ethnoecological interviews and casual observation indicated that people are generally aware of this process, the change in floristic composition that occurs over time, and the range of animal species associated with the microhabitats created. Details of information derived from a course of interviews on this topic are given in chapter 6.4.2. According to this, many species of game animal are known to frequent old farms (cf. Linares 1976) and take advantage of their provision of food and shelter, especially browsing animals able to feed off the new growth. In particular, fallows typically contain important food plants for tapirs *(Tapirus terrestris),* red brocket deer *(Mazama americana)*, agoutis *(Dasyprocta agouti)*, all species of macaws (*Ara* spp.), as well as plants eaten by many other animals popular as human food. Some cultivated tubers persist for many years after the abandonment of farms, and provide a food source for collared peccaries *(Tayassu tajacu)* in particular, and also for laba *(Agouti paca)* and white-lipped peccaries *(Tayassu pecari)*. Both species of brocket deer are also reported to use the thick undergrowth present in old farms as hiding places. Fallows are reported to commonly harbour high densities of ants of various species, providing food for giant armadillos *(Priodontes maximus*) and giant anteaters *(Myrmecophaga tridactyla*). It is perhaps significant that many of the species mentioned are important seed dispersers: their dispersal of seeds into old farms when

they move from adjacent areas of higher forest may be an important mechanism of facilitation in the succession in old farms. Anthropic dispersal of seeds prior to the abandonment of the farm may enhance the future attractiveness of these areas to game animals: all wild fruits eaten by people are also important food species for forest frugivores.

The use of active farms by wild animals is also of importance (see summaries of ethnoecological data in chapter 6). Several species of game animal are also important crop predators, including both species of peccary, laba, agouti and red brocket deer (see section 6.4 for more detailed information on crop predation). Brown capuchins *(Cebus apella)* and 'haka' *(Eira barbara)* are also reported to be regular crop predators, but although these species may be shot in protecting the farm from their raids, they are rarely or never hunted for food.

White-lipped peccaries *(Tayassu pecari)* are the most destructive of all crop predators, due to the high numbers in a typical herd. A single visit by this species may be sufficient to completely destroy a farm. Their high mobility also makes it unlikely that the farmer or anyone else will obtain the recompense of a hunting opportunity as a result of such an event. The prospect of predation by this species is commonly cited as a reason why people in Maruranau nowadays avoid establishing farms in deep forest, a practice which they say was much more common in the past. In Sand Creek, it is also a major concern. This species is much less important as a food source in this village, in which livestock, fishing and savannah hunting are of greater importance. It seems that these two factors are jointly responsible for white-lipped peccaries being regarded as a pest species.

Other species of crop predators are less voracious, although their depredations are nonetheless a source of complaint among farmers. On the other hand, their use of the farms and the farming area increases their availability to hunters: most kills of agouti and red brocket deer seem to result from their proximity to farms, and laba and collared peccary *(T. Pecari)* who avail themselves of farm produce also commonly suffer this fate. There seems to be no conscious appreciation of these presumed benefits, however, and crop predation is viewed as a destructive activity with wholly negative consequences.

Use of farms by some non-game species is also important to humans: avian frugivores are responsible for the dispersal of seeds of some crops. In particular, informants reported that cassava seeds are dispersed throughout the farming area by a particular bird known as **irodada**, an unidentified species of pigeon (family Columbidae). This may be an important mechanism promoting varietal diversity in this

crop. According to the reports of people in Maruranau, it also means that in most cases, clearing an old farm causes the growth of cassava as a volunteer, from seeds already present in the soil. During visits to farms during 1998, I observed seed cassava to be present in many farms. It appears that in this year, when owing to drought many families suffered a shortage of cassava sticks (stem cuttings that are used as propagules), cassava growth from seeds alleviated the situation somewhat. The cassava seed bank thus seems to provide a safety net in times of shortage as well as stock for genetic diversification.

My impression is that levels of agricultural pressure, in this village at least, remain sufficiently low that forest degradation is avoided and farming rather causes biotic enrichment by increasing the area of gap and edge habitats and thus promoting the abundance of its associated plant and animal species. This effect has previously been noted to be a mechanism via which, intentionally or unconsciously, indigenous agricultural activities can lead to enhancement of the biotic richness of their area, over both short-term and evolutionary time scales (Balée 1989, 1993; Meilleur 1994: 267-271; Escamilla et al. 2000). In an ecotone habitat that may promote genetic diversity even in the absence of human manipulation, the biological effects may be of even greater significance. Informants often described local phenotypic variation in Wapishana animal categories referring to what are conventionally considered single biological species; in some cases the Wapishana language subdivides categories corresponding to biological species on this basis. For example, one informant described two distinct named types of **oran** *(Agouti paca),* differing in size and colour, and several people referred to distinct named forms of **bichi** *(Tayassu pecari)*. I was unable to verify the biological basis of these claims within the present study, but clearly the effects of anthropic modification on the local genetic diversity of wild species are an important topic for further study.

Whatever the detailed ecological consequences of agricultural activities, it seems likely that human nutritional advantages must also accrue, as the frequency of hunting opportunities within and near the farming area is raised. The ecology of agriculture, succession in fallows, and the effects on game animal populations and thus hunting returns are clearly complex subjects of central importance to the understanding of the human position in the forest ecosystem. The restricted and qualitative assessment presented here probably raises more questions than it answers, but it demonstrates the potential value of further, detailed interdisciplinary research on this topic.

4.3 Hunting and Trapping of wild animals

4.3.1 Hunting Technology

The overwhelming majority of hunting employs bow and arrows. Guns are considered more effective (cf. Hames 1979; Hill and Hawkes 1983: 163), but the extent of their use is limited by logistical and economic constraints. Firearm licenses are very difficult to obtain, which according to some, is the consequence of a persistent unease in central government over the status of the Rupununi region that dates back to the Rupununi uprising. While the requirement for a license can not be strictly enforced in such a remote area, a license is essential for the purchase of cartridges and powder. The cash outlay involved is also prohibitive for the majority of people.

Bows and arrows are locally made and employ a combination of natural and manufactured components. The techniques of manufacture entirely from local materials are still known, but more effective materials such as metal points and nylon fishing line (to attach the heads of drop-point arrows) have superseded these in normal circumstances. Bows up to around 2m in length are carved from long pieces of the hardwood **takuba** *(Swartzia dipetala)*. Trees of this species are felled specifically for this purpose, and pieces of wood trimmed from them as required, often over a period of several years. The bow string is usually woven from the cultivated plant **crawa**. Arrows are built on shafts made from the dried stalks of arrow cane, cultivated in a small number of more or less permanent fields. This species seems strongly to resist the intrusion of gap colonisers and its fields do not readily succumb to the usual process of succession. Arrowheads of a variety of designs are made from scraps of metal salvaged from old cutlasses or whatever other source might be available. The most commonly used of these is the **chiparari**, which has a large point suitable for use on white-lipped peccaries and other species of large game. Flights are made from laterally bisected feathers of the powis *(Crax alector)*. Paste is made from a combination of the latexes of two trees – **kaziman** *(Couma* sp.) and **min** - mixed and boiled until they form a thick glue.

Dogs are ubiquitous hunting partners, without whom the capture of many game species would be vastly more difficult, if not impossible. Most regular hunters own several dogs, often specialised for the pursuit of particular species thanks to training by their owner. Pursuit of some species involves complex techniques, whose learning requires extended periods of training completed by only a small number of dogs. Others may acquire their skills via less thorough instruction, sometimes by practice

alone. A variety of **binas**[4] may be applied to dogs in the course of their training, or to a dog whose success declines for any reason. There are also many binas used by hunters on themselves, to develop and maintain stamina, patience, accuracy, alertness or other useful skills.

4.3.2 Social and spatial organisation of hunting

The majority of hunting is done opportunistically: men carry their weapons and take their dogs whenever they go into the forest, for example when going to the farm, to fish or to gather wild fruits or other forest products, in order to take advantage of chance encounters with game. A good deal of hunting also takes place in the course of travel to and from fishing grounds on the Kwitaro or other major rivers, as the main hunting roads all double as routes to important fishing sites. Hunting also takes place during extended stays at the farm, when the farm house acts as a base for forays deeper into the forest. Extended visits to the forest in which hunting is the major objective are also commonly undertaken, but it is exceedingly unlikely that any such trip would involve hunting alone, to the exclusion of all other activities.

This accords well with optimality models based upon a prey distribution that is patchy and unpredictable in both space and time, when encounters with prey are irregular (cf. Hawkes et al. 1982). The prey species that exemplifies this situation is the white-lipped peccary *(Tayassu pecari),* and it is probably appropriate to regard this hunting strategy as being at least partly adapted to the pursuit of this species. In contrast, excursions devoted exclusively to hunting most commonly take place in circumstances when prey location and movements are somewhat more predictable and the likelihood of encounter high. Examples might include shining along creeks for the riparian laba *(Agouti paca)*, staking out fruiting trees known to be regularly visited by game animals, or pursuing a persistent farm predator known to be operating in a particular area.

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[4] The Creolese term 'bina' refers to a wide variety of treatments, based upon preparations of both plant and animal origin, considered to be efficacious in imparting or enhancing some desired skill or property in the individual to which they are applied. This concept is more extensively discussed in Im Thrun [1883], which provides several illustrated examples.

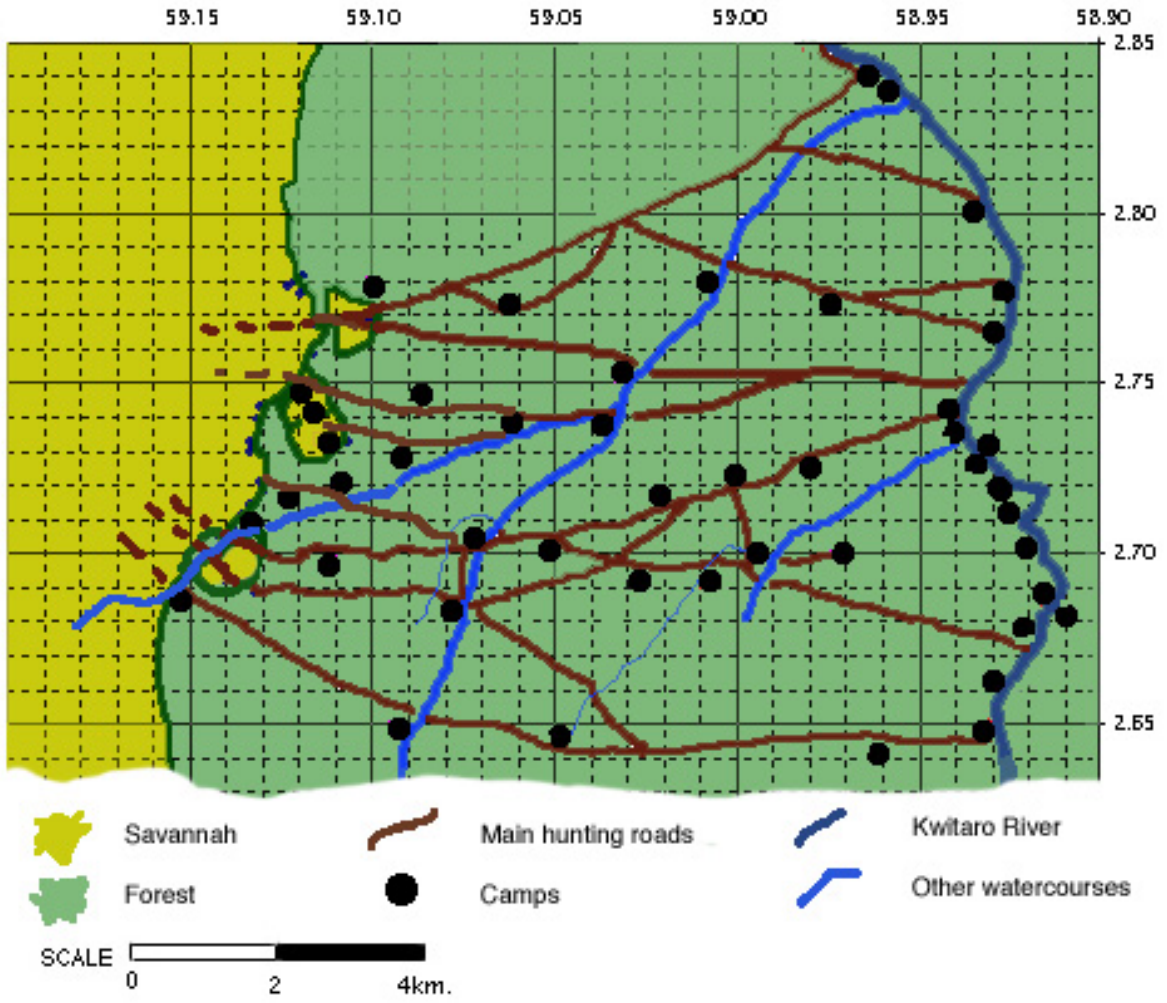

Figure 4.2. Map of main hunting roads in Maruranau

Despite the importance of hunting in the farming area, it is the area of forest beyond that is locally regarded as the major hunting area. Figure 4.2 shows the location of the main hunting roads in Maruranau. Most of these are extensions of farm roads, and each leads to a landing on either Kwitaro or another sizeable watercourse where a hunting and fishing camp is permanently located. In some cases, there are several such sites along a single hunting road, in others only a single one at its terminus. For example, on the northernmost road to Kwitaro - which is also the shortest – there are no camps until it meets the river at Kaziman Bau. Along one of its southerly branches, however, there are camps located at Kwitaro, its major tributary Machiwi'izi, and at a site halfway in-between. Permanent camps are constructed in a similar fashion to houses on the savannah, the major differences being that they are open-walled and, etai *(Mauritia flexuosa)* being both rare and difficult to dry in the forest, thatched with the leaves of other palms. The preferred thatching material appears to be kokerite *(Attalea regia),* but the actual choice depends on what is available locally, and may include low *(Oenocarpus bacaba),* turu *(O. bataua),*

manicole (*Euterpe* spp.), or a combination of these. A group of six workers is able to construct such a shelter, big enough to sleep all six, in a single day. With maintenance, they may last for as long as fifteen years. Hunters also construct a variety of temporary shelters for overnight accommodation when they are unable to reach a camp. These are usually based upon a basic frame made from saplings and to which a hammock can be tied, covered with a sloping roof of either palm leaves or the less durable, but ubiquitous and abundant, wild banana.

Hunting roads and the campsites thereon are considered to be owned by particular individuals. As is the case with farm roads, ownership is originally vested in the man who first cut the hunting line and established the camp. Most of the hunting lines in Maruranau were cut prior to living memory, and their ownership has subsequently been inherited cognatically through male lines: on a man's death, ownership may pass to his son, son-in-law, or nephew. Usufruct rights appear to be transmitted in a similar fashion: a man can retain ancestral rights of use of a particular area for hunting, even if ownership has been inherited by someone else. An individual's use of a particular area for hunting will in any case emerge naturally from their education. Boys learn to hunt by accompanying their fathers and uncles, some of which latter, under the system of cross-cousin marriage, would in ideal circumstances later have become their fathers-in-law. As well as the technical skills involved, they thus acquire a detailed knowledge of the geography and ecology of particular areas, which in most cases will become their major hunting grounds in adulthood. For people without inherited rights of use, the permission or invitation of the owner of a line or camp is formally required prior to its use for hunting or other activities. In practice I never heard of any instance of permission for access being refused, although in principle the system does allow for regulation of hunting pressure, via the decisions of owners of lines regarding who should be granted access. In practice, the major consequence is that most areas of deep forest are more or less exclusively hunted by a small number of people, often restricted to members of a single regular hunting group.

Most hunting expeditions are undertaken by groups of from two to four men, in most cases relatives or affines. A few men go to the forest alone or with their wives, although these are exceptional cases. In some cases residential propinquity or simply friendship is the basis for the composition of hunting groups. Men will often have an effective choice among different groups of relatives as hunting companions, owing to the flexibility provided by the cognatic system of affiliation to groups, though most people on most occasions appear to go hunting with the same partners. This

flexibility may be important for a young man with a choice of hunting areas. It appears to me that a choice between his father's or his father-in-law's hunting line could be determined by social or ecological criteria. This could act as another mechanism for distributing hunting pressure evenly, in cases where people chose to hunt mainly in those of the areas available to them subject to the least use. A further consequence of this is that hunters may choose to hunt with different groups, and perhaps along different lines, when circumstances dictate. For example, a man whose regular hunting partners were unable to go hunting due to absence, injury, illness or customary prohibition could temporarily affiliate with a different group of relatives or affines, who may hunt along a different line.

4.3.3 Prey choice of hunters

Hunting behaviour was investigated both in interviews and by direct observation. Two queries concerning habitat use and preferred prey species give a fair guide to the choice of game species in idea and practice. In household interviews, forty respondents indicated habitat use based upon the broad division between forest and savannah. Twenty households reported that they use only the forest for hunting, seventeen both forest and savannah, and three the savannah alone. These results indicate that although hunting is, in this village, predominantly based in the forest, savannah hunting is also a significant aspect of subsistence activity. In twenty-three interviews, respondents listed their preferred game species. Table 4.5 summarises the results, indicating the frequency with which certain species or categories of game animal were included in these lists. Most of the species mentioned are predominantly or exclusively forest-dwelling. The savannah specialists mentioned are the savannah deer *(Odocoileus virginianus),* and ducks, which include two species: **bididi** *(Dendrocygna viduata)* and **bai** *(Cairina moschata)*. These were mentioned in 17 percent and 22 percent of interviews respectively, figures consistent with the assessment of the significant, if limited, usage of the savannah in hunting. The category 'armadillos' also includes one species *(Cabassous unicinctus)* that is predominantly savannah-dwelling, and the fairly high score attained by this category probably includes some measure of savannah-based hunting effort. It is also worth noting that some other game categories mentioned are found in the savannah as well as in the forest. In particular, *Agouti paca* and *Dasyprocta agouti* inhabit riparian forest adjacent to large watercourses on the savannah, and many people hunt these species during the rainy season when flooding forces them to move to more open

areas on higher ground. Parrots and toucans are both found in riparian forest and bush islands on the savannah, and also hunted in these habitats.

Table 4.5. Percentage of Maruranau hunters interviewed to report hunting of particular categories of game animal.

English name	Latin name	Percentage of hunters interviewed reporting hunting
Laba	*Agouti paca*	86
'Hogs'	*Tayassu tajacu/T. pecari*	86
Birds	Aves	86
'Accouri'	*Dasyprocta agouti*	73
Armadillo	*Dasypus/Cabassous*	56
Powis	*Crax alector*	52
Macaw	*Ara* spp.	52
Tapir	*Tapirus terrestris*	43
Marudi	*Penelope* spp.	39
Parrots	*Pionus* spp./*Amazona* spp.	34
Toucan	*Ramphastos* spp.	34
Ducks	*Dendrocygna viduata/Cairina moschata*	21
Savannah deer	*Odocoileus virginanus*	17
Bush deer	*Mazama americana*	8
Worakobra	*Psophia crepitans*	4

Among mammals, only eight Wapishana categories, encompassing up to twelve biological species, were mentioned. The peccary species *(Tayassu tajacu* and *T. pecari*, reported as a single category in interviews) and *Agouti paca* were the most commonly mentioned categories, followed by the orange-rumped agouti and then armadillos, which in addition to *C. unicinctus*, also includes two species of *Dasypus (D. kappleri* and *D. novemcinctus)* and perhaps also *Priodontes maximus*, although the latter is very rarely encountered and unlikely to have been uppermost in the minds of interviewees. Tapirs were mentioned by less than half of the interviewees, probably because this species is the subject of wide-ranging customary prohibitions (see chapter 5.3), such that large numbers of households include at least one person unable to consume its meat. In fact, this result may somewhat overstate the level of hunting upon tapirs, as another method suggested a very low kill rate for this species. The low score for brocket deer is perhaps unexpected. *Mazama gouazoubira* is not commonly hunted or eaten, again as a result of customary prohibitions, but the same does not hold for *M. americana*, which other sources indicated to be a popular food (see below). One suggestion is that encounters with *M. americana*, more than any

other, occur by chance when it is either spotted, or located by dogs within the farm area, rather than in situations where hunting is the major activity.

Another point that stands out is that primates were not mentioned by any respondent, although over the course of the study it became clear that *Ateles* (females only), *Alouatta*, *Chiropotes*, *Pithecia*, and both species of *Cebus* were all hunted on occasion. This probably reflects a decline in the consumption of primates owing to two factors. One is technological: monkeys are very difficult to kill with bows and arrows, and an arrow shot at them is very likely to be lost. Many informants remarked how commonly monkeys, especially the large howler and spider monkeys, were shot and eaten in the days when guns and ammunition were readily available. The second factor is cultural change: many children and young adults refuse to eat monkey meat, and many older people whose children have adopted this habit report that they have as a consequence ceased to pursue monkeys. An interesting comparison can here be made with Orealla, where all age groups regard the consumption of monkeys with a certain revulsion, owing to their perceived similarity to people. When a family of Trio spent a few years living in their reservation, many people in Orealla found their consumption of monkey meat somewhat disconcerting. It may be that a transition in eating habits currently in progress in Maruranau occurred in previous generations in Orealla, where the history of exposure to non-indigenous customs and of missionary and state education is somewhat longer.

Half of the categories of game arising in interviews correspond to birds. As well as important food sources in their own right, birds also provide a source of animal protein which can be used when others are unavailable. In particular, customary prohibitions during illness or convalescence, following birth of a child, and on many other occasions, may affect some households for long periods (chapter 5.3). Avian species are less commonly the subject of such restrictions, and may be of great dietary importance at such times. The aggregate category 'birds' was mentioned at a frequency equal to that of both peccaries and laba. Individual species or smaller categories each obtained somewhat lower scores, indicating a diversity of individual proclivities within this category. Powis *(Crax alector*), macaws (All four locally-occurring species of *Ara*), marudis *(Penelope* spp. and possibly members of closely related genera), parrots and toucans were all mentioned by over one third of interviewees. Surprisingly, worakobra *(Psophia crepitans)* were mentioned with very low frequency, and maams (various species in the genera *Tinamus* and *Crypterellus*) not at all, despite the fact that other sources suggested the importance of these species as food to be somewhat greater (see below). Many other species of bird

regarded as edible were omitted, along with reptilian species, which provides an indication of the limitations of interview data on this subject. Despite this, it provides an instructive guide to hunting preferences, particularly in conjunction with other methods employed in this study.

In order to improve the data set on hunting rates, eleven men of various ages were interviewed about their lifetime hunting rates. They were asked to recall, or estimate, the numbers of particular animal species they had killed over the course of their lives. The exact figures obtained are presumably highly unreliable in most cases, as few people, especially successful hunters with large numbers of kills to their credit, had concerned themselves with maintaining precise mental records. However, some individuals gave figures which they suggested were quite precise, and even in more uncertain cases the figures given may provide at least a rough indication of levels of hunting pressure. No distinction was made among capture methods, and the lists thus given included animals trapped or gathered, as well as those hunted.

A total of 91 animal categories were mentioned, a few of which refer to more than one biological species. Several species were included that are rarely or never killed for food, but generally because of their perceived pest status. These included several species of felid, (occasionally killed in the hope of selling the hide), fox *(Cerdocyon thous)* and opossum (various species of Didelphidae). Two methods were used to derive an indication from these data of the relative frequency of different animals as foods. Firstly, the total numbers reported by each hunter were summed across each animal category, and the animal categories ranked according to this score. The second method was to rank animal categories according to the number said to have been killed by each individual hunter. The arithmetic mean of these ranks was calculated for each animal, and the categories listed in order of increasing average rank.

The two methods gave very similar results, and collectively allowed each category of animal mentioned to be assigned to one of three classes according to estimated hunting pressure. Top of the list by both methods, and by a considerable margin in each case, was the Wapishana category **wurada**, referring to two species of tortoise *(Geocheleone* spp.) which are procured by gathering (see chapter 4.5.1 below). The next five categories were also identical by both methods, though in slightly different orders. They were collared peccary (*Tayassu tajacu*), white-lipped peccary (*T. pecari)*, laba (*Agouti paca*), **kapash** (three species of armadillo: *Dasypus novemcinctus, D. kappleri* and *Cabassous unicinctus*), and agouti *(Dasyprocta agouti*). A further eleven segregates were listed before an obvious cut-off point in the total

numbers recorded for each species. Ten of these were identical to those among the next eleven species according to average rank, and I determined to include these ten in the class of most heavily hunted animals. Sixteen animal categories were thus determined to comprise those subjected to the heaviest hunting pressure, and these are listed in table 4.6. The two categories found in only one of these top-ranked groups and thus relegated were **kowachi**, the coatimundi *(Nasua nasua*) and **maami** *(Tinamus major*).

Table 4.6. Animal categories reported by hunters to have experienced high mean levels of hunting pressure over time..

Wapishana name	English name	Latin name
Bakuru	Collared peccary	*Tayassu tajacu*
Bich	White-lipped peccary	*T. pecari*
Oran	Laba/paca	*Agouti paca*
Kapash	Armadillo	*Dasypus* spp., *Cabassous unicinctus*
Sokoru	Agouti	*Dasyprocta agouti*
Adori	Accouri	*Myoprocta acouchy*
Koshara	Red Brocket Deer	*Mazama americana*
Pawish	Powis	*Crax alector*
Katorizo	Etai macaw	*Ara manilata*
Maratu	Marudi	*Penelope* spp.
Shaakoo	Scarlet Macaw	*Ara macao*
Namachi	Worakobra/Grey-winged trumpeter	*Psophia crepitans*
Wurada	Yellow-footed tortoise, red-footed tortoise	*Geocheleone* spp
Sowan	Iguana	*Iguana iguana*
Atukara	Salapinta	*Tupinambis negropunctatus*
Atoru	Caimans/'Alligators'	*Caiman* spp.

I assigned animals to the next group on the basis of total numbers reported alone, as for most of them the figures for average rank converged somewhat. This is because for each of the less commonly hunted animals, several hunters reported that they had never killed them, and they thus formed part of a large group with identical, minimum, ranks for that particular interviewee. Somewhat arbitrarily, I selected the figure of thirty as the lowest total score that would merit inclusion in the second class, on the basis that it is a round number which separated the groups roughly in half, and fell between a species of duck reported by people to be a popular food, and the fox, which is normally hunted only for pest control. Table 4.7 lists the animal categories included in this second group.

Table 4.7 Animal categories reported by hunters to have experienced intermediate mean levels of hunting pressure over time.

Wapishana name	English and/or Creolese names	Latin name
Kowachi	Coatimundi/'Kibihee'	*Nasua nasua*
Kasho	Capybara/'Waatrash'	*Hydrochaeris hydrochaeris*
Aro	White-tailed or 'savannah' deer	*Odocoileus virginianus*
Powatu	Brown capuchin/'Jack'	*Cebus apella*
Wishi	Bearded saki/'Bisa'	*Chiropotes satanas*
Roomi	Spider Monkey/'Kwata'	*Ateles paniscus*
Oao	Wedge-capped capuchin	*Cebus olivaceus*
Adorom		*Cavia aperea*
Daakari	Savannah quail	*Colinus cristatus*
Maami	Maam	*Tinamus major*
Kazaru	Blue and gold macaw	*Ara ararauna*
Chaakoi	Toucan	*Ramphastos tucanus*
Wakokoo	'Pigeon'	*Columba cayennensis*
Kuwiari	Red macaw	*Ara chloroptera*
Kochoi		*Pipile pipile*
Pada-pada	'Pigeon'	*Zenaida auriculata*
Bididi	Duck	*Dendrocygna viduata*
Dazao	**'**Water Turtle'	Testudinata
Matada	Giant river turtle	*Podocnemis expansa*
Dyaoruka	**'**Water turtle**'**	Testudinata

Table 4.8 lists a third group of animal categories, those determined to have a low hunting pressure. This includes all categories for whom the total number of reported kills was insufficient for inclusion in the second group, above another arbitrary cut-off point. All cases where the total reported number of kills was less than ten were treated as insignificant and discounted.

Several features of this analysis are noteworthy. First, **koshara** is indicated by this method to be a game animal of considerable importance, suggesting that the results of the household interviews are somewhat misleading in this particular respect. Second, all the primate species are in the second or third classes, reflecting the fairly low hunting pressure on these animals already discussed. Third, tapir is killed at a very low frequency, being in the lowest class with a score somewhat lower than that of, for example the rarely seen, and even more rarely killed, wedge-capped capuchin monkey *(Cebus olivaceus)*. The grey brocket deer is another species that, apparently for similar reasons, finds itself included in the third class (see chapter 5.3). Finally three categories of reptiles were included in the top category despite not featuring in household interviews on hunting preferences: **sowan** *(Iguana iguana)*, **atoru** *(Caiman* spp.) and **atukara** *(Tupinambis negropunctatus).* Presumably this reflects a difference between hunting preferences and hunting practices: while they are not the most sought after prey, they are nonetheless perfectly good food and opportunities to catch them are not rejected.

Table 4.8 Animal categories reported by hunters to have experienced low mean levels of hunting pressure over time.

Wapishana name	English name	Latin name
Wuruuzu	Fox	*Cerdocyon thous*
Suburu	Howler monkey/'Baboon'	*Alouatta seniculus*
Kodoi	Tapir/'Bush cow'	*Tapirus terrestris*
Sowai	Grey brocket deer	*Mazama gouazoubira*
Oroa	White-faced saki	*Pithecia pithecia*
Paashim	Giant anteater	*Myrmecophaga tridactyla*
Witaro	Midas tamarin/'Marmoset'	*Saguinus midas*
Kinyaridi din	Jaguar	*Panthera onca*
Chaumaa	Squirrel monkey/'Sakiwinki'	*Saimiri sciureus*
Koshara din	Puma	*Puma concolor*
Yawari	Opossum	Didelphidae
Irodada	'Pigeon'	Columbidae
Bai	Duck	*Cairina moschata*
Karapa		*Ortalis ruficauda*
Zoruwii	'Small maam'	*Crypterellus soui*
Kaikai	Parakeet	*Aratinga leucophthalmus*
Washanao	Heron	*Ardea* sp.
Chiziki	Parakeet	*Aratinga partinax*
Kanawada	Giant caiman	*Melanosuchus niger*
Arawish	Water turtle	*Phrynops* or *Podocnemis*
Tomtom	Lizard	Sauria

Overall, it appears that although a large number of animal species are edible, in practice hunting effort is concentrated on a relatively small number of species of mammal, bird and reptile, all of which have been documented as being important game animals elsewhere in Amazonia (cf. Hames 1979; Hill and Hawkes 1983; Souza-Mazurek et al. 2000). Although the reasons for prey choice are not thoroughly explored in this thesis, it may be that many of the less popular game species are being harvested at below their maximum sustainable yield. There may thus exist a potential for increased harvest of some of the less popular species should circumstances demand. On the other hand, low species-specific hunting rates may in some cases be the result of scarcity. The ecological consequences of hunting appear to be affected by systems of symbolically encoded regulation, and this is discussed in chapter 5.

4.3.4 Trapping.

A wide variety of animal species are kept as pets. Most popular are birds, particularly Psittacines and small songbirds, but numerous species of mammals and reptiles were also either observed to be, or reported to have been, kept by somebody at one time or another. These are mostly caught opportunistically, commonly as young animals

when the mother has been hunted, and the most popular bird species seem to be the only ones for whom great dedicated efforts are made. The capture of wild animals for the pet trade was formerly an occupation undertaken by large numbers of Wapishana men. The documented trade focused on psittacine birds, in particular macaws, and other showy avian species such as toucans. In the early 1990's the annual harvest of birds from the Rupununi region as a whole was estimated to be a total of 8,000, about one-third of the total national export figure (ARU 1992: 41). Involvement seems to have been demand-driven, and the absence of buyers in recent years has led to the virtual cessation of the trade in Maruranau, although some less remote villages such as Parikwarawaunau and Sand Creek still retain seasonal involvement in a trade now apparently dominated by passerines.

Interviews with former trappers shows them to be at best only faintly aware of the origins and motives of their buyers and of the destination and fate of the animals sold, and of the legal and political factors that have been responsible for the change in circumstances. The arrival of a purported buyer stimulated one group to resume trapping macaws expeditions, although to no avail as the trader never returned to purchase the birds. During the course of this study, a Georgetown-based animal trader visited Maruranau and several other Wapishana villages, expressing an interest in purchasing live specimens of more unusual species, including several species of anurans, chelonians, and other herps, as well as some invertebrates, such as poisonous spiders. After a process of public debate, the village decided to accept his proposition and supply the animals requested. Although no sales had been made by the time of my departure, numerous people were by that time keeping animals they had collected in anticipation of his return, indicating that levels of interest in trapping as a source of income remain high.

4.4 Fishing

All aquatic habitats are exploited for fish, all species of which are considered edible. A variety of methods are used, depending on a number of factors, such as the time of year, habitat type, and fish species being sought. Many exploit the seasonal movements of fish: seines are set and traps built to intercept fish moving downriver after spawning in the headwaters, as the waters drop from their peak at the height of the rainy season. Traps may range from small funnel-like structures woven in a couple of hours from palm fronds and vines, to huge stockades built across major creeks over several weeks and often left in place for months. Seines are placed throughout the rainy season in savannah lakes or deep pools in major rivers. Line fishing is

employed at times of lower water, and may apply an intimate knowledge of the microhabitat use and food preferences of the particular species targeted. Some fish are hunted with bows and arrows, on a smaller scale to those used in hunting, either from a canoe or by diving, if a face mask is available.

Some specialised techniques are applied to particular species of surface-feeding predatory fish. Spring rods are set in suitable habitat for haimara *(Hoplias macrophthalmus)*, or less commonly for pirai *(Pygocentrus nattereri* or *Serrasalmus rhombeus)*, and hooks attached to floating lengths of palm petiole may be set out for houri *(Hoplias malabaricus)*. Haimara and other large predatory fish may also be caught with lines strung across waterways at night, from which hooks are set near the water's surface at regular intervals.

Poisoning of fish is a commonly used method, which may be employed in major rivers of both forest and savannah when the water is low or descending. Poisoning also takes place in stagnant ponds left on the savannah following the receding of flood waters and the breaking up of creeks during the dry season. It is this latter activity that is the source of local concern about environmental damage, as in this situation the poison does not disperse, but destroys most of the fish and other animal life in the pools, including fish too small to be worth catching which would otherwise recruit into the harvestable population in subsequent years. Poisoned pools are also dangerous to livestock grazing on the savannah, and cattle and other domestic animals have on occasion died as a result of drinking from them. A variety of poisons, which in Wapishana are collectively referred to as **oko**, may be extracted from both wild and cultivated plants according to the use required. At least four species of forest vine are used for this purpose, of which the most powerful is reputed to be haiari, or **aishara** *(Lonchocarpus* sp.). In addition, fish poisons can be derived from at least three different kinds of forest tree and four kinds of cultivated plants, including the cultivated shrub **konani** *(Clibadium* sp.). In the majority of cases the poison is extracted from the root of the plant, although in some species the active ingredient is found in the leaf.

4.5 Gathering

4.5.1 Gathering of wild animal foods

The gathering of wild animal foods is less important than animal husbandry, fishing or hunting, but nonetheless significant, being practiced by just over 60 percent of households interviewed. A small range of food items was mentioned by respondents,

and most of these in very small numbers; these responses are summarised in table 4.9. The exception is the meat of chelonians, which according to interviews with hunters, appears to be overwhelmingly the most important wild animal food (chapter 4.3.3). 89 percent of the households specifying types of animal food collected mentioned 'land turtles' or tortoises, a category which encompasses both the yellow-footed tortoise *(Geocheleone denticulata)* and its rarer red-footed congener *(G. carbonaria),* respectively known locally as the forest and savannah turtle. 'Water turtles', referring to several species of aquatic chelonians found locally, was the other major category, mentioned by 61 percent of respondents. The other four categories: the eggs of chelonians, of iguanas, crabs, and snails, were each mentioned in less than 15 percent of interviews.

Table 4.9. Percentages of Households in Maruranau interviewed indicating use of gathered animal foods to report use of particular categories of such foods

Food Category	Percentage of respondents reporting use
Tortoise	89
Turtle	61
Turtle eggs	14
Iguana Eggs	14
Crabs	11
Snails	6

The majority of harvested tortoises are *Geocheleone denticulata,* but only because it is far more common than *G. carbonaria*, and both are collected indiscriminately when found. The high frequency with which these species were mentioned in interviews on household subsistence strategy reflects their high rate of consumption (see chapter 4.3.3 above). The presence of numerous discarded shells in various states of decay is characteristic of hunting camps and farm houses in the forest, where they are employed as seats and rough bowls when needed. In fact, many people consider that their populations have declined significantly as a result of high consumption, particularly along farm roads and in other areas subject to high levels of human traffic.

Over the course of the study I witnessed a pragmatic response to this perceived decline, in the form of a process of incipient management of *Geocheleone* populations by one group of hunters. The strategies employed included selective capture according to age and sex and the relocation of animals, especially females, from rarely visited areas to the vicinity of hunting camps and lines. The viability of this

practice depends on the fact that the actors regularly use a particular area for hunting, and since their hunting grounds are rarely visited by others they can be confident that they themselves are likely to reap the benefits. The population decline reported in areas used more frequently by a greater number of people may be an inevitable tragedy of the commons scenario, there being no incentive to refrain from capture in the absence of any collective strategy for management of wildlife resources.

Both interview data and field observations suggest that the capture of other chelonian species is less important. This is probably due to them being less frequently encountered, but several aquatic species are generally collected whenever found. Many of the smaller species are kept as pets, largely because they are known to command relatively high prices in the live animal trade. Even in the absence of any regular market, many people consider it worth keeping valuable animals in case a buyer should happen to pass by. The larger species of aquatic tortoise are rarely caught in Maruranau, as the areas within which they are found are very remote from the village and rarely visited by the residents. However, many people reported that they had killed and consumed these species in large numbers in earlier times, particularly balata bleeders who had worked in areas where they are more common. During the course of this study occasional reports came of their capture. One individual showed me a shell of a **kudyawarun** (unidentified chelonian) he had killed, having seen it at night and mistaken it for another species, later to learn that its killing is tabooed.

I was also shown young specimens of the giant river turtle, *Podocnemis expansa* that had been collected on the Rewa and brought back to the village to be reared there. This species is very rare on the Kwitaro, and ethnoecological reports indicate that the falls where this river passes through the eastern extent of the Kanuku range form a barrier to the dispersal of both this and the black caiman *Melanosuchus niger*. However, its abundance on the Rewa is well known (Parker et al. 1993) and populations also exist in the Rupununi river. Both of these populations are regularly exploited by specialist groups among the Wapishana. A hunting group from Shea makes annual trips to Rewa during the laying season in February and March in order to collect eggs and, if opportunities arise, they will also hunt adults. In Sand Creek, the meat has particular cultural significance, as it is traditionally served at a Christmas feast organised by the village council. Hunting expeditions are normally commissioned by the toushao to make extended trips up the Rupununi and catch turtles for this purpose during December. However, during this study the current toushao reported

that the take had diminished rapidly over recent years, a result of an apparent decline in population. Such has been his concern over this situation that he has in some recent years cancelled the hunting trip for fear of completely extirpating the local population.

The low frequency at which other animal foods were mentioned presumably reflects relatively low overall importance in the local diet, although some may be seasonally important and particular individuals or families may specialise to some extent in the exploitation of food sources that are not widely used in the general population. The category 'turtle eggs' in the interviews includes those of *Geocheleone* as well as of some of the aquatic species, although this was not specified in the interviews. Another species of reptile whose eggs are popularly consumed is the iguana *(Iguana iguana)*. The main nesting areas for this species in sandbanks on the Kwitaro and other major waterways are well known; during its nesting season in September and October these sites may be visited, nests located and the eggs dug out. Some people practice regulation of the egg harvest, leaving a small number of eggs undisturbed in any nest they raid. I have also observed nesting females being released when caught as their nest was dug out, in order to ensure a harvest of eggs in subsequent years. These practices are not universal, and adult iguanas are also hunted outside the breeding season for food. Some informants suggest that overexploitation of both eggs and adults has caused the virtual extirpation of iguanas from the vicinity of settlements. Although not mentioned in the interviews, the eggs of wild birds are occasionally eaten. In particular, maams (several species of *Tinamus* and *Crypterellus*) may be flushed from their nests at the base of trees by people roaming in the forest off the trails. In such cases, it is believed that the parents will never return to the nest, and the eggs are inevitably collected.

Invertebrate foods are also gathered on occasion: both snails and crabs were mentioned in household interviews, but only by a small number of respondents. Two of the three segregates distinguished among the crustacea are considered edible, and are actively sought in the banks and beds of creek, particularly by women. They may also be inadvertently caught on fishing lines. Some other invertebrate foods were not mentioned in household interviews but were observed to be eaten during the course of the study. Palm grubs are cultivated in a variety of species, including *Mauritia flexuosa*, *Oenocarpus bataua* and *O. bacaba*, trees of which are felled and a pair of holes bored in the trunk to allow entry of the 'father'. This practice appears to be quite rare, and a successful operation was not observed over the course of the study, although a small number of discarded trunks was seen. Several species of caterpillar

are eaten, a practice which appears to be in decline and uncommon among the younger generation. This may reflect a general decline in levels of consumption of invertebrate foods, as Farabee reported that a great variety of insects were eaten, including the grubs of bees, wasps and beetles as well as palm grubs (for which he gives the Latin name *Calandra palmarum)* (Farabee 1918: 41). In addition, several species of wild bee (another of the few invertebrate categories for which the Wapishana language has specific names) are exploited for honey, which I observed to be on sale in the village intermittently, although this was not reported in household interviews. Honey is used as a sweetener for foods such as porridge, and is also occasionally added to the recipe for parakari prior to fermentation, in order to produce a more potent brew.

Interestingly, it is only among the lepidoptera that I recorded divergent linguistic treatments of larval and adult forms: tadpoles, for instance, are referred to simply as 'young frogs'. I was able to record only two names for adult lepidopterans: one for the blue morpho *(Morpho menclaus)*, and one residual class for the rest, both of which were terminal categories. However, the basic term for caterpillars, **taruwiin**, is highly differentiated, and encompasses several different categories assigned binomial names such as **guayaba taruwiin** ('guava caterpillar') for a kind of caterpillar most commonly found on guavas. This is despite the fact that the ontogenetic relationship is well known to people, and may reflect the fact that some larval forms have a utilitarian value, which is not shared by the adults. However, I found no evidence for a similar linguistic treatment of other invertebrate larvae reported by Farabee to have been eaten.

4.5.2 Gathering of wild plant foods

The gathering of plant foods is dominated by the fruits of trees from both forest and savannah, of which ten categories were mentioned in the course of interviews (Table 4.10). Over the course of the study, fruits of several further species of wild trees were also either observed to be eaten, or stated by informants to be edible, but the list elicited includes those that I most frequently observed to be consumed. Six segregates were mentioned by over 70 percent of respondents. Three of these incorporated four botanical species of palms, whose fruits I observed to be collected and eaten far more frequently than others, and whose consumption I believe to be of the greatest importance among non-cultivated plants. The two species of

Oenocarpus[5] were treated as a single category. Their fruits are collected in large quantities when they are in season, and are boiled to make a porridge or a hot drink. The fruits of the etai palm, *Mauritia flexuosa,* are gathered from groves along creeks in the savannah. They can be made into a drink, or the flesh mashed and formed into balls, but appear to be most commonly consumed as fresh fruits. Immature fruits, referred to in Wapishana as **shuruk,** are sometimes sucked for refreshment. Interestingly, the patrimony of this species is, to my knowledge, unique in the Wapishana language, which may reflect its importance in both nutrition and construction (see chapter 4.5.3 below). The etai fruit is known as **dyuwu**, and the tree as **dyuwuza**, whereas in almost all other cases the fruit is referred to simply by following the name of the tree with the general term for fruit, **aku**. The fruit of *Attalea regia* is another seasonally important food, again generally eaten as a fresh fruit although processing methods are known. The dry seeds of this species are of importance as a source of fish bait, as they often harbour an insect larva known as the kokerite worm, or **yapun**. Some older informants report that **yapun** were occasionally consumed as food, but that this practice has nowadays virtually ceased.

