CHAPTER 9

Ethnobiodiversity Surveys of Human/Ecosystem Relationships

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Introduction

Civilizations are founded on the surplus of nature and paradoxically their sustainability is threatened by human misuse of nature. Environmental transformations within the natural systems of most Pacific Islands have often been purposeful. They vary in intensity from profoundly changing the environmental structure to subtle alterations of species composition and relative abundance. Consequently, although landscape transformations do result from human intervention as well as natural processes (see Turner, et al., 1990; Wilson, 1992), human beings, through cultural patterns of behavior and rationale, are the key agents of the alterations. These can be minimized through the application of appropriate resources management practices.

The purpose of the Pacific Asia Biodiversity Transect (PABITRA) studies is to examine biodiversity patterns across the Pacific Islands *sensu* MacArthur & Wilson (1967) and to study island landscapes under the pressures of global change. The methods outlined in this chapter are intended to identify sets of data significant for evaluating environmental transformation associated with human agency. We seek to identify human knowledge about the environment, their decision making logic, as well as their rationale for the intensity and distribution of alterations of natural biological diversity. The PABITRA network recognizes two different and yet related roles of indigenous/local people within the Pacific Islands being studied. First, and foremost, local communities are the stewards (caretakers) of the biological diversity and keepers of knowledge about the biodiversity that has been handed down from their ancestors over millennia. Non-local (outsider) scientists should never forget this central relationship. Second, because knowledge is produced through their own intimate interactions with the environment, members of local communities are the best people to conduct basic research and to gather data about their own patterns of interactions with the biological diversity. For instance, Maori scholar Linda Tuhiwai-Smith (1999) elaborates on the potential for misinterpretation and misrepresentations of local environmental knowledge [and human environmental relationships] in her discussion of the inherent tensions produced when outside researchers assume the role of purveyors of indigenous cultural knowledge.

This chapter is structured around three parts. Part I focuses on the **rational or scope** of conceptual arguments about human-environment interactions. Attention is also given to the impacts that global linkages of trade and geo-politics can have on local biodiversity. We include a simplified model to illustrate these interactions. Part II is a set of postulate**s** that form a basis for future ethno-biodiversity investigations. Part III describes a PABITRA-tested methodology for conducting ethno-biodiversity research. The treatment is by no means exhaustive since we go into some detail about a small set of ethnographic methods and have only mentioned the many others that ethno-botanists use. Since the discipline of ethnobiology is rapidly emerging (Salick et al. 2003) we expect the range of research questions and methods to be in flux for some time. Nonetheless, we anticipate that the conceptual arguments as well as the research methods outlined here will be useful for outsider scientists and local communities in their transect-wide studies and hypotheses formulation. The ultimate aim of the methods presented here is to foster decisions that give rise

to wise resource management and conservation of natural biodiversity in the Pacific and other traditional semi-subsistence economies.

Part I: Rationale or Scope

Culture and Resource Use

Since one aim of PABITRA is to understand the nature of human environmental interaction for the purpose of moderating the pace and direction of change, it is important also to understand *why* particular choices are made that affect biodiversity. Answers are needed for why human agents leave some natural areas relatively undisturbed (exhibiting a low level of interaction); destroy or drastically degrade some natural ecosystems; deliberately or unwittingly introduce alien species; and why some groups seek to enhance their natural environment. We agree that much of the "why" in human-environmental relations can be understood only through an examination of the *social side* of the equation—that is, through understanding the motivations of individuals and societies that create the "what" (Sack, 1990). This argument implies that the relationship between people and nature everywhere is mediated by culture (the way of life of a group of people). It is the culture that places certain values on nature. Culture influences decisions about desirable levels of individual and community consumption of the products of nature. Culture also shapes environmental attitudes and actions for responsible stewardship. Culture can also be implicated in cases of mindless environmental alteration and degradation.

Traditional cultures are generally considered to have evolved in isolation. This is not entirely true, since there is an historic element that new settlers bring along. This historical element also affects their impacts on the biodiversity. Moreover, contemporary external influences have played apparent isolation barriers are removed. Figure 9.1 is designed to emphasize the connectivity within local communities. It draws attention to the contemporary reality in which local communities are increasingly linked with outside cultures and economies in our hyper-connected world. Each element in the model is explained in the text that follows.