Three other segregates were mentioned at frequencies comparable to that of the palms mentioned, although observations of their consumption in the field were less common. Wild cashew (*Anacardium giganteum)* was mentioned at the highest frequency of all species (joint with *Oenocarpus*), despite the fact that it is a fairly rare tree, individuals of which fruit at intervals of several years. Its popularity most likely reflects the fact that fruits are highly prized for their delicious taste, rather than high levels of consumption. Unusually, in this species the same word – **kawarori** – is used to refer to both the tree and the fruit. *Manilkara bidentata* is a far more common tree, but its consumption was not observed so frequently as that of the palm fruits mentioned. This may be abnormal, as in at least one of the years during which this study was conducted trees of this species failed to produce fruit. I suspect that gastronomic criteria might have led this species to be mentioned at a frequency somewhat higher than might have been expected on the basis of levels of consumption alone. The category **koram** ('whitees') refers to an undetermined number of species in the genus *Inga*, most of whose fruits are edible, and is also used polysemously to refer to a single species of this genus. The frequency with which this category was mentioned is probably at least partly a function of the relatively wide

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5 The genus *Jessenia (J. bataua* being the palm turu/**ochori)** has been reassigned to *Oenocarpus*.

biotic diversity it represents. This term is, as far as I was able to ascertain, a unique one among tree names in the Wapishana language, in that several terminologically distinguished categories of trees are all, in the first instance, referred to under the same name. The specific names for these trees, all of which are themselves primary lexemes, are more rarely employed. In interviews, for example, I always had to prompt people for these specific names when they used the term '**koram**' in its more general (and usual) sense.

Table 4.10. Percentage of households interviewed in Maruranau indicating the use of wild fruits to report the use of fruits of particular tree species.

Latin name	English name	Percentage of respondents reporting use
Oenocarpus spp.	Turu	83
Anacardium giganteum	Wild Cashew	83
Manilkara bidentata	Balata	81
Inga spp.	Whitee	79
Mauritia flexuosa	Etai	75
Attalea regia	Kokerite	73
Hymenaea oblongifolia	Locust	46
Spondias mombin	Plum	44
Astrocaryum sp.	Akuyuro	15
Bertholletia excelsa	Brazil Nut	13

Of the remaining trees mentioned in interviews on the collection of fruits, locust *(Hymenaea oblongata)* is a tree of both forest and bush islands in the savannah, whose fruits are commonly collected in the latter, and which is occasionally cultivated in the vicinity of homesteads on the savannah. The Brazil nut, *Bertholletia excelsa,* was mentioned at an exceedingly low frequency, probably because only one specimen of this species is known within the reservation, and its consumption within the village is therefore fairly rare. Trips are also made to gather nuts from stands of trees outside the reservation, between the Kwitaro and Rewa Rivers, but somewhat less frequently as their location is several days' journey from the village.

The ecological consequences of the collection of fruit are mixed. A recurrent theme among those concerned with conservation in the South Rupununi is the damage caused by the felling of fruit trees, especially palms, for their fruits. As all of the trees concerned are also important food plants for forest animals, many of which are themselves commonly hunted, when this takes place on a large scale the ecological consequences, particularly from the perspective of provision of human needs, could be devastating. This problem is only currently manifest within the most

regularly visited areas, but as these are also the main hunting and gathering areas its significance may be more than trivial. On the other hand, many people practice less damaging harvesting strategies, climbing trees to cut individual racemes or branches and in some cases leaving fruit specifically to ensure it is available for recruitment and animal consumption.

4.5.3 Gathering for non-alimentary purposes.

A large number of plant and animal species are gathered for subsistence purposes other than food. Most important, in both subsistence and ecological terms, are those providing building materials. Houses are thatched with palm leaves, the preferred of which is that of etai (*Mauritia flexuosa)*. All savannah houses in Maruranau, where this species is abundant, are thatched with these leaves. In Rupunau, however, substantial etai groves do not occur within the vicinity of the village and only two villagers able to afford to implement haulage by vehicle or draft animal are able to roof their house with this material. Other houses are covered with the leaves of kokerite *(Attalea regia)*, a material whose appearance, rain-repelling properties, and durability are considered inferior. As mentioned above, houses in the forest, where etai is unavailable, are thatched with leaves of a variety of species: kokerite *(Attalea regia)*, low *(Oenocarpus bacaba)*, turu *(O. bataua)* and manicole *(Euterpe* spp.) are the most common.

Collection of etai leaves rarely involves felling the tree; instead, expert climbers scale the trunk and cut the leaves. In most cases a single leaf is left, and people claim this is sufficient to ensure complete recovery of the tree within a couple of years. Felling of the trees for either leaves or fruit is considered highly irresponsible behaviour, one which I did not observe, although previously abundant stands in the vicinity of Marurawa'o creek, in the centre of Maruranau village, are reported to have been felled over the years. Many people believe this to be the cause of declines in the hydrology – the creek is no longer flowing year-round - water quality, and abundance of fish, although it is also thought that poisoning might be a factor. There are also concerns that the recruitment of etai may be adversely affected by the burning of the savannah that regularly takes places in the dry season. Some people believe that this can kill seedlings and young trees, and at current levels is preventing the establishment of new trees in etai stands. Forest palms may be felled for their leaves more commonly: I have seen young kokerite palms within a small monospecific stand cut in the construction of a hunting camp. The practices observed are unlikely to be

damaging at the low levels of exploitation to which these stands are currently subjected, given the wide geographic dispersal of forest dwellings.

A variety of hardwood species of forest timber are employed in house construction, both in the village and in the forest. Depending on size, these may be used for house posts, beams and rafters. A few individuals have access to chainsaws, of which there are two in the village, and operate businesses in the sale of sawn boards. At the moment this operates almost entirely on a local level, and the limited extent of the markets available in the village restricts levels of extraction. However, some areas are locally depleted in the most favoured timber species: as mechanical haulage is not available this is restricted to within a few miles of the 'bush mouth', as the boundary between forest and savannah is called in Creolese. The high selectivity and the use of mature trees makes this an area in which the risks of use exceeding the limits of sustainability are high. A small number of vines are also used in building, for tying together wooden materials.

Traditional crafts retain an indispensable role in subsistence, particularly in the processing of cassava. Graters, matapees (long woven tubes used for squeezing the poisonous juice out of grated bitter cassava), sifters and fans are all made from local materials, as are baskets, warishis (woven backpacks used for carrying farm produce to the house, or provisions on extended forest trips), carrying bags and other items, including some of a purely ornamental nature. The loss of the skills employed in making this technology is a widespread concern among those wary of the increasing focus of Wapishana youth towards Brazil. A small number of species are employed, most important being mokoro *(Heteropsis flexuosa)*, nibi *(Clussia* spp.), and other vines such as **mamu'uzu** (not identified); tibisiri, a product of the etai leaf, and the leaves of etai and other palms such as low, are also important as craft materials. Balata remains important in the manufacture of locally-used products, most important of which are gobis, large containers used to hold water or other drinks. Other purposes for which plant parts and other forest products are gathered include medicine, incense, latex for glues and firelighters, cigarette papers, binas and a variety of magical uses.

4.6 Animal Husbandry

The rearing of domestic livestock by Wapishana people probably postdates the settling of European ranchers on their land by a fairly short interval. Farabee (1918) makes no mention of the keeping of domestic animals, and it had earlier been reported that Wapishana people met by Schomburgk expressed a disdain for the flesh

of the European pig (Schomburgk 1923: 310). Im Thurn reported that the meat of exotic animals introduced by Europeans was avoided by all Amerindians unless 'blown' on by a piaiman (see chapter 5.2) (Im Thurn 1883: 47, 368). However, this situation clearly changed over time, and by the 1940's the practice of animal husbandry appears to have become commonplace among the Wapishana (Peberdy 1948: 18, 31-32). Nowadays it is a very widespread practice: 95 percent of households interviewed reported that they kept at least some domestic animals. The size of household stock holdings varied from a single chicken to fairly large numbers of cows, pigs and other animals. There is clearly a great deal of interhousehold variation in the relative importance of domestic and wild sources of animal protein.

The Wapishana language has an extensive nomenclature of domestic animals. All the familiar species - cow (**tapi'izi**), pig (**kooshi**), sheep (**kazinizo**), goat (**boochi**), horse (**kawaro**), donkey (**chaakashi**), mule (**boozo**), chicken (**kuruku**), turkey (**piiru**), guinea fowl (**pikodu**), as well as cat (**pishan**) and dog (**arimaraka**) – have Wapishana names. Many more specific names exist which refer to particular age-sex classes, and to castrated males. The etymology of these terms has not been investigated, and it is possible that many, if not all, have been borrowed or adapted from various of the non-Amerindian languages to which Wapishana people have been exposed over the course of their recorded history.

The common appearance of domestic animals in myth and folklore attests the extent to which animal husbandry has been incorporated into Wapishana culture. Various of the associated skills – those of cattle management being a particularly impressive example [e.g. See Brock 1972] - have nowadays been seamlessly integrated into the repertoire of subsistence strategies.

Of the domestic animals, cows, pigs and chickens — the latter generally being raised for the production of meat rather than eggs, although eggs are also eaten — are the most important as sources of meat. Horse, donkeys, cats and dogs are not eaten, and the other species listed above are fairly uncommon. Horses and donkeys are used as draft animals and for transportation; horses particularly in the location and rounding-up of cows. Cows are also put to work — to carry heavy loads, or as a means of transport when ridden or used to pull bullock carts.

A system of herd management based upon open access to grazing lands operates throughout the Rupununi, allowing cattle and horses especially to roam over large areas of the savannahs for much of the time. Fences are very rare, and the notorious Wapishana fence, marking the boundary between reservation lands and the Dadanawa grazing lease, is derelict over large stretches. Some parts of the Dadanawa

lease do remain fenced off, and a long stretch of fence was constructed by residents of Rupunau to prevent cattle from the adjacent Weirmoor ranch from entering farms, but for the most part the animals have the run of the savannah, and Wapishana-owned animals often mingle with those of the commercial ranches. Round-ups of cattle are conducted after calving in order to brand young animals and make use of the milk, and horses which range too far may be captured and brought closer to home. Pigs also range freely, though their owners try to encourage them to remain within fairly restricted areas. In most cases these are close to the homestead, but a persistent increase in stocking density has led to an expansion into the unsettled savannah areas in the west of the reservation. There are concerns in Maruranau that a shortage of savannah land suitable for keeping livestock may soon be encountered if current trends towards greater herds of livestock continue. In the case of both cows and pigs, particularly errant behaviour on the part of any individual animal is considered problematic, and may induce the owner to slaughter it. One reason for this is the inconvenience involved in locating and keeping track of the animal, another that such animals are considered to be particularly vulnerable to predation by jaguars or pumas.

A more serious problem associated with domestic livestock is their predation of cultivated plants. Savannah farms and gardens must be securely fenced against the incursions of cattle and pigs, which considerably increases the workload associated with the maintenance of the gardens. Pigs that persistently raid their owner's house garden may be prematurely slaughtered for that reason. Cultivated trees at the homestead, especially coconuts, must also be enclosed by fences in order that they are not eaten and destroyed by browsing cows. Forest farms close to the savannah are also vulnerable to cow predation, and those closest to the forest edge are often at least partially fenced, or the entrance to the farm road blocked with a fence, for this reason. Cows have been known to travel a mile or more into the forest to feed at a farm, and for this reason many people prefer to cut their farm somewhat further in. The owner of the livestock appears to assume little culpability in cases of farm-raiding, and it appears that the onus is more on the farmer to ensure their fields are protected. In cases witnessed during this study where one person's crops had been damaged by another's livestock, the owner did not appear to be accountable to the farmer for the damage caused. Another destructive habit of many cows is the eating of clothes, which forces people to be somewhat vigilant when washing clothes and hanging them out to dry. Some cows appear to be prepared to go to considerable lengths to procure unguarded items of clothing, and one particularly notorious

individual resident in Aishalton became locally renowned under the name of 'Guyana Stores', due to the extensive wardrobe that was reportedly retrieved from its alimentary canal following its slaughter.

Animal husbandry has both direct and indirect effects on human ecology. Animals broaden the use of the resource base via their consumption of grasses and other savannah plants – cows, for instance, consume many species of wild fruits, and pigs forage extensively in swamps, and are particularly fond of etai fruits. A few people have experimented with the planting of more palatable grasses such as barama grass imported from Brazil, but such activities appear not to be extensive, perhaps because there is no guarantee to the planter that their own animals will get the benefits. Some of those with fairly sizeable herds of cattle are able to engage in corral agriculture, although not all choose to do so. Manure is sometimes collected to fertilise house gardens and to enrich the soil in which trees are planted, although overall this resource is much underused.

The availability of domestic meat directly affects hunting levels by providing an alternative source of protein (cf. Jorgensen 2000: 262). Some men have effectively abandoned hunting, and regard themselves as specialist vaqueiros, although all retain possession of weapons and take advantage of hunting opportunities that come their way, for example in village-wide peccary hunts (see chapter 8.1.1) and chance sightings of animals. The option of a lifestyle centred more around the village is one that is taken up by a significant number of people, and many such as shopkeepers, teachers and perennial members of the village council, also rely on livestock for a high proportion of their protein intake.

Another effect of the presence of livestock is a changing of the human relationship with those carnivores prone to prey on domestic animals. Jaguars and pumas killing cows or pigs are generally hunted down and attempts made to kill them. Some people also attempt to kill large felids encountered on their hunting lines, believing them to be competitors for game animals and to pose a danger to both people and hunting dogs. This type of behaviour could date back to before the introduction of domestic livestock, but is more casual and opportunistic than is the case with livestock predators, the stalking and killing of which is carried out methodically and purposefully. Smaller predators such as foxes, opossums and raptors are more commonly found to prey on chickens, and considered pests; the former two are generally killed when found near human habitations.

4.7 Biodiversity Use: the synecology of Wapishana subsistence

4.7.1 Use of animals

A systematic overview of animal use was achieved in interviews on ethnozoological nomenclature (see chapter 6.1). In these interviews, I elicited a total of 378 named terminal categories in the animal kingdom. Of these, 169 were normally included in the category **'wunii'**, meaning 'animals eaten by people', and are thus considered edible. A few species of animal, both edible and non-edible, have medicinal or symbolic uses, but these are few in number and not often used, and the ecological effects of this type of usage are probably minor. I recorded such uses for nine Wapishana animal categories not normally considered edible, meaning that a total of 47 percent of animal categories named in the Wapishana language have direct human uses.

As previous sections of this chapter indicate, actual use of animal species is for the most part restricted to a relatively small number of those species considered edible. However, some of the species consumed less regularly may be important for particular people or groups, seasonally, in the provision of micronutrients or as reserve sources of animal food at times of food stress or when other sources are not available.

4.7.2 Use of plants

Further data on plants use was collected using ethnobotanical survey plots, which were established at a number of sites in the forest. Within these plots information was recorded on the floristic composition (in terms of Wapishana ethnobotanical categories), and the Wapishana researchers involved also recorded information on the uses of the trees located within. In addition, I recorded much information on plant use on an ad hoc basis, based upon my observations and the statements of collaborators in other areas of the research programme.

Ethnobotanical survey plots included a total of 199 plant categories of tree habit. The researchers involved knew uses for 144 of these, and uses for five more were provided by other informants. The statements of other informants also corroborated many of the observations recorded in connection with the plot surveys, and the small number of additional uses recorded suggests that the majority of this information is widely known. In addition, other informants provided the names of a further 56 segregates not encountered in the survey plots, 51 of which were ascribed uses. A total of 315 different uses were recorded for these 195 useful segregates.

Useful trees were assigned to use categories by a method derived from Johnston and Colquhuon (1996). Their categories were modified slightly, dropping that of commercial timber trees, which I deemed to be of little relevance to the present study. This was despite the fact that some people, particularly those who had worked with coastlanders, did have some knowledge of which species were marketable. In its place I included firewood, a usage not mentioned at all in their paper, but which I consider to be important in the context of the present study. Its inclusion here as a separate category allows the remaining categories to be consistent with those in their study, which was based in the village of Kurukupari in central Guyana. The six categories employed in the present study were as follows:

Edible - in 50 of the 53 recorded cases, these were producers of edible fruits. The others included four palms felled to cultivate grubs, three of which also produced edible fruit, one producing an edible oil and two used for beverages.

Technological - including a variety of materials used for making tools and utensils, such as woods, fibres, gums and resins, and other uses such as making canoes, firelighters, insecticides, fish poison and sources of fish bait.

Construction - all materials used in the manufacture of dwellings or forest camps, including house poles, beams and rafters, wattles, thatching materials and materials used for tying.

Medicinal - any tree product used for the treatment of ailments.

Firewood - on many occasions, especially in the forest, people would not seek specific trees for firewood. Instead, they would use whatever dead wood was available, with the exception of a few species known either to burn poorly or to emit noxious fumes. However, there are also certain trees particularly useful for firewood, either in general or on specific occasions, and those recorded as such have been included in this category.

Miscellaneous - a variety of functions not included in any of the above, including incenses and other products with esoteric uses, decorations and cigarette papers.

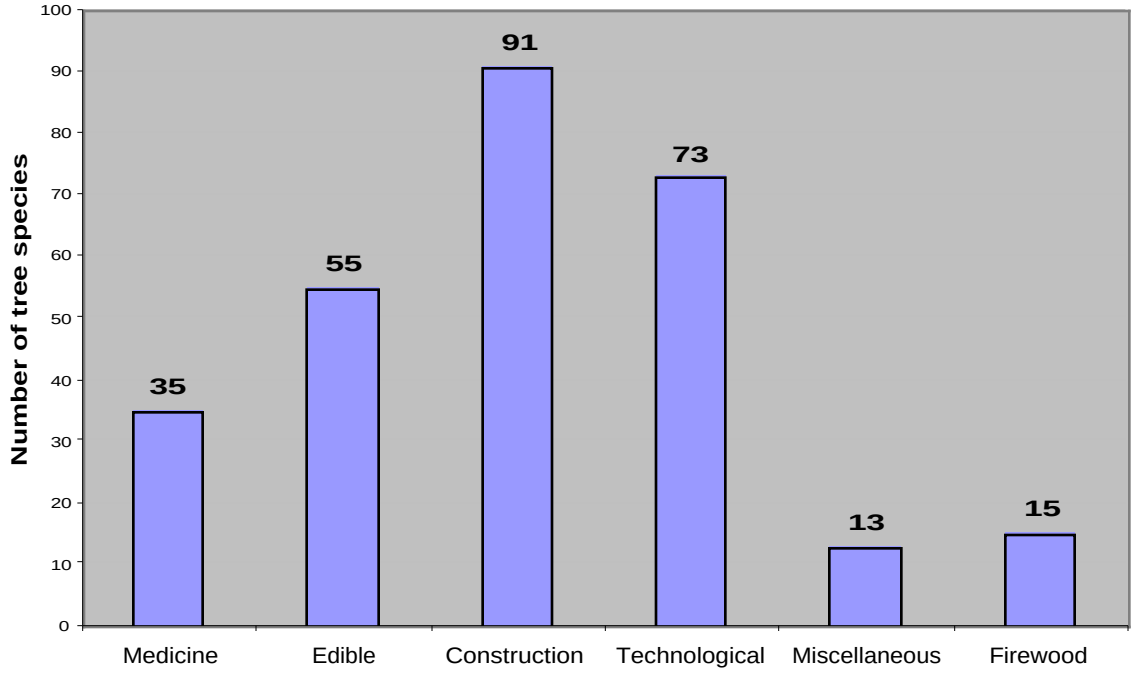

Figure 4.3. Number of trees named in Wapishana for which uses were documented within each of the six use categories, following Johnston and Colquhoun (1996).

The proportions of useful trees in each of these categories, shown in figure 4.3, differed markedly from those reported from Kurukupari. The most marked difference was the much greater numbers of species deemed useful in construction, the largest category in the present study. The proportion of medicinal uses reported in the present study was much less. As in the Kurukupari study, the pattern of numbers of tree species per category was similar to that of number of uses per category (see figure 4.4). The greatest number of cases of multiple uses of a species within a category (figure 4.5) occurred in the technological category, within which five uses were recorded for one segregate **(iziari**, the balata tree *Manilkara bidentata).* I do not find this result surprising, as this was the most diverse of the use categories employed. However, it does differ from the results from Kurukupari, in which the large medicinal category exhibited the greatest occurrence of multiple uses.

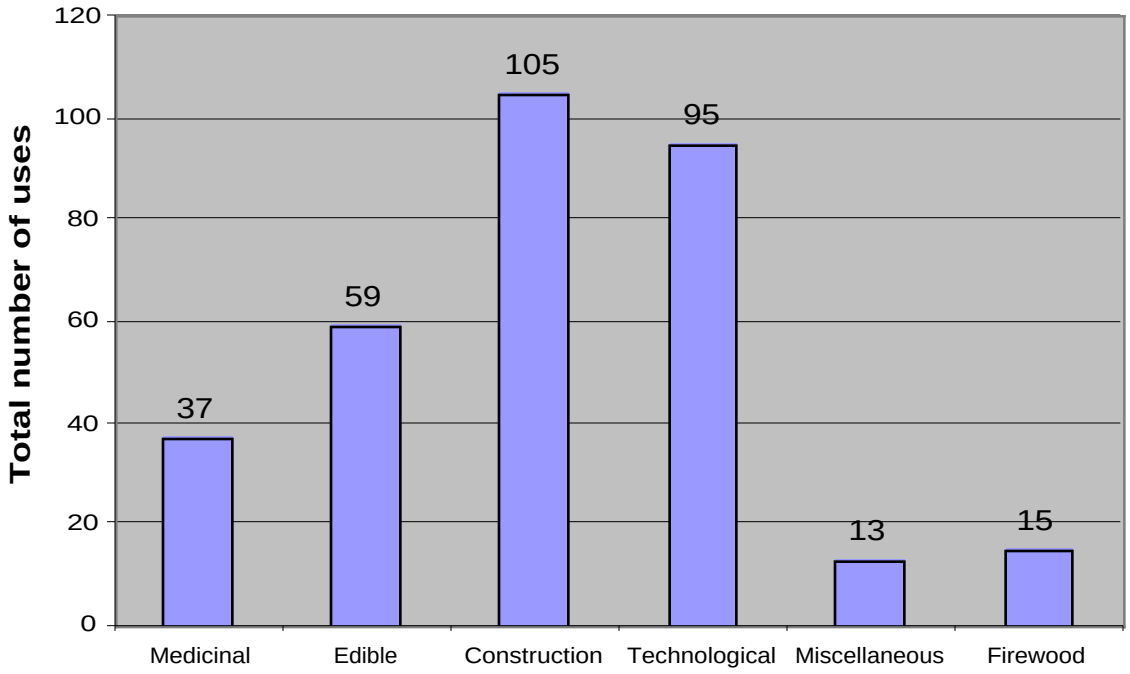

Figure 4.4. Total numbers of recorded uses for trees within each use category, following Johnston and Colquhoun (1996)

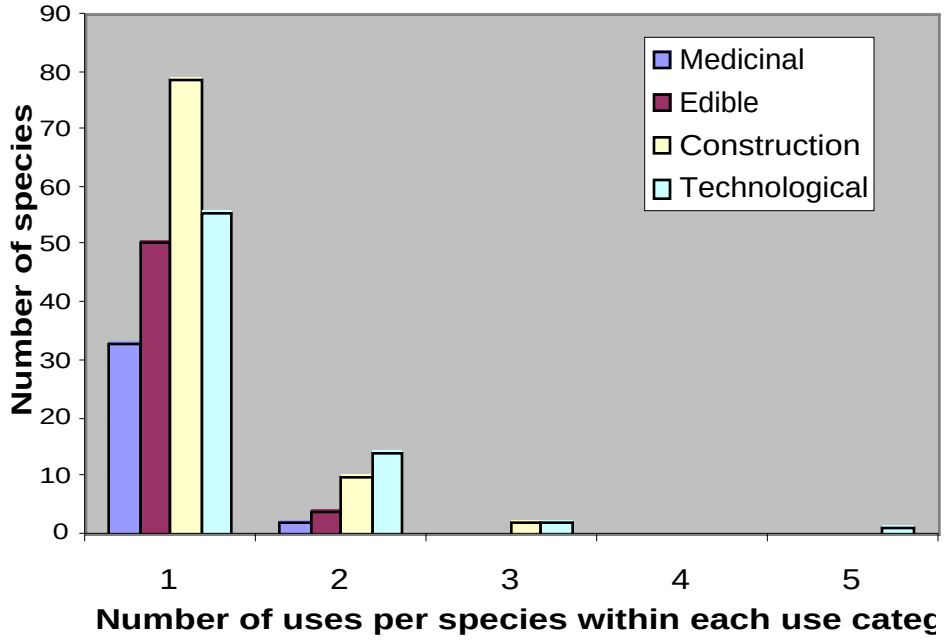

Figure 4.5. Numbers of tree species for which multiple uses per use category were recorded.

These two main differences between the results of the studies may well have different explanations. The smaller number of construction species reported at Kurukupari may be due to the demographic domination of this village by Lokono people. In Lokono settlements I have visited on the coast, board houses are more

common than more traditional structures. A smaller variety of timber species is suitable for this use than for the construction of a typical Rupununi dwelling. It may be that gathered construction materials other than timber are also employed more frequently in the cash-starved and isolated South Rupununi, where nails and other manufactured substitutes, though desired and used when available, are more difficult to come by. I have not visited Kurukupari and do not know if it is indeed the case that board houses are the norm and manufactured articles more readily available. The greater numbers of medicinal uses of plants in Kurukupari may be the result of the mixed tribal composition of that community, in which Lokono, Makushi and Wapishana people are all represented. Widely shared medicinal knowledge from all these tribes may have therefore been documented in that study.

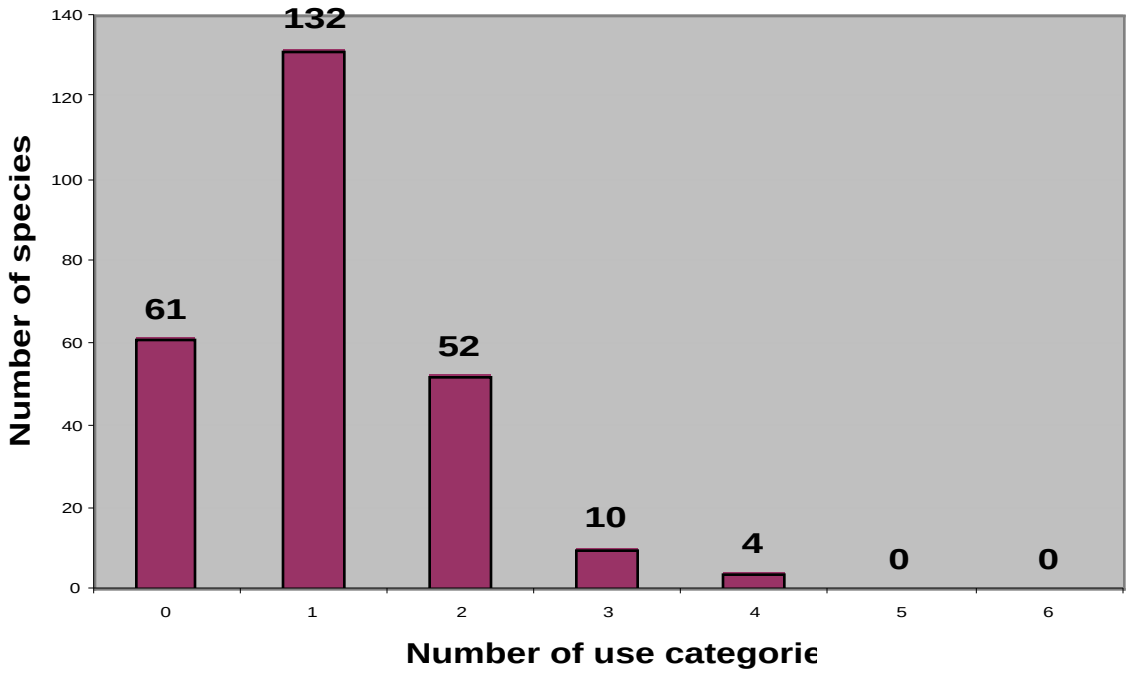

Figure 4.6. Frequency distribution of number of use categories in which trees were represented, following Johnston & Colquhoun (1996)

In other respects the data sets from the two studies were similar. The majority of useful trees recorded in this study were included in only a single use category, and indeed had only one use. No segregate was represented in more than four use categories, though four were represented in four, ten in three and 52 in two (figure 4.6). The greatest number of uses for a single species was **iziari**, with nine, and a total of 76 segregates had more than one reported use (figure 4.7). It is certain that the proportion of useless segregates is underestimated, as their lack of relevance to my study meant that people were less likely to mention them to me. If it is assumed

that the proportion of segregates with no recorded use encountered in plot surveys is representative of the population as a whole, for the 51 useful segregates recorded under other circumstances it is to be expected that a further fourteen segregates with no use must exist. If this is the case, uses were recorded for 195 of 264 segregates implied by the results, or 74 percent. A very small number of trees were encountered in the plot surveys for which no Wapishana (or other) name was known. As a result of this, and the fact that trees with no use are more likely to be lumped in the folk nomenclature, the proportion of botanical species with no use is probably slightly higher. It must also be noted that the information recorded in this study does not encompass the entirety of botanical knowledge even within the study village, let alone the botanically varied area encompassed by the totality of Wapishana settlement.

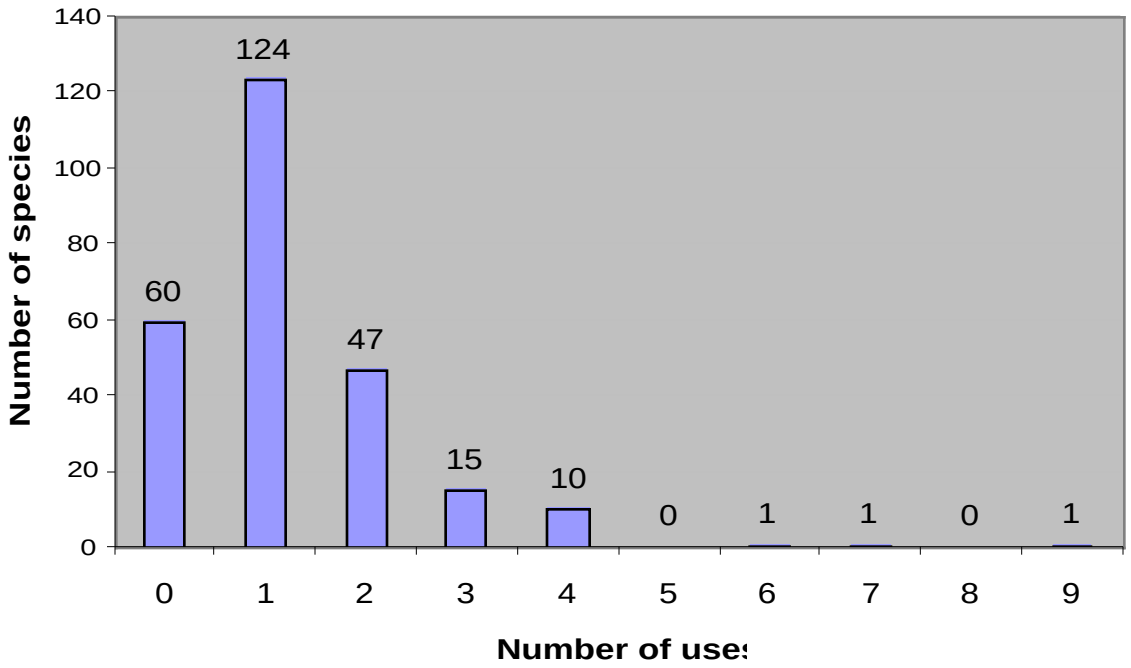

Figure 4.7. Frequency distribution of numbers of reported uses per tree, following Johnston and Colquhoun (1996).

Of the 195 useful segregates, the uses of 111 included one or more that involve the felling of the entire tree. Specifically, these included uses in construction of houses, manufacture of dugout canoes, and the manufacture of certain craft items such as bows and cassava graters. A further 4 species of palm trees were reported occasionally to be felled in order to cultivate palm grubs. A lack of quantitative data on harvesting levels and their effects on populations limits the extent to which it is possible to examine the ecological consequences of this. Informants in Maruranau did report instances of very local depletion of some species of timber trees felled for

construction, in particular areas of the reservation. The possible effects of human harvesting of particular tree species on the local ecology are explored in chapter 8.2.

4.8 Summary and Conclusion

Overall, Wapishana people in Maruranau make extensive use of the biodiversity of both forest and savannah for subsistence purposes. There is evidence of the conscious application of ethnoecological knowledge in hunting, fishing and the gathering of animals in particular (see chapter 8.1). There is also evidence that utilitarian factors are encoded in the Wapishana biological lexicon, in which the treatment of several categories of non-cultivated plants and animals of utilitarian importance is atypical. The overall subsistence strategy is dominated by agriculture, but the employment of ethnoecological knowledge in this field of activity was not investigated to any meaningful extent in this study.

The possibility that the effects of agriculture on the forest ecosystem complement hunting by raising the availability of game animals was raised in chapter 4.2.6. The emergent properties of the agro-ecosystem are further discussed in chapter 9.2. Along with the factors mentioned in the current chapter, regulation of human exploitation of natural resources as a result of symbolically-encoded restrictions on subsistence activities appears to be an important component of this. Chapter five introduces this subject, and is concerned with Wapishana symbolism and its ecological consequences.

CHAPTER 5: SYMBOLISM

5.1 Syncretism and the Wapishana world view

The importance of Wapishana cosmology in the present study proved to be somewhat greater than I originally anticipated. In this acculturated and nominally Christian people, I did not expect that resource use would to any great extent continue to be regulated by traditional, symbolically-prescribed systems of regulation such as those described by Descola [1994], Ross [1978], Reichel-Dolmatoff [1971, 1976] and Balée [1994]. Over the course of the study, however, it became clear that the nature of the modern Wapishana belief system is syncretic. Christian beliefs and practices have not displaced their local antecedents, but the two appear, so far, to have been reconciled. This has occurred in less dramatic, coherent and formalised a fashion than that of the Hallelujah church (Butt 1959, 1960; Butt Colson 1998), but one which shares its essential nature as a novel synthesis of traditional and Christian beliefs. A model in which Christianity forms a philosophical framework within which certain specific aspects of Wapishana belief have been retained is one that, although crude, is not entirely misleading.

Some people indicated to me that the formal coherence of the Christian world view was something they had found the traditional system unable to provide (although this may be a consequence of the fact that it is nowadays somewhat degenerate), and for this reason they found Christianity more satisfying intellectually (cf. Horton 1971). However, concepts in the traditional system associated with sickness, healing, and the human relationship with the natural world — matters of day-to-day importance whose practical functions Christianity is unable to fulfil — are strongly retained and form essential components of the modern world view with important manifestations in terms of lifestyle. Those with possible ecological functions are considered in some detail later in this chapter.

To give an example of the way in which indigenous and exotic concepts have been integrated, the Christian term 'God' is translated by the Wapishana term **Tominkaru**, and the latter is employed within church services as well as in general use. The concept appears to be somewhat different from the Christian one of a single all-powerful creator separate from the creation since the same term also refers to spirits considered to be creators of individual species of animal and plant. Wapishana creation myths recorded by Ogilvie (1940) indicate the creator's twin aspect and his active role as a culture hero, motifs more typical of Amerindian than Christian belief systems. The same stories also contain many elements with clear parallels in Christian

myth, such as the Garden of Eden and the great flood, which may indicate that the syncretic process was already underway relatively soon after missionisation. Acculturative influences on Wapishana tradition are also evident outside the strictly religious sphere, in the incorporation into folklore of exotic elements such as domestic livestock and the life of the animal herder, musical instruments, and the Brazilian nation and people (cf. Drummond 1974).

Informants in the present study generally distinguished between indigenous beliefs and practices and those originating with their adopted religion. Statements about current aspects of Wapishana belief or practice were typically qualified with statements along the lines of 'this is what we Wapishana believe', or 'this is what we Amerindians believe'. A further distinction was often made between aspects of the belief system which had been retained and those which are nowadays abandoned or questioned, or the beliefs of 'old time people'.

Particularly during the early part of the study, I often encountered a certain reticence about matters of spirituality and esoteric beliefs. Although many people were more open on these subjects once they were convinced that I was both genuinely interested in and respectful of them, others remained evasive even after I had got to know them well.

This chapter does not give a comprehensive overview of Wapishana cosmology, but rather emphasises spiritual beliefs and practices with possible ecological effects. The next section describes some basic concepts associated with sickness and healing in the Wapishana belief system, which form the major structural context within which specific systems affecting usage of natural resources operate. Subsequent sections are concerned with these specific systems, in which the relationships between human actors and various forms of nature spirit affect the exploitation of nature by the former in various ways.

5.2 Healers, sickness and healing among the Wapishana.

A key institution in Wapishana cosmology and associated practice is that of the traditional healers, referred to in Creolese as 'piaimen'. They may be either men or women, **marunao** and **marunawabo** being the respective Wapishana terms. Their work nowadays forms a complementary system in conjunction with whatever form of conventional medicine may be available: people generally seem to make use of the latter whenever possible, but most will additionally consult a **marunao**. Investigation of the practices of the latter took the form, to some extent, of salvage ethnography. Many people concurred that the leading practitioners were now deceased, and it is

clear that many aspects of knowledge and practice have indeed been lost. On the other hand, people did on occasion allude to the continued presence of powerful **marunao** and **marunawabo** in the region, though apparently not in Maruranau itself. I got a clear impression that these surviving practitioners maintain a very low profile with respect to outsiders. Certainly, all attempts I made to follow up hints made to me about their presence quickly proved unsuccessful, my enquiries being met with claims of ignorance as to their identity and location. There are certain aspects of Wapishana culture that are rarely or never revealed to outsiders; certainly the time I spent in the area was not sufficient to allow me to access to some of its more esoteric aspects. For both these reasons, the following account is both superficial and fragmentary, although it clearly indicates the value of more thorough investigation. The wish expressed by more than one person in Maruranau to document Wapishana spiritual practices comprehensively indicates the most appropriate form that such a project could take.

Any such efforts may be too late to prevent the loss of some key knowledge. In particular, the role formerly adopted by shamans as effective ecological managers (chapter 6.5) appears nowadays to take the form of memories of actions of persons who are now deceased. In the realm of healing, however, knowledge appears to have been far less specialised. Many ethnopharmacological techniques are very widely known, and numerous people among older age groups retain extensive personal pharmacopoeias. In the realm of spiritual healing too, there are many people who retain knowledge of esoteric techniques. Although the master practitioners are said to have passed on, this body of knowledge has not entirely died with them. However, many people have expressed concern that, like many other aspects of specialised local knowledge, this is not being effectively transmitted to younger generations.

Wapishana concepts of disease and practices involved in treatment have much in common with those recorded in other Amerindian groups, particularly elsewhere in Guyana. Disease is considered to result from the actions of evil spirits, many of which have an ultimately human origin in the form of kanaima activity. The concept of kanaima (**kanaumuu** in Wapishana) has some similarities with that described in other Guyanese tribes (Anthon 1957; Roth 1950), and appears to encompass malevolent entities of both human and non-human natures. As a human entity, the kanaima appears to be a shaman who employs their skills to cause harm to others. One such individual is reported to have led a highly active life in Maruranau within living memory. He is said to have caused the deaths of a huge number of people, and severe illness in many more, over a period of many years before being killed by

another villager employing a magical technique based upon the use of the pelt of a male spider monkey. The term kanaima was often employed to refer to dangerous spirits residing in forest and savannah with no apparent connection to living humans. It may be that they are connected in some way with the deceased since many people when speaking in English used the term interchangeably with 'jumbie', a Creole term apparently more or less identical in meaning to the more familiar term 'ghost', which I heard explicitly applied to the spirits of dead people. One such kanaima resides on a depopulated area of savannah in Maruranau Reservation, and is reported to have killed all the people who formerly resided in that area. Kanaima seems to be considered the root cause of most, if not all, deaths (also see Baldwin 1946: 51; Foster 1990: 171-174). Medical explanations are accepted, but kanaima is considered to be the ultimate cause of conditions such as cancer, for example. Unsurprisingly, accusations of kanaima activities are among the most grievous insults imaginable, and their occurrence is a sign of considerable social tension.

Traditional healing is concerned with dispelling the spiritual causes of illness via application of remedies of plant, or less commonly animal, origin, and other therapeutic techniques such as blowing, massage, and the use of various forms of incense. The most commonly used incense is **marou aiba**, the sap of the tree **marou**, or haiawa *(Protium* sp.). This is burnt one or more times a day when any member of the household is affected by an illness, and often as a precautionary measure in households with young children; its smoke may also be used for more intensive treatments. It efficacy depends upon its ability, to dispel evil spirits, a process called **shunaribai** or **shandan**. Several other incenses share this property, including that of locust *(Hymenaea oblongata);* one informant told me that the skin of the **niinito** (possibly *Galictis vittata)* may be burnt for the same reason. Some exotic plants, including lime and garlic, may also be used for this purpose.

The practice of 'blowing' among the Akawaio has been described with greater detail than I am able to provide for the Wapishana (Butt 1956), but such information as I have is consistent with that account. The combination of breathing in a particular fashion and giving a spoken invocation is thought to be efficacious in a variety of circumstances, from illnesses such as muscular pains, cuts and snake bite to more serious spiritual attacks. Blowing for healing purposes is often combined with other of the medical techniques mentioned: it may, for example, increase the efficacy of herbal or patent remedies. Bathing in blown water is employed as a prophylactic measure for people particularly vulnerable to spiritual attack, such as young babies and relatives of a recently deceased person. Blowing may also be employed for

malevolent purposes associated with kanaima activity, although of course nobody would admit to any but the vaguest knowledge of this. The skills involved in blowing are not widely distributed, and knowledge of them is reported by many people to be in decline. There also exist still more specialised healing methods, practised by only a few specialised healers, including blood-letting, soul retrieval (**pudapudan doruna**, literally 'spirit come home') and extrusion. Some informants alluded to the ability of piaimen to work in altered states of consciousness, and it was sometimes hinted that this was achieved through the use of tobacco and other power plants, although details remained obscure and I met no-one who professed to have a practical knowledge of such techniques.

5.3 Human spirits, animal spirits and dietary prohibitions.

A cornerstone of Wapishana cosmology is a belief in a richly-populated world of unseen spirits intimately associated with both human and non-human aspects of the visible material world. Every human has an individual spirit aspect persisting beyond the life of the physical body, referred to by either of two apparently synonymous terms: **ma'achai** and **doronaa**. Many illnesses are believed to originate in the **doronaa**, through which spiritual factors capable of causing disease act. The **doronaa** of a recently deceased person is believed to pose some sort of a danger to their relatives, even if they do not live in the immediate vicinity, and the latter will ensure they take measures for their spiritual protection.

The same terms are used to refer to the spirits associated with animals. These are not individuated, but a single spirit is believed to be associated with each segregate recognised among the animals. The properties of the spirit appear to reflect the appearance and behaviour of the animal with which it is associated. Animal spirits are believed to be capable of inflicting disease or death upon people, particularly very young children or those weakened by disease or kanaima activity. This danger is the basis for numerous dietary prohibitions restricting the kinds of meat, both wild and domestic, that people may eat at particular times. The dietary restrictions are prescribed according to the judgement of a **marunao**, and appear to be specific to the illness. I elicited lists of a variety of prohibited species associated with particular conditions. Tapir meat features very commonly in such prohibitions, and a high proportion of people in Maruranau are apparently permanently unable to consume this food as a result of past kanaima activity.

Dietary prohibitions associated with the birth of a child commence with the couvade (**sanadan koraidaonaa**), a post-natal period of rest and fasting imposed

upon the father. For a period of around two weeks following the birth, the father must spend most of his time resting in his hammock, and avoid all but the lightest work. Proscribed activities include both traditional pursuits such as hunting, and the non-traditional such as sharpening or using a cutlass and inflating bicycle tyres. He must abstain from any sexual relations and must follow a severely restricted diet devoid of all meat and all but a few smaller species of fish. Violation of the couvade incurs consequences prejudicial to the health of the infant, including bleeding from the navel, swollen abdomen and incessant crying, conditions which will ultimately prove fatal without the intervention of a **marunao**. Private ceremonies are performed to mark the father's resumption of activities such as hunting, fishing, and farm work. These involved the bathing of the infant in water which has been blown, the latter involving a spoken prayer which invokes the spirit of certain animals: the **maroro** *(Priodontes maximus)* prior to resuming farm work, for example, a species of heron known as **washanao** (*Ardea* sp.) prior to resuming fishing on the savannah. The dietary restrictions (although not, according to some people, the injunction against work) also apply to the mother, and hence normally extend to the entire household. They exist to protect the infant from the risk of its spirit being captured by that of the animal consumed, which could have fatal consequences. The household may resume the consumption of particular meats after the infant has reached an appropriate age, as advised by a **marunao**, who also attends the first meal to include the meat, in order to blow the latter. The period of abstention may be fairly short, as in the case of the two peccary species. In the case of animals whose spirits are considered to be stronger, particularly the **sowai** *(Mazama gouazoubira),* it may extend to two or three years. The spirits of spider monkeys *(Ateles paniscus)* and tapirs *(Tapirus terrestris)* are also considered to be particularly strong, and according to some informants consumption of these meats is subject to post-natal prohibitions enduring for a year or more.