External influences and local biodiversity—External world-views (representing set beliefs and values, attitudes and actions, a sense of right and wrong, notions of what is sacred or profane) are often fully or partially different from those of indigenous communities within the Pacific. For one thing, indigenous cultures of the Pacific have lived in constant awareness of natural limits to resource use because severe environmental consequences of their actions were very soon felt on the small islands they inhabit. When they penetrate into Pacific island communities, external cultures and economies tend to have rapacious impact on the natural environment (for example: phosphate mining in Nauru, military activity in Micronesia and plantation agriculture in Hawai`i.). Furthermore, the hegemonic nature of western technologies, thought and attitudes have had the effect of undermining the confidence of local people with respect to the validity of their own way of life: their environmental ethic, their environmental knowledge, beliefs about the sanctity of nature and natural objects, and the sustainability of their local subsistence economy. Thus penetration by outside influences can and often has given birth to new forms of social consciousness and new relationships with nature and especially new activities that accelerate the pace of environmental transformation. Juvik (1993) has provided evidence of how outside religious ideology can alter traditional environmental perspectives from ones in which people feel a responsibility to conserve resources for future generations, to alternative perspectives that embrace other-worldly views that can lead to a negation of human stewardship of nature. Members of indigenous communities who are shifting their focus from their own cultural traditions to the values of external cultures need to be reassured that their own traditions, (including their "scientific " knowledge and environmental perspectives) have value and should be retained and used.

Ethics, Values and Biodiversity—Ethics and values in the model emphasize the importance of ideology of a culture in decision-making. A community's belief about people's situation in nature, supreme being(s) and supreme forces, justice, and responsibility for others and future generations all influence decisions that people make to use or not use; to protect or not protect species; and to conserve or not conserve biotic (living species) and abiotic (non-living elements) of local ecosystems. Therefore, when it comes to environmental transformation, knowledge about ethics helps to point to why people take certain actions and not oth-