5.4 Further forms of nature spirits

A number of locations on the savannah, in forests, and along rivers are considered to harbour entities of a variety of forms believed to possess supernatural powers and capable of endangering human well being and life. Among these are aquatic anteaters referred to by the same Wapishana names - **paashim** and **tamanwa** — used, sometimes inconsistently, to refer to the species *Myrmecophaga tridactyla* and *Tamandua tetradactyla* . They are described as being smaller than these species and entirely white in colour, and are said to reside underwater in specific locations in

rivers, especially at rapids or deep pools. They are considered dangerous, and are reported to attempt to capture and drown people swimming or wading in the rivers at these points. Some people also consider them to have ecological roles, in ensuring maintenance of the hydrology and the supply of fish in particular creeks. Water anteaters were most commonly mentioned in connection with savannah rivers, although some informants gave statements indicating their presence in forest rivers.

In rivers in the forest such as Kwitaro, anacondas of extremely large size are considered to be associated with the deep pools commonly used for fishing, and are apparently responsible for maintaining the quality of these watercourses. Their relationship with smaller anacondas is obscure. They are sometimes distinguished terminologically with the lexeme **'dyo dana'i**' (referring to the comparability of their dimensions with those of the etai palm, *Mauritia flexuosa)*. A similar form of splitting also occurs in a small number of other animal species whose members are nonetheless considered to be of the same kind and so this observation may not be of any great significance. It is notable that, unlike the other entities considered in this section, I did record claims of personal sightings of these. I suggest that this indicates that for the Wapishana the phenomenon in question is the attribution of supernatural powers to materially existing animals.

Anacondas *(Eunectes murinus)* are in general attributed high levels of spiritual power, such that they are feared by people. Anyone who kills an anaconda is considered susceptible to revenge attacks by its spirit. One man who had been forced to kill an anaconda that had tangled itself inextricably in his seine told me that its spirit had appeared to him in a dream as a man armed with a shotgun, wounding him with a bullet in his lower back. This injury had manifested itself physically as a severe pain in that region. Had he been shot in a vital organ, it could have been fatal. Traditional healing techniques were successfully employed in curing the injury and ensuring protection from further spiritual attack.

The spirits of land camoudi *(Constrictor constrictor)* are also believed to be dangerous to people, and these snakes are for this reason avoided by people and rarely, if ever, handled. Coming into contact with this species of snake is believed to make a person vulnerable to an incubus/succubus type possession. The snake's spirit appears in the dreams of the affected person as a highly attractive and seductive member of the opposite sex. After a time, in addition to providing sexual gratification in these dreams, the spirit begins feeding its victim, with the consequence that they cease eating in waking life and thus slowly starve to death. Again, a course of very severe treatment administered by a **marunao** is the only course of action that can

save the life of the person so afflicted. Women are considered to be especially vulnerable to this sort of attack during menstruation, when they are discouraged from visiting the forest for fear that land camoudi spirits will seek them out and start their attack. Some other animals are considered to share the land camoudi's propensity for this form of attack: over the course of the study, a single unidentified species each of bird and lizard were indicated to me to have this property.

Two lexemes refer to apparently mythical forms of tigers: **kodoi din** (tapir hunter) and **namachi din** (worakobra *(Psophia crepitans)* hunter). Leaving aside the possibility that one or more species of felids unknown to science inhabit the more remote forests of the Guyanese interior, descriptions of these creatures do not correspond with those of any known species of animal. They do not, however, appear to be conceptually distinguished from more familiar felids such as jaguars and pumas: their names were generally incorporated into lists of animal names within the category **baudokoru**, and appear to be regarded as equally real. No informant, however, claimed to have seen one of these animals, the descriptions given being at least second-hand, although many reported that they had encountered the effects of their presence. Inhabitants of caves near the tops of certain mountains in both forest and savannah, they make their presence felt in response to certain human activities in the vicinity, in particular the cooking of pepper and, according to some, the presence of menstruating women. On such occasions, they are heralded by sudden outbreaks of highly intense wind, rain and thunder, following which, it is believed, they will appear and devour the people should the latter neither have made their escape nor blown in the appropriate way to subdue them. Similar dangers are raised by other fantastic entities, including a dragon-like creature called **wurapiroo**, and a giant known as **ini**, either or both of which may, according to some informants, exercise control over the **kodoi din**, **namachi din**, and **paashim**. Informants in Maruranau indicate that all of these entities are particularly common in many parts of the Kanuku mountains, including their eastern extension towards the Rewa and Essequibo rivers, and in many hills and mountains throughout the Rewa River system.

A similar phenomenon is reported to occur in certain deep pools in major rivers: cooking with pepper at the side of these pools is reported to cause a similar tempest within them. Such pools are under the protection of a guardian — referred to as the pool's 'grandfather' by one informant — who appears to take the form of a cave-dwelling aquatic tiger. In most major rivers there are distinctive rock formations believed to have the potential to cause disease or other misfortune to those who pass by them without saying appropriate prayers or leaving a suitable offering. I

myself suffered a mysterious and highly debilitating attack of malaria-like symptoms (though medical tests showed it was not malaria) after having camped at one such spot: a large rock in the Kwitaro river used by the **ini** as a fishing spot, and where people claim to have heard him on moonless nights.

Similar concepts exist among other Amerindian tribes. Lokono and Warao people in Orealla reported their belief in 'bushcow tigers' and 'water dog tigers'; the latter seem to have many features in common with the Wapishana **namachi din**. Published data on Makushi nomenclature includes eighteen terms for felids with no obvious scientific gloss, including the **kamisharai**, or worakobra tiger, and the **wairarimi**, whose name may be derived from waira, the Makushi term for tapir. Like their Wapishana equivalents, they are reported to reside in mountains. The same study also reported a belief among elder Makushi in an aquatic anteater named shipipti, though this was said to be black in colour (Forte et al. 1996b: 55-56, 68).

A clue to their actual identity comes from reports of interactions between these beasts and Wapishana piaimen who are said to have been able to initiate communication and hence effect control over their activities. One informant suggested that it was only the piaimen who were able to so much as see these entities, and although informants were generally vague about the circumstances of such encounters, various statements allude to the use of altered states of consciousness. It appears that these are spiritual entities capable under certain circumstances of manifesting in material reality in the fashion described. The control exerted by the piaimen appears to have been considerable: informants in Maruranau reported that such entities were more common in former times, sometimes indicating particular places where they had been located, but that now-deceased piaimen had subdued all present along the Kwitaro and within the forests to its west. I visited several locations which my companions informed me had been home to **kodoi din** and **namachi din** prior to the intervention of a **marunao**. A recurrent metaphor for this process was that the tiger had been 'tied up', and people often described this process as having occurred in a dream. It is noteworthy that the metaphor of tying up implies the possibility of release. It was also reported that the action of a **kanaumuu** could release these entities or call them to his assistance.

Nature spirits are also conceived which have special relationships with particular species of animal, but appear to be distinct from the animal spirits themselves. Best known of these is a spirit known as **picha**, a dwarf-like anthropoid said to be the leader of white-lipped peccary herds. Some informants appeared to conflate this concept with that of supernatural entities such as **kodoi din**, but what relationship,

if any, they are generally conceived to have remained obscure. I also heard the term **picha** used more generally to refer to figures similar in appearance, but with no apparent association with peccaries, and assumed to embody some physical danger to humans who might encounter them. Some people also conflated the concept of the **picha** with those of other dangerous nature spirits such as kanaima and bush daidai, the latter being a semi-human forest-dwelling entity common to both Amerindian and non-Amerindian Guyanese folklore.

The peccary master himself is highly anthropomorphised, and is considered to direct the wanderings of his herd based upon his knowledge of the forest and according to his own mysterious agenda. He is reported to lead the herd partly by means of whistles, which are often audible at night – a further link with the concepts of kanaima and jumbie, to whom mysterious nocturnal whistles are also attributed. The **picha**'s control over the movement of peccary herds provides a basis for influence over the latter by the **marunao**, who is able to communicate with the **picha** and thus negotiate the movements of the herds as desired. Informants in Maruranau related to me how a now-deceased **marunao** used this method to effect the return of collared peccaries to their hunting area after a period of many years in which they had scarcely been encountered. Some years after that, he was able to cause a violent herd of peccaries that had attacked people on several occasions to disperse from the area.

The **picha** is greatly concerned with human hunting of his flock, an activity he is said to relish, as their shooting with arrows and shotgun cartridges provides him with a supply of ammunition for his own hunting of maams *(Tinamus major).* The exception to this is the case of the lead animal in any herd, called **ikuwi**, upon which the picha rides (referred to by some people as his horse): any hunter who shoots and wounds or kills this individual will suffer an identical fate himself. A further practice shared with human hunters is the use of dogs – the **picha** is reported to take the spirits of dogs killed by peccaries and employ them as his own hunting dogs.

I was able to record somewhat less information about the spirit master of the collared peccary. According to one informant, this spirit's activities limit hunting of its charges – a hunter who wipes out an entire herd rather than leaving some animals as prescribed, is likely to suffer a potentially fatal nighttimes attack. The same informant also reported that he had suffered the death of a hunting dog whose spirit had been taken by the abuya master while it was in pursuit of a herd.

5.5 Ecological Implications

The major question the preceding account raises, in the context of this thesis, is the extent to which Wapishana cosmology either incorporates or formerly incorporated systems concerned with the regulation of the ecological impacts of subsistence activities. Sufficient evidence is not available fully to resolve this question, but the data presented in this thesis does allow some inferences to be made. A strong case can be made for the existence of regulatory mechanisms within the system of taboos on consumption of meat, and also within the geographical restrictions imposed on human activity by the presence of nature spirits. However, it must also be pointed out that these may be partly or wholly explained by factors other than adaptation to the local ecology, and it is entirely possible that they have no adaptive significance at all. This thesis does not provides comprehensive accounts either of Wapishana symbolism, or of the factors which affect the profile of hunted species and the spatial dimensions of resource use. Recognising that these may have alternative explanations which account equally well for the data, this section examines the case that the systems described do have ecological functions.

The extent to which the prohibitions on meat consumption described limit the numbers of animals actually hunted is difficult to assess. However, it is clear that at any instant in time a significant number of people may have reason to avoid consuming the meat of particular species. The effective extension of prohibitions to the entire household greatly increases the numbers of people affected. In the case of post-partum prohibitions of extensive duration — a year or more, in some cases — a household may be affected on an almost constant basis throughout the reproductive life of the parents. This is the case with *Mazama gouazoubira*, a species which most hunters report themselves to have killed on very few, if any, occasions (see chapter 4.3.3). Other prohibitions are less persistent, but given the high fertility and short birth interval that remain characteristic of Wapishana households, it is apparent that many hunters, while in their prime, will be compelled to avoid particular species of game animal for periods whose cumulative duration is substantial. It is probably safe to say that this has tangible effects, over the lifetime of a household, on the overall subsistence strategy and on hunting behaviour in particular.

Times when people are unable either to hunt or to consume meat at all are rarer, and it may be that the effect on actual hunting levels is slight. It is to be expected that times of absolute prohibition will encourage the use of alternative sources of protein, but it is also entirely possible that hunting effort would be increased immediately after such periods, when people may be craving somewhat for meat.

However, it seems certain that the profile of game species taken by individual hunters at particular times, and of a community as a whole, is strongly affected by the existence of species-specific prohibitions. Thus, the hunting pressure exerted on populations of the most preferred game species may be reduced, as hunters unable to consume them turn their attention to alternative targets.

The most appropriate geographical scale at which to consider the ecological effects of hunting prohibitions may be that of the hunting road. Each of these is typically used by a fairly small number of hunters, in several cases a number of close relatives who generally hunt as a single group. The common extension of dietary prohibitions to relatives means that all may on occasion be subject to the same prohibition. Even when this is not the case, the group will presumably be less likely to seek out, track or attempt to pursue game that one or more of its members is prohibited from eating. Furthermore, because some men, and their dogs, specialise somewhat in the hunting of particular animals, their lack of participation may reduce the ability of the group as a whole to capture the prey species concerned. The result will be that local hunting pressure on the species concerned will be markedly reduced or absent for the duration of the prohibition. Prohibited species will thus experience a spatial refuge from hunting within that particular area, for as long as the prohibition is in effect.

The case of the tapir may be particularly significant in this. Owing to its low population density, reproductive rate and growth rate, this species is particularly vulnerable to overhunting. The other species most favoured as game by Wapishana hunters are all more abundant and have higher rates of reproduction, and thus are better able to withstand hunting pressure (Bodmer et al. 1994; Bodmer 1995; Bodmer et al. 1997a; Alvard et al. 1997). The ecological importance of tapirs as dispersers of several species of forest trees has already been noted, and it is also worth noting that of the other mammal species commonly hunted, only the scatter-hoarding rodents act as dispersers, and the range of species involved and geographical scope appear to be far more limited. There are thus compelling ecological reasons for the provision of special mechanisms for the conservation of populations of tapirs, more than any other species of forest animal.

The other major dispersers of forest trees are the large primates. Although the studies cited above demonstrated that they are also susceptible to overhunting when shotguns are commonly used, hunting of primates is subject to severe technological constraints in a society for whom bows and arrows remain the major hunting weapons (Hames 1979: 233). The long duration of post-partum prohibitions on consumption

of spider monkey meat may, however, be significant here, particularly as hunting for this species preferentially targets females.

Whether the system of prohibitions described actually fulfils this function is a matter on which for now it is only possible to speculate. A more thorough examination of this question could take the form of precise documentation of the extent and duration of prohibitions on the consumption of tapir meat, comparison of levels of hunting and meat consumption in the presence and absence of prohibitions on both inter- and intra-household bases, and tapir censuses to assess the sustainability of prevailing levels of hunting. The presence of tapirs within even the most frequently visited and heavily hunted areas in Maruranau is in favourable contrast to the situation reported from other areas of forest where tapirs are hunted (e.g., Fragoso 1991). Overall, the system of prohibitions on game consumption is one similar in many respects to that described in greater detail and in a situation of far lesser acculturation among the Tukano (Reichel-Dolmatoff 1976). The form of the Wapishana system is consistent with the suggestion that it functions to regulate game harvest. Whether it does, in fact, have adaptive value as a mechanism to maintain species-specific hunting rates within sustainable levels is a far more complex question. A broader version of the research programme suggested above might go some way towards answering it.

The activities of the malevolent nature spirits discussed in chapter 5.3 have the effect of keeping significant areas of forest, savannah and river largely free of human activity on a close to permanent basis. These areas may effectively function as preserves where ecological processes may take place unaffected by human impacts. There is much evidence that such areas can form a key feature of an overall strategy for the conservation of exploited species and ecosystem functions. Modelling of the dynamics of animal populations subject to hunting pressure indicates that the existence of spatial or temporal refuges from hunting is an effective strategy for preventing the extinction of game populations under hunting pressure (Joshi and Gadgil 1991). This finding is supported by preliminary data on the ecology of *Tapirus terrestris* which suggests that declines in hunted populations may be buffered by immigration of animals from adjacent areas free from hunting (Novaro et al. 2000). Sacred groves in India, in a situation of high levels of forest clearance and degradation, were observed to contain populations of economically important plants rare or extinct in surrounding areas (Gadgil and Vartak 1976). Among the Rungus of Sabah, sacred groves were formerly maintained on the basis of fear of spirits thought to reside there, and appear to have contributed to the maintenance of populations of

forest animals and the local hydrological balance (Appell 1997). It may possibly be significant in the latter respect that the abodes of the terrestrial spirits described above are generally mountains. Reservation of deep pools within rivers as unexploited zones by a combination of secular and religious methods is a strategy employed by many fishing peoples of the Niger River. Its conservation functions are explicitly recognised and have been incorporated into modern fishery management plans (Price 1995: 290-2). In the district of Churachandapur in north-eastern India, the conservation functions of sacred groves, areas of forest not used for shifting cultivation due to the local belief that they harboured nature spirits, are also a component of modern management plans (Gadgil et al. 1998: 42-44). The evidence that the system described among the Wapishana might also have conservation-related functions is not at present incontrovertible, but is nonetheless compelling.

The mechanisms described may plausibly have formed key components of systems for the regulation of human impact on populations of exploited wild species, both at the level of populations of individual species and of forest, savannah and riverine ecosystems. The reports of informants of the historical role of **marunao** in this suggests that they played some sort of controlling role in this, prescribing food prohibitions and opening (possibly also closing) previously inaccessible areas to human activity. The questions of whether they did indeed fulfil roles as effective decision makers concerning natural resource management, and if so how they gathered and processed the information necessary to achieve this, are compelling. Unfortunately, it seems that the reported degeneration of the system means that they will never be answered. More importantly from the perspective of the present-day Wapishana, there is a real danger that any regulatory functions that might have existed are in the process of being lost. The possible effect of this on the ecological impacts of resource use is an issue of great importance to local decision makers.

CHAPTER 6: ETHNOECOLOGY

This chapter is the first of three concerned with the core of the research data upon which this thesis is based, a study of the ethnoecological knowledge of Wapishana hunters about twelve species of mammals. The first section reports the methods employed in and findings of a preliminary study of Wapishana ethnozoological nomenclature, conducted as a necessary prelude to the ethnoecological study. The next section describes the methods used in collecting ethnoecological data, and provides some general comments on the data set. Detailed results for each of the twelve animal species given special consideration are presented in the next section. Following this, ethnoecological data on crop raiding and use of old farms by non-domesticated animals is presented. The final section of this chapter gives some preliminary conclusions, prior to the more detailed evaluation and analysis of the ethnoecological data set that occupies chapters 7 and 8.

6.1 Wapishana ethnozoological nomenclature and classification

6.1.1 Methods employed

Ethnozoological nomenclature and classification were surveyed to obtain a basic overview of the classification of the natural world in the Wapishana language The main aims for this component of the research were initially to acquire a common language in natural history sufficient to allow me to discuss ethnoecology and other matters relating to wildlife with Wapishana people. I later attempted to gather sufficient information to be able to assign tentative identifications to as many as possible of the Wapishana biological categories arising in the course of research on ethnoecology and cultural ecology.

Field-based observations allowed the identification of those species observed of the mammals and birds, the two groups for which high quality visual guides are available (Emmons and Feer 1997; Eisenberg 1989; Schaunsee and Phelps 1978). Vertebrates of other groups were documented by the taking of digital photographs whenever an opportunity to do so arose. To each of which was attached a Wapishana name, generally at the time of sighting, although I also took advantage of the ability to view pictures instantly, in order to ask individuals not present at the time of sighting for corroboration of names. In the case of invertebrates the taxonomic affinity (usually at the level of order) would be recorded on sight along with the Wapishana name. In some cases photographs were also taken, particularly in cases where Wapishana nomenclature distinguished categories at levels finer than those of the phylogenetic groups to which I was able to assign specimens in the field.

The above methods did not allow for complete coverage as despite efforts to observe as many of the species named in the Wapishana language, not all could be seen over the course of the study. A small number of informants were provided with notebooks and requested to make lists, in their own time, of all animal species known to them. On completion, this was followed up with interviews in which attempts were made to obtain provisional translations via verbal description and indicating pictures in the works named above.

Informants would also provide names of species illustrated in various field guides to local mammals and birds (Emmons and Feer 1997; Eisenberg 1989; Schaunsee and Phelps 1978). In most cases these works were used with apparently high accuracy: different people's identifications were generally consistent with eachother, and those made in the field, and corresponded with biogeographical reality. On occasion, I made field identifications using these guides which disagreed with those of my Wapishana colleagues. When the opportunity arose to resolve the dispute, in the form of a repeat sighting, I almost invariably found it was I who was in error, and it appears that the people I was working with were readily able to accommodate themselves to the limitations of pictorial representations of these animals. Given the low frequency of observation of most species in the wild, this provided a useful indication of the referents of Wapishana terms when the former were not seen over the course of the study, and a valuable corroboration among different individuals of names elicited in the field.

A preliminary investigation of classification was also made by this method: informants were asked to indicate the existence and composition of any named groups of which they were aware. During the subsequent interview, I also asked people whether the referent of any particular term had 'any partners', as a means of identifying covert categories. This question was also asked during some ethnoecological interviews on particular species: 'Does.....have any partners?'. The term ‘partner’ employed was that that I considered best to express the notion of affiliation in Guyanese Creole. In most cases, people responded by naming those folk categories, if any, they regarded as most similar to that under discussion. The question frame employed was deliberately vague and ambiguous, in order that answers might also be given on other bases upon which people might consider categories to be connected, for example ecological associations. I was also able to gather some information on covert categories from observation of use in conversation: in particular, people would often use different terms to refer to the same animal when telling me about it, from those they used in conversation among

themselves. Such a circumstance arose when people, aware of my interests, told me the most specific name they had for an animal, but in conversation used a more general name.

In the case of plants, many names for both trees and understorey plants were recorded in the course of ethnobotanical plot surveys (see chapter 4.7.2). Woody plants were identified, when possible, using available field guides (Roosmalen 1985a; Gentry and Vasquez 1993). In many cases, especially of timber trees, were also known to people by their Creolese or Arawak name, which although insubstantial evidence for identification, was a possible indication in the absence of more conclusive information. A large number of Creolese and Arawak names for trees are reported in two reference texts on Guyanese botany (Mennega et al. 1988; Polak 1992). A small number of Wapishana names are also listed in the former work, which provided a useful starting point for identification. However, many of the field identifications I made contradicted the glosses provided in this work, which I suspect is based upon data collected in the Wapishana villages of the Kanuku foothills. It may be that there are regional differences in usage of the Wapishana names for trees, reflecting regional variation in species composition at each site. For example, the same name may be used for two closely related tree species, only one of which is found at each site.

6.1.2 Results

A list of all Wapishana names recorded and their scientific glosses is presented in the appendix. Here I will report key features of the Wapishana classification of animals. Some information was collected on plant classification, but sufficient only to give a very sketchy picture. The time and effort I was able to dedicate to the subject of ethnozoological classification was also limited, and insufficient for comprehensive documentation. The findings I present here are thus preliminary and somewhat tentative. Further work on this subject may revise the picture given here substantially, however, all the findings reported are correct in so far as my limited investigations allowed me to ascertain.

The Wapishana language incompletely partitions the zoological domain. Among the larger vertebrates, the most salient categories in the Wapishana language mostly show a one to one correlation with scientific species, and closely satisfy Berlin's definition of the folk generic (Berlin 1992). The concept of a natural kind appears to be based on both Aristotelian and reproductive criteria. When called upon to justify a terminological distinction of two perceptually similar species, informants would refer

to morphological differences between the two. When I asked why the male and female forms of *Pithecia pithecia*, the highly sexually dimorphic Guiana saki, were both given the same name **(oroa)**, people would explain it on the grounds that they were the male and female of the same monkey. Terminal categories were, as far as I could tell, consistently employed by members of all sectors of the population irrespective of differences in the circumstances of use.

There are some important exceptions to the correspondence with scientific species. Both species of *Geocheleone*, for example, are referred to in the first instance by the name **wurada**. When, as happens rarely, there is a need to distinguish the two, they are referred to by specific names, binomial derivations of this term based upon different habitat use. The term is polysemous, **wuradanao** (the suffix '**nao**' pluralises nouns) being a collective term corresponding in meaning to the composition of the biological order Testudinata. The referential domain of the term **kapash**, for armadillo, has a similar structure. In its restricted sense, it refers to the two *Dasypus* species, specific names for which, like those of **wurada**, are binomial derivations from this name, although in this case based upon morphological differences. It also has extended senses in which it incorporates *Cabassous unicinctus*, and sometimes *Priodontes maximus* as well.

Smaller, less familiar groups may be highly lumped with respect to the scientific classification: the murids and didelphids, for example, are lumped to sub-family level. Within these groups phenotypically distinct forms can be readily recognised, indicating that these aggregations are purely linguistic, not perceptual. Most invertebrate taxa are also highly lumped, commonly to the level of the order. Most of these polytypic terminal categories appear to correspond closely to phylogenetic groupings. Those invertebrate groups that are divided into terminologically distinct forms almost all have nutritional value or some other special significance to people, such as those that are dangerous or have some symbolic significance (for examples of the former see chapter 4.5.1). These include many hymenopterans, larval lepidopterans, some chelicerates and a few dipterans.

A few animal species are split with respect to the biological classification. Within the category **suburu** (*Alouatta seniculus*), for example, a smaller kind called **sooman sik** is distinguished. Among **powatu** (in its restricted sense, see below), a large type is referred to as **wainsari**. These two examples appear to refer to intraspecies morphological differences based on gender - both of these species exhibit a marked size dimorphism among males and females. There are other examples, where categories corresponding to biological species are split and named binomially, which

may reflect local phenotypic diversity within the species, as I have already discussed in chapter 4.2.6.

Some evidence was found for degeneracy within the ethnozoological lexicon: sometimes informants, when presented with an obscure specimen for identification, suggested that although they did not know the name, an older person might, or that it might once have had a name but that this was now forgotten. Further work could aim to investigate the patterning of knowledge among different age groups further. Zoological terms appeared to be consistently applied by different people, regardless of age or gender.

The extent to which zoological groups are aggregated into broader, named groups in the Wapishana language is limited; few words corresponding to higher-order folk categories are in regular use. There is no unique beginner in the animal kingdom: the nearest equivalent is '**aimaakannao**', a word that also means 'things'. When applied to animals, it appears to have two or three different meanings, corresponding to several levels of inclusiveness. It was not entirely clear to me whether any of these meanings corresponded exactly to the zoological sense of the term 'animal'. The conceptual distinctness of the zoological domain was demonstrated by the use of a binary classification of animals based on perceived edibility. '**Wunii**' refers to edible animals, '**mawuniki**' to those not considered edible. All animals appear to be assigned to one of these two groups. Membership of these groups appears to be flexible according to personal dietary idiosyncrasies. One man who told me he had eaten jaguar on occasion, suggested that this meant that it had now become **wunii** for him.

The animals are linguistically subdivided into higher order groups along at least three crosscutting systems. One is that based on use value described above, another is ecological, based on habitat use, and a third appears to be based on perceptual similarity. In the latter system, higher order categories often, but not always, correspond to phylogenetic groups. Major categories in this system included **kopaunao** (fish), **kotu'uzanao** (birds), **kowazazunao** (snakes), **baudokorunao** (felids and some other carnivores) and more restricted uses of the term '**aimaakannao**', which in some circumstances appeared roughly equivalent to mammals, in others incorporated members of other phylogenetic groups. As has already been mentioned in the case of **wuradanao**, some more inclusive groups are formed by pluralising the name of a focal species. These include **kibaronao** (anurians) **waronao** (parrots) and **powatunao**, which includes monkeys (**powatu** is also the specific name for *Cebus apella*) and other arboreal mammals. People

commonly translate this term into English as 'monkey', which appears to be employed as a literal translation of the Wapishana term, not solely to refer to primates. The term **powatunao** also seems to be interchangeable in meaning with '**dukornainao**', translated as arboreal animals, but also used by some people to refer to some tree-dwelling birds. The systems of classification into more inclusive groups do not appear to be conceptually separate. Terms from each are used as appropriate, and interviews aimed at elucidating patterns of higher-order categorisation could result in the emergence of any combination of terms from all three systems.

Many more intermediate categories appear to exist in which the constituents are aggregated on the basis of perceptual or ecological similarity and named by pluralising the name of one of their constituent folk species. Naming and composition of these groups varies in consistency – some appear largely consistent among informants and over time, others are less stable and appear to be constructed on an *ad hoc* basis as the situation demands. Many informants commented on the contrast between English and Wapishana in the extent to which names for groups of species are employed, and in many cases, the English or Creolese term for certain higher order groupings seemed to be more readily used. Creolese names for animals appeared to be generally known and widely employed.

6.2 Research methods employed in ethnoecology

6.2.1 Ethnoecological Data Collection

Four methods were employed in the documentation of ethnoecological knowledge:

1. Semi-structured interview.

The majority of the research effort dedicated to ethnoecology was expended in this activity. Interview methods were adapted from Townsend (1995: 2). A paper published after the start of this study, which came to my attention only following its completion, endorses the semi-structured interview as the best method for the elicitation of ethnoecological knowledge (Huntington 1998). The group interview method recommended by Huntington was not employed in the present study. Most interviews were conducted on a one-to-one basis, although in a very small number of cases interviewees were accompanied by family members, and passers-by on occasion sat in on interviews for a brief period, and these supplementary interviewees occasionally volunteered information. This was neither encouraged nor discouraged, although I considered it preferable that the majority of interviews remain on a one-to-one basis for the purpose of consistency and greater simplicity of analysis. The

format employed allows analysis to address the issues of the distribution of knowledge among individuals and the reconciliation of contradictory information among informants. Such would not be possible had group interviews alone been employed. The enquiry would be improved, however, by following up individual interviews with group interviews. In particular, comparison of patterns evident among individual interviews and the debates and any consensus emerging from them within the group interview context would be most instructive. A further methodological improvement would be to employ local interviewers to conduct interviews in a setting in which interviewees might feel more fully relaxed (Huntington 1998: 299), and in the context of the present study, in the Wapishana language. This would raise the possibility, however, of interviewees not mentioning information they assumed would already be known to a local person.

Interviews were conducted in English, and the majority were ostensibly focused on a single named category in the animal kingdom. In the early stages of the study, the choice of subject was determined by a certainty on my part that I had an accurate understanding of the biological referent of the lexeme, in Wapishana or Creolese, employed to denote it. At first, this depended on my having elicited the name from the interviewee on an occasion when we had jointly observed its referent and I had been able to assign it a definite scientific identification. As time passed and my familiarity with local usage of animal names grew, I felt able to proceed with less thorough adherence to this aspect of methodological rigour. In particular, I became confident that the biological lexicon was widely shared and consistently employed among different people, and that interviewees were able to offer reliable identifications based on all but the most misleading of the illustrations in Eisenberg (1989) or Emmons and Feer (1997). The freedom from these initial constraints allowed me to determine the choice of interview subject on the basis of the overall aims of the study.

Most subject species were mammals, this group combining familiarity to interviewees, ease of reliable identification in the field, the availability of scientific data on ecology to employ as a basis for comparison of ethnoecological data, and in many cases economic and ecological importance. Some interviews were also conducted on species of subsistence importance from other vertebrate classes: birds, reptiles and fish, and a small number of interviews employed botanical categories as their focus. Two major goals defined the profile of interview subjects over the course of the study. One was to conduct at least one interview on each terminal category among the mammals named within the Wapishana language, and on other vertebrate

species of subsistence importance. The other was to conduct interviews with several different people on a focal group of species. This focal group consisted of those species that exemplified the criteria listed above, and comprised the majority of the most important game animals, along with all but the smallest members of the primate order. Reasonable quantities of ecological information collected in scientific studies have been published for many of these species. In the case of primates, one study presents ecological data collected in Suriname for all eight species found at the site of the present study (Mittermeier and Roosmalen 1981). For commonly hunted animals, some - particularly the ungulate species - have been fairly well-studied, but generally in locations at vast distances from Southern Guyana, and in very different habitats (see references in chapter seven for details).

Most interviews conformed to a standard format. Each would begin with either of the questions: "What do you know about.....(species x)", or "What can you tell me about....(species x)". In some cases when the subject of the interview was chosen by the interviewee, this first question was anticipated by the interviewee and therefore omitted. In any case, the interviewee would be allowed to talk uninterrupted for as long as desired; I would intervene at this stage only on rare occasions when I determined the interviewee to have deviated excessively from the topic in hand. This was an exceptional occurrence, as in some cases such deviation proved to be a source of useful information which might not have emerged in the course of a more structured interview.

Following the first stage, I would ask the interviewee to expand upon or clarify certain points raised in the initial response. A series of specific questions would then be asked on a set of subjects which I considered to comprise a basic overview of the ecology of any animal species. Essentially, the questions corresponded to those that I would hope to address were I engaged in a conventional programme of research on the synecology of the animal in question. Subject areas covered were diet ("What does it eat?, "Does it experience food shortage at any time and if so what does it eat then?", or "What is its most important food?"), dispersal behaviour of frugivores ("Does it plant or spread any seeds", or "What happens to the seeds it eats?"), social behaviour ("How many move together?"), predation and competition ("Does anything eat it?" and "Does it have any enemies?"), reproduction ("when does it give birth?", "How often can it give birth?" and "How many young does it give birth to at once?"), classification (Does it have any partners?", and given a positive response to the previous question, "Why do you say these are partners?"), and human use ("Do

people use this and for what?", "How many times have you killed it?", "Are there any times when you should not kill or use it?").

Experienced interviewees would often anticipate many or all of the standard set of questions. Interviews would be concluded with another open-ended question, of the form, "Is there anything more you can tell me about...?", thus providing another opportunity to volunteer information not covered in any of the fixed questions. In practice, a positive answer to this final question was obtained only in a small number of interviews. Deviations were often followed, particularly when they appeared to be leading to interesting information - for example, during a discussion of one species, interviewees would often digress and start talking about a relative, predator or competitor. Interviews on *Agouti paca*, for example, almost inevitably incorporated a brief description of the hunting behaviour of *Speothos venaticus*, its major predator.

On most occasions, a single interviewee would participate in several interviews successively on a one-to-one basis, over the course of a day or, in some cases, several days. Some interviews were also conducted opportunistically, for example in a break from other activities during the course of a day's fieldwork. The majority of interviewees were mature men, experienced as hunters and in most cases having spent extensive periods in the forest working as balata bleeders or in activities associated with the balata industry. The initial intention was to document knowledge acquired in hunting and other forest-based activities by those people with most experience of the forest. The assumption that this would be a male-dominated domain of knowledge remained untested during the course of this research programme. While women tend, in general, to spend far less time in the forest than men, and many women have little or no experience of the forest beyond their farming area, it is certainly not the case that women are, as a whole, ignorant of the subjects with which these interviews were concerned. Many women of all age groups had extensive experience in the deep forest obtained by accompanying fathers, husbands and other male relatives on hunting or balata bleeding expeditions.

Evidence of areas of ethnoecological knowledge in which women were more proficient than men did emerge during the course of the study. In particular, many older women were reported to have extensive experience of hunting, acquired during the days of the balata industry when the seasonal depopulation of men forced them to take over this traditionally male-dominated area of subsistence activity. Reports of informants suggest that the profile of game species taken in these circumstances differed considerably from that of male hunters, due to differences in hunting ranges - activity was concentrated more greatly in the vicinity of the house and farm, and

target species, with a greater focus on avian species. Both within the field of interest of this particular study, and especially more generally, the documentation of female-dominated areas of knowledge remains an important goal in the recording of Wapishana ethnoecology.

2. Unsupervised writing of information by informants.

Some experienced, literate informants were provided with notebooks and wrote notes on various species in their own time. In some cases, a follow-up interview was conducted of the same format as above, but in which the first question was functionally replaced by the written notes.

3. *Ad hoc* elicitation of information and volunteering of information by informants

In the course of trips to the forest, my companions would often point out the food plants of particular animals or their feeding signs, their tracks (indicating habitat use and the size and composition of groups), their sleeping or resting places, seedlings dispersed by animals, and other things they considered to be of interest to me. Such incidents provided useful information either not recalled or not considered relevant in the interview context, and often provided a foundation for further discussions on the local ecology. Some informants also took the opportunity to demonstrate points they had made to me in earlier interviews.

4. Observations of the application of ecological knowledge in praxis.

In some cases I was able to document knowledge that was either implicit or which for some other reason was not covered in interviews, by observing how people apply their ecological knowledge in the course of forest-based activities. This took place during the course of normal subsistence activities, such as hunting, fishing and gathering, but was perhaps most graphically demonstrated when people were involved in the collection of ecological data (see chapter 8.3). I worked with several people in recording field data on animal ecology and describing tree plots, activities which oblige people to engage in intimate interactions with the forest. I was continually impressed by the levels of detailed knowledge and understanding applied by people in undertaking these tasks. In both their subsistence and research tasks, people were employing skills and knowledge that were clearly covert and impossible to express in the abstract. This also raised problems in its documentation, such insubstantive phenomena being difficult to record accurately in the abstract medium provided by fieldnotes.

6.2.2 Mechanisms of acquisition of ethnoecological knowledge

Interviews on ethnoecology often provided useful insights into how the knowledge reported was acquired, via the statements of interviewees about how they came to know a particular fact. The most important point to be made is that most of the information provided appears to be empirical. When someone told me something based on something other than direct personal experience, they generally qualified it as such, and this nonetheless was relatively rare. Statements about the sources of information indicated that a subset of the methods employed in biological research is effectively employed.

Direct observation is of major importance, particularly for arboreal species such as primates and many birds. This generally takes place on a casual basis, and not in the sustained and repeated fashion employed in biological research. Some people do go out of their way to observe animals and learn more about their behaviour. One interviewee, for example, told me that he had climbed a tree used for sleeping by spider monkeys, in order to observe their distribution and posture when asleep. The observation and interpretation of animal spoor is also commonly practiced, and is perhaps more important for many of the less easily observed species. I had many opportunities to observe this in practice when with people in the forest. Tracks and feeding signs are closely observed and interpreted, and dung may be examined for evidence of current diet. The diets of hunted animals are also revealed by inspection of gut contents, during the cleaning of carcasses in preparation for preservation or cooking.

6.2.3 Organisation and analysis of ethnoecological data

The discussion that follows is largely restricted to the data obtained in formal interviews, as this method can be treated as fairly standard for analytical purposes. A total of 204 interviews were conducted on the ecology of named animal species. For a number of species in the focal groups, there were interviews with several different informants, and these sets of interviews formed the basis of detailed analysis. The species concerned were: *Tayassu tajacu* (11 interviewees), *T. pecari* (15), *Tapirus terrestris* (13), *Mazama americana* (13), *Agouti paca* (14), *Dasyprocta agouti* (12), *Ateles paniscus* (12), *Alouatta seniculus* (9), *Cebus apella* (7), *C. olivaceus* (5), *Pithecia pithecia* (7), *Chiropotes satanas* (5) and *Saimiri sciureus* (7). Two different rationales were employed in selecting these species for in-depth research. The first applies to the first six species, five of whom were shown by the results on Wapishana cultural ecology to be among the most important game animals locally (see chapter

4.3). Tapirs represent a unique case, owing to the apparent existence of special mechanisms regulating their hunting (chapters 5.3, 5.5). The others are the largest species of primate found in the area, which I chose partly out of personal interest, but also because they are generally more amenable to direct observation than other, non-arboreal species of neotropical mammal and, for the larger species at least, relatively good ecological data sets are available for comparison.

For the purpose of analysis, interview data was separated into two categories: specific dietary information, and information on all other aspects of ecology. Dietary information was encoded into spreadsheet on a species-by-species basis thus: the text of each interview was examined and all food items mentioned listed. The data from all interviews about a particular species was aggregated into a single spreadsheet with a single column for each interviewee, a row for each different food item mentioned: each cell was given the value '1' if that food item was mentioned by that interviewee, '0' if not. The matrix thus created for each species was used as the basis for analysis. The majority of the data on other aspects of synecology could not easily be encoded in this binary format. Each interview on a particular animal species was read and the information therein assigned to topics in a flexible, open-ended fashion. Similar spreadsheets were constructed for each species, each column again representing one interviewee and each row one topic, or related theme. The nature of the topics was determined by a pragmatic consideration of the information contained in interviews, for the purpose of uniting related information given by different interviewees in a single row of the spreadsheet in order that the latter gave a clear overview of the sum of the information elicited. No topics were fixed a priori (although some, such as group size, invariably occurred) and as many topics as were necessary to accommodate all the information were employed in each case. Each of these second set of spreadsheets was examined and used as the basis of a written summary of the interview data for each particular species.

6.3 Results

This section summarises the ethnoecological data set for each species in turn. It indicates how a consensus was (or was not) determined from the ethnoecological data, prior to the comparison with ecological data presented in chapter 7. In all cases, I attempted to be as objective as possible in determining consensus. Although in most cases a clear answer emerged from the combined responses of all those interviewed on a particular species, there is no method which allowed for the reconciliation of qualitative responses while totally eliminating personal judgement on

my part. In all cases I looked for patterns of identical or consistent answers across at least two interviewees. Information provided by only a single interviewee was deemed to be spurious, as was any where contradictory observations were each provided by more than one informant. In such cases, the information was not employed in the comparison.

A similar technique was used in evaluating dietary data. Any food item mentioned by more than one interviewee was included, those only mentioned by a single informant rejected. This method is not entirely satisfactory, as neither does a single mention of a food item mean it is not eaten, nor do multiple mentions — which may not necessarily be independent data points — indicate for certain that it is. However, I think the method employed is fairly conservative, in that it is much more likely to exclude correct observations than include incorrect ones. If error of this sort is inevitable, I feel for the purposes of the analysis in this study it is better to be conservative. To avoid repetition, I have not included complete lists of ethnoecological information on diet here. This information is found in the comparison between the ecological and ethnoecological data sets that it the subject of chapter seven.

6.3.1 Collared peccary, 'abuya'.

A range of group sizes was given which suggested a modal group size of 6-12. At the extremes, two suggested group sizes of up to twenty while one said they were solitary. Two interviewees pointed out that group size is smaller under hunting pressure. Two interviewees also mentioned that males may move alone. All six interviewees who considered ranging behaviour agreed that groups occupy definite home ranges, one giving a size of one and a half miles. Two of these suggested groups may abandon their home ranges in response to hunting pressure, another that migration may occur as a result of food scarcity. One interviewee reported that ranging behaviour varies seasonally, groups ranging widely in search of food during the dry season but remaining within a more restricted area during the rainy season.

All eleven interviewees included seeds as a major dietary component, and eight additionally mentioned fruits. Seven included worms, and only one roots. Five interviewees considered there to be a seasonal food shortage, during the dry season. Of two who said there was no food shortage, one added that this was because they could eat dry seeds, available year round, and that they were fat during August. A further four interviewees corroborated the use of dry seeds during the dry season. Several of these mentioned particular species eaten at this time, but the identity of

these differed in each case. Another interviewee said that worms were eaten when fruit was not available. Eight interviewees who considered the relationship with seeds all agreed that it was predatory. Nine interviewees mentioned crop-raiding by this species: for cassava according to all, yams according to eight, eddoes according to two and sweet potatoes to one.

All eight interviewees talking about activity patterns agreed them to be diurnal. Ten interviewees identified holes as resting places: eight of these specified that these could be holes in rotten tree trunks or in the ground. Three interviewees added that the burrows used were those dug by the **Maroro**, *Priodontes maximus,* which one interviewee consequently described as the 'brother-in-law' of the collared peccary. Eight interviewees talked about litter sizes: five of these said two young were born at a time. Of the others, one said 1-2, another 2-4, and another 6, 'like pigs'. Of eight comments on the timing of birth, six were to the effect that there was no particular breeding season, while each of the two who contradicted this suggested a different time of year to be the breeding season.

Two interviewees pointed out that abuya are found throughout the forest – according to one, mostly in the farm area – and absent on the savannah, although another said that they occasionally make temporary excursions onto the savannah. Four interviewees mentioned their use of swamps, in two cases adding that feeding may take place in this habitat type. Predators mentioned were jaguar, *Panthera onca* (nine times), puma, *Puma concolor* (four times), land camoudi *(Constrictor constrictor)* (twice) and bushmaster *(Lachesis muta)* (once). Three interviewees also described interspecific interactions with the larger congener *Tayassu pecari,* from which abuya is said to flee.

6.3.2 White-lippedpeccary,'kairooni'.

Several categories of food items were listed: fruit was mentioned by fourteen of the fifteen interviewees, seeds by twelve, worms by nine, snakes by eleven and tubers by two. Several interviewees named the fruits or seeds of specific tree species as being of particular importance in the diet: **pokoridi** *(Attalea regia)* in three cases - one of whom mentioned that seeds are broken open in order to get a grub which is found inside - **iziari** *(Manilkara bidentata)* and **daba** *(Peltogyne* sp.) each in two cases, and **tokoro** *(Licania* spp.) and **naata** *(Hymenaea oblongata)* seeds once each. Earthworms and bushmaster were each mentioned once in this context. Seven interviewees considered there to be a food shortage during dry season, while two others contradicted this, one arguing that their broad diet and exceedingly high

mobility prevented this. Three of those identifying a food shortage said that worms were eaten at this time, two said dry seeds – meaning those of trees that had fruited the previous rainy season – and one each said fish, **poo'a** fruit *(Pouteria* sp.) and **tokoro**. Five interviewees mentioned that this species sometimes raids farms, two saying that a farm can be destroyed in a single visit. Another said they often feed off yams and other tubers when these are present in old farms. Four interviewees stated that dogs may be killed when hunting this species, one further claiming that dogs may be eaten. Three pointed out the danger to humans, one saying that people are sometimes killed when hunting while another related a tale of how he had been seriously injured in an attack. In connection with their consumption of snakes, several interviewees suggested them to be immune to snakebite. Four attributed this to antivenom secreted by the scent gland; one said that he sometimes carried this gland himself for use as antivenom. All fourteen interviewees to consider the relationship to seeds agreed that they are destroyed when eaten.

All agreed that groups are large: the lowest figure given was 20-50, and eleven interviewees said that groups can exceed one hundred animals in size - up to one thousand, according to one individual. Four interviewees discussed intergroup interactions, considered by all to be aggressive – one attributed this intergroup aggression to the males. Two interviewees talked of temporary dispersal of groups: during feeding according to one, when resting according to the other, groups aggregating again for travel. Two interviewees mentioned the security against predation provided by the large group, one observing that the group can kill large felids. Nevertheless, fourteen considered jaguars to be predators, and ten pumas, though five of these specified that these felids prey only on young animals. Two described how jaguars follow the herd waiting for opportunities to attack stragglers lagging behind the main group. Five interviewees also considered that two aquatic predators – water camoudi *(Eunectes murinus)* and black caiman *(Melanosuchus niger)* might take opportunities to catch peccaries when they are crossing large rivers. Two interviewees pointed out the herd's ability to cross rivers of any size by swimming. In considering habitat use, five other interviewees remarked upon their habit of coming out of their usual forest home onto the savannah during the rainy season months of June, July and August, and three of these observed that this was done in order to feed off the fruits of the palm **dyuwuza** *(Mauritia flexuosa)*. One interview suggested that during the dry season they might be found in the vicinity of large rivers, in order to make use of drying pools for bathing and for foraging for earthworms or fish. Three other interviewees made mention of their use of swamps for bathing and/or

feeding, and another two of their preference for areas of forest dense with lianas. Twelve interviewees described their ranging behaviour, all agreeing that herds roam over huge areas – two interviewees said they might travel to the Essequibo or further – without inhabiting any particular home range. Three of these also suggested that a herd will migrate some considerable distance out of an area in response to hunting.

Of eleven figures given for litter size, eight were within the range 1-3, one other was 2-4. Two aberrant answers were 6-8 and 5-7, the latter of which was qualified by comparison with domestic pigs. Seven interviewees considered there to be no fixed breeding season, but five others said that births were concentrated in the rainy season.

6.3.3 Red brocket deer, 'bush deer'.

All thirteen interviewees listed fruit and leaves among the food items consumed. Two also listed flowers, one grass and one seeds. Only four specified foods of major importance: two of these said the fruits of **naata** *(Hymenaea oblongata)*, one of these adding those of **kumaraokou** *(Ficus* sp./spp.*)*, the others both saying crops: young black-eyed beans in one case, leaves of various crop plants in another. Only three interviewees considered there to be a seasonal food shortage, which they agreed occurred in the dry season. Two others said that although food scarcity was not a problem, this species could suffer from water shortage during the dry season. Another interviewee said that migration to the vicinity of large watercourses might occur in the dry season as a result of this. Seven interviewees made statements about dry season foods, of whom five said leaves, one specifying those of **tooru** *(Cecropia* sp.). Two of these and one other considered farms to be an important food source during the dry season. The final interviewee said the dry season diet consisted of the fruits of manicole *(Euterpe* spp.), and flowers; the latter answer was corroborated by one of the others. Twelve interviewees talked about crop-raiding by this species, generally agreeing that the young pods of black-eyed beans as well as the leaves of several crop species – cassava, sweet potatoes, yams, eddoes and pawpaws – are all eaten. Interviewees' statements about the use of seeds were contradictory. Five said that seeds were destroyed by chewing during the consumption of fruit, although one of these said that a small number of species may be dispersed. Four other interviewees claimed that seeds regurgitated following rumination could subsequently grow, and hence were dispersed that way. Two others suggested that some seeds could be dispersed endozoochorously in the faeces.

Opinion was also divided about the ranging behaviour: four interviewees considered that fixed home ranges were occupied, four that they were not. Use of microhabitats was a less controversial topic, eleven interviewees mentioning the use of one or both of thick secondary growth or small open spaces within the forest as resting places. One interviewee suggested that usage of the two alternates seasonally, the former being used during rainy season and the latter in the dry season. Three interviewees specified that old farms are a preferred habitat for this species. Two interviewees also mentioned sporadic use of the savannah, one specifying that this occurs in the rainy season. Ten interviewees considered activity patterns, all agreeing that they are mostly nocturnal, being active from late afternoon to early morning. Two of these said that daylight activity may be more common when rain is falling. Eight interviewees said that this species is normally solitary, though three of these suggested that they may move in pairs during the time of breeding. Two other interviewees considered pairs to be the norm, one saying that groups of three - male, female and dependent offspring – could sometimes be found. Twelve interviewees agreed that a single calf is born, though one of these said that older females may give birth to twins. The timing of birth was controversial, two interviewees agreeing on the timing (one of these said rainy season, another said June) while two others said that births could take place at any time of year. Two interviewees mentioned that the mother leaves the young calf hidden while she goes off to feed.

Most interviewees agreed on the major predators. Twelve mentioned the puma, whose Wapishana name **koshara din** means 'red brocket deer hunter', and eleven jaguar. Camoudis were mentioned five times and harpy eagles *(Harpia harpyja)* twice. Three interviewees talked about the strategy used by this species in trying to escape from hunting dogs – running a long distance, doubling back, jumping into creeks and running into the savannah.

6.3.4 Tapir, 'bushcow'.

All thirteen interviewees agreed that the diet is composed of fruit and leaves, and two specified young leaves. Seven identified particular species as of major dietary importance, five of whom stated the fruits of **zuupu** *(Spondias mombin)* to be the most important food. One of these added the fruit of **kawarori** *(Anacardium giganteum)* and the leaves of **tooru** *(Cecropia* sp.*)*, each of which food items was additionally mentioned by one of the two remaining interviewees providing information on this subject. Eight interviewees considered tapirs to be affected by a

seasonal food shortage, located by seven of these in the dry season. Seven of these said that leaves form the majority of the diet during the dry season: some suggested that fruit is the preferred food, and leaves a substitute eaten during times when fruit is not available. One interviewee specified **tooru** leaves as the major dry season food. Two respondents said that the fruits of **wamooko** and **zudu** (two species of *Parinari*) were eaten during the dry season – one of these considered there to be no dry season food shortage on account of the availability of these fruits. Eleven interviewees said that seeds eaten by this species are dispersed endozoochorously; one contradicted this answer, characterising it as a seed predator.

Twelve interviewees gave information on group size, all agreeing that tapirs are solitary in most circumstances. Several of these added that groups of two (according to five people) or three (according to a further three) may also be found, being either mothers with dependent young or temporary associations of a pair of breeding animals. Only three interviewees considered these groups to remain within fixed home ranges – three miles in size according to one – as opposed to five who said they were errant. Three interviewees mentioned that encounters between males are often aggressive. All ten answers on litter size agreed that a single young was born, though they did not agree on the timing - two said rainy season, one March, one November, while three interviewees said there was no breeding season. One interviewee stated the gestation period to be one year.

Seven interviewees described the activity pattern as being nocturnal, two of whom added that during the rainy season they might also be active during the day. One interviewee contradicted this, saying they could be active at any time. Eight described similar forms of resting place: six said a fallen tree, one of these added that they also rest by riverbanks and another that they rest in thick bush generally, the latter answer being corroborated by the two remaining respondents. Six interviewees mentioned their need for bathing places, three of these and one other saying they are found mainly in the vicinity of rivers.

Two interviewees said **kodoi** have no predators, but seven identified jaguars as predators while puma and water camoudi were each mentioned twice. In two cases, interviewees specified that these predators could kill young tapirs but not adults. Three interviewees mentioned a predator called **kodoi din** (tapir hunter), which appears to be a mythical animal. Two interviewees mentioned a relationship that tapirs have with an insectivorous bird - named as **kodoi chizan** by one – which cleans it of ticks.

6.3.5 Red-rumped agouti, 'rabbit'.

There was a clear consensus on the broad aspects of diet. Eleven of the twelve interviewees mentioned seeds as a major dietary component, four also mentioned fruits and two of these also volunteered that the legs of young yellow-footed tortoises *(Geocheleone denticulata)* are sometimes bitten off and eaten. All twelve interviewees mentioned crop-raiding, and many gave lists of crops consumed: most commonly mentioned were cassava roots and sweet potato, while yam, peanuts, corn and beans were also mentioned more than once. In specifying the most important foods, four interviewees mentioned the seeds and fruits of **pokoridi** *(Attalea regia)*. **Tokoro** *(Licania* spp.) and **naata** *(Hymenaea oblongata)* once. Five interviewees considered there to be a seasonal food shortage, and those who were specific said this was in the dry season. However, a further five, in contradicting this, made reference to strategies for ensuring a supply of food during the dry season. Among these, three mentioned farm raiding, while another two suggested that they return to sites where they have previously eaten fruits, in order to eat seeds left behind on the occasion of these earlier feeding visits. Six interviewees mentioned the strategy of burying caches of seeds as dry season food stores, and of these four said a single species, **tokoro**, was stored in this way. Only one interviewee gave an indication that he considered this to be a possible means by which seeds of this species were dispersed. Otherwise, the relationship between agouti and seeds was universally considered a predatory one.

Collectively, interviewees indicated the use of a broad range of habitats. Four stated that all (terrestrial) habitat types found locally are used: three of these and one other mentioned that they are found on the savannah in bush islands and riparian forest. Three informants suggested that agoutis are most common in the farming area, and a fourth corroborated this by saying they were most common near the bush mouth. Answers on ranging behaviour were contradictory: four interviewees considered them errant, although two of these mentioned that a mother with young will temporarily stay in one place, while five others considered fixed home ranges to be occupied.

All ten who gave information about diurnal activity patterns agreed that agoutis are active during the daytime. Four of these further stated they could, on occasion, also be active at night. All eleven interviewees who considered the subject of resting places indicated that holes were used for this purpose, and seven specified either holes in the ground, in rotten tree trunks, or both. The use of spaces beneath tree roots and beneath fallen trees, were each mentioned by a single person.

Most agreed that this is a solitary species: seven interviewees gave this response, of which one mentioned that individuals may occasionally aggregate at food sources. A further two gave group sizes of one or two, and one interviewee said that pairs were the norm. All gave figures for litter size, of which all but one fell into the range 1-3; this range itself was specified in three cases. The exceptional answer was four. Four interviewees suggested breeding seasons; although their answers varied, all are consistent with a with a pattern in which the majority of births take place over a period of several months beginning late in the dry season. Five interviewees mentioned maternal care, in the form of provision of food to young while they are in the hole; two others mentioned that the young are born in the hole.

A range of predators was listed: jaguar, puma, ocelot *(Leopardus tigrinus)*, jaguarundi *(Herpailurus yaguarondi)* and land camoudi were each mentioned by a majority of interviewees, harpy eagle by two.

6.3.6 'Laba', paca.

All fourteen interviewees stated seeds to be an important dietary component, and all but one included fruit. Seven interviewees also mentioned cassava as a major food. Only two singled out the fruits of individual species as being of prime importance: **naata** *(Hymenea oblongata)* and **waazu** *(Astrocaryum* sp.). All six interviewees mentioning a food shortage specified that this occurred in the dry season, but they gave somewhat contradictory examples of foods available at this time: five mentioned crop-raiding, and two old or buried seeds. When food species were specified, **waazu** and **dyuwuza** *(Mauritia flexuosa)* were each mentioned twice, while **naata**, **poo'a** *(Pouteria* sp.) and guava *(Psidium guajava)* only received a single mention each. Eleven interviewees indicated that they regarded this species as a seed predator, but one of these, along with another interviewee, also pointed out that they may disperse seeds synzoochorously when they carry them from the vicinity of the parent tree.

All but one of the interviewees stated group size to be one, two, or either one or two; the exceptional answer was 1-3. Some of those giving group sizes of 2 or 1-2 suggested that groups of two might be breeding pairs. Four interviewees further mentioned that temporary aggregation into larger groups may occur at feeding places, or (in one answer only) along creeks. Six interviewees gave information on habitat use, in every case describing the animal as riparian, and in one case mentioning that creek sides in both forest and savannah were used. Three interviewees mentioned a form of seasonal migration in which creekside areas

occupied in the dry season are abandoned for higher ground when they are flooded during the rainy season.

Eleven considered activity patterns, which were unanimously stated to be nocturnal, and one interviewee additionally suggested they might not be active on moonlit nights. Twelve interviewees agreed that holes are used for resting places, and the majority specified that these may be burrows in the ground or holes in rotten wood. All eleven interviewees who considered the question of ranging behaviour agreed that the animals occupy fixed home ranges (this included those already mentioned who described seasonal migration, along with a further individual who suggested that these home ranges might be abandoned in response to food scarcity).

Eleven gave figures for litter size: seven said a single young was always born, the remaining four that they were born either singly or in pairs. Contradictory responses were obtained concerning the timing of birth: two said June, one April, one December, one dry season, while two interviewees said there was no fixed breeding season. One interviewee stated that gestation was three months in duration, and he and three others gave figures for the duration of the period of maternal care ranging from one month to 3-4 months.

A long list of predators was given, of which the most commonly mentioned was the **wichaa waru** *(Speothos venaticus)*, considered by those who mentioned it to be a specialist laba hunter. Jaguar, puma, ocelot and camoudi also were each named as predators by several interviewees.

6.3.7 Black spider monkey, 'kwata'.

All twelve interviewees concurred that fruit dominates the diet, one adding flowers and young leaves. Seven suggested individual food species of particular importance: **ochoro** and/or **mapuza** *(Oenocarpus bataua* and *O. bacaba)* in three cases, **iziari** *(Manilkara bidentata)* in two others, while **naata** *(Hymenaea oblongata),* **otoochi** *(Chrysophyllum* sp.) and **kaawai** (possibly *Micropholis venulosa*) were each mentioned by a single interviewee. Ten of the twelve interviewees mentioned the occurrence of a seasonal food shortage during the dry season, giving a variety of suggestions as to what sources of food were available at this time. Four said young leaves were eaten, two specifying those of **koron** *(Catostemma fragrans),* in one case along with **tooru** *(Cecropia* sp.). Several species of fruit were also mentioned as dry season foods: **ochoro**, **wamooko** *(Parinari excelsa)* and **naata** were those mentioned more than once, while **kumaraokou** *(Ficus* sp. or spp.*)*, **taasho** *(Muellera*

frutescens) and **zudu** *(Parinari* sp.) were all mentioned once. Three interviewees mentioned that spider monkeys call more often during this time of food stress, and several that they are fat during the rainy season, at which time of year they are hunted. Nine interviewees considered the relationship to seeds, and all described a process of endozoochorous dispersal. Seven of these indicated that seeds of all species whose fruits are eaten are dispersed in this fashion, while two believed dispersal to be more selective. Only one of the latter two specified, saying that only the seeds of various species of *Inga* were dispersed in this fashion. Three interviewees described how water is obtained from holes in trees where it collects.

Figures given for group size were fairly consistent in all but one case; these answers ranged from 1-15, with the aberrant answer being 30-40. Among the other answers, all encompass the range 4-6, which can be regarded as a modal value within the broader range mentioned. A single interviewee described a fusion-fission organisation, where a large group who share a single sleeping tree will disperse in smaller groups for the day's foraging. Other information on social dynamics was limited and contradictory: one interviewee said that young disperse from their natal groups at maturity, another that individuals remain with the natal group for life.

All seven interviewees who talked about activity patterns agreed this species is diurnal. Eleven interviewees specified a resting place, an emergent tree, and six of these suggested that a single species, **itki'izi**, serves this purpose. Eight interviewees maintained that groups have fixed home ranges. Two of these said that a group would return to the same tree, or one of a number of suitable trees known to them, to sleep. Another two believed that a group would defend its area from incursions by other groups. Three interviewees disagreed, saying that groups do not move within any specific areas. Of five interviewees talking about habitat use, four remarked that this species is found only in high forest, although one of these and one other individual did say that on rare occasions individuals might emerge temporarily onto the savannah.

Eight interviewees talking about litter size all agreed that a single young is born. Six located the breeding season at around the same time, although this was expressed in a variety of ways: three said rainy season, two said the month of May, and one reported at the time when food is abundant. Only one interviewee contradicted this, saying there is no particular breeding season.

In considering predation, nine interviewees identified the harpy eagle as the major predator, while one said that humans were the only predators. Four interviewees described a habit of throwing debris such as rotten wood at people.

6.3.8 'Baboon', red howler monkey.

All nine interviewees included fruits in their lists of foods, eight also included young leaves, two included flowers and a single interviewee said that spiders were eaten. Three considered leaves to be the most important foods, while three others mentioned particular species of fruit, a different species in each case. Five of the nine identified a seasonal food shortage, taking place in the dry season according to three, expressed by the other two as the time when fruit is scarce. All five agreed that leaves formed the diet at this time of year, and three who specified all agreed that the leaves of **koron** *(Catostemma fragrans)* were of particular importance. Five of eight interviewees to consider the fate of seeds said they are dispersed endozoochorously, while three others said that seeds are not eaten.

Suggestions as to group size were quite consistent, a mode of 4-6 being evident within a range of 2 to 12. Four interviewees gave accounts of group composition based upon a distinction between smaller and larger individuals. The latter were considered by two interviewees to be large males: one of these said two of these were present in each group, the other that there may be either one or two. A further interviewee said that a group of six would include one adult pair and four of the smaller individuals, and the fourth indicated that the small kind, named **sooman sik** in Wapishana, moved in the same group as the larger one. Five interviewees said that definite home ranges are occupied, of a size of one and a half miles in one case, 'two hills' in another, while four considered them to be errant. One suggested that the territory was defended against other groups, while two others described how groups sing at eachother and fight on meeting.

Seven interviewees who considered reproductive behaviour all agreed that a single young is born. Three of these said there was no breeding season, two said young were born in the rainy season and another that young were born twice yearly. Only one mentioned that the mother carries the young on her back and feeds it.

On daily activity patterns, two interviewees described a conventional diurnal pattern, one said they travel day or night, while two others pointed out that they sleep in the middle of the day and are active early morning and late afternoon, and sometimes on moonlit nights. All nine interviewees agreed that tree tops are used to rest, and six further specified that tree tops overgrown with vines and other epiphytes are used. Two interviewees mentioned that water may be obtained from tree holes, or in their absence howler monkeys may descend to the ground to drink. Three interviewees mentioned the danger of falling, but gave a different reason in

each case: being blown from the tree tops by wind, falling when rotten branches break, and falling when travelling at night. Four interviewees raised the subject of calling, two of whom said they call in the morning, one adding that they also call late in the day. One said that calling regularly occurs at 2 am, and the fourth did not mention the timing of calls, but said they climb to tree tops to ensure the call travels far and arrange themselves in a particular formation.

All nine interviewees identified the harpy eagle as a major predator, and two of these each added a species of felid. Three interviewees said that chronic infestation with mosquito worms was a continuous condition - most serious during the dry season, according to one, and caused by the consumption of certain fruits (one interviewee specified *Spondias mombin)* according to the other two.

6.3.9 Brown capuchin, 'common monkey', 'Jack'.

All seven interviewees identified fruit as a major dietary component; three of these additionally mentioned arthropods. Five interviewees identified a single food species of key importance. In three cases, this was the fruit of the kokerite palm *(Attalea regia)*, while **waazu** *(Astrocaryum* sp.) and **kawarori** *(Anacardium giganteum)* fruits were each mentioned once. Four interviewees mentioned the occurrence of a seasonal food shortage, during the dry season. Only two of these suggested what might be eaten over this period, and their answers differed: one said fruits of **koram** *(Inga* spp., on this occasion used in its generic sense), another insects and bushrope fruits. Six interviewees considered the question of seed dispersal, five of these stating that seeds were not normally eaten and therefore not dispersed. One of these did add that seeds of *Attalea* were occasionally dispersed synzoochorously, when the fruits were carried to be consumed away from the parent tree. One interviewee suggested that some small seeds were eaten and dispersed endozoochorously, but did not name the species. Three interviewees mentioned that hard fruits or nuts could be broken open by banging them against branches. Four interviewees also mentioned farm raiding for corn, and two said that sugar cane may also be taken.

A range of different group sizes was suggested: 4-10, 5-10, 8-17, 10-15, and three larger answers: 15 or more, 15-30 and 20-30. These are difficult to reconcile except by considering group size to be variable. A single interviewee distinguished the social behaviour of the **wainsara**, indicating that it is solitary. This name was employed by several interviewees to refer to a kind of **powatu** distinguished by its large size, and described by one interviewee as specifically being a large male. Another interviewee described the **wainsara** as the **'toushao'** for the group. Group

dynamics were considered by three interviewees, two of whom considered groups to be permanently stable, while the other said that males might occasionally transfer between groups, but not females.

Five interviewees spoke of the formation of mixed-species groups with **chaumaa** *(Saimiri sciureus)*; one of these also said they might join groups of **wishi** *(Chiropotes satanas)*. One interviewee specified that it was the males who form groups with **chaumaa**, another that it was small groups with less than four members. Three interviewees agreed that young are born singly, while the fourth answering this question stated that one or two might be born at once. Of six responses concerning the breeding season, one considered there was none but the others were consistent. According to four interviewees, the breeding pattern is determined by the phenology of **koram**: three of these indicated that young are born when this species is in fruit and the other that mating occurs when it is in flower. The remaining answer was consistent with this: that young are born in the rainy season.

All four interviewees to consider activity patterns said this species was diurnal, while all seven interviewees concurred that they make use of kokerite palms to rest, four providing the additional detail that they shelter under the large woody spathes. One specified that this was a rainy season strategy, and that in the dry season they might sleep in any thick growth of lianas up a tree.

All seven interviewees mentioned eagles as predators: in six cases the harpy eagle, in one another species *(Bursarellus nigricollis)*. Two saw fit to note that this species is sufficiently intelligent to outwit attempts at capture by jaguars, a phenomenon that is recorded in Wapishana folklore.

Five of the seven interviewees considered **powatu** groups to occupy particular home areas, one specifying a size of two miles, although another mentioned that they will move far from their home area to search for food. Of the two who suggested there is no fixed home range, one qualified this by saying that a group may return to particular sleeping places.

6.3.10 Wedge-capped or weeping capuchin.

There was a high degree of agreement in interviewees' statements on diet. All five mentioned fruit as a major dietary component, and four of these also stated that arthropods are consumed. The three who suggested most important foods all included the fruits of species of *Inga*, while no other food item obtained more than one mention. Four interviewees indicated a food shortage during the dry season, though there was some disagreement on the sources of food at this time: **wamooko**

(Parinari excelsa) fruits were the only item mentioned more than once, and another interviewee named other species of *Inga*. One interviewee added bamboo shoots to **wamooko** fruits, and the fourth suggested young leaves and insects. Only two informants considered that seed dispersal takes place: all agreed that seeds are dropped at the site of consumption rather than eaten, but two suggested that fruits may on occasion be carried some distance from the parent tree prior to consumption, one specifying that **wamooko** is the only seed thus dispersed. Two interviewees indicated that the location of fruit trees (and in one case, sleeping trees) is remembered by the monkeys; one of these said they visit trees to check the ripening of fruit.

As with *Cebus apella*, an overlapping range of group sizes was given: 4-6, 6, 6-8, 8-10 and 10-12. The lack of a consensus suggests that answers might reflect differing experiences of this fairly rare species, and thus implies group sizes ranging from 4-12 individuals. Three interviewees distinguished two kinds of **oao** at this stage, one being a big one which was said to form groups of one or two on occasion. One interviewee suggested that mixed groups were sometimes formed with **powatu** *(Cebus apella)* and **chaumaa** *(Saimiri sciureus)*. Four interviewees talked about group dynamics. One stated that individuals remain with the natal group for life, while three noted incidences of intergroup transfer, of males according to two, of the bigger kind to the other. The three interviewees who mentioned litter size agreed that a single young is born. One of these considered there not to be any breeding season, but the others gave fairly close answers: one said April, the other said mating in March followed by birth in May.

Although only one interviewee mentioned a diurnal activity pattern, he along with two others mentioned that they rest in the spathes of kokerite trees. Of those interviewees mentioning ranging behaviour, two said they had no fixed home range while those two who contradicted this gave somewhat different details: an exclusive range of three miles versus a shared range of one mile.

Four interviewees mentioned predators, in three cases the harpy eagle, in another the smaller powis eagle.

6.3.11 White-faced or Guianan saki, 'hoori'.

All seven interviewees agreed that fruits are eaten, while two additionally mentioned leaves and flowers, and one other added insects. Those four who specified foods of major importance all said the fruits of **pokoridi** *(Attalea regia)*, while two of these also added the fruits of **koram** (various species of *Inga*). Three interviewees said

there was a seasonal food shortage during the dry season, but disagreed as to which foods were consumed at this time. Contradictory claims were also made on the topic of seed use: two said that seeds were dropped at the time of eating, another that they were predated upon, and another that either may occur depending on the tree species. Two interviewees considered endozoochorous dispersal to take place selectively, but disagreed on the species concerned - one said all species of *Inga*, another an unspecified range of small seeds.

Interviewees also differed in their opinions on ranging behaviour. Three interviewees considered groups to be errant, two to have restricted home ranges, and another that they may or may not return to the same place. In group size, all answers ranged between two and six, four answers being at the lower and three at the upper end of this range. All four who ventured suggestions as to group composition agreed that they included both sexes, those who had suggested group sizes of 5-6 both saying that this would include one or two males. Two interviewees also considered intergroup relationships to be aggressive, though another said that groups may aggregate temporarily to feed at the same kokerite tree.

Two interviewees talked about activity patterns, both saying they are diurnal. Two interviewees said that groups rest for the night under kokerite leaves, one saying they might also rest in trees of different species: in the latter he concurred with the other two interviewees giving information on this topic, one of whom specified that thick growths of epiphytes near treetops were used. Two interviewees said that this species was most common in the farm area. Three interviewees also pointed out a curious locomotory pattern, one focusing on movement between tree trunks, the others describing how they move between trees by jumping sideways.

Six interviewees mentioned predation, among them naming a number of species of eagles as predators. Two of these said that predator avoidance was based upon crypsis rather than flight.

All five interviewees talking about litter size said a single young is born. Two specified a birth season, one saying March or April – when kokerite fruits are available – the other May. Two interviewees said that birth could take place annually, and one of these said that reproduction is slow overall as a result of females not becoming mature until three years of age.

6.3.12 Brown bearded saki.

All interviewees agreed that the diet is composed of fruit alone; four of the five further specified that unripe fruits are eaten. Two of these four ventured opinions

that this was destructive behaviour, in that fruit was eaten before having had a chance to mature and the tree was thus prevented from producing seeds. Four interviewees specified a single most important food species: in two cases this was **iziari** *(Manilkara bidentata)*, in two others **ma'arasao** (not identified). Only one interviewee considered a seasonal food shortage to affect this species: according to him, this occurs in the dry season when **koobiki** and **dyakara** (both species of *Inga*) are the main sources of food.

Each interviewee gave a slightly different range of group sizes, but these answers all overlapped and can be regarded as consistent. The smallest range suggested was 15-20, which was encompassed within those of all other responses. Two interviewees gave a minimum group size of 8, two gave a maximum size of 20 while other maxima were 30, 40 and 50. This suggests a consensus of groups ranging from 8 to 40 in size, with 15 to 20 being the most common. Two interviewees described a fusion-fission pattern of social organisation in which groups disperse into smaller feeding subgroups comprising small numbers of individuals, and aggregate at particularly ample food sources. Both considered this pattern to be a strategy for coping with the variable abundance of fruit, many trees providing too little to feed the entire group. A further interviewee mentioned that, owing to the large size of the social group, they will consume all the fruit on a tree on a single visit. Both the aforementioned interviewees also stated that groups sleep in a dispersed pattern, sometimes on different trees. These two were also the only interviewees to claim the use of home ranges, for which they suggested similar sizes (two miles and two-and-a-half miles respectively); both also noted that these home ranges were not exclusive to a single group.

Information on habitat use was roughly consistent. Two interviewees stated that this species lives only in high forest and is not found in the farming area, while another stated that they require large areas of forest and are therefore absent from forest islands. A fourth interviewee said they resided (meaning the location of nocturnal resting places) in mountains, but often descended to lower-lying areas during the course of the day's foraging.

All three informants giving information on reproductive behaviour agreed that a single young is born. Two of these also said that parturition takes place at a particular time of year; however the times they suggested for this differed.

Four interviewees gave information on predators, and all of these listed the harpy eagle (although the term used, **kokoi**, is also a generic term for eagles). Two of these each listed a further species of predator – the powis eagle in one case, and **oao**

din (an unidentified felid, probably an alternative name for *Puma concolor*) in the other.

6.4 Further information from ethnoecology

Ethnoecological interviews highlighted numerous cases of usage of crops in farms by forest animals. A number of examples of animals feeding on the fruits of trees planted by people were also given. This information is reported in the sections on individual animal species in the next chapter, and is summarised in the following table:

Table 6.1. Ethnoecological data on use of farm crops and planted trees by non-domesticated animals

Crop plant	**Consumers reported in ethnoecological interviews**
Cassava (*Manihot esculenta*)	*Tayassu tajacu, T. pecari, Tapirus terrestris, Mazama americana, Dasyprocta agouti, Agouti paca*
Sweet potato (*Ipomoea batatas*)	*Tayassu tajacu, T. pecari, Mazama americana, Dasyprocta agouti, Agouti paca*
Yam (*Dioscorea cayennensis*)	*Tayassu tajacu, T. pecari, Mazama americana, Dasyprocta agouti, Agouti paca*
Eddo/dasheen (*Colocasia esculenta*)	*Tayassu tajacu, T. pecari, Mazama americana, Dasyprocta agouti, Agouti paca*
Banana (*Musa*. spp)	*Tapirus terrestris, Mazama americana, Dasyprocta agouti, Agouti paca, Eira barbara*
Pawpaw *(Carica papaya)*	*Tapirus terrestris, Mazama americana, , Eira barbara*
Black-eyed bean *(Vigna sinensis)*	*Mazama americana, Dasyprocta agouti*
Pumpkin *(Cucurbita maxima)*	*Mazama americana, Dasyprocta agouti*
Watermelon *(Citrullus vulgaris)*	*Mazama americana*
Cashew *(Anacardium occidentale)*	*Mazama americana, Agouti paca*
Guava *(Psidium guayaba)*	*Mazama americana, Agouti paca*
Peanut *(Arachis hypogea)*	*Dasyprocta agouti*
Maize *(Zea mays)*	*Dasyprocta agouti, Agouti paca, Cebus apella*
Mango *(Mangifera indica)*	*Agouti paca*
Sugar Cane *(Saccharum officianum)*	*Cebus apella, Eira barbara*

Table 6.2. Ethnoecological data on plants characteristic of early succession in abandoned farms (indicates species reported to be largely or wholly restricted to old farms)*

Name	Uses*	Animal consumers
buru	E	None reported
toro *(Cecropia* sp.)	N	Browsed by *Tapirus terrestris*.
kaamaniu *(Pouroura* sp.**)**		Fruits eaten by *Crax alector* and both species of *Tayassu*.
mokoro	T	Eaten for water by *Tayassu pecari*.
manada	N	Trunks bitten by *Cebus apella* for water. *Tayassu pecari* forage at base.
kochoiwi'izan *(Euterpe* sp.)	C, (E)	Fruits eaten by macaws, parakeets, toucans, *Penelope* sp., *Pipile pipile*, *Mazama* spp., *Dasypus* spp.
yurou	N	Fruits eaten by bats, *Tayassu* spp., *Dasyprocta agouti* and *Myoprocta acouchy*
i'ichoro	N	Fruits eaten by chibid, eaten and dispersed by bats.
kapash dyo	N	Fruits eaten by *Dasyprocta agouti, Myoprocta acouchy*, farm birds such as *Leptotila rufaxilla* and *Geotrygon montana*.
***kaazi'ikun** **(**'wild potato'**)**	T	Leaves browsed by *Mazama* spp. Seeds eaten and dispersed by pigeons.
kazakazari (razor grass)	N	Browsed by *Mazama* spp. Seed eaten by *Leptotila rufaxilla*.
sokoru atun	N	Young seeds eaten by *Mazama* spp., *Dasyprocta agouti*, pigeons, rats.
sha'akai	N	Young shoots eaten by *Mazama* spp.
ma'achaiwaodukori	N	Young and old leaves browsed by *Mazama* spp., *Tapirus terrestris*.
kizam daru kadin	T, (E)	Fruits eaten by **chibid**. Home to caterpillar **(kazak dare**) sometimes eaten by people.
pawish surizowao	N	Fruits eaten by armadillos. Seeds eaten and dispersed by *Leptotila rufaxilla*.
ini didada (wild pepper)	E	Fruits eaten and dispersed by **chibid**
pichabau	N	Flowers eaten by *Geocheleone* spp.
siizan (wild banana)	T, C	None reported
ma'acha'iko	N	Fruits eaten by bat, seeds by *Tayassu* spp., *Dasyprocta agouti* and *Myoprocta acouchy*.
taoitub	N	None reported
soomakun	N	None reported

(*) Use categories (see chapter 4.8): E — Edible; (E) — considered edible by some; C – Construction; T — Technological; N – No reported uses

The topic of the changes over time in the plant and animal species to be found in abandoned farms, was the subject of a series of interviews with a single informant. This information was supplemented by observations volunteered by other informants within ethnoecological interviews or on a casual basis while in the forest. This

revealed information about this important area of human subsistence that augments that already incorporated into the model of human synecology, and which is summarised in tables 6.2 and 6.3.

Table 6.3. Plants indicated to be characteristic of late succession in old farms. (indicates species reported to be largely or wholly restricted to old farms)*

Name	Human use	Animal use
Mapuza *(Oenocarpus bacaba)*	E, T, C	Fruits eaten by *Tayassu* spp., *Mazama americana, Dasyprocta agouti* and *Agouti paca*
Ochoro *(Oenocarpus bataua)*	E, T, C	Fruits eaten by *Tapirus terrestris, Tayassu* spp., *Mazama americana, Dasyprocta agouti* and *Agouti paca*
Kawarori *(Anacardium giganteum)*	E	Fruits eaten by *Tapirus terrestris, Tayassu* spp., *Mazama americana, Dasyprocta agouti* and *Agouti paca*
Dyakara *(Inga* sp.)	E	Fruits eaten by *Aratinga leucophthalmus, Ara macao, Ara ararauna, Cebus apella, Chiropotes satanas, Tayassu* spp., *Tinamus, Crax alector, Saguinus midas, Saimiri sciureus*.
Zuum	C, T	Fruits eaten by *Ara macao, Ara chloroptera, Ara ararauna.*
Mashimkara		None reported
***Omaatukun**	C	Fruits eaten and dispersed by pigeons *(Columba* spp. and *Geotrygon montana)* and *Geocheleone* spp.
***Katubara**	T	None reported
Kokirai	N	None reported
Waazu *(Astrocaryum aculeatum)*	T, E	Fruits eaten by *Cebus apella* and various species of murid. Fallen seeds eaten by *Tayassu* spp. and *Dasyprocta agouti*.
Kodoi autakan **('tapir guava')**	N	Fruits eaten by *Tapirus terrestris*.
Kumitii	N	None reported
Toizau (*Astrocaryum* sp.)	N	None reported
Itki'izi	N	None reported

6.5 Comments on the ethnoecological data set

One of the most striking features of the dietary information is the low frequency with which most food items were mentioned for particular animal species. A high proportion of the food items recorded for each animal were each named by only a single interviewee, for example 49 of the 97 food items mentioned for red brocket deer, and 43 of 70 in the case of tapir (see summary table in chapter 7.14.1 for figures for all species). I suggest three major factors that might explain this:

1. Limitations of the interview context.

The formal interview setting is one that was unfamiliar to most participants, and for this reason may not have been conducive to the recall of all pertinent information.

More fundamentally, it is unlikely that the areas of knowledge under investigation were cognitively ordered by interviewees according to the same abstract categories as I employed in the collection of information. Most interviewees will not have employed a mental category corresponding to an interview topic such as 'information on animal (x)' which could be instantly recalled and verbalised on demand.

Evidence for this exists in the way in which interview data was supplemented with information given in other contexts. Aside from those discussed above, many interviewees were prompted to give extra dietary information by the sight of fruits I had collected for identification. One informant gave information on the ecology of several tree species, in both interview and unsupervised writing. Substantial quantities of information on animal diets was obtained in both these exercises, that had not appeared in his interviews or written pieces about the animal species concerned. This phenomenon of incomplete recall is a significant methodological problem, which leads to incomplete data sets and a difficulty in analysis. I address this problem more fully later (chapter 7.14.2), and make a number of suggestions for improved methodology that could contribute to overcoming it.

2. Patterning of information according to variation in knowledge among interviewees.

The majority of information on ecology appeared to derive from personal observation; information based upon hearsay or anecdote was generally qualified as such during the course of the interview (chapter 6.2.2 above). Much of the inter-individual variation in information given in interviews derives from variation in the personal experience upon which it is based. Biogeography is an important factor: most individuals concentrate the majority of their forest-based activities within fairly restricted geographical areas – one or two farm roads or hunting lines, for example – and there may be substantial differences in floristic composition among these sites. These local floristic differences will effect differences in the diets of herbivorous, particularly frugivorous, animals. Many important species of fruit tree have very patchy distributions, and local differences in abundance of particular species will exert strong effects on the frequency with which particular animal species may be observed to feed upon them. To a certain extent, then, many informants were reporting information on the diets of animals within quite specific localities. Within Maruranau, there are people from the north of the village who have rarely, if ever, visited areas of the forest in the south of the reservation, and vice versa. The use of aggregated data from interviews with several people increases the area of forest and range of floristic communities effectively studied in this fashion. A systematic test of the effects of

this could be conducted by examining patterns of similarity in ethnoecological knowledge within and between groups of people who use the same areas.

The majority of interviewees were former balata bleeders, whose collective experience covers a vast area of forest. Balata bleeders typically seem to have spent most of their time working along particular lines within restricted geographical locations, although some did range more widely. These locations, however, seem to have been dispersed over much of the south-eastern corner of Guyana and indeed beyond – one interviewee was a member of the legendary group of bleeders arrested in Suriname on suspicion of spying (ARU 1992: 43). How much of this manifest in interviews is not clear: some individuals seem to have reported solely on the basis of their experience locally, while others clearly incorporated information from further afield; only in a minority of cases were particular observations geographically delimited by the interviewee. The uneven distribution of ecological information among the population is a matter worthy of further investigation, and the complementary use of group and individual interviews would be a useful technique in this.

3. Patterning of knowledge according to frequency of occurrence and ease of observation.

It is obvious that the more rarely an event occurs, the less likely it is to be observed and retained to be subsequently mentioned in an interview. Rare events witnessed some time in the past are also presumably less likely to be recalled in the interview situation. The low frequency with which some food items were mentioned may reflect relatively low importance in the diet of the animal in question. A similar effect may result from factors which reduce the likelihood of observation, such as inaccessibility for human observers or distribution that is clumped within areas rarely visited by people or otherwise geographically restricted.

Resolving the problems arising from inter-informant variability in responses is a significant methodological challenge, which must be overcome if ethnoecology is to fulfil the potential that is the main subject of this thesis. Some of the methodological improvements I suggest towards the end of the next chapter could contribute to this; how successful they are in this respect is a question which can be answered only when they are taken into the field. Analytical advancements which would provide more effective and accurate methods for evaluating contradictory data and determining whether answers given with low frequency reflect specialised knowledge or informant error, would clearly be of great use. Consensus analysis has the potential to be useful in this. I did make attempts to employ it in the present analysis, but existing methods appeared not to be designed to cope with data of this sort and

satisfactory results were not obtained. Adapting the methods of consensus analysis to deal with ethnoecological data was beyond the scope of the present thesis; however, it is a task which may prove important in the continued development of research methods in ethnoecology.

This chapter has demonstrated the accessibility of ethnoecological data via an interview framework based upon categories derived from the biological sciences. The next chapter further explores the compatibility of ethnoecological and scientific methods, and presents a direct comparison between data sets generated by the two methods.

CHAPTER 7: ETHNOECOLOGY 2 - COMPARISON OF ETHNOECOLOGICAL AND ECOLOGICAL DATA.

7.1 Introduction

This chapter presents an evaluation of the ethnoecological data set based upon a direct comparison with the published literature. For each species subject to an in-depth ethnoecological investigation, a comparison with the ecological literature was conducted. The quantity and quality of literature available varied greatly among species. A great deal of literature exists on some of the primate species, some of it based upon multi-year studies, and collared peccaries have been the subject of several studies, whereas for some other species such as the agoutis very little field data is readily available and many basic aspects of their ecology have not been documented. Further, in many cases the best ecological data sets available for comparison are from field sites a considerable distance from that of the present study. Much of the data on the ecology of peccaries, for example, is from a site in Amazonian Peru. While there is some degree of floristic overlap, the habitats are sufficiently different in terms of climate and floristic composition that differences between the two sites in the ecology of local populations of a species are to be expected.

Direct comparison was made both of species lists of foods consumed, and of other aspects of the ecology. Food lists were compared at both the generic and family levels. Given that many of the botanical glosses assigned to Wapishana plant names in the present study are tentative, I considered it more appropriate to employ the genus, at which the glosses used are more likely to be accurate, than the species as the most precise taxonomic level for comparison. Owing to the differences in the study sites between the two data sets, I also made a comparison at the family level. Two sites which are widely-dispersed geographically may have limited floristic overlap at the genus or species level, but most families of plants have a very wide geographical distribution. As fructiferous characteristics are one of the major bases according to which plants are assigned to families, it is to be likely that a species of frugivorous animal will consume fruits of plants of the same family in different locations.

Comparison of qualitative observations was made on the basis of compatibility. For each observation included in the ethnoecological data set, information on the

same subject was sought in the ecological literature. When the latter was available, I noted whether the corresponding information in the two data sets was consistent.

7.2 Collared peccaries

Specific food plants recorded more than once for **bakuru** included the reproductive parts (fruits, seeds or both) of those species listed in table 7.1. In this and subsequent such tables, the two right-hand columns show whether each of these was corroborated in the ecological literature, by the reported consumption of fruits of either the same genus ('Gen'), or the same family ('Fam'). Other foods included in the ethnoecological data set on **bakuru** but not listed in the table were the shoots of wild banana, **yapun**: an insect larva found in old seeds of *Attalea regia*, and the cultivated tubers cassava (*Manihot esculenta*), sweet potato (*Ipomoea batatas*), yam (*Dioscorea cayennensis*) and eddo (*Colocasia esculenta*).

Most of the published ecological data on collared peccaries *(Tayassu tajacu)* comes from very different habitats to that in which the present study is located. The exception is that of Henry (1997), who reported the contents of stomachs collected in French Guiana to include a high proportion of seeds, a lesser proportion of fruit pulp and a similar proportion of animal matter. More specific identifications of food items were not made. Kiltie (1981a) found seeds of several species of palm, including *Jessenia* (which has since been re-assigned to *Oenocarpus)*, in collared peccary stomachs collected in Peru. Small quantities of animal material were regularly found, and reported to consist mostly of insect parts, though the study period did not include the time of greatest food scarcity. Bodmer (1989) also found seeds of *Oenocarpus (Jessenia)* in collared peccary stomachs from Peru, along with those of *Virola, Inga* and unidentified members of the families Anacardiaceae, Apocynaceae (very low frequency), Leguminosae and, at a very high frequency, Sapotaceae. In a later study from the same location, earthworms were among several animal foods identified, but were recorded in smaller quantities than insects, molluscs and mammals (Bodmer et al. 1997b: 15-27). Food plants reported from a dry forest in the Venezuelan Llanos showed no overlap with those recorded here in terms of species and genera, but included members of the families Anacardiaceae, Leguminosae and Palmae. The parts of plants eaten were, again, mostly fruits and seeds (Barreto et al. 1997). None of the ecological studies consulted appears to have taken place in an agricultural area, but there exist anecdotal reports of consumption of a variety of cultivated plants (Sowls 1984: 196). Roots and tubers of non-cultivated plants are reported to be important in the diets of peccaries in the Brazilian

caatinga (Olmos 1993), and were also regularly found in stomach samples analysed in Peru (Bodmer et al. 1997b: 18).

Table 7.1. list of food plants recorded in ethnoecological interviews on Tayassu tajacu, and their corroboration in the ecological literature

Wapishana name	Latin name	Gen	Fam
Ochoro	*Oenocarpus bataua:* Palmae	X	X
Mapuza	*Oenocarpus bacaba*: Palmae	X	X
Koobiki	*Inga ingoides*: Leguminosae (Mimosoideae)	X	X
Koram	*Inga alba*: Leguminosae (Mimosoideae)	X	X
Koto'u	*Virola surinamensis*: Myristicaceae	X	X
Iziari	*Manilkara bidentata:* Sapotaceae		X
Pokoridi	*Attalea regia:* Palmae		X
Poo'a	*Pouteria* sp.*:* Sapotaceae		X
Daba	*Peltogyne porphyrocardia*: Leguminosae (Caesalpinioideae)		X
Naata	*Hymenaea courbaril*: Leguminosae (Caesalpinioideae)		X
Kawarori	*Anacardium giganteum:* Anacardiaceae		X
A'akush	*Manilkara excelsa*: Sapotaceae		X
Otoochi	cf. *Manilkara*: Sapotaceae		X
Kaawai	*Micropholis venulosa:* Sapotaceae		X
Kaziman	*Couma* sp.: Apocynaceae		X
Roomi au	*Sacloglottis cydonioides:* Humiriceae		
Bowao	*Tetragastris* sp./spp.: Burseraceae		
Tokoro	*Licania* spp.: Chrysobalanaceae		
Widu'oko	not identified	–	–
Koomaru	not identified	–	–
Arakiki	not identified	–	–

Curiously, several of the cited studies report consumption of fruits of *Spondias mombin, Mauritia flexuosa, Astrocaryum* and *Euterpe*, each of which was mentioned by only a single interviewee in the present study and thus eliminated from the analysis. It seems likely that these fruits are consumed by collared peccaries in the area of the present study, as there is no reason to believe that foods consumed in one area would be avoided in another. If this is indeed the case, it demonstrates a weakness of the analytical method in which food items mentioned only once are eliminated.