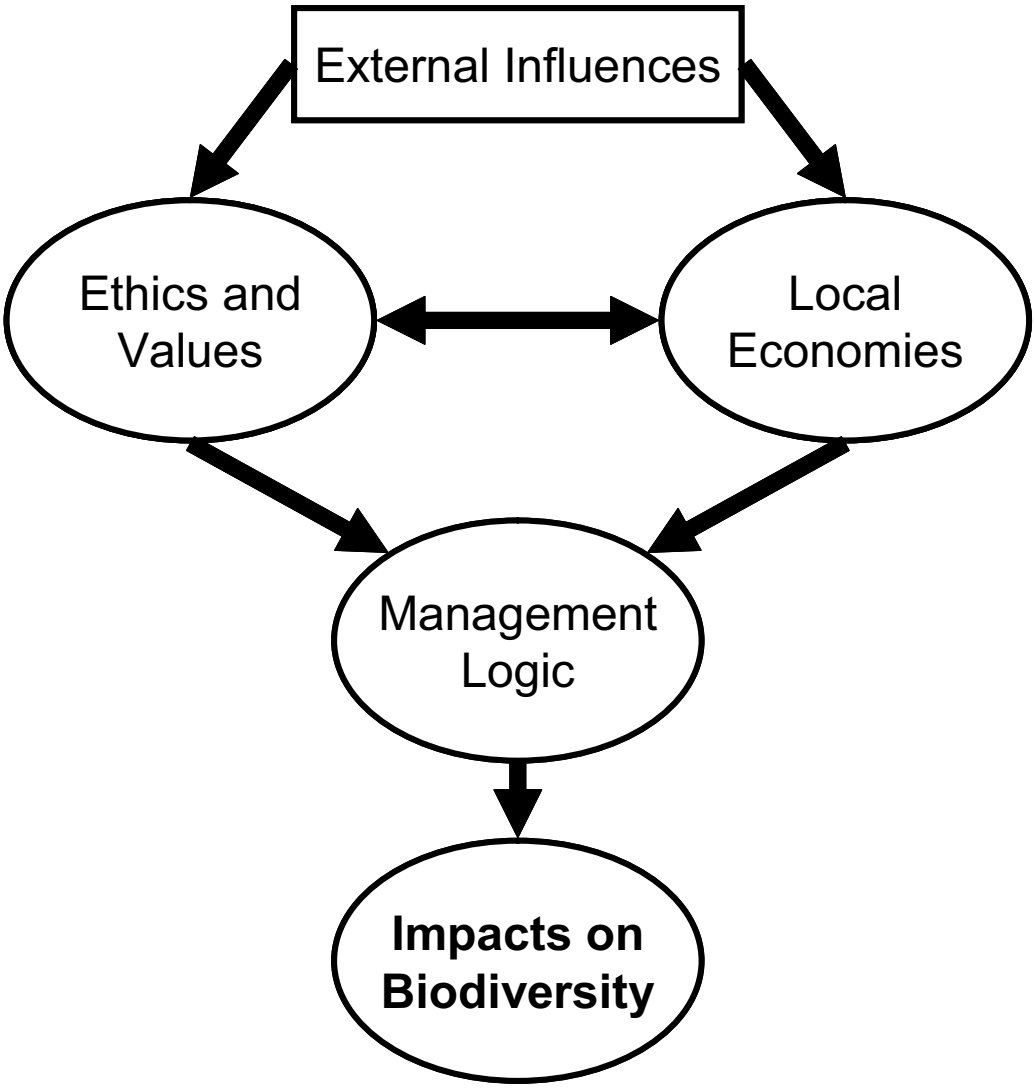

Figure 9.1. Schematic diagram illustrating the interactions within local communities and the external environment.

ers. Ethics in this sense "refers to both the actual moral judgments and actions that people make regarding what they consider to be personally and socially virtuous, right or good, and to the moral reasoning they use to justify such judgments and actions" (Engels, 1993:187). Ethics emerge from a community's system of belief, and they can be altered over time as influences filter into the local community from the external environment. For instance in many Pacific islands indigenous communities do recognize the fragility of overusing certain species of animals or plants. This causes them to impose restrictions upon their usage. Sometimes the "taboos" last for years.

Local economies and biodiversity—The local economy is perhaps the element most susceptible to external influences because it is responsible for stimulating new demand for export (of local commodities like taro and sweet potatoes, phosphates or timber), and new desires for importation of foreign commodities (like

television sets and automobiles). The external forces of causation can be identified and their impacts evaluated. However, as shown in the model the response to external influences may be modulated by local codes of ethics and values.

Management logic and biodiversity—The environmental attitudes and actions of a community are the outcome of the interaction between a community's environmental ethic – its bundle of beliefs and values **about** nature, and the pressures to extract resources **from** nature. Pressures arising from within the community because of high rate of natural population increase, failure to impose restrictions on use of diminishing resources and the weakening of traditional management, do result in loss of indigenous biodiversity. Pressures from outside to extract resources (e.g., lumber or fish) exacerbate the environmental transformation process. Outside influences can accelerate the pace of change of biodiversity.

Rational decision making processes can have unanticipated consequences. Scientists working on conservation of a species may negatively impact another species. There is not an easy way to have all species benefit from scientific decisions. Likewise, when members of a traditional culture use resources from the environment, as they improve conditions for desirable species, other species may be lost.

The management logic employed by members of a community is related to realities of the social context in which people find themselves. In the Pacific islands that context has been primarily 1) production for consumption, 2) limited trade, and 3) low levels of material wealth accumulation. Although, the context of Pacific island communities is quickly changing to one of resource extraction, increasing trade flow, and accumulation of wealth, the traditional management logic is still reliant upon former custom driven experiences. Because of globalization, resource use decisions are increasingly made by those who are more wealthy, international or national governments, or other decision makers lacking local knowledge of the environment, and who lack a long-term perspective or concern about the impacts at a particular place.

Community resource needs and biodiversity

As can be expected from the complexity of interactions between people and the environment implied in the foregoing discussion, there are several approaches to the study of human environment interactions. Here we emphasize cultural ecological and ethnobiological approaches. Both involve combining of ethnographic and biodiversity documentation/ experimentation in varying proportions depending on the research questions being addressed. The general task of these methods is to develop clear understandings of the roles of human communities within specific environments, specifically the nature and rationale of choices that are made. The data collected will allow local and external scientists to obtain a picture of the nature and extent of the human imprint on the landscape, the reasons for the changes observed and the type of management controls. Ultimately these data will provide the basis on which judgments are made about the limits as well as the potential for sustainability of ethnobiodiversity.

Ethnobiodiversity studies that emphasize the choices made by members of local communities made must document the artifacts or *visible imprints* of a culture on the physical environment, People's beliefs, values and attitudes or mental constructs (also called mentifacts), and the local system of governance and processes by which local environmental actions are sanctioned or denied.

Artifacts related to biodiversity—Artifacts or *visible imprints* of a culture on the physical environment are the most salient and easily identified ethnobiological data that is observed. The most common artifacts include houses, fields, tools, canoes, etc. These are the evidence of patterns of human practices and alterations of the environment. The visible imprints of culture on the landscape have links to biological sustainability that has reinforced development of cultural practices. Examples we have observed of cultural artifacts and links to biodiversity are listed in Table 9.1. Other artifacts that have been found of importance include terraces (removal of stones), burial sites, and petroglyphs (Mueller-Dombois et al. 2004).