Table 7.2. Comparison of ethnoecological and ecological data sets for Tayassu tajacu

Subject	Ethnoecological data	Ecological observations
Diet	Seeds, fruits, grubs found in palm seeds, earthworms, roots and cultivated tubers. Food more abundant in wet season, when fruit dominates diet. Dry seeds eaten in dry season. Seed predators.	Reproductive plant parts dominate diet [1,2,3,4,5] Earthworms one of several categories of animal foods eaten [5] Raid crops [6], consume roots and tubers [5,7] Levels of consumption of seasonal fruits vary according to availability [5] Palm seeds often left on forest floor for several weeks before consumption [2] Seeds masticated, so dispersal unlikely [1,2] Bite sufficiently strong to crush some, but not all, seeds consumed [8] Consume palm seeds for larvae of insect seed predators [19]
Intraspecific behaviour	Modal group size 6-12, maximum 20. Males sometimes solitary. Group size smaller in hunted populations.	Group size 1-20+, modes 1 and 6-10 in Venezuelan forests [9] Mean group size 6.7, range 4-11 in Paraguayan Chaco [10] Herd sizes 6-15 [11] Group sizes 1-16 in Texas [12] Herd sizes range from 1-18, mean 4.89, at a number of forest sites in Brazil, subjected to varying hunting pressure. Mean at unhunted site slightly larger than overall mean: 5.75 [13] Herd sizes in French Guiana from 5-11 [14]
Habitat use	Occupy fixed home ranges, occasionally abandoned. Shelter in holes in rotten tree trunks or old burrows of *Priodontes maximus*. Found throughout forest, use swamps for feeding.	Home range stable over 6 month study period [10]. Stable home ranges overlapping at peripheries (Arizona) [11] Stable, though seasonally variant, overlapping home ranges. Burrows used for sleeping [14]. Preference for moist forests and várzea [5] Regularly visit wallows [17]
Activity	Diurnal	Diurnal [6]
Reproductive biology	Usual litter size 2	Mean litter size 1.89 in Texas [15] Mean litter size in Peru 1.93 [5,16] Most common litter size 2 [6]
Interspecific interactions	Predated upon by *Panthera onca*, *Puma concolor*, and *Boa constrictor.* Displaced temporarily by *Tayassu pecari.*	One group observed to change home range in response to range shifts of sympatric feral hogs *(Sus scrofa)* [12]. Predation by *Panthera onca* and *Puma Concolor* [6,14,18] Predation by *Panthera onca* [20,21]

[1] Kiltie 1981a [2] Bodmer 1989 [3] Henry 1997 [4] Barreto et al. 1997 [5] Bodmer et al. 1997a [6] Sowls 1984 [7] Olmos 1993 [8] Kiltie 1982 [9] Robinson and Eisenberg 1985 [10] Taber et al. 1994 [11]Schweinsburg 1971 [12] Ilse and Hellgren 1995 [13] Peres 1996 [14] Judas and Henry 1999 [15] Hellgren et al. 1995 [16] Gottdenker and Bodmer 1998 [17] Kiltie and Terborgh 1983 [18] Cunningham et al. 1999 [19] Kiltie 1981b [20] Emmons 1987 [21] Tewes and Schmidly 1987

Overall, the dietary data in the present study exhibits both overlap and contrast with the results of the ecological studies cited. All but two of the eighteen food plants recorded in this study correspond at the family level, and five at generic and specific levels. This is despite the geographical separation of the study sites and the relatively small proportion of food plants identified to generic or species level in the ecological studies cited. Various food items, both specific and categorical, commonly reported in ecological studies were either not recorded in or eliminated from this study, indicating that a comprehensive list of foods was not obtained.

In other aspects of ecology investigated, the present study corresponds closely to the results of ecological studies (table 7.2). Twenty-one observations were derived from the ethnoecological data set for which information on corresponding subjects was available in the biological literature on this species, and in all cases the information provided was either identical or consistent. The ethnoecological data set also includes a number of important observations not included in any of the published data.

7.3 White-lipped peccary

The list of foods reported in multiple ethnoecological interviews on **bichi** included the reproductive parts (fruits or seeds or both) of the plant species listed in table 7.3. Other plant foods included those already listed for the collared peccary: wild banana, and the cultivated tubers cassava *(Manihot esculenta),* sweet potato *(Ipomoea batatas),* yam *(Dioscorea cayennensis)* and eddo *(Colocasia esculenta).* Animal foods listed were earthworms, **yapun**, snakes - of which bushmaster *(Lachesis muta)*, labarria *(Bothrops atrox)* and land camoudi *(Constrictor constrictor)* were all specified - fish found in drying pools and bird eggs, of which those of the **maami** *(Tinamus major*, and possibly other closely related species of ground-nesting birds) were specified.

Stomach contents of white-lipped peccaries in Peru included seeds of *Mauritia flexuosa* and species of *Astrocaryum* and *Oenocarpus (Jessenia)* (Kiltie 1981a). Later studies from Peru reproduced these findings, and also identified seeds of *Euterpe*, *Spondias*, *Inga* and *Virola*. Remains of plant reproductive parts identified to the family level included members of the Apocynaceae, Bombacaceae, Chrysobalanaceae, Lecythidaceae, Moraceae and Sapotaceae (Bodmer 1989: 467). *Oenocarpus bataua* has since been specifically identified in stomachs of peccaries in this area (Bodmer et al. 1997b: 18-19). Consumption of *Spondias mombin* was reported from dry forests of the Venezuelan llanos (Barreto et al. 1997: 281) All but two of the twenty-five

fruits listed for whom identifications are suggested are thus represented in the ecological data by members of the same botanical family, and corresponding reports of congenerics exist for eight.

Table 7.3. List of food plants recorded in ethnoecological interviews on Tayassu pecari, and their corroboration in the ecological literature.

Wapishana name	Latin name	Gen	Fam
Mapuza	*Oenocarpus bacaba*: Palmae	**X**	**X**
Koram	*Inga alba*: Leguminosae (Mimosoideae)	**X**	**X**
Ochoro	*Oenocarpus bataua:* Palmae	**X**	**X**
Dyuwuza	*Mauritia flexuosa:* Palmae	**X**	**X**
Koto'u	*Virola surinamensis*: Myristicaceae	**X**	**X**
Waazu	*Astrocaryum aculeatum*: Palmae	**X**	**X**
Zuupu	*Spondias mombin:* Anacardiaceae	**X**	**X**
Wabo	*Euterpe stenophylla*: Palmae	**X**	**X**
Pokoridi	*Attalea regia:* Palmae		**X**
Iziari	*Manilkara bidentata:* Sapotaceae		**X**
Poo'a	*Pouteria* sp.*:* Sapotaceae		**X**
Daba	*Peltogyne porphyrocardia*: Leguminosae (Caesalpinioideae)		**X**
Otoochi	cf. *Manilkara*: Sapotaceae		**X**
Naata	*Hymenaea courbaril*: Leguminosae (Caesalpinioideae)		**X**
Kawarori	*Anacardium giganteum:* Anacardiaceae		**X**
Minau	*Bertholletia excelsa*: Lecythidaceae		**X**
Wamooko	*Parinari excelsa:* Chrysobalanaceae		**X**
Tokoro	*Licania* spp.: Chrysobalanaceae		**X**
Katowari	*Bagassa guianensis:* Moraceae		**X**
Taasho	*Muellera frutescens:* Leguminosae (Papilionoideae)		**X**
Kaziman	*Couma* sp.*:* Apocynaceae		**X**
Koron	*Catostemma fragrans*: Bombacaceae		**X**
Bakopara	*Pouteria sericea*: Sapotaceae		**X**
Bowao	*Tetragastris* sp./spp.: Burseraceae		
Roomi au	*Sacloglottis cydonioides:* Humiriceae		
Widu'oko	not identified	**–**	**–**
Poorau	not identified	**–**	**–**
Koomaru	not identified	**–**	**–**

Studies from Brazil and Peru report roots to be an important component of the diet of white-lipped peccaries (Olmos 1993; Bodmer et al. 1997b: 18). Anecdotal information concerning consumption of crops apparently applies to both species of *Tayassu* (Sowls 1984: 196). Data on consumption of animal foods included earthworms, but at a lower frequency than insects, molluscs and uniramians, none of which were mentioned in the present study aside from the insect larva **yapun**. The proportion of reptile flesh was also lower than would be consistent with the ethnoecological data, and fish were not mentioned at all, although over 20 percent of animal foods could not be identified (Bodmer et al. 1997b: 25).

Overall, the ethnoecological data on diet concords well with the published data, if the geographical differences are again taken into account. Of twenty-five food species in the ethnoecological data set for which I have botanical glosses, twenty-three are corroborated to family level, and eight to genus or species. The ethnoecological data set does not include several types of animal food reported to be eaten in Peru. How much of this discrepancy is due to ecological differences and how much to methodology is difficult to determine. The greater overlap in identity of plant foods compared with those of collared peccary is the result largely of the inclusion in the ethnoecological data set of several of the relatively small number of food species identified in ecological studies for both species of *Tayassu* but not mentioned here as being foods for *T. tajacu*.

As table 7.4 indicates, ethnoecological data on other aspects of ecology is also closely consistent with the published data. The only apparent contradiction is a calculation of home range sizes from the only study to have radio-collared white-lipped peccaries (Fragoso 1998), which is somewhat smaller than the reports of collaborators in the present study would suggest. However, there are two key factors that might account for this. Firstly, the duration of Fragoso's study was one year, and historical accounts recorded in the present study suggests that white-lipped peccary presence at particular sites varies over far longer time-scales. Secondly, Fragoso studied animals in a protected area free from hunting pressure, which is significant in the light of the observation in the present study that hunting may be a key factor in the migration of white-lipped peccary herds. The results of various other studies appear to contradict Fragoso's, although radio-tracking was not employed in any of these (Kiltie and Terborgh 1983: 248-251; Hernandez et al. 1995; Peres 1996: 120-121). With regards to reproductive behaviour, one study in Peru reported there not to be any seasonal birth peak, but took place in a much less seasonal habitat than that of the present study (Gottdenker and Bodmer 1998).

Table 7.4. Comparison of ethnoecological and ecological data sets for Tayassu pecari

Subject	Ethnoecological data	Ecological observations
Diet	Fruit, seeds, snakes, worms, grubs, roots including cultivated tubers. Seed predators.	Diet dominated by plant reproductive parts [1,2,3,4,5] Plant roots also eaten [2,5,6] Crop predation reported anecdotally [7] Various animal foods eaten including insects and earthworms [2] Seeds crushed when eaten [1,3,8]
Interspecific	Kill hunting dogs. Immune to snakebite. Herd forms strong defence against predators but young animals predated by *Panthera onca, Puma concolor, Melanosuchus niger* and camoudi.	Various accounts of varying reliability concerning ferocity of herds to humans, dogs and other predators, [7] Reports of herds mounting massed defence against jaguars; predator defence suggested to be main benefit in group formation [3] Predation by *Panthera onca* [13]
Intraspecific	Large groups of 20-100 or more individuals. Temporary group fragmentation.	Group sizes counted 90-138, usual estimates 100-200. Smaller groups of c.30 believed to be satellites of larger groups [3] Groups of 14-60 observed in Venezuelan dry forest, some solitary individuals [9] Groups from 30-40 to 100-200 [10] Group sizes 70-260[11]
Habitat use	Range over huge areas. Come onto savannah during etai fruit season. Use swamps and thick liana forest.	Appear to have large but often definite home range [7] Apparently nomadic or migratory: range over areas larger than study sites [3,9,11] Home range calculated to be 60-200 km^2 [3] Home ranges up to 109.6 km^2 [10] Return to regular feeding sites at annual and shorter intervals [10] Prefer stream beds and várzea forests [2] Regularly use wallows [3,7]
Reproductive	Litter size 1-3. Born mainly in rainy season	Mean litter size in Peru 1.67+0.53, range 1-3 [2,12] Observed timing of mating implies birth peak in rainy season [3]

[1] Bodmer 1989 [2] Bodmer et al. 1997a [3] Kiltie and Terborgh 1983 [4] Kiltie 1981a
[5] Barreto et al. 1997 [6] Olmos 1993 [7] Sowls 1984 [8] Kiltie 1982
[9] Hernandez et al. 1995 [10] Fragoso 1998 [11] Peres 1996
[12] Gottdenker and Bodmer 1998 [13] Tewes and Schmidly 1987

7.4 Lowland Tapir

Table 7.5 lists species whose fruits were reported, by more than one interviewee, to be eaten by **kodoi.** In addition, there were corroborated reports of consumption of several cultivars: bananas *(Musa* spp.), and the leaves of cassava *(Manihot esculenta***)** and pawpaw *(Carica papaya*). Leaves of non-cultivars listed more than once were **tooru** *(Cecropia* sp.), wild whitees (several species of *Inga)* and finally grass.

Table 7.5. List of food plants recorded in ethnoecological interviews on Tapirus terrestris and their corroboration in the ecological literature

Wapishana name	Latin name	Gen	Fam
Zuupu	*Spondias mombin:* Anacardiaceae	X	X
Kawarori	*Anacardium giganteum:* Anacardiaceae	X	X
Iziari	*Manilkara bidentata:* Sapotaceae	X	X
Wamooko	*Parinari excelsa:* Chrysobalanaceae	X	X
Zudu	*Parinari* sp.	X	X
Dyuwuza	*Mauritia flexuosa:* Palmae	X	X
Kumaraokou	*Ficus* sp/spp.: Moraceae	X	X
Ochoro	*Oenocarpus bataua:* Palmae	X	X
Katowari	*Bagassa guianensis:* Moraceae	X	X
Kaawai	*Micropholis venulosa:* Sapotaceae	X	X
Tooru	*Cecropia* sp.	X	X
Poo'a	*Pouteria* sp.: Sapotaceae		X
Pokoridi	*Attalea regia:* Palmae		X
Ma'aso	*Andira surinamensis:* Leguminosae (Papilionoideae)		X
Taasho	*Muellera frutescens:* Leguminosae (Papilionoideae)		X
Mawaorakun	*Trichilia pleeana:* Meliaceae		
Roomi au	*Sacloglottis cydonioides:* Humiriceae		
Kaziman	*Couma* sp.: Apocynaceae		
Widu'oko	not identified	–	–
Koomaru	not identified	–	–
Kodoi autakan	not identified	–	–

The ecological study located closest geographically is that of Henry et al. (2000) in French Guiana. Their list of fruits consumed by tapirs includes *Spondias mombin, Bagassa guianensis, Mauritia flexuosa, Ficus* sp., *Parinari excelsa, Manilkara* cf. *bidentata* and *Oenocarpus (Jessenia) bataua*. Salas and Fuller (1996), reporting information derived from ethnoecological investigation as well as conventional ecological research techniques, give a list of thirty-three fruits eaten by tapirs at their research site in Southern Venezuela. These include *Anacardium giganteum, Ficus* spp., *Inga oerstediana, Oenocarpus (Jessenia) bataua, Microphilis melinoneana, Parinari excelsa, Spondias mombin,* and unidentified species of Chrysobalanaceae and Sapotaceae. This study also reported selective browsing on *Cecropia*. Bodmer (1990) gives a shorter list of fruits eaten by tapirs in Peru, including *Mauritia flexuosa, Oenocarpus (Jessenia)* sp., and unidentified species of Sapotaceae, Araceae, Chrysobalanaceae, Leguminosae and Menispermaceae.

Food plants recorded in these studies concord strongly with the results of the present study, despite the difference in the study locations. For eleven of seventeen

fruits eaten for which scientific identifications are proposed, either the same species or a congener is reported to be eaten by tapirs elsewhere. The consumption fruits of members of the same family is reported in the ecological literature in a further four cases. One of two genera on whose leaves tapirs are reported to browse is corroborated in another study of *Tapirus terrestris*. Additionally, browsing on leaves of *Cecropia* has been reported for *T. bairdii* (Terwilliger 1978: 213).

Table 7.6. Comparison of ethnoecological and ecological data sets for Tapirus terrestris

Subject	Ethnoecological observations	Ecological observations
Diet	Fruit and leaves, especially young leaves. Fruit dominates diet during rainy season, leaves during dry season. Endozoochorous dispersal of seeds of most fruits eaten.	Fruits and leaves [1,2]. Fruit, leaves and fibre [3] Several studies provide evidence for endozoochorous dispersal [1,3,4,5,6]; one contradictory finding is based on unproven methodology [2].
Social	Usually solitary, groups of 2 or 3 occasionally found due to mother-offspring association and temporary association of breeding pairs.	Solitary except during reproductive season [7]
Habitat use	Require treefall gaps and access to bathing pools.	Forage preferentially in treefall gaps, preferentially use creekside habitat [8].
Reproductive	Single young born.	Not reported from wild
Activity patterns	Normally nocturnal.	Normally nocturnal, occasionally diurnal [9]

[1] Bodmer 1990 [2] Salas and Fuller 1996 [3] Henry et al. 2000 [4] Fragoso 1997
[5] Rodrigues et al. 1993 [6] Olmos et al. 1999 [7] Bodmer and Brooks 1997
[8] Salas 1996 [9] Emmons and Feer 1997: 174

In other subject areas the two data sets were in agreement in each of ten comparable observations (table 7.6). One published paper claims to contradict the ethnoecological observation concerning seed dispersal by tapirs (Salas and Fuller 1996). However, the link between this conclusion and the experimental data is so tenuous that the argument is entirely unconvincing in the light of findings in several studies to the contrary.

7.5 Red Brocket Deer

Fruits and seeds reported to be eaten by **koshara** are shown in table 7.7. Flowers were also listed as an important food, of which only those of **kumaraokou** were specified. Leaves were also reported to be a major food category: those of **tooru** (*Cecropia* sp.), **kodadam** (not identified), **bishawud** (not identified) and **kodoi zapori** (not identified) were specified, along with grasses and those of the cultivars

cassava *(Manihot esculenta),* black-eyed bean *(Vigna sinensis),* sweet potato *(Ipomoea batatas),* pawpaw *(Carica papaya)* and yam *(Dioscorea cayennensis).* Several other cultivated plants were also reported to be eaten: banana, *(Musa* spp.) pumpkin *(Cucurbita maxima),* watermelon *(Citrullus vulgaris),* andthe fruits of cashew *(Anacardium occidentale*) and guava *(Psidium guayaba)* trees.

Table 7.7. List of food plants recorded in ethnoecological interviews on Mazama americana, and their corroboration in the ecological literature

Wapishana name	English name	Gen	Fam
Poo'a	*Pouteria* sp.*:* Sapotaceae	**X**	**X**
Wabo	*Euterpe* sp.: Palmae	**X**	**X**
Zuupu	*Spondias mombin:* Anacardiaceae	**X**	**X**
Mapuza	*Oenocarpus bacaba*: Palmae	**X**	**X**
Ochoro	*Oenocarpus bataua:* Palmae	**X**	**X**
Wurada urud	*Inga* sp.: Leguminosae (Mimosoideae)	**X**	**X**
Takuba	*Swartzia dipetala*: Leguminosae (Papilionoideae)	**X**	**X**
Koram	*Inga alba*: Leguminosae (Mimosoideae)	**X**	**X**
Koobiki	*Inga ingoides*: Leguminosae (Mimosoideae)	**X**	**X**
Shurara	*Inga* sp.: Leguminosae (Mimosoideae)	**X**	**X**
Dyakara	*Inga* sp: Leguminosae (Mimosoideae)	**X**	**X**
Kodoi aridu'i	*Inga laterifolia*: Leguminosae (Mimosoideae)	**X**	**X**
Naata	*Hymenaea courbaril*: Leguminosae (Caesalpinioideae)		**X**
Kumaraokou	*Ficus* sp./spp.: Moraceae		**X**
Kawarori	*Anacardium giganteum:* Anacardiaceae		**X**
Dyo	*Mauritia flexuosa:* Palmae		**X**
Taasho	*Muellera frutescens:* Leguminosae (Papilionoideae)		**X**
Kaziman	*Couma* sp.*:* Apocynaceae		**X**
Wamooko	*Parinari excelsa:* Chrysobalanaceae		**X**
Kaawai	*Micropholis venulosa:* Sapotaceae		**X**
A'akush	*Manilkara excelsa*: Sapotaceae		**X**
Katowari	*Bagassa guianensis:* Moraceae		**X**
Barotaba'u	*Aspidosperma excelsum:* Apocynaceae		**X**
Roomi au	*Sacloglottis cydonioides:* Humiriceae		
Bowao	*Tetragastris* sp./spp.: Burseraceae		
Autaka	*Myrcia* sp.: Myrtaceae		
Arakiki	not identified	**–**	**–**
Kodadam	not identified	**–**	**–**
Dido'u	not identified	**–**	**–**

Branan et al. (1985) report information on the diet of red brocket deer *(Mazama americana)* from a part-year study in Surinam. Their list of food plants includes two species of *Pouteria*, *Euterpe oleracea*, one species of *Inga* and two species of *Swartzia*. Bodmer (1989) lists fruits consumed by *Mazama americana* in Peru. Among

these, several are identified to genus or better, including *Euterpe* (the most frequently occurring food), *Mauritia flexuosa, Oenocarpus (Jessenia), Inga, Spondias* and *Swartzia.* Other plants whose fruits were reported to be eaten are of several families, including Sapotaceae, Moraceae, Apocynaceae and Chrysobalanaceae. Bodmer (1997) further reports the consumption of leaves of Gramineae, but no others. Among the twenty-six fruit species reported in this study for which I am able to suggest scientific names, twelve are corroborated to genus and a further eleven to family in the scientific literature.

Table 7.8. Comparison of ethnoecological and ecological data sets for Mazama americana

Subject	Ethnoecological Observations	Ecological Observations
Diet	Fruits, leaves, flowers, several kinds of crops Scarcity of food and water possible during dry season, at which time leaves dominate diet, especially those of *Cecropia*, and farm crops also more regularly used Some seeds predated, others dispersed endozoochorously via either regurgitation or defecation.	Stomach samples contained 80% fruits and around 20% leaves/fibre [1] Stomach samples averaged 56% of flowers, fruits and seeds by volume, leaves also important [2] Proportion of leaves rises greatly when fruit unavailable [1], up to nearly 80% of dry season diet [2] Palm seeds digested in rumen [1]
Habitat use	Rest in thick liana forest or small open spaces Often frequent fallows Occasionally move temporarily onto savannah No consensus on ranging behaviour	Found throughout the forest, but favour dense vegetation. Rest in sheltered spots when not active [6]
Activity patterns	Mostly nocturnal and crepuscular Sometimes active in daytime during rain	Mostly active night, early morning and late evening [7]
Reproductive	Single young born Possible birth peak in rainy season Mother leaves calf hidden while foraging	Not reported from wild
Intraspecific	Most commonly solitary, also in pairs	Solitary [6,7]
Interspecific	Predators *Puma concolor, Panthera onca*, Camoudis, *Harpia harpyja* Predator evasion by changing direction and passing through creeks and savannahs	Predated by jaguar [3,4] Remains found in nests of *Harpia harpyja* [5]

[1] Bodmer 1989 [2] Branan et al. 1985 [3] Emmons 1987 [4] Tewes and Schmidly 1987 [5] Rettig 1978 [6] Emmons and Feer 1997: 178 [7] Eisenberg 1989: 325

Table 7.8 compares ethnoecological observations on red brocket deer with data from the ecological literature. In eleven cases of information on the same subject, the answers are identical or consistent in all cases.

7.6 Orange-rumped agouti

Table 7.9. List of food plants recorded in ethnoecological interviews on Dasyprocta agouti

Wapishana name	English name
Pokoridi	*Attalea regia:* Palmae
Poo'a	*Pouteria* sp.*:* Sapotaceae
Tokoro	*Licania* spp.: Chrysobalanaceae
Waazu	*Astrocaryum aculeatum*: Palmae
Naata	*Hymenaea courbaril*: Leguminosae (Caesalpinioideae)
Iziari	*Manilkara bidentata:* Sapotaceae
Bakopara	*Pouteria sericea*: Sapotaceae
Koram	*Inga alba*: Leguminosae (Mimosoideae)
Dyuwuza	*Mauritia flexuosa:* Palmae
Mapuza	*Oenocarpus bacaba*: Palmae
Kaziman	*Couma* sp.*:* Apocynaceae
Wamooko	*Parinari excelsa:* Chrysobalanaceae
Minau	*Bertholletia excelsa*: Lecythidaceae
Ochoro	*Oenocarpus bataua:* Palmae
Otoochi	cf. *Manilkara*: Sapotaceae
Bowao	*Tetragastris* sp./spp.: Burseraceae
Chaawudu	*Attalea dahlgreniana*: Palmae
Zuupu	*Spondias mombin:* Anacardiaceae
Kaawai	*Micropholis venulosa:* Sapotaceae
Kawarori	*Anacardium giganteum:* Anacardiaceae
Mangoro	*Mangifera indica*: Anacardiaceae
Arakiki	not identified
Kawaazu	not identified
Widu'oko	not identified

Fruits and/or seeds reported to be eaten by **sokoru** are listed in table 7.9. Also commonly reported as foods were various crop plants: cassava roots *(Manihot* esculenta), sweet potatoes *(Ipomoea batatas),* yam *(Dioscorea cayennensis),* pumpkin *(Cucurbita maxima),* peanut *(Arachis hypogea),* maize *(Zea mays)*, black-eyed beans *(Vigna sinensis),* eddoes *(Colocasia esculenta)* and bananas *(Musa* spp.). Other foods mentioned more than once were the kokerite worms **yapun**, tree shoots, and, somewhat surprisingly, the legs of young yellow-footed tortoises, *Geocheleone denticulata.* I could find no specific information on dietary composition in the literature for this species, which to date has been little studied in the wild.

Table 7.10. Comparison of ethnoecological and ecological data sets for Dasyprocta agouti

Subject	Ethnoecological observations	Ecological observations
Diet	Seeds dominate, fruits also important Raid farms for a variety of crops Use discarded animal bones and tortoise shells for gnawing Face food shortage during dry season, when food is obtained by crop-raiding, returning to sites where fruit pulp previously eaten to consume the seeds, and use of seeds cached when abundant, especially those of *Licania* *Attalea regia* and *Licania* most important foods Seed predators	Seeds and fruit pulp each comprise around 40% of diet, seeds being slightly more. Small amounts of unspecified animal food eaten [1] More pulp eaten when available, but total food intake lower at time of peak fruit availability [1] Bury nuts in ground to be retrieved when food scarce [6]
Habitat use	Found in forest, bush islands and gallery forest in savannahs Most abundant in farming area	Inhabit all forest types, including disturbed forest[2] Prefer areas with undergrowth for cover [6]
Activity patterns	Diurnal, sometimes nocturnal	Diurnal, with activity extending into first hour of night [2]
Resting place	Burrows or holes in rotten trees	Not reported
Intraspecific	Solitary or in pairs	67% of encounters in field lone animals; social groups based around breeding pair and their offspring but individuals within a group occupy separate home ranges [2]
Reproductive	Litter size 1-3 Births concentrated over extended period in late dry season and early rainy season Born and cared for by mother in burrow	1-3 young, mean 2 [2]
Interspecific	Predators include *Panthera onca, Puma concolor*, *Leopardus* sp./spp., *Herpailurus yaguarondi*, *Constrictor constrictor* and *Harpia harpyja*	Agoutis eaten by *Panthera onca, Leopardus pardalis* and *L. wiedii* [3] *Dasyprocta variegata* eaten by *P. onca, Puma concolor, L. pardalis* [4] Remains of *D. agouti* found in nests of *Harpia harpyja* [5] Antipredator behaviour exhibited towards several species of snake [2]

[1] Henry 1997 [2] Dubost 1988 [3] Tewes and Schmidly 1987 [4] Emmons 1987
[5] Rettig 1978 [6] Emmons and Feer 1997: 226-7

Table 7.10 compares the small ecological literature on *Dasyprocta agouti,* which is sometimes included in the species *D. leporina* (e.g., Eisenberg 1989: 399), with ethnoecological data collected in the present study. Nine of ten observations in the ethnoecological data set concur with the published literature. The exception is the finding that food intake is actually highest during the time of year when fruit

availability is at its seasonal low (Henry 1997). While it could be that this reflects the consumption of higher volumes of low quality foods, the way in which the dry season food shortage was articulated by ethnoecological informants clearly implied a lower quantity of available food, and it does not appear that the two are reconcilable.

7.7 Laba

Table 7.11. List of food plants recorded in ethnoecological interviews on Agouti paca

Wapishana name	English name
Pokoridi	*Attalea regia:* Palmae
Dyuwuza	*Mauritia flexuosa:* Palmae
Poo'a	*Pouteria* sp.*:* Sapotaceae
Kawarori	*Anacardium giganteum:* Anacardiaceae
Ochoro	*Oenocarpus bataua:* Palmae
Waazu	*Astrocaryum aculeatum*: Palmae
Naata	*Hymenaea courbaril*: Leguminosae (Caesalpinioideae)
Iziari	*Manilkara bidentata:* Sapotaceae
Zuupu	*Spondias mombin:* Anacardiaceae
Wamooko	*Parinari excelsa:* Chrysobalanaceae
Mapuza	*Oenocarpus bacaba*: Palmae
Koram	*Inga alba*: Leguminosae (Mimosoideae)
Otoochi	cf. *Manilkara*: Sapotaceae
Bowao	*Tetragastris* sp./spp.: Burseraceae
Bakopara	*Pouteria sericea*: Sapotaceae
Taamada	*Eschweilera wachenheimii*: Lecythidaceae
Koron	*Catostemma fragrans*: Bombacaceae
Marushobi	*Geissospermum argenteum*: Apocynaceae
Mawaorakun	*Trichilia pleeana:* Meliaceae
Tokoro	*Licania* spp.: Chrysobalanaceae
Mangoro	*Mangifera indica:* Anacardiaceae
Guayaba	*Psidium guajava*: Myrtaceae
Toboicho	*Anacardium occidentale*: Anacardiaceae

Foods reported more than once for **oran** included the seeds and/or fruits of the species listed in table 7.11. Flowers were also reported to be eaten, including those of **taamada** *(Eschweilera wachenheimii)*. The fruits and/or seeds of several cultivated tree species were also reported to be eaten, especially **mangoro** *(Mangifera indica*), and also guava **(***Psidium guajava*) and cashew **(***Anacardium occidentale*). Several farm crops were also reported to be eaten, including corn **(***Zea mays*), bananas **(***Musa* spp.) and pumpkin, and the roots of yam **(***Dioscorea cayennensis***)**, sweet potato **(***Ipomoea batatas***)**, eddo **(***Colocasia esculenta***)** and **–**

most frequently – cassava *(Manihot esculenta)*, especially roots left to soak in forest creeks during processing. **Oran** were also reported to gnaw upon the shells of dead turtles and animal bones, especially those discarded around hunting camps.

Of all the species of animal focused upon in this chapter, it is *Agouti paca* whose ecology is most poorly known, and those papers that do exist on the subject are not readily available. The comparison in table 7.12 is based upon species accounts in two general texts on neotropical mammals, and various papers on species of predator, which include records of the consumption of *A. paca* as prey. Fourteen observations on comparable subjects are all consistent between the two data sets.

Table 7.12. Comparison of ethnoecological and ecological data sets for Agouti paca

Subject	Ethnoecological observation	Ecological observation
Diet	Seeds, fruits, crops – especially cassava Dry season food shortage, at which time feed off farm crops, seeds buried during their time of abundance and the seeds of *Mauritia flexuosa* and *Astrocaryum aculeatum*	Seed predators, but also disperse some buried seeds synzoochorously. Fruits, nuts, seeds [5] Eat fruits and some tubers [6]
Social	Group size 1-2 Groups of two may be breeding pairs Sometimes aggregate at feeding places	Usually solitary, although mother may be accompanied by young. Male and female territories overlap [5] Pairs share territories, but forage alone [6]
Habitat use	Riparian habitats in both forest and savannah. Migrate seasonally in response to inundation	Most common near watercourses or seeps [6]
Activity patterns	Nocturnal	Usually nocturnal [5,6]
Resting place	Burrows in ground or rotten tree trunks	Digs burrows or appropriates those of giant armadillo [5]
Ranging behaviour	Occupy fixed home ranges	Occupy and defend fixed home ranges [5]
Reproduction	Litter size 1-2 Parental care lasts 3-4 months	Usually single young, rarely twins [5]
Predation	*Speothos venaticus* reported to be specialist laba predator *Panthera onca, Puma concolor, Leopardus* sp./spp. and camoudis (*Constrictor constrictor* and *Eunectes murinus*) also listed as predators.	Hunted and eaten by *Speothos venaticus* [1,2] Eaten by *Panthera onca, Leopardus pardalis* [3] Eaten by *Panthera onca, Puma concolor, L. pardalis* [4]

[1] Peres 1991 [2] Deutsch 1983 [3] Tewes and Schmidly 1987 [4] Emmons 1987
[5] Eisenberg 1989: 395-6 [6] Emmons and Feer 1997: 224-5

7.8 Black spider monkey

Specific food items reported more than once for **roomi** included the fruits listed in table 7.13. Young leaves and flowers were also reported to be eaten, but only one species of leaf was specified – **koron** – and no species of flower.

Table 7.13. List of food plants recorded in ethnoecological interviews on Ateles paniscus, and their corroboration in the ecological literature.

Wapishana name	Latin name	Gen	Fam
Iziari	*Manilkara bidentata:* Sapotaceae	X	X
Ochoro	*Oenocarpus bataua:* Palmae	X	X
Mapuza	*Oenocarpus bacaba*: Palmae	X	X
Koram	*Inga alba*: Leguminosae (Mimosoideae)	X	X
Otoochi	cf. *Chrysophyllum*: Sapotaceae	X	X
Naata	*Hymenaea courbaril*: Leguminosae (Caesalpinioideae)	X	X
Roomi au	*Sacloglottis cydonioides:* Humiriceae	X	X
Zuupu	*Spondias mombin:* Anacardiaceae	X	X
Roomi dukodokun	cf. *Leonia*: Violaceae	X	X
Kaawai	*Micropholis venulosa:* Sapotaceae	X	X
Poo'a	*Pouteria* sp.*:* Sapotaceae	X	X
Dyakara	*Inga* sp: Leguminosae (Mimosoideae)	X	X
Koobiki	*Inga ingoides*: Leguminosae (Mimosoideae)	X	X
Wamooko	*Parinari excelsa:* Chrysobalanaceae	X	X
Bowao	*Tetragastris* sp./spp.: Burseraceae	X	X
Zudu	*Parinari* sp.*:* Chrysobalanaceae	X	X
Kawarori	*Anacardium giganteum:* Anacardiaceae	X	X
Taasho	*Muellera frutescens:* Leguminosae (Papilionoideae)		X
Pokoridi	*Attalea regia:* Palmae		X
Kaziman	*Couma* sp.*:* Apocynaceae		X
Koron	*Catostemma fragrans*: Bombacaceae		**(X)**
Widu'oko	not identified	–	–
Arakiki	not identified	–	–
Sho'oruku	not identified	–	–

A study of the ecology of *Ateles paniscus* in Surinam recorded the consumption of the fruits of *Oenocarpus bacaba*, *Inga alba* and nine other species of *Inga*, *Chrysophyllum auratum*, *Sacloglottis cydonioides*, *Spondias mombin*, *Leonia glycycarpa*, *Micropholis guyanensis*, *Pouteria guianensis* and one other species of *Pouteria*, *Parinari excelsa, Parinari campestris, Tetragastris altissima, T. panamensis*, and *Anacardium giganteum* (Roosmalen 1985b: 52-64). Although *Catostemma* is not mentioned, and may not have been present in van Roosmalen's study area, two other

members of the Bombaceae – *Ceiba pentandra* and *Pachira insignis* – were both among the species whose leaves were most commonly observed to be eaten (Roosmalen 1985b: 75). Later supplementation of van Roosmalen's data with observations from French Guiana added *Hymenaea courbaril* to his list of fruits eaten (Roosmalen and Klein 1988: 467-472). Also in French Guiana, fruits of 69 species were observed to be consumed. These included *Manilkara bidentata*, *Inga alba* and one other species of *Inga*, two species of *Chrysophyllum*, *Sacloglottis cydonioides*, *Leonia glycycarpa*, *Micropholis* cf. *venulosa*, three species of *Pouteria*, *Tetragastris altissima* and *T. panamensis* (Simmen and Sabatier 1996). An earlier study from French Guiana included *Oenocarpus bacaba*, three species of *Inga*, and *Chrysophyllum lucentifolium* among a total of 44 species whose fruits were eaten (Guillotin et al. 1994). Roosmalen also reported the consumption of fruits of member of the family Apocynaceae, and thus of twenty-one fruits recorded in the present study, seventeen were corroborated to genus or species in other studies, and three of the remaining four to family. The single species whose leaves were reported to be eaten in this study was corroborated to family level.

In other aspects of ecology, most observations were in agreement with published data (table 7.14). Exceptions were in an observation on seasonal variation in calling behaviour, and data on the timing of birth, both of which were contradicted by Roosmalen's finding. Roosmalen's observation about responses to the presence of a harpy eagle are also inconsistent with reports that it is a predator in this study, but also with the recorded observation of predation by an ecologically equivalent species in French Guiana (Juillot 1994). The greatest contrast in the two data sets came in the number of food plants reported . Roosmalen recorded 171 species whose fruits were eaten among a total of 217 food plants, compared with 47 segregates recorded in this study, only 23 of which were corroborated by being mentioned by more than one interviewee. The numbers of food items reported were lower in the other ecological studies, but they were both based on short-term data and almost certainly incomplete. Furthermore, there were some notable absentees from the list of food plants obtained in the present study. *Bagassa guianensis,* for example, was reported to be an important food source in both Surinam (Roosmalen 1985b, Norcock and Kinzey 1994) and French Guiana (Simmen and Sabatier 1996), but not mentioned here. Floristic differences among sites certainly affect the diet: *Ateles* are reported to be opportunistic feeders, whose specific dietary composition depends on the relative availability of different food plants. *B. guianensis* may be consumed less frequently as a result of its being less abundant at the present study site. However, its absence

from the current data set almost certainly reflects a deficiency in the ethnoecological method.

Table 7.14. Comparison of ethnoecological and ecological data sets for Ateles paniscus

Subject	Ethnoecological observations	Ecological observations
Diet	Fruits most important foods, young leaves and flowers also eaten. Food shortage during dry season, dry season foods are fruits of *Oenocarpus bataua, Parinari excelsa* and *Hymenaea oblongata* and young leaves including those of *Catostemma fragrans.* Fat during rainy season. Disperse seeds of most fruits eaten endozoochorously.	82.9% of feeding observations fruits, 7.9% young leaves, 6.4% flowers [1] 85.4% of feeding observations fruits, 9.5% young leaves, 2.5% flowers [2] Dry weight of stomach samples included 90.23% fruit, 9.59% leaves [3] Fruit availability declines in dry season, over which period proportion of diet comprised of flowers and leaves increases [1] Proportion of leaves in diet rises to 25.96% in season of lowest fruit availability [3] Accumulate fat reserves during period of maximum fruit availability [1] In 93.5% of fruit feeding records, seeds dispersed endozoochorously, including 138 of 171 species whose fruits eaten [1]
Intraspecific	Groups sizes 1-15, most commonly 4-6 Call more frequently during season of food shortage	Total group size 15-20, but entire group rarely together: forage in subgroups of 1-6, most commonly 2-4 [1] Call less frequently in dry season than rainy season[1,4]
Resting place	Emergent **Itki'izi** trees (not identified) used for sleeping	Only emergent trees with particular characteristics used for sleeping, restricted to a small number species [1]
Ranging	Most interviewees consider fixed home ranges to be used	Groups use fixed home ranges [1]
Habitat use	Restricted to high forest Water drunk from tree holes	Vast majority of sightings in high forest [1] Numbers of *A. belzebuth* drastically reduced in disturbed cf. undisturbed forest [5] Observed to drink water from tree holes [2]
Reproduction	Litter size one Births concentrated in rainy season	Litter size one [1] Birth peak at end of shot dry season [1]
Interspecific	Predated by *Harpia harpyja* Sometimes pelt humans with rotten wood	No apparent fear of *Harpia harpyja* [4] Predation on a young individual observed by *Morphnus guianensis*, which is apparently exclusive with *Harpia harpyja* [6]

[1] Roosmalen 1985b [2] Simmen and Sabatier 1996 [3] Guillotin et al. 1994
[4] Roosmalen and Klein1988 [5] Bernstein et al. 1976 [6] Julliot 1994

It is likely that working with larger numbers of ethnoecological informants would increase the number of food plants recorded, at least up to a point, and rectify particularly important omissions. However, the large disparity between the numbers of food plants recorded by the two methods suggests that even with more

informants, ethnoecological methods would not document diet as comprehensively as the sustained and intensive observation employed in an ecological study of the duration and quality of Roosmalen's.

7.9 Red howler monkey

Despite the reported importance of leaves in the diet, only a single species was specified: **Koron** *(Catostemma fragrans*: Bombacaceae). Fruits reported to be eaten are listed in table 7.15. Although flowers were reported as a category of food, none were specified.

Table 7.15. List of food plants recorded in ethnoecological interviews on Alouatta seniculus, and their corroboration in the ecological literature

Wapishana name	English name	Gen	Fam
Iziari	*Manilkara bidentata:* Sapotaceae	X	X
Otoochi	cf. *Chrysophyllum*: Sapotaceae	X	X
Kaawai	*Micropholis venulosa:* Sapotaceae	X	X
Bowao	*Tetragastris* sp./spp.: Burseraceae	X	X
Koram	*Inga alba*: Leguminosae (Mimosoideae)		X
Dyakara	*Inga alba*: Leguminosae (Mimosoideae)		X
Wamooko	*Parinari excelsa:* Chrysobalanaceae		X
Zuupu	*Spondias mombin:* Anacardiaceae		X
Koron	*Catostemma fragrans*: Bombacaceae		
Taasho	*Muellera frutescens:* Leguminosae (Papilionoideae)		
Ochoro	*Oenocarpus bataua:* Palmae		
Widu'oko	not identified	–	–

Fruits reported to be eaten by *Alouatta seniculus* in French Guiana included *Manilkara bidentata,* five species of *Chrysophyllum*, three species of *Micropholis* and two of *Tetragastris* (Julliot 1996). A total of 97 species were reported to be eaten for fruits, 93 for leaves and 36 for flowers. Among the fruits eaten were those members of the families Chrysobalanaceae and Anacardiaceae, and among the species whose leaves are eaten were members of the Bombacaceae (Julliot and Sabatier 1993). Fruits of *Manilkara bidentata*, three *Chrysophyllum* species, two species of *Micropholis* and two of *Tetragastris* were among 43 species consumption of whose fruits was recorded in another study in French Guiana (Simmen and Sabatier 1996). In Surinam, howler monkeys were reported to feed off members of the families Leguminosae (Mimosaceae) and Sapotaceae (Mittermeier and Roosmalen 1981: 20-22).

Table 7.16. Comparison of ethnoecological and ecological data sets for Alouatta seniculus

Subject	Ethnoecological observations	Ecological observations
Diet	Fruits and young leaves most important, flowers also eaten Leaves dominate diet when fruit less available Seeds which are eaten dispersed endozoochorously.	Diet fruit and leaves; most folivorous of Surinam's primates [1] Two different studies reported 54% and 55.7% of feeding observations on young leaves, 3% and 1.2% on mature leaves, 25.5% and 42% on fruits and 12.6% and 0.7% respectively. Proportion of leaves rose as high as 78% and over 90% at time of seasonal fruit shortage [2,3] Endozoochorous seed dispersal [1,4,5]
Intraspecific	Group size 2-12, most commonly 4-6 Size dimorphism evident among individuals in groups, but no consensus as to basis of this Groups vocalise and display when meeting	Review of studies shows groups sizes of up to 15 commonly reported, means ranging from around 6-9. Solitary males occasionally observed [6] Group size highly variable both within and between habitats, mean troop sizes reported vary from 4.3 to 10.5 [7] Sexually dimorphic in terms of size; female weight average 69% of male weight [6,7] Howling usually initiated in response to approach of another group [6,7]
Ranging behaviour	Some interviewees consider fixed territories to be used, some do not	Occupy non-exclusive home ranges [6]
Habitat use	Tree tops used for sleeping, especially those overgrown with lianas Water obtained from tree holes if available, may descend to ground to drink if not Sometimes suffer injuries through falling	Sleeping sites not reported
Activity Pattern	Active early morning, late afternoon and sometimes on moonlit nights Rest in middle of day	Most studies show activity peaks early morning and late afternoon, much of middle of day spent resting. Occasionally observed to change sleeping tree in middle of night [6]
Reproductive	Litter size 1 No consensus on timing of birth	Only single young appear to have been reported [6] Slight seasonality in births [7]
Interspecific	Main predator *Harpia harpyja,* may also be predated by Felids. Often chronically infested with mosquito worms	Predation by harpy eagle reported [8, 9] Predation by jaguar observed under unusual circumstances [10]

[1] Mittermeier and Roosmalen 1981 [2] Julliot and Sabatier 1993
[3] Simmen and Sabatier 1996 [4] Julliot 1996 [5] Julliot 1997 [6] Neville et al. 1988 [7] Crockett and Eisenberg 1977 [8] Sherman 1991 [9] Rettig 1978
[10] Peetz et al. 1992a

As with spider monkeys, the number of food species recorded was dramatically less than those documented in ecological studies, indicating the ethnoecological data set

to be far from complete. The extent to which the identities of food species is corroborated by the ecological data is somewhat less. Conspecifics or congenerics were recorded for only four of eleven food species recorded in the present study, and a further four were corroborated to family level. This difference probably reflects a greater degree of botanical overlap between the site of Roosmalen's study and the location of the present study, though in the absence of comparative botanical data this is only an inference based upon their relative geographical locations. In all other aspects of ecology, the ethnoecological data concords with the literature (table 7.16). Several observations made by informants in the present study were not reported in the literature.

7.10 Brown Capuchin

Plant foods reported to be eaten by **powatu** included the fruits of the species listed in table 7.17. Several categories of invertebrate food were reported, viz "insects", "spiders", and the larvae of 'marabunta' (several species of wasp). The consumption of two cultivated plants was also mentioned – maize *(Zea mays)* and sugar cane *(Saccharum officianum).*

Table 7.17. List of food plants recorded in ethnoecological interviews on Cebus apella, and their corroboration in the ecological literature.

Wapishana name	English name	Gen	Fam
Iziari	*Manilkara bidentata:* Sapotaceae	X	X
Koram	*Inga alba*: Leguminosae (Mimosoideae)	X	X
Waazu	*Astrocaryum aculeatum*: Palmae	X	X
Otoochi	cf. *Chrysophyllum*: Sapotaceae	X	X
Toizau	*Astrocaryum* sp.	X	X
Dyakara	*Inga* sp: Leguminosae (Mimosoideae)	X	X
Kazarazowao	cf. Sapotaceae	–	X
Pokoridi	*Attalea regia:* Palmae		X
Karaboao	*Carapa guianensis*: Meliaceae		X
Kawarori	*Anacardium giganteum:* Anacardiaceae		X
Naata	*Hymenaea courbaril*: Leguminosae (Caesalpinioideae)		X
Bowao	*Tetragastris* sp./spp.: Burseraceae		
Wamooko	*Parinari excelsa:* Chrysobalanaceae		
Siizan	'wild banana'	–	–
Widu'oko	not identified	–	–

An ecological study in French Guiana reported a total of 66 food plants to be eaten by *Cebus apella*, including four species of *Inga* (none identified) and members of the

families Arecaceae (Palmae), Meliaceae and Sapotaceae (Guillotin et al. 1994). Both *Tetragastris* and *Chrysophyllum* were recorded at the study site, but neither was reported to be consumed by *Cebus apella*. Further ecological data from the same site reported consumption of fruits of *Manilkara bidentata,* ten species of *Inga* – although not including *I. alba* - four species of *Chrysophyllum*, various palms and one member of the family Anacardiaceae. (Simmen and Sabatier 1996). In Colombia, the recorded diet of *C. apella* includes fruits of unidentified species of *Astrocaryum* and one member of the Anacardiaceae. A separate study recorded the consumption of *Zea mays* (Freese and Oppenheimer 1981). A recent study of capuchin feeding ecology in the Iwokrama Reserve reported *C. apella* to consume fruits of *Manilkara bidentata*, *Astrocaryum vulgare*, an unidentified species of *Inga*, and members of the family Caesalpinioideae (Wright 2002).

Table 7.18. Comparison of ethnoecological and ecological data sets for Cebus apella

Subject	Ethnoecological data	Ecological observations
Diet	Fruits – especially *Attalea regia* – and arthropods Use branches to open hard fruits Raid crops Food shortage during dry season Little or no seed dispersal: most seeds not eaten	Diets of all capuchins consist of fruits and insects [1] Fruits and insects dominate diet [2] Cebus apella diet consists of 68.29% fruits and seeds, 26.74% invertebrates by dry weight [3] Around 80% of feeding observations on fruits, around 20% on invertebrates [4] Stomach contents weigh less during season of lowest fruit production [3] Most seeds not eaten; some small seeds may be dispersed endozoochorously [2]
Intraspecific	Group size variable: 4-30 Large individuals terminologically distinguished	Reported group sizes range from 3-40 [1]
Interspecific	Form mixed groups with *Saimiri* Major predator *Harpia harpyja*	Commonly associate with *Saimiri* [1,2] Those of *Cebus* most common prey remains found in nest of *Harpia harpyja* [6]
Reproductive	Litter size one Births timed to coincide with fruiting of *Inga alba*	Litter size one, some seasonality reported [1]
Activity patterns	Diurnal	*C. capucinus* diurnal [1]
Habitat use	Sleep under bracts of *Attalea regia*	Most common sleeping site on leaves of palm *Oenocarpus bataua* [7]
Ranging behaviour	Occupy fixed home ranges	Field evidence suggests occupation of fixed home ranges [1]

[1] Freese and Oppenheimer 1981 [2] Mittermeier and Roosmalen 1981 [3] Guillotin et al. 1994 [4] Simmen and Sabatier 1996 [6] Rettig 1978 [7] Zhang 1995

Of the twelve segregates of non-cultivated plants for which identifications are suggested in this study, five are corroborated to the level of genus or species, and a further five to that of family. Other ethnoecological data is consistent with the published ecological data, in the case of each of ten comparable observations (table 7.18).

7.11 Wedge-capped capuchin

Fruits reported to be eaten by **oao** are listed in table 7.19. Other categories of foods reported, none of which were specified more closely, were several categories of arthropod food - 'spiders', 'insects' and 'caterpillars' – and leaves. A recent study of the ecology of this species in the Iwokrama reserve largely agrees with the details of this: *Manilkara bidentata, Attalea maripa*, and unidentified species of *Inga* were all observed to be consumed, along with at least one unidentified species in the Anacardiaceae (Wright 2002).

Table 7.19. List of food plants recorded in ethnoecological interviews on Cebus olivaceus, and their ecological corroboration.

Wapishana name	English name	Gen	Fam
Iziari	*Manilkara bidentata:* Sapotaceae	X	X
Pokoridi	*Attalea regia:* Palmae	X	X
Koram	*Inga alba*: Leguminosae (Mimosoideae)	X	X
Koobiki	*Inga ingoides*: Leguminosae (Mimosoideae)	X	X
Shurara	*Inga* sp.: Leguminosae (Mimosoideae)	X	X
Wurada urud	*Inga* sp.: Leguminosae (Mimosoideae)	X	X
Dyakara	*Inga* sp: Leguminosae (Mimosoideae)	X	X
Ochoro	*Oenocarpus bataua:* Palmae		X
Zuupu	*Spondias mombin:* Anacardiaceae		X
Bowao	*Tetragastris* sp./spp.: Burseraceae		
Wamooko	*Parinari excelsa:* Chrysobalanaceae		
Widu'oko	not identified	–	–
Kazarazowao	not identified	–	–
Arikiki	not identified	–	–

Seven of eleven identified food plants reported in the ethnoecological data set are thus corroborated to genus level, and a further two to the family level. In other aspects of ecology, all eight ethnoecological observations for which ecological data on the same subject is available, are in agreement (table 7.20).

Table 7.20. Comparison of ethnoecological and ecological data sets for Cebus olivaceus

Subject	Ethnoecological observations	Ecological observations
Diet	Fruits, especially various species of *Inga*, arthropods, leaves. Food shortage during dry season, when *Parinari excelsa* fruits eaten Some seeds may be dispersed synzoochorously	67% of feeding time spent eating plant material, 33% foraging for insects. Plant material eaten 80% fruit, 10% leaves and 10% flowers. Fruits of Moraceae, Palmae, Sapindaceae eaten [1]
Intraspecific	Group size variable, between 4-12 Larger type also found singly or in pairs Males may transfer between groups	Ranges of group sizes of 10-20 and 12-20 reported from Surinam and Venezuela [2] Solitary and transient behaviours observed in individual *C.capucinus* males [2]
Reproductive	Litter size 1 Breeding season April/May	Birth seasonality has been reported for other capuchin species [2]
Habitat use	Rest in trees of *Attalea regia* Remember locations of useful trees	C. capucinus readily able to remember locations of fixed food resources [3]
Interspecific	Main predator *Harpia harpyja*	Remains of *Cebus* regularly found in nest of *Harpia harpyja* [4]

[1] Mittermeier and Roosmalen 1981 [2] Freese and Oppenheimer 1981
[3] Garber and Pacialli 1997 [4] Rettig 1978

7.12 Brown bearded saki

All food items listed for **wishi** were fruits of forest trees, listed in table 7.21.

Table 7.21. List of food plants recorded in ethnoecological interviews on Chiropotes satanas, and their corroboration in the ecological literature.

Wapishana name	English name	Gen	Fam
Otoochi	cf. *Chrysophyllum*: Sapotaceae	X	X
Bowao	*Tetragastris* sp./spp.: Burseraceae	X	X
Dyakara	*Inga* sp: Leguminosae (Mimosoideae)	X	X
Koobiki	*Inga ingoides*: Leguminosae (Mimosoideae)	X	X
Shurara	*Inga* sp.: Leguminosae (Mimosoideae)	X	X
Iziari	*Manilkara bidentata:* Sapotaceae		X
Taasho	*Muellera frutescens:* Leguminosae (Papilionoideae)		X
Zudu	*Parinari* sp.: Chrysobalanaceae		X
Katowari	*Bagassa guianensis:* Moraceae		X
Kaawai	*Micropholis venulosa:* Sapotaceae		X
Kaziman	*Couma* sp.*:* Apocynaceae		
Ma'arasao	not identified	–	–
Widu'oko	not identified	–	–
Sho'oruku	not identified	–	–

Two studies report plant species whose fruits and/or seeds are eaten by *Chiropotes satanas* in Surinam. The earlier, more complete study includes *Chrysophyllum auratum* and three other genera in the Sapotaceae, *Tetragastris altissima* and *T. panamensis*, six species of *Inga*, one species from the Papilionaceae, one from Chrysobalanaceae, and species from three different genera among the Moraceae (Roosmalen et al. 1981). The later study lists the top twenty foods observed to be eaten over a six-month period, which include three species of *Inga*, and members of the families Sapotaceae, Leguminosae (Papilionoideae), Chrysobalanaceae and Moraceae (Norcock and Kinzey 1994). Partial information on diet from Venezuela included *Chrysophyllum lucentifolium* and unidentified members of the Leguminosae and Moraceae among the fruits eaten (Kinzey and Norcock 1993). Of the eleven identified food plants in the present study, five are thus corroborated to genus level and a further five to family level.

Table 7.22. Comparison of ethnoecological and ecological data for Chiropotes satanas.

Subject	Ethnoecological data	Ecological observations
Diet	Entire diet consists of fruits, both ripe and unripe Seed predators	204 of 217 feeding observations on fruits and/or seeds. Immature seeds consumed of 52 of 86 plant species eaten. [1] Over 90% of feeding observations on fruits or seeds [2] Over 90% of feeding samples on fruits and seeds [3] 66.4% of feeding observations involved seed predation [1] 38.75% of seeds eaten predated, 51.25 dispersed[2] Seeds masticated in 86.4% of feeding samples[3] Feed mostly on fruits whose seeds are eaten [4]
Social	Group size 8-40, usually 15-20 Groups separate temporarily for feeding, according to quantity of fruit available on any particular tree. Group will also disperse somewhat for sleeping	Group size 8-30+, specific sizes observed were 8, 9-12, 15+ and 27+ [1] 'Feeding units' of 9 and 13 individuals in size reported [3] Local fission of groups on arrival at food sources [3]
Habitat use	High forest	98.7% of observations in high forest [1] 100% of observations in high forest [2]
Reproductive	Litter size 1	Litter size 1 [1]
Interspecific	Predated by *Harpia harpyja* and possibly other eagles	Remains found in nest of *Harpia harpyja* [5]

[1] Roosmalen et al. 1981 [2] Mittermeier and Roosmalen 1981
[3] Norcock and Kinzey 1994 [4] Kinzey and Norcock 1993 [5] Rettig 1978

Other ethnoecological data is compared with the ecological literature in table 7.22. The eight observations comparable between the data sets concur in all but one important case. While ethnoecological informants all characterised this species solely as a seed predator, studies of its ecology in Surinam showed that in many cases seeds may actually be dispersed (Roosmalen et al. 1981; Mittermeier and Roosmalen 1981). The error may be due to people generalising on the basis of observations on the consumption of unripe fruits and predation of their seeds, a unique and thus distinctive behaviour among Guyana's monkeys. This could lead to a misconception that seed predation always takes place when fruits are eaten by this species.

7.13 Guiana Saki

All those interviewed about **Oroa** reported that ripe fruits are eaten. Those mentioned more than once are shown in table 7.23. Other food categories reported were young leaves and flowers, but in neither case was reference made to any specific kinds. A partial list of foods eaten by *Pithecia pithecia* in Surinam included the fruits of two species of *Inga* and seeds of one species from the Sapotaceae among a total of seventeen species (Buchanan et al. 1981). Fruits reported to be eaten in Venezuela included *Chrysophyllum argenteum* and other members of the Sapotaceae, along with members of the Mimosaceae (Kinzey and Norcock 1993). The brevity of all lists of food species probably results from the difficulty of observing this highly cryptic monkey species in the wild.

Table 7.23. List of food plants recorded in ethnoecological interviews on Pithecia pithecia, and their corroboration in the ecological literature.

Wapishana name	English name	Gen	Fam
Koram (specific sense)	*Inga alba*: Leguminosae (Mimosoideae)	X	X
Koram (general sense)	*Inga* spp.: Leguminosae (Mimosoideae)	X	X
Dyakara	*Inga* sp: Leguminosae (Mimosoideae)	X	X
Diparitan	*Chrysophyllum argenteum*: Sapotaceae	X	X
Koobiki	*Inga ingoides*: Leguminosae (Mimosoideae)	X	X
Iziari	*Manilkara bidentata:* Sapotaceae		X
Pokoridi	*Attalea regia*: Palmae		

Both ethnoecological and ecological data on other aspects of the ecology of this species are also limited (table 7.24). In all seven cases of comparable observations, they are compatible.

Table 7.24. Comparison of ethnoecological and ecological data sets for Pithecia pithecia

Subject	Ethnoecological observations	Ecological observations
Diet	Fruits dominate, leaves and flowers also eaten Most important foods fruits of *Attalea regia* and *Inga* spp Food shortage during dry season No consensus on whether seeds dispersed	20 of 22 feeding observations on fruits, one on flowers, one on leaves [1] 2 spp. of *Inga* eaten [1] 54.5% of feeding observations involved seed predation [1]
Intraspecific	Group size 2-6, always including both sexes Aggressive intergroup interactions	Live in family groups usually of 2-4 animals. Solitary individuals sometimes seen. Occasional reports of larger groups [1]
Activity patterns	Diurnal	Not reported
Habitat use	No consensus on ranging behaviour Shelter under kokerite leaves or in thick epiphyte growth near tree-tops Most common in farm area Move between trees by jumping	Most sightings in high forest, but many also in liana forest [1] Mainly use lower levels of forest [1,2] Often move by leaping [1]
Interspecific	Predated upon by several species of eagle. Predator evasion based upon crypsis	Remains found in nests of *Harpia harpyja* [3] Habit of hiding in foliage when disturbed makes observation in the wild very difficult [1]

[1] Buchanan et al. 1981 [2] Mittermeier and Roosmalen 1981 [3] Rettig 1978

7.14 Summary and discussion

7.14.1 Evaluation of ethnoecological data in comparison with the ecological literature

Overall, the observed correspondences between the ethnoecological and ecological data sets are very strong, as is indicated by the summary in table 7.25. 148 distinct observations were derived from the ethnoecological interviews for which comparable information existed in the literature. Of these, 144, or 97 percent, were consistent with those reported in the literature. Further to this, there were several cases in which information was provided by several informants for which no comparable reports existed in the literature. Given the general accuracy of the information for which comparisons could be made, it appears that in some subject areas the ethnoecological data set provided information that has not yet been documented by biological researchers.

In terms of detailed information on diet, there was a high degree of overlap among the food species indicated by interviewees and those reported from ecological

Table 7.25. Comparison of ethnoecological and ecological data sets

Species	Number of interviews	Number food species in ecological studies	Number of food species in ethnoecological interviews	Food species in ethnoecological data set corroborated in ecological studies to family level	Food species in ethnoecological data set corroborated to genus level	Number of other ethnoecological observations for which comparable ecological data available	Proportion of observations in previous column for which observations compatible
Tayassu tajacu	10	[*]	85/29	89% (16/18)	28% (5/18)	21	1.00
Tayassu pecari	14	[*]	87/42	92% (23/25)	32% (8/25)	15	1.00
Tapirus terrestris	13	33[1]	70/27	88% (15/17)	65% (11/17)	10	1.00
Mazama americana	13	56[2]	97/48	88% (23/26)	48% (12/26)	11	1.00
Dasyprocta agouti	12	ND	64/37	ND	ND	10	0.90
Agouti paca	14	ND	79/35	ND	ND	14	1.00
Ateles paniscus	12	171[3]	48/26	95% (20/21)	81% (17/21)	15	0.87
Alouatta seniculus	9	97 [4]	34/15	73% (8/11)	36% (4/11)	18	1.00
Cebus apella	7	66 [5]	35/18	83% (10/12)	42% (5/12)	11	1.00
Cebus olivaceus	5	20[6]	39/17	82% (9/11)	64% (7/11)	8	1.00
Chiropotes satanas	5	20+[7]	32/15	91% (10/11)	45% (5/11)	8	0.88
Pithecia pithecia	7	17[8]	28/10	83% (5/6)	50% (3/6)	7	1.00
TOTALS/AVERAGES				**88% (139/158)**	**49% (77/158)**	**148**	**0.97**

[1]Salas and Fuller 1996 [2]Branan et al. 1985 [3]Roosmalen 1985b [4]Julliot & Sabatier 1993 [5]Guillotin et al. 1994 [6]Wright 2002 [7]Norcock & Kinzey 1994 [8]Buchanan et al. 1981. ND – ecological data not available. [*] for the peccaries, diet has mostly been reported in terms of plant families.

studies. The proportion of food items recorded for single species in this study, for which the consumption of related species has been reported from ecological studies, was calculated at the levels of the family and genus. Levels of correspondence thus calculated for individual animal species ranged from 73-95 percent (88 percent overall) for correspondences at the family level, and 28-81 percent (49 percent) at the generic level. The ecological data currently available does not allow a more complete assessment of the ethnoecological data on diet. I have already noted the effect of the geographical discrepancy among study locations. Additionally, much of the reported ecological data is incomplete, and dietary studies in which food lists are both comprehensive and fully identified are rare. The single example of a species whose feeding ecology has been the subject of a detailed, multi-year study at a site reasonably close to the present one is *Ateles paniscus*. It seems significant that the recorded diet of this species shows the highest level of overlap of any with data recorded in the present study, at both familial and generic levels. As far as can be inferred from the published data, then, it appears that information on diet is accurate. However, further comparison with the published literature shows that it is far from comprehensive.

The dietary data collected in the present study includes lists of food plants far shorter than those in many of the conventional studies cited. Among the primates, numbers of fruits recorded to be eaten in ecological studies of *Ateles paniscus, Alouatta seniculus* and *Cebus apella* were all far greater than in the present study. Numbers of food plants for *Chiropotes satanas* and *Pithecia pithecia* were comparable, but in these cases the lists in the ecological literature are incomplete. The number of fruits reported to be eaten by *Tapirus terrestris* in this study was comparable with that of Salas and Fuller (1996), but the latter is based on a short-term study supplemented by ethnoecological data, and thus may be expected to reproduce any shortcomings exhibited by the data set of the present study.

The discrepancy between the two data sets is even greater when other categories of food are considered. The present study recorded the identities of only one species of leaf consumed by each of *Ateles paniscus, Alouatta seniculus* and *Tapirus terrestris*, compared to 28, 98 and 88 species respectively reported in the literature (Roosmalen 1985b: 74; Julliot and Sabatier 1993: 536; Salas and Fuller 1996: 47). Other food categories such as flowers and invertebrate foods appear to be similarly clumped, although in the ecological literature, for the latter at least, the difficulty of field identification often lead to the same result (e.g., Freese and Oppenheimer 1981: 345). In some senses the ethnoecological data is constrained by

the Wapishana biological lexicon. This is particularly true of plants of liana habit, very few of which are individually named, the remainder being subsumed under the large residual category **kazidaro**. In Surinam, 25.6 percent of species fed upon by *Ateles paniscus* were reported to be of liana habit (Roosmalen 1985b: 50). In interviewees on this and other species, interviewees often reported that the fruits of several kinds of lianas were eaten, but that the plants concerned did not have Wapishana names. The same may well apply in the case of invertebrate foods, as many categories of invertebrates appear to be highly clumped in the Wapishana classification (chapter 6.1.2). It may also be that observations on habitat use were lexically constrained, given the limitations of the recorded classification of ecological zones in the Wapishana language.

Further limitations on ethnoecological data are evident in certain subject areas not covered in the majority of interviews, and not included among the data reported here. My earliest phase of interviews included questions on group dynamics and breeding rates. In the former case, answers given were invariably to the effect that juvenile animals, on maturity, remain in the natal group to breed with either parents or siblings. Such answers are clearly at odds with basic biological theories relating to inbreeding avoidance, and in terms of biological science are of little value. In relation to breeding rates, in almost all cases females were presumed to have young on an annual basis. What appears to be happening here is that people are overgeneralising from the individual to the species. It appears that most animal species exhibit birth seasonality at the site of the present study, and at the species level can be accurately considered to breed every year. Translating this to the species level on the basis of an implicit assumption that individual females breed in every breeding season leads to the answers given. It is unsurprising that these subject areas are not accurately reported in ethnoecological enquiry, owing to methodological constraints on the part of the informant. The collection of such information by biologists depends on regular observations of particular animals recognised at either the group or the individual level, sustained over extended periods of time. Clearly naturalists who do not interact with animals in the same way are not going to be able to reproduce results collected under such conditions.

7.14.2 Suggested methodological improvements

The data set in the present study also exhibits the consequences of methodological constraints on the part of the researcher. In this case, however, it is possible to make recommendations directed towards establishing the most effective methodology for

this type of research. First is the question of sample size: clearly, the greater the number of interviewees, the greater the quantity of information that will be collected, especially in terms of diet lists. However, larger sample sizes will also increase the possibility that inaccurate answers given by one interviewee would be confirmed by another. Clearly the analytical methods for determining whether or not to accept answers that occur with low frequency need to be improved. Another methodological improvement that would help address the problem of interindividual variability is group interviews. This would be most effective in combination with the method of individual interviews employed in the present study. Individual interviews compel the interviewee to respond, and it is likely that many people provide information in this setting that they would not in a group context where people are effectively competing for speaking time, and may face the prospect of censure for inaccurate responses. Discussion in a group context may also encourage people to modify their opinions in the light of what other people are saying: the dynamics of this process are complex and not necessarily based upon deference to superior knowledge (see Ellen 1993: 134-138). I propose that group interviews would therefore be most effective as a follow-up to a programme of individual interviews such as was undertaken in the present study. The data set of pooled information from the individual interviews would form the starting point for discussion in group sessions, and the latter would thus be concerned with establishing a consensus on controversial or infrequently mentioned points within the former.

A further methodological improvement concerns the focus of interviews. I have already noted that the lists of food plants obtained were somewhat incomplete, and also that interviewees often volunteered information, within and outside of the interview context, in respond to the sight of a fruit or a plant known to be food for a particular animal. A small number of interviews were also conducted on tree ecology: the distribution, animals known to feed upon and dispersal strategy of particular segregates of trees. Much information was given in these interviews that did not arise in interviews on animal ecology, even with the same informants. Interviewees, therefore, were not effectively recalling all that they knew when interviewed (or even when using the more reflective method of writing in their own time), and the focus on the plant eaten rather than the animal provided a stimulus to the recall of different information.

Conducting ethnoecological interviews on every single plant that might be eaten could be a rather laborious method, particularly if only a few species of consumers are of interest. More efficient would be the use of botanical voucher specimens to serve

as concrete stimuli for responses. Interviewees could be asked to pick out the plants eaten by a particular animal, asked whether a particular animal eats the species represented by each voucher specimen in turn, or asked to list the animals who feed on each species in turn, depending on the aims and setting of the study and the time available. It is clear that for ethnoecological information to be scientifically useful requires translation of the local botanical and zoological lexicons, and for this as well as the methodological use that can be made of voucher specimens, a study such as this one would be most effectively conducted in conjunction with a thorough study of ethnonomenclature, especially of plants.

The methodological improvements suggested would significantly increase the research effort involved in recording ethnoecological knowledge. To what extent any particular research project would incorporate them would depend on its exact aims and the resources available. In the present study, a large and potentially valuable ethnoecological data set was developed without employing such a rigorous methodology. However, in a situation where an effort was being made to record information on the local ecology, the advantages of implementing a full ethnoecological research programme would easily justify the effort. The gathering of a comparable set of baseline data on the local ecology by conventional methods would require substantially more in the way of time, expense, and employment of external technical expertise.

7.14.3 Conclusion

This analysis shows the ethnoecological data set to be accurate, but to exhibit particular limitations. Dietary data is incomplete, and in certain subject areas it is difficult to elicit reliable information. The latter may result from the occurrence of contradictory responses that are hard to reconcile with each other, in which case reliable observations given by some informants may be obscured by unreliable answers on the part of others less competent in the subject area. In some subject areas responses were incompatible with basic biological theory, reflecting domains of thought structured on bases other than empiricism. The methodological improvements suggested, and those that may be conceived and enacted by future researchers in this field, hold the potential to address these limitations somewhat. However, there is also an extent to which they appear inherent: not all subject areas in the biological sciences are amenable to investigation by ethnoecological methods.

It is notable that the subject areas in which explicit ethnoecological knowledge was found to be deficient are among those key to management programmes based

upon biological science. Evidence of customary management systems based upon wholly different premises was encountered in this study (chapter 5). The culturally prescribed patterns of behaviour involved in this, in the structural context of the systems of belief and practice that underlie them, can be regarded as a group-level cultural adaptation, encoded symbolically and concerned with regulation of human exploitation of the natural environment. The individual technical knowledge that would be required for conscious management is not accessible. In its absence, it may be that covert mechanisms for avoiding the depletion of game and other forest resources have evolved.

The greater part of the data, however, falls within an area of overlap between the perspective, derived from the biological sciences, upon which the research programme was based, and the ways in which Wapishana collaborators organise and articulate their knowledge about natural history. The two systems of thought are shown to be compatible to a large degree, and the levels of correspondence among the ethnoecological and ecological data sets is spectacular, considering the incompleteness of much of the former and the geographical disparity of the two. The results are consistent with DeWalt's thesis, in that ethnoecological methodologies have been demonstrated to generate accurate, site-specific data most of which is compatible with the theoretical framework provided by the biological sciences

In practical terms, the value of ethnoecology in providing baseline biological data has been demonstrated. The limitations shown by this method suggest its major utility to be as a complement to, rather than a replacement for, conventional methodologies in field biology. The results of this study endorse the suggestions of previous writers (Townsend 1995) that ethnoecological data can provide a body of baseline data amenable to testing by biological research methods. However, I believe this understates its value somewhat, and this is the theme of the next chapter, which is concerned with current and potential practical applications of ethnoecology.

CHAPTER 8: APPLICATIONS OF ETHNOECOLOGICAL KNOWLEDGE

This chapter considers practical applications of ethnoecological knowledge, both in existing subsistence practices and in novel situations. The first section describes how ethnoecological knowledge is currently incorporated into the methods used to procure animal foods, in hunting, gathering and fishing. This thus substantiates the claim made earlier in this thesis, that such knowledge has an adaptive value in increasing the effective availability of animal foods. The second section describes an analysis of the ecological relations of subsistence, in which ethnoecological data is incorporated into a theoretical framework based upon biological ecology, in order to illuminate some of the secondary ecological relationships involved in human subsistence. The third section further explores the linkage between ethnoecological knowledge and ecological science, but in a practical sense. It describes the outcome of a collaborative research project in which Wapishana hunters sought to apply their skills to the collection of ecological data.

8.1 Applications of ethnoecological knowledge in subsistence

A variety of species-specific strategies are employed in Wapishana hunting, mostly broadly similar to those that have been described for other Amazonian hunting groups predominantly reliant on bows as a weapon (e.g., Hill and Hawkes 1983). Those of five major game species are presented here, being those which I was able to document reasonably via a combination of the following methods: observation of hunts, hunters accounts of the details of a hunt as related within a short time interval afterwards, and repeated mention of particular hunting techniques by different informants. All demonstrate, in differing respects, detailed knowledge of the behaviour and ecology of the animal species concerned. I thus present them both for the sake of ethnographic documentation and as examples of the direct application of ethnoecological knowledge in subsistence pursuits. Further sections following these describe the employment of ethnoecological knowledge in the gathering of animal foods and in fishing. Overall, the accounts suggest that ethnoecological knowledge is a crucial aspect of appropriation of animal food, and provide strong evidence for its adaptive value in this respect.

8.1.1 Hunting of white-lipped peccary, Tayassu pecari

This species, known as 'bichi' in Wapishana, is the most popular of all game animals, both (jointly) as reported in household interviews and as people express in conversation, although recall data on kill rates suggests that T. tajacu outnumbers it in terms of individuals killed (chapter 4.3.3). The first question asked to people returning from a forest trip is whether this species was seen, and all reports of sightings, chases and kills are circulated widely within the local social network. News of a successful hunt seems to spread quickly throughout the home village of the hunter, and large-scale kills may be discussed in villages at considerable distances. There is thus a constant circulation of information on the movements of herds among hunters, and every hunting party departs for the forest with the benefit of this knowledge of any recent sightings. Although the hunting of other species is, of course, a popular topic of conversation, talk of 'bichi' overwhelmingly dominates. It is possible that this is a collective adaptation to the problems caused by the ranging behaviour of this species, herds of which move rapidly and unpredictably over vast distances. The basic opportunistic strategy which comprises much of the hunting undertaken in Maruranau can be viewed as being adapted to the biology of this species more than any other, though the distributions and sightings of most game species are to some extent patchy in both space and time. The particular importance attached to this species of game animal is also signified symbolically, in that it appears to be the only animal species whose spiritual aspect functions to encourage, rather than deter, its hunting (chapter 5.4).

Bichi hunts are of two qualitatively different types: those undertaken when small hunting parties encounter the animals in the forest, and larger-scale occasions similar to that previously described among the Waiwai (Mentore 1995), in which the entire population of a village might be involved. The latter situation arises during the height of the rainy season, when peccary herds often emerge from the forest onto the savannah. Local ethnoecological wisdom has it that they do this in order to feed on the fruits of the etai palm *(Mauritia flexuosa)*, which is rare in the forests of the Kwitaro river basin, but highly abundant in the vicinity of swamps and watercourses on the savannah. When a herd is spotted or tracked on the savannah in the vicinity of a village, a shout is raised and word quickly spread throughout the homesteads and farming areas. All other tasks are abandoned as men and older boys collect their weapons and rush to the scene; women at the scene will also find or improvise weapons in the hope that opportunities for their use may arise. A loose form of organisation may operate among the hunters as attempts are made to surround the

herd, anticipate its movements and intercept it. This is more pronounced on occasions when the herd is spotted near to the forest edge and trailed before emerging onto the savannah, or retreats into the forest at the sight of people. In such cases, a number of men with dogs will attempt to head off the herd in the forest and drive it out on to the savannah or to where others lie in wait along farming roads. In most circumstances though, each individual seeks to maximise his own chances of killing the greatest number possible. Aside from a precaution not to kill the lead animal (see chapter 5.4), no restraint is exercised on the take and wholesale slaughter will commonly ensue. A successful group hunt of a large herd will usually see most families take at least one animal; some individuals are fortunate enough to kill several on such occasions. The extensive sharing of meat that takes place in the following period of plenty ensures that very few, if any, in the village do not reap at least some benefit. Those animals that do escape are often tracked by hunters – especially those individuals who are unsuccessful in the initial hunt. This tactic exploits the behaviour of members of a herd disrupted by hunting, who often remain in or return to the vicinity of the hunt in an attempt to regroup.

Encounters between peccary herds and small hunting groups in the forest take a different form. Most commonly, the first indication perceived will be the tracks of the animals; herds are also often located by means of their distinctive sound or smell. During the rainy season, when tracks are easy to follow, a herd may be tracked for several days and over a considerable distance, often with the assistance of dogs. When animals are located, hunters without dogs will employ stealth in attempting to approach as closely as possible before identifying a target and shooting their arrow: herds with experience of being hunted take flight on being disturbed by people and are subsequently difficult to track down again. Dogs expedite the killing by moving ahead of the hunters and rushing the peccaries, who respond by turning to face them and standing their ground. This provides the hunters with time to approach the animals more closely and take aim at a stationary target. The risks involved for the dogs in facing well-armed and aggressive opponents are considerable; a single peccary bite can prove fatal and mortality rates are high.

8.1.2 Hunting of collared peccary, **Tayassu tajacu**

The successful hunting of this species, known as **bakuru**, depends almost entirely on the use of a dog trained for the purpose. On locating a herd, the dog gives chase, the hunter following behind as fast as possible, shouting constant encouragement. The peccaries typically respond by separating into smaller groups. If the dog persists in its

chase of one such group, they will eventually take shelter in one of their sleeping places – an empty, rotten tree trunk, or the vacated burrow of a giant armadillo. The dog remains at the entrance, keeping them trapped there until the arrival of the hunter, who quickly cuts down saplings and constructs a cone of these around the entrance to the hole, trapping the peccaries within. A kokerite palm is then located, and a long petiole cut, at an angle to provide a sharp end. This is then pushed into the hole to drive the peccaries out, one by one, into the funnel. Each animal is killed on its emergence from the hole by a blow to the back of the neck with a cutlass.

Collared peccaries are common pests at the farm, where they feed on all kinds of tuber. Herds tend to follow a fairly regular cycle of movement: having fed at the farm once, they are likely to return after an interval of several days. This behaviour is exploited by the hunter, who will thus be able to predict when they are likely to return to the farm. Farmers suffering crop predation from collared peccaries, who do not have a dog trained for their capture, may ask the assistance of someone who does have a suitable dog in killing them. Collared peccary movements are also to some extent predictable in the face of seasonal changes in food availability. Hunters familiar with an area are thus able to exploit their knowledge of the distribution of the tree species which they know collared peccaries are feeding off at any particular time of year, to improve their chances of locating herds.

8.1.3 Hunting of laba, Agouti paca

The laba, **oran** in Wapishana is regarded by many as the best-tasting of all wild meats, and is a highly prized food. It is hunted by a variety of methods. Some rely on its often predictable movements: they may regularly use the same path to travel on different nights, and can be caught by building a raised platform above or adjacent to this upon which the hunter lies in wait after dark. The capture is made easier by use of a torch, as shining a bright light in the animal's face causes it to stand transfixed and allows an easy kill. This response to light is also exploited in another method of hunting, in which a hunter travels a creek – either in a canoe or on foot along the creek bed during dry season – shining a torch to locate and petrify any laba that may be present along the banks.

During mango season, seeds of the fallen fruits are an important food for laba, and several animals may visit a single tree in the forest during the course of a night. They are often caught by climbing the tree and waiting in the night for the animals to come; many mango trees in the forest have platforms built in to the crotch for this purpose. Some people also bait them with corn or cassava, left in a particular place

for several consecutive nights until the animal acquires the habit of visiting the spot. Laba are also common crop predators, fond of corn and cassava - particularly when scraped cassava roots are left to soak in a creek prior to making farina - and are often killed in the course of their nocturnal raids on the farm.

During the day, laba may be driven out of their resting places, burrows in the ground or rotten tree trunks, in which their presence is given away by their habit of covering the entrance with dead leaves. The burrows are reported always to have two holes, and the second is located and blocked. A trained dog may be sent down to drive out the animal, which is killed either with a blow to the head with a cutlass, dispensed by someone waiting by the hole, or with an arrow. In the absence of an appropriately skilled dog, a piece of vine, palm petiole or other suitable material is cut and pushed into the hole until it is obstructed by the animal within. The length of the vine is used to determine the location of the animal, which is reached either by digging or chopping the wood.

Laba, along with agouti *(Dasyprocta agouti*) and one species of armadillo *(Cabassous unicinctus*) are also commonly hunted on the savannah during the rainy season. All of these species are known to inhabit gallery forest along watercourses in the savannah, and when these areas flood they are driven out to relatively small areas of savannah on higher ground, where they may be more easily spotted by hunters. In Maruranau, this time of year is also, and for the same reason, the main season for hunting the savannah deer *Odocoileus virginianus*.

8.1.4 Hunting of Red brocket deer, Mazama americana

This species, called **koshara** in Wapishana, is commonly hunted in the farm area, owing to its crop-raiding behaviour and use of fallows for feeding and resting in thick secondary growth. Persistent visits to a farm often inspire the construction of a **wabun** – a raised platform constructed of wooden poles – on which a hunter will wait after dusk for the animal to come. They may also be shot opportunistically when spotted in farms, or run down by dogs. Normally a dog requires some experience in chasing **koshara** before they are able to catch them. If successful in their pursuit, they will catch the deer by a leg or the neck, allowing the pursuing hunter to catch up and kill it with arrow or cutlass. The related grey brocket deer *(M. gouazoubira)* is hunted far less often. In part this is a consequence of its lower availability – it tends to inhabit deeper forest and is not commonly associated with the farming area – but the main reason appears to be a strong symbolically encoded prohibition on its consumption (chapter 5.3).

8.1.5 Hunting of armadillos: Dasypus novemcinctus, D. kappleri, Cabassous unicinctus, Priodontes maximus

Many of the hunting techniques for *Dasypus* spp. correspond to those for laba, owing to some pertinent behavioural similarities. The tendency to use regular trails allows the construction of a wabun. They also sleep in holes during the day – their presence is betrayed by a cloud of insects, which are their constant companions, at the mouth of the burrow - and can be located and dug out by the same methods. *P. maximus* can not be caught in the same way as it burrows at too high a speed. Owing to its rarity, it is infrequently caught; the few captures of which I was told all resulted from chance encounters. *Cabassous unicinctus*, mainly found on the savannah, is one of the few species reported to have been severely diminished in number. It was apparently very common, even in the vicinity of the village, within living memory. However, the introduction of a novel and infallible technique for their capture – flooding out of the burrow with a bucket of water – led to the severe depletion of this species within all frequently visited areas.

8.1.6 Gathering of animal foods

The strategies used for the location of yellow- and red-footed tortoises *(Geocheleone* spp.) vary seasonally. Ethnoecological informants described seasonal changes in the activity patterns of these species, resulting from seasonal variation in food availability, of which this flexibility is a result. The scarcity of fruit during the dry season obliges them to be highly mobile, and at this time of year they are most commonly found during the course of their travels. Many that I observed to be captured at this time of year were encountered by chance when people were travelling in the forest for other main purposes. Others were found when people searched for them in the vicinity of trees known to be a source of their food at that particular time of year.

In the rainy season the abundance of fruit allows the tortoises to adopt more sessile habits. Food is easily located and when not feeding the tortoises are reported to spend most of their time hiding in leaf litter or wood debris. People out and about in the forest will actively search for them at the base of the trees whose fruits or flowers they eat, and in areas suitable for hiding nearby. In the latter process, assistance may be provided by a dog with appropriate training, able to sniff out and uncover hidden tortoises.

The gathering of eggs of turtles and iguanas is also heavily dependent on ethnoecological knowledge. Those people who collect these foods do so on the basis of a precise knowledge of the reproductive behaviour of the animals concerned: the timing of laying eggs, the signs which show where a female has made her burrow, the criteria used by the animals for selecting sites for laying, and the exact locations of particular breeding sites. I have observed individuals practicing habitat modification in favour of nesting iguanas. In one case, having noted a female iguana using a sandy area on the east bank of the Kwitaro for laying, an individual cleared a small sandy area on the other bank, adjacent to his camp, in such a way as to make it a more attractive nesting site. As he predicted, in the next breeding season she laid her eggs at the site he had prepared, thus providing him with easier access to the eggs.

Finally, a knowledge of microhabitat preferences is employed in the collection of other animal foods, such as crabs and snails. Those who consume these foods are aware of the specific habitat types in which they are found, and will search for them in suitable locations. Overall, ethnoecological knowledge appears commonly to be employed in the location of many different kinds of gathered animal foods.

8.1.7 Fishing

As already noted (chapter 4.4), many of the variety of fishing techniques rely heavily on ethnoecological knowledge. This was demonstrated in people's explanations of why they employed particular fishing techniques in particular circumstances. A series of ethnoecological interviews on fish were conducted with a single informant. Although the results are not reported in detail in this thesis, they demonstrated an extensive and detailed knowledge of aspects of the ecology and behaviour of fish species relevant to their capture.

A knowledge of the broad-scale movements of fish of many species as a result of seasonal hydrological changes is essential to success in the setting of seines, building of fish traps, and poisoning of moving rivers and creeks. Knowledge at a finer scale of the habitat use of particular fish species, and its seasonal changes, is also basic in techniques such as line fishing, diving for large fish, and the setting of spring traps and floating traps, for which site selection is of crucial importance. The choice of bait for fishing with hooks is based on a knowledge of the dietary preferences of the fish species being sought, and may be applied in combination with knowledge of habitat use, in order to select the appropriate bait to catch the species of fish known to be present at a particular location at a particular time of year.

8.2 Ethnoecological insights into the ecological consequences of human resource use

This chapter explores possible uses of ethnoecological data, which is here integrated with data on cultural ecology, in order to generate hypotheses concerning the ecological consequences of human activities. The ethnoecological data set used is a list of species of plants consumed by a set of animal species of particular importance. This is combined with data on the human ecological relationships with the plant species concerned, in order to determine predict how anthropic factors affect the availability of food for these animals.

A list of food plants was derived from ethnoecological interviews on six species of animals: the major game animals *Tayassu tajacu, T. pecari, Agouti paca, Dasyprocta agouti* and *Mazama americana*, and the ecologically important *Tapirus terrestris*. All the food plants attaining more than one mention in ethnoecological interviews on at least one of these species were listed, a total of 55 species. To each of these was assigned a score, based on frequency of occurrence in ethnoecological interviews. For each of the six animal species, the proportion of interviewees to mention that food item was calculated. For each food item, these figures were summed across all six animal species. The sums represent an index of overall dietary importance of these food species for the six animal species concerned, at least according to ethnoecological interviews.

The accuracy of the figures thus calculated for the importance of food plants in the diets of the animals concerned can not be determined in the absence of detailed local ecological data. The demonstrated accuracy of ethnoecological data suggests they are of some value, in that high scores are likely to reliably indicate high levels of consumption. On the other hand, the limitations of the ethnoecological data set already observed must also affect this data (chapter 7.14.1). The list does not include all the food items for the animals concerned, and it may be that even food items of considerable importance are omitted. It seems likely that the list would be biased in favour of those food plants which are also of importance in human subsistence, as these are generally more familiar, often more frequently visited and presumably given closer attention to than those with no known uses. Given the focus of this particular exercise on the overlap between human and animal interactions with plants, it is unlikely that its aims will be dramatically undermined by any such bias. However, it is possible that the extent of overlap of human and animal use of plants is overstated in this analysis. A further weakness is that the methods used take no account of seasonality, which may be a key factor contributing to the dietary

importance of particular foods, especially in an environment such as this in which many animal species suffer seasonal food shortages (Terborgh 1986).

For each plant species in the list, several items of information about their human ecological relations were incorporated. One was also derived from ethnoecological knowledge, and was whether the plant in question had been reported to occur in old farms. The others concerned human usage: for each species, whether the fruit was eaten by people, whether any recorded uses involved felling the tree, or whether there were any reported uses that did not fall into these categories, were all noted. The results are summarised in table 8.1. In this table, plant names are in Wapishana. The column 'frequency' refers to frequency of inclusion across animal species, i.e. it gives the number of the six animal species for which it was reported as food by more than one ethnoecological informant. 'Score' refers to the figure mentioned above, the sum, for all six species of the frequency, across interviewees, with which this food plant was mentioned.

Table 8.1. Human interactions with key food plants of important animal species

Food plant	Score	Freq.	Fruits eaten	Felled	Other human use	Anthropic Habitats	Human Interaction
Poo'a *(Pouteria* sp.)	4.23	6	Y	N	N	N	Y
Pokoridi *(Attalea regia)*	3.51	5	Y	Y	Y	N	Y
Iziari *(Manilkara bidentata)*	3.41	6	Y	Y	Y	N	Y
Zuupu *(Spondias mombin)*	2.28	5	Y	N	Y	N	Y
Ochoro *(Oenocarpus bataua)*	2.24	6	Y	Y	Y	Y	Y
Kawarori *(Anacardium giganteum)*	2.16	6	Y	N	Y	Y	Y
Naata *(Hymenaea courbaril)*	2.07	5	Y	Y	Y	N	Y
Mapuza *(Oenocarpus bacaba)*	1.91	5	Y	Y	Y	Y	Y
Dyo *(Mauritia flexuosa)*	1.79	5	Y	Y	Y	N	Y
Koram *(Inga alba)*	1.49	6	Y	N	Y	N	Y
Wamooko *(Parinari excelsa)*	1.44	5	Y	N	Y	N	Y
Widu'oko	1.33	4	Y	N	Y	N	Y
Bowao *(Tetragastris)*	1.32	5	Y	Y	Y	N	Y
Tokoro *(Licania majuscula)*	1.31	4	N	Y	N	N	Y
Tooru *(Cecropia)*	1.31	2	N	N	N	Y	Y
Waazu *(Astrocaryum*	1.14	3	Y	N	Y	Y	Y

Food plant	Score	Freq.	Fruits eaten	Felled	Other human use	Anthropic Habitats	Human Interaction
Roomi au *(Sacloglottis cydonioides*	1.12	4	Y	N	N	N	Y
Mangoro *(Mangifera indica)*	1.06	2	Y	N	Y	Y	Y
Daba *(Peltogyne porphyrocardia)*	0.96	2	N	Y	Y	N	Y
Kaziman *(Couma macrocarpa)*	0.9	5	Y	N	Y	N	Y
Otoochi *(Manilkara* sp.)	0.87	4	Y	N	N	N	Y
Wabo *(Euterpe)*	0.84	2	Y	Y	Y	Y	Y
Bakopara *(Pouteria sericea)*	0.77	3	N	Y	N	N	Y
Kumaraokou *(Ficus)*	0.77	2	N	N	N	N	N
Mawaorakun *(Trichilia pleeana)*	0.68	2	N	Y	N	N	Y
Komaro	0.65	3	N	N	N	N	N
Koobiki *(Inga ingoides)*	0.61	2	Y	N	N	N	Y
Suuzu *(Musa* spp.)	0.56	2	N	N	Y	Y	Y
Koto'u *(Virola surinamensis)*	0.54	2	N	Y	Y	N	Y
Katowari *(Bagassa guianensis)*	0.53	4	N	Y	Y	N	Y
Kaawai *(Micropholis venulosa)*	0.52	4	N	N	Y	N	Y
Kododotan	0.46	1	N	Y	Y	N	Y
Taasho *(Muellera frutescens***)**	0.45	3	Y	N	N	N	Y
Minau *(Bertholletia excelsa)*	0.38	2	Y	N	Y	N	Y
Zudu *(Parinari* cf. *campestris)*	0.38	1	Y	N	N	N	Y
Arakiki	0.37	1	Y	Y	N	N	Y
A'akush *(Manilkara excelsa)*	0.35	2	N	Y	Y	N	Y
Koron *(Catostemma fragrans)*	0.29	2	N	Y	Y	N	Y
Wurada urud *(Inga* sp.)	0.23	1	Y	N	N	N	Y
Bishawud	0.23	1	N	N	Y	Y	Y
Takuba *(Swartzia dipetala)*	0.23	1	N	Y	Y	N	Y
Shurara *(Inga* sp.)	0.23	1	Y	N	N	N	Y
Taamada *(Eschweilera wachenheimii)*	0.21	1	N	Y	Y	N	Y
Chaawudu *(Attalea dahlgreniana)*	0.17	1	Y	N	Y	N	Y
Kawaazu	0.17	1	N	N	N	N	N

Food plant	Score	Freq.	Fruits eaten	Felled	Other human use	Anthropic Habitats	Human Interaction
Dyakara *(Inga alba)*	0.15	1	Y	N	Y	Y	Y
Autaka *(Myrcia* sp.)	0.15	1	Y	N	Y	Y	Y
Kodoi aridu'i *(Inga laterifolia)*	0.15	1	Y	N	N	N	Y
Dido'u	0.15	1	N	Y	N	N	Y
Barotaba'u *(Aspidosperma excelsum)*	0.15	1	N	Y	N	N	Y
Kodoi autakan	0.15	1	N	N	N	Y	Y
Ma'aso *(Andira surinamensis)*	0.15	1	N	Y	Y	N	Y
Pawpaw *(Carica papaya)*	0.15	1	Y	N	N	Y	Y
Poorau	0.14	1	N	N	N	N	N
Marushobi *(Geissospermum argenteum)*	0.14	1	N	N	Y	N	Y
MEANS/TOTALS	0.90	2.71	32	24	33	13	53

For all but four of the fifty-seven major plant foods derived from the ethnoecological data, a human interaction was recorded. Thirteen of these Wapishana categories were reported to grow in fallows, and for two of these no human use was recorded. A significant proportion of major food plants for game animals, therefore, exploit anthropic habitats. Ethnoecological research thus suggests several hypotheses concerning this relationship amenable to testing by ecological research methods. First, that the densities of these plant species are positively affected by environmental modifications resulting from human agriculture. Second, that this affects the behaviour of game animals, which are attracted to the farming area by the presence of these plants and thus are more readily available to hunters. Third, if it is indeed the case that the densities of these plants are increased by human intervention, that this raises the carrying capacity for their animal consumers and thus increases the abundance of game.

Fifty-one of the major animal food sources have recorded human uses. In thirty-two cases, the fruits are also eaten by humans. In twenty-four cases, ten of which involve species whose fruits are also eaten, at least one of the uses involves felling of the entire tree. For a further five useful species, none of the recorded uses fell into either of these categories. The consumption of fruits by people can affect their availability to animals in either a positive or a negative fashion. On the one hand, fruits may be dispersed, deliberately or inadvertently, into the farming area, thus enhancing the chances that individuals of that species will be amongst those that

establish themselves in the secondary forest that eventually takes over old farms. In the cases of several of the species reported to be common in fallows, this is the mechanism reported to be responsible (chapter 6.4). Again, biological research methods would allow it to be determined whether this is indeed the case. On the other hand, if human exploitation of fruit reduces its availability to animal consumers, it is possible that this could negatively affect their populations, or cause them to migrate from areas impoverished in food trees as a result of human activity. This may be most pronounced when trees are felled to obtain the fruit, and similar ecological effects can result from other human uses of trees which involve their felling. Intuitively, it seems most likely that this would negatively affect the densities of the tree species involved, due to the wide interindividual distances between conspecifics in tropical forest habitats with high floral diversity, and the high probability that the gap created will eventually be filled by individuals of different species. On the other hand, in many cases the understorey beneath a canopy tree will be dominated by its offspring, leading to a high probability that felling the tree will lead to its replacement by a conspecific. Where trees are found in monospecific stands of any great size, population thinning may have positive effects on overall growth and fruit production. These postulated scenarios, and the consequences for the behaviour, density and potential harvest of game animals, again represent alternative hypotheses amenable to discrimination by the use of biological research methods.

A subset of the ethnoecological data collected in the present study has thus been employed to generate a series of specific, testable hypotheses about human effects on the natural environment. All of these are in some way relevant to considerations of management of local ecosystems, reconciling various human uses and extendible, in principle, to criteria based purely on conservation of biodiversity and community structure. The utility of ethnoecological knowledge in this respect has been to allow attention to be drawn to potential conflicts between direct human uses and the needs of economically or ecologically important animal species.

8.3 Ecological research as applied ethnoecological knowledge

The analysis presented in the previous chapter demonstrates the utility of ethnoecological knowledge as a component of a methodology for investigating the ecological consequences of activities associated with human subsistence. The practical skills associated with human exploitation of natural resources are also sufficiently flexible to be applied to other contexts. In the present study, several people who had worked as informants in the ethnoecological component of the

research later collaborated on biological research projects focusing on the ecology of *Tapirus terrestris* and *Tayassu tajacu*. Various skills conventionally applied in hunting were employed for this. The research site was selected on the basis of known occurrence of the animals involved. The individuals involved elected to use a site within their hunting grounds, which other people use only rarely, in order to minimise the chances of any conflicts of interest arising over their activities. This also made logistical sense, as the researchers already had a close familiarity with much of the terrain covered.

During the research itself, skills in tracking and interpreting animal signs were constantly employed. Under good conditions, Wapishana researchers were able to determine the numbers of animals in a group, assign them to age-sex classes, and often to determine behaviour. Almost all of the data collected was based upon observations of tracks rather than the animals themselves, as the latter were accustomed to being hunted and hence highly cautious and flighty. Tracking was also used to locate and determine usage of feeding sites, resting places and other locations used by the animals. Food plants were easily identified in the local language thanks to the botanical skills of local researchers. I was able to assign scientific identifications to many of these using field guides (Roosmalen 1985a; Gentry and Vasquez 1996). The work involved in obtaining accurate scientific glosses of all ethnobotanical lexemes relevant to the study would not be considerable. Within the context of a more extensive programme of ecological research, it would be more than compensated for by making local botanical expertise accessible for scientific usage.

Overall, the individuals involved adapted readily and speedily to the novel context of scientific research. They were easily able to transfer their skills to the making of observations, and with a small amount of training from me in recording observations were able to maintain their field notebooks efficiently. Work progressed with a minimum of supervision on my part, sufficient to keep me appraised of developments, and the accumulation of field data was rapid. This proved a highly cost- and time-effective way of initiating field studies in ecology, and it is hoped that short ecological papers may be written based upon the results. I believe that further, more prolonged and elaborate collaborations between indigenous and western-trained scientists could be an effective means to harness more productively the economic and human resources currently available for ecological research in neotropical forests.

8.4 Summary and Conclusion

Ethnoecological knowledge, and the associated body of skills, have here been shown to have important current applications in subsistence. This thesis did not by any means explore all aspects of this, and it may be that in areas of subsistence less closely attended to, such as agriculture and collection of plant foods, important bodies of skill and knowledge exist which were not addressed in the present study. The knowledge of the local ecology demonstrated in the last two chapters appears to go beyond the immediate demands of subsistence, and for some of the participants in this phase of research an understanding of the local biota clearly has intellectual as well as practical importance.

The exploration of the relationship between ethnoecological knowledge and scientific research and knowledge presented in this and previous chapters substantiates DeWalt's (1994) thesis concerning their complementary nature. Scientific ecology has provided a theoretical framework within which it was possible to elicit, record, analyse and evaluate ethnoecological data. The ethnoecological data itself has provided locally specific information on the ecology of various animal species, which within the scientific framework employed has permitted the generation of various hypotheses concerning the local ecology. The high level of accuracy of the ethnoecological data, as demonstrated in the previous chapter, indicates that hypotheses thus generated merit being taken seriously by ecologists. The value of ethnoecological knowledge as a method for generating baseline data on the local ecology has thus been confirmed (cf. Townsend 1995; Donovan and Puri 2000; Puri 2001).

This study also shows that the potential relationship between the two systems of knowledge and practice can be more involved. Ethnoecological knowledge and the practical skills employed in subsistence have been shown to be readily transferable to the task of the collection of field data on the local ecology. In particular, local knowledge of biogeography and the detailed local geography (for researchers to find their way around their study site, no insignificant task in neotropical forests), skills in tracking and interpreting animal behaviour from their spoor, and skills in identification of plants and animals, all predispose themselves to employment in ecological research projects. The scope for the involved, equitable and ongoing participation of local nature experts in ecological research programmes is thus great.

The analysis presented in chapter seven also demonstrated various limitations of the ethnoecological data set, which is incomplete in various respects and in some subject areas does not provide scientifically meaningful information. These very

weaknesses correspond to some of the main strengths of the biological research endeavour, which has developed specialised methods and technical applications not normally available in other contexts. The employment of biological techniques in data collection and analysis can provide insights into subject areas – such as population dynamics – not amenable to investigation in the relatively informal and unstructured fashion in which ethnoecological knowledge is acquired.

Although it is not explored in the current thesis, it is likely that biology can provide further theoretical insights not readily provided by ethnoecology. Possible examples that come to mind include the concept of keystone species of both producer and predator (e.g., Terborgh 1986), ecosystem-level properties such as community structure and its relationship to stability (Pimm 1986), and the relationship between harvest and production of populations subject to human exploitation (e.g., see Millner-Gulland and Mace 1998: 13-29, 51-83). All of these areas have potential applications to local management, and all incorporate theoretical ideas which are counter-intuitive or otherwise obscure to more casual observation.

In short, then, the potential clearly exists for a richly productive and synergistic relationship between ethnoecology and scientific ecology. A collaboration on these terms between local communities concerned with improving management practices relating to natural resources and the scientific community is one which would be greatly beneficial to both parties. With this finding in mind, and having concluded reporting and analysing field data, in the next chapter I return to the research questions introduced at the start of the thesis.

CHAPTER 9: RESEARCH QUESTIONS

This chapter returns to the four research questions introduced in chapter 1. Each is addressed in turn, with reference to the field data reported in earlier chapters.

9.1 Is the conservation of biodiversity and ecosystem function of importance to the people of the South Rupununi?

There are two different angles to this question as addressed in this thesis. The first concerns local attitudes: is 'conservation' a term that has currency locally, and are the concepts it embodies concordant with the expressed wishes of local people? The second is implicit, and concerns local dependency on wild species and ecosystem processes: how important is local biodiversity and ecological integrity to the local economy?

Local attitudes to conservation were investigated in local meetings and by means of interviews with community leaders (chapter 3.3.2). Though there was some variation in opinion, it is fair to say that most people considered conservation to be an issue of importance, but in a particular sense: this importance was expressed in utilitarian terms. This utilitarian sense was broad, including aesthetic value and abstract ideas such as freedom of lifestyle choice and cultural distinctiveness. However, it was a perspective which described the limits of conservation interest: the notion of conservation for its own sake, rather than as a means to maintaining and improving local lifestyles and ensuring the continued economic independence and distinctive identity of the Wapishana people, appeared not to be widely entertained. Conservation as a measure imposed from outside, which could inhibit local autonomy, individual freedom and access to land and resources, was a possibility of which people were well aware, and steadfastly opposed.

The utilitarian basis of local conservation interest was confirmed by the data collected on cultural ecology. This indicated direct use value for several hundred species of plant and animal (chapter 4.7). Many of these appear to be used fairly rarely, at least over the course of the present study, indicating that under normal circumstances people use only a subset of the resources and procurement methods available to them. Some of the rarely-used species may be of importance to particular groups of people, in particular locations, and at particular times. In this manner local biological diversity, and local knowledge of its uses, supports security of food supply by providing for interindividual variation in subsistence strategy and flexibility in individual strategy.

Subsistence is also heavily dependent on certain local ecological processes. In particular, the major basis of subsistence is long-fallow swidden agriculture, where productivity is maintained by the process of secondary succession. Succession in old farms is, in turn based upon the growth of plants from the seed bank and from seeds inadvertently introduced by people, immigration of plants via wind dispersal, and the immigration of animals and their dispersal of plant seeds into the gap created. The immigration of species to fallows depends upon their production of a population surplus via ecosystem processes in mature forest and secondary forest in various stages of regeneration. Many species of game animal are favoured by vegetation changes occurring in old farms, and succession and associated processes thus support the procurement of animal food as well. Production and procurement of fish depend upon a different set of ecological processes: seasonal changes in hydrology and the associated large-scale movements of fish stocks.

9.2 Does the Wapishana subsistence system exhibit features that can be considered habitat/resource management?

What is of most interest in the context of this thesis is management with conservation functions, which I here define as any rules or behaviours relating to exploitation of the natural environment whose effect is to promote the conservation or sustainable use of natural resources. I have already stated my adherence to the controversial position that effective management of natural resources for sustainable use can be an emergent feature of human social groups even if individual actions are neither consciously nor explicitly directed to this end (chapter 1.2.2). This position contradicts that of some previous writers (Alvard 1993, 1995; Hames 1987), and while I agree with them that there are important qualitative distinctions between management practices directed to conservation that are and are not based upon conscious intent, I disagree with their argument that unintended ecological effects of human actions are not significant to discussions of human ecological management.

Data collected in the present study can provide some support to this position, in that certain features of the Wapishana subsistence system can be plausibly argued to encode functions relating to sustainable use. However, this data does not demonstrate that these features operate in any systematic fashion, or that they do actually function to promote the sustainability of resource use. Further data are needed on the relationship between accepted subsistence practises, symbolically encoded restrictions on exploitation, and the ecological effects of these, in order to advance this argument further.

Agriculture is the basis of Wapishana subsistence and forest use (chapter 4.2). Productivity of the forest ecosystem is diverted to human use directly by the cultivation of food plants, and indirectly by the use of the habitat spaces thus created by useful non-domesticated species — crop predators, gap-adapted plant species of direct utility and others that attract useful animal species to fallows — and consequent human harvesting of these populations. There appears to be no conscious notion of either conservation, or of management for purposes other than the direct cultivation of crops. Further, there is no evidence of any emic concept analogous to that of the mixed-use agroecosystem that I would employ, within which a perspective of a management system might be encoded.

In agriculture and other areas of subsistence, people are clearly aware of the direct ecological consequences of their actions. This is the basis for current concerns about fish-poisoning and felling fruittrees, the reports of population declines in over-exploited animal species, and, at least partly, the recognition of the need to maintain fallow periods of appropriate length. However, I found no evidence that people are consciously aware of the systemic properties of the local subsistence system. While it seems likely that this system has significant ecological effects with important implications for human subsistence (chapter 4.2.6), any management functions it incorporates are certainly covert.

Subsistence activities appear to be regulated via mechanisms not explicitly recognised as such, but which may nonetheless promote sustainable use of game populations and other natural resources exploited by people (chapter 5.5). Temporary prohibitions on the consumption of certain types of foods, especially meat, can for their duration ensure a relaxation, or total cessation, of species-specific hunting pressures within particular hunting areas. The maintenance of spatial reserves in particular areas of forest and river may function to provide refuge areas where population growth of exploited species can take place unhindered by human harvesting, thus providing a surplus population for dispersal into adjacent areas where populations have been depressed, or an area which can be opened up for human use if circumstances make this necessary.

Degradation of these systems as a result of cultural change has made certain of their key features obscure to this study. It appears that specialised shamans formerly exercised control over these systems, thus providing the link between rules and behaviour, the two aspects of the definition of management given above. While this control mechanism has not entirely disappeared, results obtained in this study suggest that it is in decline. This unfortunately makes inaccessible what are perhaps

the most interesting questions. Did these people act as ecological mediators, prescribing patterns of activity that formed adaptive responses to changing ecological circumstances? And if so, what were the mechanisms by which ecological change was perceived and decisions made as to how to act upon it? Accounts given by informants in the present study alluded to the use of non-ordinary states of consciousness to engage with the spiritual entities responsible for regulating human ecological relations, though unfortunately it appears that thorough documentation of these practices among the Wapishana may no longer be possible.

Intriguing as these ideas are, the possibility of determining whether and how the activities of shamans related to ecological reality appears no longer to exist. The question of whether Wapishana resource use can be considered to represent a system of management must therefore be considered in more mundane terms. The element of conscious individual choice appears to be slight, although it is worth pointing out that a shaman's skills are not entirely esoteric, and knowledge of certain techniques appears to be shared by numerous individuals. Many people are able to self-regulate their relationships with nature spirits via their own knowledge of 'blowing' (chapter 5.2), and regulation of subsistence activities by these methods appears to include some element of individual choice. However, I found no case in which people demonstrated any explicit awareness of ecological functions associated with such activities. If they do encode conservation strategies, these are based on cultural knowledge encoded implicitly in accepted rules of behaviour, rather than individual awareness and manipulation of the emergent properties of the subsistence system.

Some evidence of conscious management was observed in the cases reported relating to usage of iguana and tortoise (chapter 4.5.1). This was clearly self-conscious and calculated, based upon the application of ethnoecological knowledge, and may be regarded as a form of incipient domestication of these species.

Ethnoecological data indicates that large numbers of wild species make use of human-modified habitats (chapter 6.4). Populations of agoutis *(Dasyprocta agouti, Agouti paca,* and *Myoprocta acouchy)* within the farming area may also be considered to blur the boundary between wild and domesticated, though in this case no conscious intent appears to be involved. The dependence on anthropogenic environments—crops, old farms, and domesticated trees— of all three species found locally is exceedingly high, according to informants (chapters 6.3.5, 6.3.6). It would be interesting to make a formal comparative study of their ecology within and outside the farm area to determine the extent to which distribution, diet, behaviour and

population dynamics are affected by human modification of the forest. Fruit trees planted by humans provide food for many species of forest animal, and some of these are able to propagate and effect dispersal without human assistance and can be considered to have become naturalised. On the other hand, populations of some non-domesticated trees are subject both to accidental dispersal and to more conscious manipulation of their populations. (chapter 6.4)

The human relationship with predators of livestock may also be considered to include some acts of conscious management (see chapter 4.6). It is an ecological intervention conducted with a precise goal in mind: the reduction of predation pressure on domestic animals, which it appears to achieve successfully. The killing of large felids not specifically known to be consuming livestock, as a consequence of their perceived status as competitors, is a more ambiguous case. Certainly it is an intervention intended to have specific ecological consequences: reducing predation pressure on game species valued by humans and thus increasing their availability to hunters. However, in the absence of more information on the ecological effects, it may be premature to draw any conclusion as to its efficacy, as there is no evidence to show that this intended consequence actually results.

The results of this study suggest the existence of a system of management neither explicitly recognised as such, nor expressed as a criterion affecting individual decision-making about subsistence. Rather, it appears to be emergent at the group level as a result of interactions among accepted techniques in subsistence, particularly agriculture (chapter 4.2.6) and hunting (chapter 4.3.1), land tenure (chapters 4.2.1 and 4.3.2), and symbolically encoded restrictions on the exploitation of natural resources (chapters 5.3 and 5.5). However, the existence of such a system can only be suggested, and not proven, on the basis of the evidence collected in this study. Its existence can not at this point be assumed, particularly given that the position exists that conscious intent on the part of individual actors is a necessary feature of management. Although I believe the latter position to be logically flawed, I can not refute it on the basis of supposition alone. More detailed study of the relationship between ideology and practice with respect to subsistence techniques, land tenure, and symbolic factors, and of the ecological outcomes of actual practises, is required in order to resolve this question satisfactorily.

9.3 Does the existing social-ecological system have properties that could promote its stability in the face of anticipated changes in the circumstances in which it operates?

Wapishana ecological relations are currently undergoing disruption along three dimensions: socio-cultural, economic and ecological. Socio-cultural change takes the form of changes in the belief system, a gradual and progressive result of the widespread adoption of Christian beliefs over the course of the past century. Many contributors to the present study voiced their concerns about the decreasing extent to which local beliefs and knowledge are being transmitted to younger generations. Assuming their impressions are accurate, the prospect of loss of the institutional knowledge encoded in aspects of tradition related to exploitation of the natural environment represents a serious danger to the continued functioning of traditional management systems, and one for which there is currently no remedy. This is not an unfamiliar phenomenon: among the Rungus of Sabah, changes in practices relating to the natural environment resulting from conversion to Christianity led to the breakdown of traditional systems of management and resultant loss of biodiversity and ecological functions (Appell 1997). As in that case, the change in beliefs and practices among the Wapishana is not taking place in isolation, but is part of a general process of degeneration of systems of transmission of traditional beliefs and knowledge, the other major driving force behind which is economic change.

The pattern of economic change is complex. On the one hand, there is a general change in subsistence practices as lifestyles become increasingly savannah-based. It appears that the majority of people are spending less time in the forest and making less geographically extensive use of it than in the past. Hunting trips are fewer and less far afield, farms are less commonly situated in deep forest, and the rearing of livestock on the savannah is an ever-increasing part of Wapishana life. This trend is exemplified in the current interest in the use of the savannah for agricultural purposes. Having said this, it must be stressed that the forest remains crucial to Wapishana lifestyles not only in economic but in cultural terms, and remains a key component of identity at the levels of individuals and larger social groups.

Despite its continued cultural and economic importance, many young people are today participating less in forest-based pursuits than was the case in the past, and consequently have less opportunity to learn the linguistic, practical and intellectual skills of their parents' generation. Wage migration is a big factor in this, and the consequent failure of many young people to acquire a full range of subsistence skills

is a matter about which many among older generations expressed grave concerns (cf. Horowitz 1998: 383). The prospect this entails of loss of identity as a culturally distinct group and capacity for economic self-sufficiency is one that is not at all welcomed. However, these changes are taking place as a result of free choices by a younger generation expressing its wish to be able to earn a cash income unavailable to most within their home villages.

The full scale of the loss entailed in the collapse of the balata industry is thus evident: it provided a means by which previous generations were able to integrate into the national economy on their own terms. It appears that this integration took place in a fashion to which subsistence practices could be readily adapted and which allowed for people to earn a cash income via exploitation of a renewable resource which could be extracted without causing environmental damage. The local body of skills connected with forest use and the associated knowledge of forest ecology were both augmented as people's employment compelled them to spend extended periods resident in the forest and frequent areas which might not otherwise have been visited. In these respects the balata industry can be considered to have been a conservation success in both cultural and ecological terms, which may hold important lessons for those seeking economic solutions to the current losses of diversity.

This study has shown that existing bodies of local skills and knowledge provide a potential for the development of income-generating activities that share these important properties. This is both in direct economic terms, in the well-explored basis for extractive industries in local knowledge of the procurement and usage of wild species, and in terms of the growing outside interest in the conservation importance of the region. I have shown that Wapishana ethnoecology and the skills associated with it are readily transferable to the context of scientific research in ecology, and that their utility in local management can be enhanced by the incorporation of insights based upon scientific research. The potential thus exists for a productive and ongoing relationship, based upon a two-way intellectual exchange, between Wapishana ethnoecologists and those who would seek to introduce scientific methods of natural resource management to their home area. This could function both in the context of local involvement in the management of formally designated protected areas and in seeking to improve local competence in natural resource management on titled Amerindian land.

Possible current strategies for the conservation of game, fish and other natural resources appear to be encoded in the interaction of pulsed prohibitions on the consumption of particular foods with the traditional system of land tenure, and in the

avoidance by people of particular areas of forest, river and savannah (chapters 5.3-5.5). These systems are not explicitly recognised to have conservation functions, and it is therefore possible that any such functions could be overlooked in a transition from customary to planned and conscious systems for managing wild resources. Covert systems of management may for this reason be more vulnerable to disruption by changes in belief systems and practices.

It must be stressed once more than the conservation/management functions of the systems described are putative. Investigation of whether they do have the functions I suggest would require the collection of data on their actual effects on human behaviour, and of the ecological consequences of this. It would be a mistake to assume that a system of this sort must necessarily have a conservation function in the absence of such empirical corroboration, even if a qualitative description suggests that this may be the case. Eghenter (2000) reports the adoption by conservationists of such an apparent misconception concerning traditional systems of land tenure in the vicinity of the Kayan Mentarang National Park in East Kalimantan, Indonesia, and points out the danger in assuming that such systems have conservationist orientations. However, in the case study provided, the system in question provided a strong case for the consideration of indigenous rights of access in planning the protected area, and has formed the basis of an ongoing dialogue between conservationists and local communities. In certain socio-political contexts, therefore, traditional practices can contribute to the resilience of the social-ecological system, even if they did not, in fact, have any such traditional function.

Local management of natural resources is becoming an issue as a result of ecological change that is occurring from both within and without. Unsustainable resource use practices are an obvious threat to any subsistence system based upon natural ecological processes. Although the present scale of resource degradation, as recorded in the present study, is small, there is the real prospect that it may be magnified in the face of an increasing population with greater demands, and in particular if current methods for the exploitation of the natural environment, and for the regulation of this exploitation, are not effectively passed on. From without there is the prospect of the incursion of extractive industries, and the more benign though still potentially dangerous interests of conservationists whose agenda might conflict with that of local populations (chapter 3.1).

The present study demonstrates a measure of dependence on resources beyond the current boundaries of titled land. Some of this is based upon direct uses such as hunting grounds, fishing sites and sources of wild products with very local

distributions. A consideration of subsistence from an ecosystem perspective may broaden its scope substantially. No species of hunted animal has greater importance in terms of Wapishana identification with the forest than the white-lipped peccary. Traditional knowledge of the geographical scales upon which management of this species must operate, is demonstrated in the wide area over which zones of restricted access are located, perhaps functioning for the benefit of this species more than any other. Land use decisions over an area far wider than that subject to sustained direct use, and beyond the current boundaries of titled land, may thus have serious implications for Wapishana subsistence and cultural identification with the natural environment.

The stability of systems of resource use is thus threatened by current and prospective changes originating in both endogenous and exogenous factors. Their resilience in the face of change — or to put it another way their ability to adapt in such a way as to ensure that systems of food production and environmental management continue to function — is contingent on the nature of their interaction with external forces. Depending on how they operate, these external forces could, as has happened so often when traditional societies have been forced to come to terms with them, effect dramatic breakdowns in local social-ecological systems, to the certain detriment of the majority of the Wapishana people. On the other hand, a scenario whereby the local and extra-local interact in a way that is mutually enhancing is feasible. A key factor to this is the extent to which existing knowledge, skills and practices relating to the natural environment are permitted to continue to form the basis of its usage and management.

I have already pointed out that the incorporation of local knowledge is neither technically simple, nor is it by any means a foolproof method that can guarantee that development will be both equitable and socially and ecologically sustainable. This thesis has demonstrated various methodological problems that must be overcome, and the integration, in practice, of local and scientific systems of knowledge will for some time continue to be an experimental approach, albeit one which holds much promise.

9.4 Does the nature of existing ethnoecological knowledge provide the basis for its integration with scientific approaches in ecology?

The ethnoecological component of this study revealed the presence of a rich body of skills and knowledge relating to the natural environment, which are applied on an ongoing basis to overcoming the problems associated with fulfilling subsistence needs

via the exploitation of locally-available natural resources (chapter 8.1). Detailed studies were made of explicit aspects of the knowledge of individuals, which revealed the collective possession of a large body of information about the ecological relationships of a number of animal species found locally. Compatibility with the biological sciences was demonstrated in the first instance by the successful elicitation of ethnoecological data within a research framework based upon categories derived from the former (chapter 6). Comparison of the data set with published information on the ecology of the animal species concerned showed there to be a large region of overlap, in which the two correspond closely in detail (chapter 7). It also revealed certain shortcomings of the ethnoecological data set as a source of information compatible with scientific approaches to ecology.

In certain subject areas, such as population dynamics and detailed social behaviour, informants did not provide useful information. This is assumed to be due to methodological constraints, and to reflect an inherent limitation of local ecological knowledge. For the majority of examined animal species, lists of food sources derived from the ethnoecological data set were much shorter than those in the most complete of the published ecological studies. In addition, much information on diet was thrown out of the data set as a result of being mentioned by only one informant. Various methodological improvements have been suggested as means to overcome this. Until they have been tested in the field it is difficult to say to what extent this is due to limitations in the methods employed for recording ethnoecological data or to shortcomings of the knowledge base.

Ethnoecology is thus of value as a methodology that can generate baseline ecological data sets, but its limitations mean that it does not by any means make scientific methods in the study of ecology redundant. On the contrary, scientific ecology can provide the means to overcome these limitations, in the form of methodological approaches not normally available to informal students of natural history. The complementary nature of the two was demonstrated by use of ethnoecological data to generate a series of testable hypotheses concerning human influences on the forest ecosystem (chapter 8.2). Wapishana hunters engaged in the collection of ecological data on two species demonstrated that their skills are readily transferable to the collection of ecological data (chapter 8.3). Many of the skills employed in this are among those that are most difficult for an outsider to acquire, such as orientation, tracking and interpreting animal signs, and accurate field identification of plant and animal species. The possibility thus exists for a profound

and complementary engagement between traditional and scientific approaches to the study and management of nature.

The potential of such an integrative approach will be enhanced with the ongoing maturity of ethnoecology as an academic discipline. One important aspect of this will be the nature of the concepts it seeks to address. In this preliminary study, the concrete ethnoecological data was of a form which, while consistent with the working definition of 'ethnoecology' employed in this thesis (chapter 1.1, Posey et al 1984), corresponds more accurately with natural history than with ecology under its definition as a science. Ecology as a formal scientific discipline works with such data as raw material, and has a historical continuity with natural history (Atran 1990), but advances upon it in terms of the conceptual tools it provides to account for and assess the outcomes of observed relationships within and between species. Ethnoecology will develop and realise its potential by making a parallel advance, by relating such data to the concepts used by non-scientific ecologists to explain the ecological phenomena they observe, and determining the heuristic value of such concepts both in their own right and as aspects of a framework that also draws on scientific ecology. Results obtained in the present study indicated that concepts corresponding with a stricter definition of ecology were employed by ethnoecological collaborators. Their full investigation among this and other groups of people will be among the tasks of future ethnoecological studies.

One concrete application of an approach based upon the integration of ethnoecology and scientific ecology would be in establishing minimum sizes which would ensure the ecological viability of indigenous territories. This requires information on the range of species used by people and the level of consumption of each, their spatial distributions, the ecological requirements of these species – including detailed information on subjects such as seasonal migration and the use of rare or spatially patchy habitats, population densities, and population dynamics including source-sink dynamics in areas where the resource management strategy includes the use of spatial reserves. Ethnoecology can provide detailed and comprehensive information on the spatial distributions and ecological requirements of useful species in particular. In these subject areas, the quantity and quality of information that can be provided by ethnoecology far exceeds that which could be achieved in a conventional ecological research programme. As already noted, ethnoecology would also involve a far more efficient use of both human and financial resources, much of the work involved effectively having already been done by local nature experts in the course of their lifetimes' experience. Scientific ecology can

provide conceptual tools useful in the analysis and evaluation of such data, as the treatment of ethnoecology in this thesis has shown (chapters 6 and 7). In areas such as population densities and dynamics, ethnoecology does not appear to provide information of the necessary quality, and here scientific ecology is of value in terms of the tools, both theoretical and methodological, that it can provide. The complementary use of ethnoecology in data collection in these particular subject areas has been shown both in this thesis (chapter 8.3) and in a number of studies already cited (chapter 1.2.4). In this and diverse other areas of research directed at the problems associated with resource management, the practical value of an approach which deeply integrates ecology and ethnoecology is clear.

Perhaps even more important than the practical value of integrating ecology and ethnoecology is its ideological and political necessity. As I have already touched upon, conservation, as both practice and ideology, can take many forms, not all of which will be consistent with the interests of the people living in the area of conservation interest (chapters 1.2.1 and chapter 3.3.2). The use of ethnoecology ensures a meaningful and continued, equitable involvement of local populations in conservations initiatives, and provides a means in which they might employ scientific ideas and methods without disempowering themselves by surrendering their control, decision-making power and full comprehension of the process to outside interests. From the perspective of outsiders with an interest in the conservation of the environment in a particular area, ethnoecology can provide an important protocol tool. Its use can reduce the possibility of imposing external priorities and values that might reflect the outsider's interests or bias at the expense of local interests. It can also provide an important mechanism of communication via which novel ideas might be introduced and evaluated in the local setting. Such would be the ideal method of dialogue between local communities and conservationists from other backgrounds, allowing the latter to adjust their ideas and approach to conform to local needs. When conservation not only conforms and, if necessary, adjusts to local interests, it is most likely to achieve the support and co-operation of the people who are most directly affected by it.

In practical terms, the value of the integrative approach can be demonstrated by a consideration of how one might try to employ ethnoecology in evaluating the sustainability of hunting. Ethnoecology certainly provides some indication of this, as people are keenly aware of changes in abundance of the animal species they hunt. In the cases of several species – iguana *(Iguana iguana)*, tortoises *(Geocheleone* spp.) and armadillo *(Cabassous unicinctus)* - this study provides ethnoecological accounts

that strongly indicate prior unsustainable levels of exploitation (chapters 4.5.1, 8.1.5). In each of these examples, however, the reported decline has been of a very large magnitude. My overall impression is that it is only in such dramatic cases can ethnoecology, used in isolation, provide a reliable indication of sustainability. In most circumstances it must also be employed in conjunction with scientific methods.

Evaluation of sustainability in scientific ecology generally takes the form of observations of changes in abundance of animals. This may be either sightings per unit survey effort or, in the case of exploited populations, catch per capture unit effort. This is essentially a formalisation of the method employed by people in observing the declines in abundance of particular species reported above. In the informal case, the accuracy is limited by the unreliability of human memory – perceptions of abundance will generally be very impressionistic, and memories of the time-scales over which they occur unreliable. Scientific biology collects such observations in a systematic and accurate fashion, such that their precision and utility are far greater, and thus provides a more powerful framework for their recording and analysis. This approach can, in turn, be enhanced by the particular contributions that ethnoecology has to make.

Most importantly, hunting activity itself can provide an opportunity for data collection. Collection and measuring of skulls provided by hunters, in connection with interview data, was successfully incorporated into a study of Ebolo hunting behaviour (Dwyer 1990). Both the accuracy and the extent of hunters' participation in such a programme can be enhanced if hunters maintain their own records of hunting trips, sightings and successful kills (Bodmer and Puertas 2000). The body of data collected can be enhanced by the incorporation of observations of tracks and other animal signs, of which local hunters are invariably the most proficient observers and interpreters (Hill et al. 1997). Further, as shown in this study, ethnoecology can provide highly detailed local information on habitat use, seasonal movements and responses to predators and competitors of hunted animals, all of which factors would need to be incorporated into the data collection and analysis regimes of a monitoring programme.

This thesis has thus confirmed and advanced the arguments of several previous, less extensive studies. First, that ethnoecological knowledge incorporates a large quantity of information that can be used to generate biological data (Townsend 1995; Ponte Johansons 1995; Ferguson et al. 1998; Myrmin et al. 1999; Huntington et al. 1999). That ethnoecology and scientific ecology therefore possess a substantial area of common ground (cf. Agrawal 1995), but also, and crucially, differ

in such a way as to be complementary (DeWalt 1996; Kalland 1997; Sillitoe 1998; Puri 2001), and that hypothesis testing can provide a bridge between the two approaches (Townsend 1995; Posey 1990: 54-55). The extension of the employment of ethnoecology into the process of collection of new biological data in the field (cf. Marks 1994, 1996; Hills et al 1997) was also favourably assessed. The ideological and practical advantages both to traditional managers of ecosystems of incorporating scientific methodologies into their skills repertoire, and to those in conservation science of giving ethnoecology prime importance in their programmes, have been demonstrated in both theory and practice. The following and final chapter summarises how these conclusions were reached and discusses their implications.

CHAPTER 10: CONCLUSION

10.1 Summary of thesis

The research on which this thesis is based was concerned with the potential contribution of ethnoecology to development and conservation. As the review of the literature in the first chapter showed, this is a subject which has been given much attention in recent years, thanks to its well-established importance in providing for the collaboration and empowerment of local people in development, and helping to ensure that initiatives are appropriate to local lifestyles, competencies and aspirations. However, there is a great need for field data on ethnoecology and all aspects of local knowledge in order to evaluate objectively its strengths and limitations, and thus work towards its practical application in development. This thesis contributes to providing such data. In it, particular attention is given to the nature of the interaction between ethnoecology and scientific biology: ethnoecology is to be evaluated in the light of a possible complimentary relationship between the two, which could allow for their integration in practice.

In chapter two, it was argued that development initiatives in Guyana, as promoted by government, industry, international financial institutions and NGO's, had failed to recognise sufficiently the potential contribution of indigenous knowledge to the immense problem of reconciling short- and long- term economic needs with the upholding of the rights of Amerindian populations to maintain their lifestyles, economic independence, and tribal identity, and the related need for maintaining biodiversity and ecological functions at national and regional levels. The past, present, and potential future contributions of indigenous knowledge and skills to the national economy were noted. I also noted that much talk promoting attention to indigenous knowledge in development in Guyana, as elsewhere, is rhetorical, and that there is a shortage of empirical data that could be used to evaluate competing arguments and provide a guide for concrete action.

Chapter three continued this theme at the local level: that of the Rupununi region, where the Guyanese population of Wapishana people reside and where this study was located. In this region, not unusually in Guyana, actual and potential threats to indigenous security and land tenure exist in the form of diverse outside interests in its natural resources. Mineral exploration and extraction and large-scale, outsider-led conservation projects are chief among these, while industrial logging remains a future possibility. Wapishana people, like Amerindian groups in Guyana as a whole, are asserting their interests via claims for land extension and an insistence on

consultation on all matters affecting land use locally. Conservation is a key local interest, provided that it is directed to the maintenance and improvement of local lifestyles and ensures that control over decision making is in indigenous hands.

Chapter four explored the basis for this utilitarian interest in conservation, and documented local use of natural resources for subsistence purposes. It showed that Wapishana people employ a variety of subsistence strategies based around agriculture, and also include some or all of the following: hunting, fishing, rearing domestic livestock, keeping house gardens and cultivating fruit trees on the savannah, and gathering wild products of both plant and animal origin. Direct dependence on a wide range of local biodiversity and on a variety of ecological processes in the forest ecosystem were demonstrated. There is evidence of local depletion of some wild species in areas subject to the heaviest human usage. More generally, however, exploitation of the forest appears to have remained within the limits of ecosystem tolerance. The observed nature of the subsistence system suggested that it could promote local biodiversity through the promotion of gap and edge habitats. The consequences of this for human use were further explored in in chapter 6.4, which combined ethnoecological data on the successional process in old farms with data on the use of favoured species.

Chapter five considered the regulation of resource use, and described endogenous components of a syncretic belief system incorporating elements of both traditional and Christian belief systems. Despite the universal adoption of Christianity, many elements of traditional Wapishana cosmology appear to have been retained. Specific aspects of this belief system were examined for their potential conservation functions, but in the absence of data on the ecological consequences of these beliefs it was possible only to speculate as to whether such functions do indeed exist.

Chapter six was the first of three on ethnoecology. It reported the methods employed and results obtained in a programme of research on ethnoecological knowledge about twelve locally occurring species of mammals, for each of which multiple informants were interviewed. The data set thus generated was rich and detailed, but exhibited certain limitations. In some subject areas little or no information of biological value was obtained. In some cases, information given was either contradictory across informants or reported at a very low frequency. Critically, analytical methods that could distinguish reliable and unreliable answers in these situations were not available. The utility of ethnoecology as a method for generating ecological data sets was confirmed, but the need to resolve this outstanding

analytical problem if it is to be of the greatest possible practical value is acknowledged.

The ethnoecological data set was evaluated in chapter seven, in which it was compared with the scientific literature for each of twelve animal species in turn. A very high degree of qualitative agreement among the results was obtained. Specific food lists overlapped to a high degree at the family level in particular, and in many cases at the generic level too, though the level of agreement in the latter case varied considerably depending on the completeness and the geographical proximity of the ecological studies being used for comparison. Species food lists were for most species far shorter than those recorded in the most complete ecological studies. Reasons for this were suggested, and a variety of methodological improvements proposed that would improve the quality of the ethnoecological data set. While the discipline of ethnoecology is still developing its methodology, its utility as a means for providing detailed and accurate information about many aspects of the local ecology has been demonstrated.

Chapter eight was concerned with practical applications of ethnoecology in several different contexts. A consideration of current applications in subsistence supported the idea that ethnoecological knowledge is of adaptive value in increasing the effective availability of a number of wild resources to human consumers. Ethnoecological data on the diets of six species of hunted animal was combined with data on human interactions with their food plants to generate a set of specific testable hypotheses concerning the ecological consequences of human use of the forest. Finally, the transfer of the tracking and identification skills of Wapishana hunters to the collection of data on forest ecology in a formal setting was reported. Overall, this chapter supported and extended previous suggestions concerning the nature of the relationship between ethnoecology and formal scientific research. It advanced the case for a profound, ongoing and dialectical relationship between the two, which would be to the benefit of both biological conservationists seeking to study the ecology of an area and indigenous communities seeking to incorporate methods based upon the biological sciences into the local repertoire of skills and knowledge.

Finally, in chapter nine, I considered several research questions raised in the first chapter in the light of the findings of this study. The answer to each, more or less, was a qualified yes, the implications of which are discussed in the next section.

10.2 Research findings and their implications

This study contributes to filling the observed gap in empirical data on ethnoecology that can serve to advance its integration with conventional approaches to resource management and development. The research findings are generally consistent with the established ideas on this theme identified in the literature (chapter 1.2), and serve to enhance and develop many of these.

Current patterns of subsistence entail an interest among the Wapishana people in biological conservation (cf. Droste zu Hulshoff and Gregg 1985; Clay 1988; Fisher 1994). Local attitudes demonstrate an interest in the utilitarian aspects of conservation, in a broad sense incorporating elements of cultural conservation, identity, independence, freedom of lifestyle choice and recreational and aesthetic criteria as well as realised and potential direct use (cf. Alcorn and Toledo 1998; Kaimowitz et al. 2000; Zimmerman et al. 2001). This demonstrates a significant measure of common ground among the Wapishana people and conservationists, though western concepts of conservation are not universally endorsed (cf. Ellen 1986; Conklin and Graham 1995; Brosius 1997; Oviedo 2001). In practical terms, conservation initiatives in the region will have the greatest chance of success if they are consistent with the local perception that conservation should be, from start to finish, employed as a tool for the safeguarding and improvement of local lifestyles, and with the need for local control over the decision making process that this implies.

The nature of such a locally determined and beneficial conservation strategy is illuminated by the study of cultural ecology presented here (chapter 4). The analysis combined the theoretical perspective of the social-ecological system (Berkes and Folke 1998a) with a consideration of the subsistence strategies of individual actors (Vayda 1996). Individual behaviour appears to operate such as to maximise expected direct returns from subsistence activities (cf. Hames and Vickers 1982; Hawkes et al. 1982; Alvard 1993, 1995). However, this takes places within various constraints of technology (cf. Hames 1979), access to resources and symbolically mediated restrictions on consumption (cf. Gadgil and Vartak 1976; Joshi and Gadgil 1991; Price 1995; Gadgil et al 1998), which may serve to help maintain levels of exploitation within the limits of sustainability (cf. Reichel Dolmatoff 1971, 1976; Ross 1978; Balée 1994; Descola 1994). The emergent properties of the social-ecological system appear to be such that the habitat modifications resulting from subsistence activities generally lead to local enhancement of both biodiversity and the proportion of ecological production available for human consumption (cf. Posey 1985; Balée 1989, 1993).

The basis thus exists within the existing social-ecological system for a continuing reconciliation of subsistence needs and the maintenance of local biodiversity and ecological processes (cf. Posey et al 1984; Moran 1993b; Hipwell 1998; Berkes 1999). However, the current social-ecological system also appears to be vulnerable, in various ways, to degradation as a result of change. From within, isolated and small-scale instances of resource degradation, and of local depletion of certain species, show the system to be vulnerable to disruption by changes in technology, subsistence practices, and belief system (cf. Appell 1997). From without, large-scale changes in land use threaten to affect indigenous land tenure and the broad ecological context within which it operates (chapters, 2.4, 2,6, 3.1, 3.3). This thesis is largely concerned with the possible contributions of ethnoecology to the resolution of the problems thus raised.

The ethnoecological and ecological data sets compared in this study (chapters 6 and 7) are compatible to a large degree (cf. Agrawal 1995), correspond closely in detail (cf. Townsend 1995; Ponte Johansons 1995; Ferguson et al. 1998; Myrmin et al. 1999; Huntington et al. 1999), and exhibit features that support the hypothesis that they are complementary (DeWalt 1994; Kalland 1997). The ethnoecological data set was limited in certain subject areas amenable to investigation by scientific methods, and the latter can thus help to fill gaps in the former (Sillitoe 1998; Donovan and Puri n.d.; Puri 2001). These limitations also caution that ethnoecology is best employed as a complement to, rather than a substitute for, scientific methods. The use of ethnoecology in generating baseline data that can form a starting point for ecological investigation was demonstrated (Posey 1990: 54-55; Townsend 1995), as was the application of existing skills to the collection of ecological data (cf. Marks 1994, 1996; Hill et al. 1997). The latter also highlights the fact that the type of explicit knowledge of ecology that forms the core of the data upon which this thesis is based is not an isolated phenomenon. Rather, it is one outcome of a body of practices relating to use of the natural environment that is generated by, and thus depends upon, a particular type of relationship between .a human society and its natural environment.

The implications of the dependence of ethnoecology upon its social-ecological context are two-fold. First, the preservation of ethnoecological knowledge systems depends on the continued integrity of the societies in which it is found. Its contributions to the resolution of regional, national and global problems can not be realised if the rights of its bearers to maintain their cultural distinctiveness are not upheld. Second, ethnoecology can be a tool for the equitable engagement of these

societies with other parties with whom they share interests in the conservation of the natural environment, and can thus contribute to local empowerment and control over the development process. The perspective of ethnoecology provides one of the clearest demonstrations of the interdependence of cultural and biological diversity.

10.3 Policy Implications

I feel it is important at this point to spell out the implications of the research findings for policy relating to the engagement of external actors with Amerindian communities, and in particular the nature of conservation and development initiatives located within or otherwise affecting Amerindian lands. However, I feel I must qualify this by making it clear that this does not imply any neo-colonial sentiment on my part. While, as will presumably be clear to anyone who has read this thesis, I have strong sympathies with the cause of indigenous self-determination, I do not suggest that this should be at the expense of the legitimate interests of any other groups of people. Nor need this be the case: I believe it to be in the interests of all Guyanese that use of the country's ecosystems remains within the limits of ecological sustainability, that the country's rich heritage of both cultural and biological diversity be retained, and that the culturally idiosyncratic contribution that Amerindian peoples can make to both of these goals be expressed to its fullest possible extent. Insofar as this thesis documents the potential scope of this contribution, its findings should have clear implications for conservation planning in Guyana, which also apply to greater or lesser extents to many other locations.

The major implication is one which is unlikely to surprise anyone resident in or otherwise familiar with the situation in Guyana's interior. No national or regional initiatives for the large-scale conservation of natural ecosystems can function without the full participation of the Amerindian population. Full participation goes beyond the often token meaning attached to this term in international conservation circles. Rather it means a complete and nonsubordinate involvement in all stages of planning, design, research and management. Key to such involvement would be a free, equitable and dialectical intellectual exchange between indigenous and non-indigenous experts on ecology.

The potential intellectual and practical contributions of Amerindian populations to such a dialogue has been highlighted by the results of this thesis. Ethnoecology, both in theory and practice, provides an important possible forum for this exchange; as it matures as a methodology its potential in this respect will grow accordingly. The skills and knowledge which form the basis of traditional resource management systems

incorporate substantial amounts of ecological information accessible to scientific investigation, and a vast body of practical skills that can be transferred to the context of modern sustainable use programmes. These skills could provide the basis for a marked expansion of the scale of extractive industries, if the appropriate marketing linkages can be developed, and the latter provides a key point for possible state intervention. They could also be employed in ecological surveying and monitoring, and in which G's AI groups have enormous latent expertise. This potential can best be realised in combination with scientific approaches. The design of management programmes will thus be maximally effective if it combines extensive use of the existing skills base with vocational education and training programmes designed to complement this with appropriate technical and practical applicatons of the biological sciences. The outcome would be a forest management sector largely staffed by people with a complementary background in both traditional and scientific approaches to resource management. The professional capacity of such a workforce would be formidable.

I have already stressed that Amerindian ecological knowledge can not be separated from its social and cultural context. Moreover, much of this is social knowledge, embedded in the belief systems, social norms and cultural practices of the societies rather than the explicit knowledge of any individuals. It is clear, therefore, that realisation of the fullest future development of Guyana's capacity in ecological management requires the maintenance of the cultural distinctiveness of indigenous societies. This does not imply either protectionism or stagnation, but simply that they be permitted to retain as full control as possible of the course of their future development, in order that adaptation to their changing circumstances can be an endogenous process which does not undermine their social or ecological integrity. This social evolution will nonetheless be shaped to a large extent by the character of the wider, Guyanese society within which Amerindian societies are located. This influence must, like the interaction between traditional and scientific knowledge systems, have a dialectical character. If the dominant national culture allows itself to be informed and altered by the influence of its Amerindian constituent, the possibility exists of the emergence of new and different forms of human relationships with nature which may ultimately provide the basis for a truly ecologically conscious national society.

10.4 Suggestions for further research

The findings of this study suggest a number of interesting possibilities for further research, both locally and elsewhere. Locally, the aspects of the research programme that generated the greatest levels of interest were those with direct relevance to cultural conservation. Specific research projects that would support this interest include the systematic study of Wapishana biological nomenclature and classification, recording this information in literary form and providing permanent records of its relationship to scientific nomenclature for local educational purposes. The recording of known local uses of wild species and the production of documents on this subject in Wapishana would also support local agendas. Another specific research interest that was raised is the recording of Wapishana cosmology and esoteric lore, especially those aspects of it currently known only to a small number of old people and in danger of being lost.

Several research projects concerned with cultural ecology also suggest themselves. I have made various conjectures in this thesis concerning the ecological impacts of human activities. The effects of human habitat modification on ecological and genetic diversity is a topic of great potential significance to conservationist interests in the region, and clearly research in this area should be a priority consideration. More specifically, I have made specific suggestions concerning possible ecological functions of food taboos and occupation of certain areas by malevolent entities (chapter 5.5). If they do actually have these functions, it is important that they are recognised and taken into account in community-level initiatives in resource management, and research in this area is therefore needed. Ethnoecological data was also used to generate a number of specific hypotheses concerning possible ecological consequences of human activities of interest: habitat enhancement for certain species of game animal on the one hand, and possible conflicts of interest resulting from human exploitation of species that are also food sources for economically important animal species (chapter 8.2). Again, the significance of these for local management suggests that it would be useful to collect ecological data that would allow them to be tested.

Possible follow-up research suggested by the ethnoecological component of this study is of the greatest general interest. Techniques in data collection and analysis are still very much developing in this field. The analysis conducted in this study indicated certain limitations of the methods used, and suggested a range of methodological improvements that could be used to overcome them (chapter 7.14.3). The next step is to take these suggestions into the field for practical

evaluation as part of an ongoing process of refinement of ethnoecological methodology.

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APPENDICES

These appendices list Wapishana animal and plant terms recorded in the present study. Although scientific glosses are suggested, none of these are definitive and they should not be treated as such. Not a single gloss has been verified with reference to a museum or herbarium specimen, although many are based upon fairly reliable field identifications. Many others are based upon inference from use of Creole names, *ad hoc* descriptions by informants of animals that I personally did not see, or informants' putting of names to illustrations in field guides. Variation in usage of terms was encountered on a few occasions, but not investigated, and is incorporated here only in those cases where different scientific glosses are reported for a single Wapishana term. All identifications suggested are thus preliminary and should be treated as such. They are presented here as a guide to Wapishana naturalists or outside researchers interested in attempting more thorough documentation of Wapishana biological nomenclature.

Spellings of Wapishana terms follow, whenever possible, the conventions employed in the most recent Wapishana dictionary compiled by the Wapishana Language Project of the Unevangelised Fields Mission in collaboration with Wapichan Wadauniinao Ati'o (WWA). Wapishana tree names were transcribed accurately, thanks to the assistance of Adrian Gomes of the WWA. Where I recorded a zoological term that appears in this dictionary, I employed the spelling used therein. In other cases, the spelling is based upon my own transcription, which is preliminary. Neither my own transcriptions nor those in the dictionary take into account variation in pronunciation that I observed within Maruranau and over the Wapishana area as a whole. I have chosen to avoid this area in recognition of the WWA's current efforts to standardise the orthography of the Wapishana language, and for this reason have adopted their transcription even in cases where it seemed to differ in some respect from the way terms were pronounced by particular Wapishana speakers. WWA's programme of Wapishana literacy is ongoing, and I recommend that future researchers with an interest in the Wapishana language seek their collaboration.

Appendix 1: Wapishana Tree Names Recorded

Wapishana name	Creole name	Scientific Identification	Source[1]
A'akush		*Manilkara excelsa:* Sapotaceae	2
Achadam		*Rheedia benthamiana:* Guttifereae	2
Adori yauwun	Whitee	*Inga* sp.: Leguminosae (Mimosoideae)	3
Aisharukun			
Ana[2]		*Sloanea grandiflora:* Elaeocarpaceae	1
Aopara	Hububalli	*Loxopterygium sagotii:* Anacardiaceae	2 3
Autaka	Wild guava	*Myrcia* sp.: Myrtaceae	3
Apichau			
Arakiki			
Atamundari			
Atorotan		*Hymenolobium* sp.: Leguminosae (Caesalpinioideae)	2
Awadikun			
Bachi Kauzu			
Bai'izi[3]		*Lecythis holcogyne:* Lecythidaceae	2
Bakoparakun			
Bakopara[4]		*Pouteria sericea:* Sapotaceae	2
Barai			
Barawadi[5]	Purpleheart	*Peltogyne porphyrocardia:* Leguminosae (Caesalpinioideae)	2 3 4
Barotaba'u	Yarola	*Aspidosperma excelsum:* Apocynaceae	3
BichiTokoro[6]		Cf. *Licania:* Chrysobalanaceae	4

[1] Sources of glosses of Wapishana terms:

1. Identification in field from van Roosmalen (1985a) or Gentry and Vasquez(1993).

2. Inferred from Wapishana name using Mennega et al. (1988).

3. Inferred from Creolese name using Mennega et al. (1988).

4. Inferred from statement of similarity to category already identified.

'G' next to a number indicates that this method was used to identify to genus.

'F' next to a number indicates that this method was used to identify to family.

[2] Less commonly given Wapishana name **powi'izi kuna.**

[3] Menneger et al. (1988) also list *Chytroma praeclara* under this name, as the 'equivalent' to *L. holcogyne* in the Kanuku mountains.

[4] Menneger et al. (1988) also list *P. grandis*, a riparian tree found along the Rupununi, under this name

[5] Similar to **daba**.

[6] Fruit larger than that of **tokoro.**

Wapishana name	Creole name	Scientific Identification	Source[1]
Borokushu		Palmae	
Bowao[7]		*Tetragastris altissima/panamensis:* Burseraceae	1
Bowaokun			
Buktori[8]		*Coutaria oblongifolia:* Lecythidaceae	1 2
Buru		Palmae	
Burishi		Palmae	
Chaakoi nyukunun[9]	Silvaballi	*Aniba riparia:* Lauraceae	1
Chaawudu		*Attalea dahlgreniana:* Palmae	1
Chibirikiti[10]			
Chiikada imidia	Chiikada partner'	cf. *Licania* : Chrysobalanaceae	4
Chiikada[11]	Tokoro partner	*Licania* cf. *kunthiana:* Chrysobalanaceae	1
Chimari'i			
Chiu[12]		*Tabebuia stenocalyx:* Bignoniaceae	2?
Choona		*Bombax surinamense/globosum:* Bombacaceae	2
Choowantan			
Choowuriktaina		*Guettarda acreana:* Rubiaceae	2
Daawiko[13]		cf. *Quiina* : Quiinaceae	1
Daba	Purpleheart	*Peltogyne porphyrocardia:* Leguminosae (Caesalpinioideae)	2 3
Dadizowao			
Daradara			
Darokai			
Darori			
Diborowudi			
Didad kun			
Dido'u			
Diparatan[14]		*Chrysophyllum argenteum:* Sapotaceae	2
Doowaki			
Dyakara[15]	Bush Whitee	*Inga alba*: Leguminosae	1G 2 3G

[7] Fruits always multi-segmented. Menneger et al (1988) give Wapishana name '**asau**' for *T. altissima.*

[8] [F] Identified in field as *E. confertiflora*, which has been re-allocated to *Lecythis*. Menneger et al. (1988) put *E. conduplicata* under this Wapishana name.

[9] Informants report the existence of 2 kinds

[10] Fruits look 'just like tomato'.

[11] Informants report the existence of 2 kinds: riparian and forest.

[12] '**Sio**' in Menneger et al. (1988).

[13] Maybe *Froesia.*

[14] Menneger et al. (1988) also list the rarer *Pouteria burchelliana* as having the same Wapishana name.

Wapishana name	Creole name	Scientific Identification	Source[1]
		(Mimosoideae)	
Dyam			
Dyamukun			
Dyo			
Dyokunudi	Iteballi	*Vochysia* sp.: Vochysiaceae	3
Dyuburwuda			
Dyuburwudakun			
Ichi			
Ichori			
Ichorikun			
Idina'a			
Ina'okakun			
Ipan[16]		cf. *Ceiba* : Bombacaceae	1
Irikuwa		Virola *sp.: Myristicaceae*	2
Ishauzu		cf. *Quiina* : Quiinaceae	1
Itikizi			
Iziari	Balata	*Manilkara bidentata:* Sapotaceae	1 2 3
Iziiyarakun			
Kaamani'u[17]		*Pourouma* sp.: Moraceae	1
Kaawai		*Micropholis venulosa:* Sapotaceae	2
Kaboowi			
Kadunuba			
Kaikaiada			
Kakutuba			
Kamadiwai			
Kamami'o			
Kaoraokun			
Karabauna			
Karaboao	Crabwood	*Carapa guianensis:* Meliaceae	3
Karashai			
Karawai			
Karimani			
Karimiti Aradau			
Kashokau'u			
Katowari	Cow-wood	*Bagassa guianensis:* Moraceae	1 2 3
Kawara'o			
Kawarori	Wild cashew	*Anacardium giganteum:* Anacardiaceae	1 2 3
Kawaz			
Kazarazowao		cf. Sapotaceae	1
Kaziman		*Couma macrocarpa:* Apocynaceae	2
Kazowaidipara			
Kibio			
Kimiti	Sweet cedar		

[15] *I.alba* was identified differently elsewhere in the present study.

[16] Member of Ceiba alliance: *Ceiba, Chorisia* or *Spirotheca*

[17] Distribution corresponds with that described for *P. guianensis* in Menneger et al. (1988).

Wapishana name	Creole name	Scientific Identification	Source[1]
Kobadi[18]		*Euterpe sp.:* Palmae	4
Kochoizan	Hill Manicole	*Euterpe sp.:* Palmae	3 4
Kodidi		*Calliandra tergemina:* Leguminosae (Mimosoideae)	1
Kododotan			
Kodoi aotakan			
Kodoi aridu'i[19]	Whitee	*Inga laterifolia:* Leguminosae (Mimosoideae)	1 2G 3G
Kodoi waunu			
Kokowiiz			
Komaro			
Konowarizanoba		*Tabebuia capitala/serratifolia:* Bignoniaceae	2
Koobiki	Whitee	*Inga ingoides:* Leguminosae (Mimosoideae)	1
Koram[20]	Bush Whitee	*Inga alba*: Leguminosae (Mimosoideae)	1 2G
Koorau ma'apaiz	'Mongoose pawpaw'		
Korii		*Buchenavia fanshawei:* Combretaceae	2
Korokorobauawun			
Koron	Baromalli	*Catostemma fragrans:* Bombacaceae	1 2 3
Korowaarii	White simarupa	*Quassia simarouba:* Simaroubaceae	3
Korua'akun			
Korwaariikun			
Kosharazaada'o	'Deer saliva'	*Calycopus revolutus:* Myrtaceae	2
Koto'u	Dali	*Virola surinamensis:* Myristicaceae	1 3G
Koutainaka			
Kubaitan			
Kubaitankun			
Kubaowii			
Kumarakoun[21]		*Ficus insipida:* Moraceae	1 2
Kumiti			
Kuruwachikuun			
Kuzowa (kizora)		*Nectandra surinamensis:* Lauraceae	2
Kuzuwaipari			
Liwa	Bamboo	*Guadua angustifolia:* Gramineae	3

[18] Similar to **wabo.**

[19] Menneger et al (1988) list *L. fagifolia* under this Wapishana name.

[20] Menneger *et al.* (1988) list 2 other species of *Inga* under the name '**kuran**'. It is possible that in these cases the Wapishana term might have been employed in its more general sense, so it is prudent to regard these as dubious.

[21] Menneger et al. (1988) gloss this name as *F. mathewsii*. Fruits appearing different to those of *F. insipida* were observed in the field, but not reliably identified to species. This category probably includes more than one biological species.

Wapishana name	Creole name	Scientific Identification	Source[1]
Ma'achai kun			
Ma'achaiwaron		*Diospyros lissocarpoides:* Ebenaceae	1
Maa'oo			
Ma'arasao			
Ma'aso	Wild mango	*Andira surinamensis:* Leguminosae (Papilionoideae)	2
Machi			
Machu'a			
Madakakowau			
Madara tain	Hasa ear		
Madikaru	Tatabu	*Diplotropus purpurea:* Leguminosae (Papilionoideae)	3
Manauzu	Whitee	*Inga* sp.: Leguminosae (Mimosoideae)	3
Manikushu			
Mapuza	Low	*Oenocarpus bacaba:* Palmae	1 3
Maran[22]		*Copaifera pubiflora:* Leguminosae (Caesalpinioideae)	2
Maroo'a	Haiawa	Protium *sp.: Burseraceae*	3
Marushobi	Bitter tree	*Geissospermum argenteum:* Apocynaceae	2
Mashimkaro		*Cordia exalta/fallax:* Boraginaceae	2
Mashomadi			
Mashuupara			
Mawaorakun		*Trichilia pleeana:* Meliaceae	2
Mazikidakutan[23]			
Minau	Brazilian nut	*Bertholletia excelsa:* Lecythidaceae	1 3
Mini			
Minikun		*Tovomita obovata:* Guttiferae	2
Miruwai			
Naata	Locust	*Hymenaea courbaril:* Leguminosae (Caesalpinioideae)	1 2 3
Nyuzdoko			
Ochoro	Turu	*Oenocarpus bataua:* Palmae	1 2 3
Omatikun			
Onam			
Onaroa			
Oozo			
Oranakaozoo	Laba cheeks'	*Pouteria* sp.: Sapotaceae	1
Orimara		*Ternstroemia dentata:* Theaceae	2
Orotum		*Byrsonima stipulacea:* Malpighiaceae	2
Otoochi		*Manilkara* sp.: Sapotaceae	1
Owaomadi		*Apeiba glabra:* Tiliaceae	1

[22] Johnston and Colquhuon (1996) also report a species of *Copaifera* under this name, but without specifying the language. However, as both produce edible oils it is likely that they are identical or closely related.

[23] Bark 'looks like corn cob'.

Wapishana name	Creole name	Scientific Identification	Source[1]
Owawashi			
Owawashikun[24]			
Ozodakun		*Trichilia pallida:* Meliaceae	1
Paipaichimaron			
Paizi	Leperwood	*Bromsimum guianense:* Moraceae	2 3
Pamuntauzu[25]	Wamara, horse eye	*Swartzia leiocalycina:* Leguminosae (Papilionoideae)	1(F) 3
Parank	Red Cedar	*Cedrela odorata:* Meliaceae	2 3
Parati'itan			
Pichabai	Footie	*Jacaranda copaia:* Bignoniaceae	3
Pii'a		*Pouteria* sp.: Sapotaceae	1
Pito			
Pitoro			
Pitorokun			
Piwari[L]	Kabukale	*Goupia glabra:* Celastraceae	3
Pokoridi	Kokerite	*Attalea regia:* Palmae	1 2 3
Poo'a		*Pouteria speciosa:* Sapotaceae	2
Poo'akun		*Pouteria cladantha:* Sapotaceae	2
Poorau			
Powato tain			
Powish abawun		*Toulicia guianensis:* Sapindaceae	2
Powizkun[26]			
Purutayawun			
Raparapa		*Pouteria* sp.: Sapotaceae	1
Raparapakun			
Rirou	Jumbie bead tree	*Ormosia* sp.: Leguminosae (Papilionoideae)	1 3
Rokodatawada			
Roomamaodi		*Apeiba echinata:* Tiliaceae	1 2
Roomi au		*Sacloglottis cydonioides:* Humiriceae	1
Roomi dukodokun		cf. *Leonia* : Violaceae	1
Sakura'i			
Saonora[27]			
Shauram niizu		Palmae	
Shawarau		*Astrocaryum jauari:* Palmae	1
Shiidi			
Shii'o		*Rinorea* sp.: Violaceae	2
Shiwishiwai			
Sho'oruku			
Shurara	Whitee	*Inga* sp.: Leguminosae (Mimosoideae)	3
Shuryan		Palmae	1
Soburo wachin,	Baboon watch'		

[24] Similar to **owawash** but 'it grow a bit higher'

[25] Menneger et al (1988) give this species the Wapishana name '**shiraip'.**

[L] Timber often confused with crabwood.

[26] Named after **powiz** (annato).

[27] 'Partner' to **kibio.**

Wapishana name	Creole name	Scientific Identification	Source[1]
Shakokomichiz			
Sokori dai	Redwood	*Centrolobium paraense:* Leguminosae (Papilionoideae)	2 3
Soomamadi[28]		*Couratari a oblongifolia:* Lecythidaceae	1
Suruan			
Suuzan	wild banana		
Taabarakun			
Taabaru[29]		*Tetragastris altissima/panamensis:* Burseraceae	1
Taamada[30]	Kakarale	*Eschweilera wachenheimii:* Lecythidaceae	1 2G 3G
Taaraindikau			
Taasho	Jennypip	*Muellera frutescens*: Leguminosae (Papilionoideae)	3
Takooza'i		*Cordia alliodora:* Boraginaceae	2
Takuba		*Swartzia dipetala:* Leguminosae (Papilionoideae)	2
Tamaru'otan		*Terminalia amazonia:* Combretaceae	2
Tamkun		*Touroulia guianensis:* Quiinaceae	2
Tapozai		*Cordia alliodora:* Boraginaceae	2
Tapozaikun			
Taramir			
Tararam ikun			
Tarokun			
Timito	White cedar	*Tabebuia* sp.: Bignoniaceae	3
Tiwit Kaiwaidikari	Partner to toowizai		
Tiziitiziiadi			
Tokoro[31]	Counter	*Licania majuscula:* Chrysobalanaceae	1 2 3
Tomadi			
Tonara[32]		*Manilkara huberi:* Sapotaceae	2?
Toona			
Toora	Congopong	*Cecropia sciadophylla/angulata:* Moraceae	1 2 3
Toriziu	Bush hog plimpler		
Towan			
Tyi'o			

[28] Same species identified as **buktori** by some informants

[29] Fruits always single-segmented.

[30] Menneger et al. (1988) list *E. subglandulosa* and *E. sagotiana* as having this Wapishana name.

[31] At least one other species of *Licania* was identified under this Wapishana name in the field. Menneger et al. (1988) list 3 species under this Wapishana name: *L. alba, L. densiflora* and *L. majuscula.* The Creolese name counta also refers to various species of *Licania*.

[32] Listed as '**Turar'** in Menneger *et al*. (1988).

Wapishana name	Creole name	Scientific Identification	Source[1]
Waataba[33]		*Paloue guianensis:* Leguminosae (Caesalpinioideae)	1
Waazinidi			
Waazu	Akuyuro	*Astrocaryum aculeatum:* Palmae	1 3
Wabo	Manicole	*Euterpe stenophylla:* Palmae	1 2 3
Wabokun			
Wada			
Wain		*Glycydendron amazonicum:* Euphorbiaceae	2
Waiwaitan			
Wakokowadi			
Wamooko[34]		*Parinari excelsa:* Chrysobalanaceae	1 2G
Wamoro taba'i			
Wanum			
Waramataba'u			
Warowaro			
Wasara		*Sloanea* sp.: Elaeocarpaceae	2
Wasarakun			
Wauraawun	Crab eye	*Moutabea guianensis:* Polygalaceae	1
Widu'oko			
Wizain[35]	Kumaka	*Ceiba pentandra:* Bombaceae	2 3
Wunutan			
Wunzara			
Wurada mapaiz		*Fusaea longifolia:* Annonaceae	1
Wurada urud	Whitee	*Inga* sp.: Leguminosae (Mimosoideae)	3
Wuzaawara			
wuzamnari			
Yamara			
Yazi yazi		*Dugetia sp.:* Annonaceae	1
Zaanai	Maho, manawur	*Sterculia or Xylosterculia:* Sterculiaceae	2 3
Zaara			
Zodakun			
Zodu		*Parinari* cf. *campestris:* Chrysobalanaceae	1
Zokoto[36]		*Couratari oblongifolia:* Lecythidaceae	1
Zuumu		*Xylopia nitida:* Annonaceae	2
Zuupu	Plum	*Spondias mombin:* Anacardiaceae	1 2

[33] Possibly genus *Elizabetha*

[34] Menneger et al. (1988) list *P. campestris* and *Hirtella obidensis* under this Wapishana name

[35] Informants report that this species flowers when leafless, which suggests it is in fact a member of the related genus *Chorisia*, although this contradicts the field identification

[36] Menneger et al. (1988) list *Mezilaurus lindaviana* under the Wapishana name '**rukut**'.

Appendix 2: Wapishana Animal Names

Wapishana Name	Creole Name	Scientific Gloss	Source[37]
Kotu'uzanao	**Birds**	**Aves**	
anoan	carrion crow	*Cathartes* sp./spp.	1
anarao		*Dendrocygna bicolor*	1
arodawuzoo		*Nyctidromus albicollis*	2
aronao	tiger bird	*Tigrisoma lineatum*	2
yaarini		*Rodager nacunda*	2
aranao		*Botaurus pinnatus*	2
bai	duck	*Cairina moschata*	1
baiauz	small duck	*Dendrocygna autumnalis*	2
bakuru'uzu		*Malacaptila fusca*	2
bananoro	king vulture	*Sarcoramphus papa*	1
bididi	wisiwisi duck	*Dendrodygna viduata*	1
bishawu			
borashawa	parrot	*Amazona amazonica*	2
budibud		*Chardrius wilsonia*	2
bururu	eagle	*Falco sparverius*	1
chaimi'izi		*Crypterellus obsoletus*	2
chaakoi	toucan	*Ramphostos cuvieri*	1
charaakwaru		*Euxenura maguari*	2
chaun		*Elanoides forficatus*	1
chibchibirin			
chiipip		*Chelidoptera tenebrosa*	2
chiiz		*Rostrhamus sociabilis*	1
chipipi		*Steatornis caripensis*	2
chipio,towizo		*Caprimulgus nigrescens*	2
chirichiizi		*Bursarellus nigricollis*	2
chuzaakoo		*Milvago chimachima*	1
chiziiki	parakeet	*Aratinga pertinax*	2
choobitu		*Ramphocelus carbo*	2
chowau	night owl	*Lophostrix cristata*	2
chowirori			
chuwachuwa		*Xiphorhynchus triangularis*	2
dakachi		*Deropytus accipitrinus*	2
daakari	quail	*Colinus cristatus*	1
dio			
diri-diri		*Vanellus chilensis*	1
doidoi		*Hoploxypterus cayanus*	2
doidoi		*Calidris minotilla*	2
dyauyari		*Leucopternis schistacea*	2
fada		*Arundinicola leucocephala*	1
ikiki		*Titrya cayana*	2
irodada	pigeon	*Leptotila* sp.	2
ishdawu'u	eagle	*Elanus leucurus*	2
ishdawu'u			
kabishako		*Icterus chrysocephalus*	2

[37] Sources of glosses of Wapishana terms:
1. Field identification using Emmons and Feer (1997) or Schaunsee and Phelps (1978)
2. Identified by informants from illustrations in Emmons and Feer (1997) or Schaunsee and Phelps (1978)
3. Inferred from informants' decription of appearance and behaviour of animal
4. Inferred from local use of English name

Wapishana Name	Creole Name	Scientific Gloss	Source[37]
kadipi		*Jacana jacana*	2
kaikai		*Aratinga leucophthalmus*	2
kamotiptip			
kaonari		*Rupicola rupicola*	2
karakarau		*Polyborus plancus*	1
karapo		*Ortalis ruficauda*	2
katorizo	etai macaw	*Ara manilata*	1
kazaru	macaw	*Ara ararauna*	1
kiizu	toucan	*Ramphostos* sp.	2
kochoi		*Pipile pipile*	1
kodoi riiz	seven colour	*Pionites melanocephala*	2
kokitara		*Theristicus caudatus*	1
kokoi		*Harpia harpygia*	1
koratu	toucan	*Pteroglossus pluricinctus*	1
korum		*Psarocolius decumanus and P. viridis*	
korokorobaa		*Trogon* spp.	1
korokoro		*Mesembrinibis cayennensis*	1
kotari		*Perissocephalus tricolor*	2
kotati		*Daptrius americana*	1
kowadiri		*Buteogallus urubitinga*	1
kowam	woodpecker	*Campephilus rubricollis*	2
kowam	woodpecker	*Dryocopus lineatus*	1
kowariparu		*Burhinus bistriatus*	1
kozubo		*Turdus serranus*	2
kuwiari	big head macaw	*Ara chloroptera*	1
mam	maam	*Tinamus* spp.	1 2
maitibizin		*Leistes militaris*	2
maakao	eagle	*Herpetotheres cachinnans*	2
maratu	marudi	*Penelope argyrotis*	1
maasowiki	night owl	*Bufo virginianus*	2
mazoauchi			
mikoro			
miso'uza		*Tringa flavipes*	2
motuzu			
namachi	worakobra	*Psophia crepitans*	1
oodaoda	eagle	*Falco femoralis*	2
odoo	dugler bird	*Phalacrocorax olivaceous*	2
odoo		*Motomus motoma*	2
onoro	crane, tiger bird	*Tigrisoma lineatum*	2
oora	marudi	*Penelope jacquaca*	2
oromotokoko	night owl	*Otus choliba*	2
orumotokuko		*Aegolius harrisii*	2
owi		*Crotophaga ani*	1
ozoru		*Ciccaba virgata*	2
pada-pada	pigeon	*Zenaida auriculata*	1
paipaicham			
pantiru		*Monasa atra*	1
parantarai	cotton bird		
parikwara	sparrow	*Ammodramus humeralis*	1
pazowaaz		*Brachygalba lugubris*	2

Wapishana Name	Creole Name	Scientific Gloss	Source[37]
pimudu	hummingbirds		
pishtodao		*Pitangus* sp.	2
poorau		*Caprimulgus cayennensis*	1
pawish	powis	*Crax* spp.	1
saabobo		*Nyctis* sp./spp.	2
saa'oo	kingfisher	*Ceryle torquata*	1
sara'o		*Camylorynchus griseus*	1
saropizo		*Reinarda squamata*	1
sau		*Zebrilus undulatus*	2
sau		*Butorides striatus*	2
shaakoo	macaw	*Ara macao*	1
shibobu	night owl	*Speotyto cunicularis*	2
shinini		*Cyanocorax cayanus*	2
shiushiu		*Panyptila cayennensis*	2
shizori		*Sturnelia magna*	2
sokoko		*Tyrannus dominicensis*	2
sowisu			
suuzu suuzu	scissortail bird	*Muscivora tyrannus*	1
suuzuam		*Chaetura cinereiventris*	2
		Micropanyptilix fuicata	2
suwisu			
taara	crane	*Phimosus infuscatus*	2
		Cercibis oxycera	2
taotao	parrot	*Amazona farinosa*	1
tararam	crane	*Jabiru mycteria*	2
taratoru		*Aramides* sp.	2
tawabo	eagle	*Micrastur* sp.	2
tibio	eagle	*Buteo nitidus*	2
tiwio		*Myiarchus venezuelensis*	2
tuzii-tuzii		*Buteo albicaudatus*	2
toikarai		*Pionus fuscus*	2
to'okori	bush quail	*Odontophorus gujanensis*	2
towi	parrot	*Pionus chalcopterus*	2
tusham	woodpecker	*Celeus flavus*	2
twatwa dyo		*Sporophila obscura*	2
uridu	dove	*Columbina/Columba*	2
uwaazdukori	robin	*Pyrocephalus rubinus*	2
waaram	pigeon	*Geotrygon violacea*	2
waash	cashew bird	*Mimus gilvus*	2
waikaa		*Gallinago* spp.	2
waitokoku	pigeon	*Columba* spp.	2
waiyaka		*Tringa solitaria*	2
waakara	crane	*Casmeriodius albus*	2
wako	duck	*Cochlearius cochlearius*	2
		Pitherodius pileatus	2
wakokoo	pigeon	*Columbina cayennensis*	1
wamoroo		*Crypturellus undulatus*	2
wanawanari	seagull	*Rynchops nigra*	2
waro	parrot	*Amazona ocrocephala*	1
waru		*Bubuleus ibis*	2
washnao	crane	*Ardea herodias*	1
wato	johnny crow	*Coragyos atratus*	1

Wapishana Name	Creole Name	Scientific Gloss	Source[37]
waioozu	crane	*Mycteria americana*	2
wiirom	chicken hawk	*Heterospizias meridionalis*	1
wiitii		*Coccyzus melacoryphus*	2
wunudari		*Lesbia nuna*	2
wushuzu		*Elaenia* sp.	2
wutu'uzu			
wu'utuuzu		*Emberizoides herbicola*	2
wu'uwuzo	night owl	*Glaucidium brasilinium*	2
yaroim		*Anhinga anhinga*	1
yiriiri		*Eurypyga helias*	1
zati'izu		*Picumnus exilis*	2
zia		*Playa cayana*	1
zopopu		*Myrmothera campanisona*	2
zoruwi		*Crypterellus* sp./spp.	1 2
Aimaakannao			
adori	accouri	*Myoprocta acouchy*	1
adorom	small waatrash	*Cavea apevea*	2 3
aro	deer	*Odocoileus virginianus*	1
aro din	savannah deer tiger	*Puma concolor*	2 3
ao	sloth	*Bradypus didactylus*	1 2 3
bakuru	abuya	*Tayassu tajacu*	1
bichi	kairuni	*Tayassu pecari*	1
chaumaa		*Saimiri sciureus*	1
kapash	armadillo	*Dasypus* spp.	1 3
kapash biaro	armadillo	*Cabassous unicinctus*	1
karicho	squirrel	*Sciurus aestuans*	1
kasho	waatrash	*Hydrochaeris hydrochaeris*	1 2
katabaro din	bushrope tiger	*Leopardus pardalis*	(1) 2
kinaridi din	cotton tiger, jaguar	*Panthera onca*	2 3
kodoi	bushcow	*Tapirus terrestris*	1
korau	mongoose	*Eira barbara*	1
korii	small rat		
koshara	bush deer	*Mazama americana*	1
koshara din	deer tiger, puma	*Puma concolor*	2 3
kowachi		*Nasua nasua*	1
kowachi din			
kowito din	lizard tiger	*Leopardus tigrinis*	3
maroro	giant armadillo	*Priodontes maximus*	2 3
niinito		*Galictis vittata*	2 3
nyoobao	crab dog	*Lontra longicaudis*	1
oran	laba	*Agouti paca*	1
oroa		*Pithecia pithecia*	1
oao		*Cebus nigrivattus*	1
pashim	anteater	*Myrmecophaga tridactyla*	1
porau'ian din	wild banana tiger		
powatu	monkey	*Cebus apella*	1
roomi	spider monkey, kwata	*Ateles paniscus*	1
saaro	water dog	*Pteroneura brasiliensis*	2 3
shishipot	night monkey		
soboru	baboon	*Alouatta seniculus*	1

Wapishana Name	Creole Name	Scientific Gloss	Source[37]
sokoru	agouti	*Dasyprocta agouti*	1
sokoru din	agouti tiger	*Herpailurus yaguarundi*	2 3
sowai	brown bush deer	*Mazama gouazoubira*	2 3
tamariu	bats	*Rhynchonycteris nasa*	1
tikazi din	fire tiger	*Panthera onca*	3
wishi		*Chiropotes satanas*	1
waariki	tamandua	*Tamandua tetradactyla*	1
waasa	small yawari	*Marmosops parvidis*	1
waasa	small yawari	*Graerlinanus microtorus*	1
waruuzu	fox	*Cercodyon thous*	1
wichaa waru		*Spoethos venaticus*	3
witaro	sakiwinki	*Saguinus midas*	1
wurada din	turtle tiger	*Panthera onca*	3
yawari		*Didelphis* spp.	3
ziwara	porcupine	*Coendou prehensilis*	1
atoru	alligator	*Caiman* spp.	1
kanawada	caiman	*Melanosuchus niger*	3
yuburu	stingray		
kasomi	electric eel		
kankorun	scorpion		
oori	scorpion		
sawariro			
kodoi maud	bushcow comb		
chiririn			
shishiba'i	centipede		
wuuzizo			
pazaro			
Kopoinao	Fish	**Pisces**	
achimara	haimara		
awuzapa	big pacu		
chawuridi	skin fish		
chaariru			
chuiuntoi			
kotii			
dyuburu	larger patwa		
goyõgoyõ	koyu koyu		
irichap			
izawadu	big dawala		
kadadaparo	small pacu		
kamonaru	dari		
karaashai	yarrow		
katuzuda	larima		
kinidu	small cassi		
kinidudari	cassi daddy		
kizipi			
konoroi	mullet		
komaro	dark pacu		
koruzu	tiger fish		
kororu			
korumasa			
madari	black hasa		

Wapishana Name	Creole Name	Scientific Gloss	Source[37]
mairi	smaller dari		
matuzaba			
motudi	small patwa		
orodada	skin fish		
otoo	mokomoko hasa		
paraorim	banana fish		
pirain	perai		
poroaba	dawala		
saabau	small pacu		
sorusaba	sunfish		
waroroo			
wararim			
wabazi	creek logologo		
waitao	white pacu		
wayo'amari	bush creek yarrow		
waru	brown skinfish		
yokonori	bigger logologo		
Koazazaunao	**Snakes**	Serpentes	
achimera'i	haimara snake		
aro ba'izin	deer whip		
azanada'i			
baraka dyo	small labarria		
dawaawa'i	land camoudi	*Constrictor constrictor*	4
dyupushanari	rattlesnake		
inizi'o	krawa snake		
ishazaro	labarria	*Bothrops atrox*	4
kadada zaapun	land camoudi		
kanoko san	bush master	*Lachesis muta*	4
karanari			
kokidi	acoushi ant snake		
korikori'i	file snake		
pakoba'i	camoudi	*Eunectes murinus*	4
pinidin	rattlesnake	*Crotalus terrificus*	4
podau			
sakotakii	rattlesnake		
shaakowai	macaw snake		
shiidaro			
somara'i	bow snake		
waro'i	parrot snake		
watuwatuzo			
yamaariwa'o			
Koiti'inao	**Lizards**	**Sauria**	
ancha			
atamunu pokuzun, atamunu kodinuuzu			
atokwari			
atukari		*Tupinambis negropunctatus*	4
chabazori			
didiza			

Wapishana Name	Creole Name	Scientific Gloss	Source[37]
ipikomoru			
pokozu			
saarowaaro			
sowan		*Iguana iguana*	1
tomtom			
Wuradanao	**Turtles**	**Testudinata**	
aa'uu	turtle		
arawish	turtle	*Phrynops or Podocnemis*	3
dazao	water turtle		
dyaoruka	turtle		
matada	water turtle	*Podocnemis expansa*	1
mata-mata	water turtle		
wurada	tortoise	*Geocheleone* spp.	1
Kibaroanao	**Frogs**	**Anurana**	
anizo	frog		
kodazo	frog		
konowaro	frog		
koraawin	frog		
parii	frog		
poipoi	frog		
tororoba	frog		
tuzao	frog		
Panaokazinao			
basharao	cockroach		
chiiki	bee		
chiwao	grasshopper		
dizodaarai	butterfly		
katudainao			
kiboo			
manuru			
mario	kabora		
mashumash			
miso	mosquito		
paraarii			
pi'isoru	cricket		
sapuzutuz	dragonfly		
shiwai	bee		
siboru misson	baboon mosquito		
suruwud			
tarobaro	fly		
wam	bee		
wainam	big grasshopper		
zi'izip	fly		
Kapudi	marabunta (wasp)		
aro kapudi	deer marabunta		
ba'itu kapudi	shoot man marabunta		
chimichimarokapudi			

Wapishana Name	Creole Name	Scientific Gloss	Source[37]
i'ian kapudi			
iwi kapudi	'lady own' marabunta		
kadipaiz kapudi			
kapash kapudi	armadillo marabunta		
kowai kapudi			
mabaru			
potari kapudi	pan marabunta		
to'otori kapudi	nail marabunta		
tootu kapudu			
tui kapudi	penis marabunta		
wuwuuzu	owl marabunta		
Owaunao	snails		
bochoochu	snail		
bokodi	snail		
irikish	snail		
owau	snail		
warorau	snail		
Wuuri	crabs		
barara	crab		
mapaari	crab		
wuuri	crab		
Matinao	ants		
chiriparu	ant		
kaashoro	ant		
koki	ant		
kokibaro	ant		
kumitiiz	ant		
maruu	ant		
minai	ant		
minaitokorun	ant		
pudiizo	ant		
wiiko	ant		
zaatu	ant		
zakaoru	ant		
Soowanao	spiders	Chelicerata	
miiki	spider		
soowa dari	big spider		
(sowa) oao	monkey spider		
Taruwiinnao	caterpillars		
awataku/guayabu'in	caterpillar		
dyuwuuzu'in	etai caterpillar		
kinyaridi'in	caterpillar		
kizam dari	caterpillar		
ko'in	caterpillar		
mangoro'in	caterpillar		
ma'oin	tree caterpillar		

Wapishana Name	Creole Name	Scientific Gloss	Source[37]
somi'in	tobacco caterpillar		
suuzin	banana caterpillar		
tobuchi'in	cashew nut caterpillar		
zario	caterpillar		