Beliefs/mentifacts related to biodiversity—Local beliefs about the natural world, and valuations of nature are not always easily articulated but are important because they provide a window onto the world-view of a society. World-views that embrace oneness with nature (monism) versus domination of nature produce entirely different human ecosystem relationships. Researchers must seek to uncover ways in which social institutions and local custom foster conservationist attitudes and values (mentifacts) or the opposite. Exam-

ples we have observed of cultural beliefs and implications on biodiversity are listed in Table 9.2.

Governance systems and processes related to biodiversity

Governance systems by which local environmental actions are sanctioned or denied in Pacific islands are highly varied although two major systems are often used: inherited leadership (chiefs) and acquired/earned (big-man). The processes used for decision making also vary from one community to the next, however, forms of consensus are commonly used that result in a combination of community understanding of the rationale for a decision as well as support for the decision. Together the governance systems and processes form the filter through which past management decisions were determined and through which future decisions must pass in order to be implemented. Examples we have observed of **cultural governance systems and processes** with implications on biodiversity are listed in Table 9.3.

Part II: Human Environmental Interactions

Ethnobiological postulates

Existing research in the Pacific islands provides information by which we can formulate postulates for testing. This is in keeping with the normative practice in science that accepts pre-existing information as a baseline on which to build new knowledge. Prior scientific observations of the authors working in a variety of Pacific Islands allow for the formulation of the following postulates. In each of these the term traditional people is used to refer to members of communities who have lived in specific environments for multiple generations, presumably leading to better understandings of and interactions with those environments.

Postulate 1. Traditional people have understandings of the relationships between the elements in biological and physical environments and understand ecosystem functioning

Pacific islanders' breadth of ecological knowledge and understandings of ecosystem linkages are often similar to those recognized by foreign scientists, but their general explanations may be dissimilar. In addition, indigenous people frequently have good management practices for sustaining biological diversity (sometimes superior to more recently introduced ones), particularly in regions where they have had hundreds or even thousands of years of subsistence survival on the land (Berkes 1989).

Long-term environmental interaction creates an intimacy with an area or place that allows some local community members to observe subtle ecological variations. However, each individual in the group does not hold the collective memory of a culture uniformly. Some individuals have better memories, some are better observers of the environment, some have chosen to compile more knowledge, and others have simply been handed the responsibility to remember and practice what has been learned. For each culture there are a few individuals who are recognized as outstanding bearers of knowledge. Their expertise may be focused in areas such as fishing, hunting, traditional medicine and healing practices, construction, mythology and even governance. But generally speaking, they each hold expertise and collectively contribute to the cultural memory.

Postulate 2. Community experts are the traditional scientists of any culture and are frequently the only persons with social permission to violate rules, experiment, or develop new guidelines for community interactions with the environment

These community experts frequently are the local decision makers and therefore can have a much greater impact upon the community's interactions with elements of the environment than does the average person–insider or outsider. For instance in several locales only the big man or chief has the authority to impose and maintain a ban (or taboo) on the harvesting of certain animal species that form part of the local food supply.

Postulate 3. Traditional experts may be involved in apparently conflicting activities

Traditional experts may be observed to be encouraging conservation of traditional practices and behaviors, while also experimenting with alternative approaches. The activities of such individuals in any culture provide the potential for long-term survival, adaptation and evolution.

Table 9.1 Examples of cultural artifacts and links to biodiversity.

Artifact	Variation	Biodiversity Implications
Settlement siting	Forested area Dry land or coastal areas	Different species lost or enhanced in selection of settlement locations
	Along water courses	Water quality impacts and different species lost or enhanced in selection of settlement locations
Building materials	Rare or abundant species Rapid or slow growing species	Positive correlation between population/settlement growth and community structure, species decline or endangerment
Tools	Canoes, spears, carvings and containers	Forest species rate of loss and replenishment positively correlated with levels of individual and community consumption or trade
Ritual goods	Feathers, foliage and flowers	Community structure, species number and diversity
Food	Hunting, fishing, farming and gathering	Species and population decline or increase—rate of change related to number of humans, population use-pressure, and management
Goods	Surplus for trade	Accelerated rate of loss of natural habitats, possible soil degradation and aquatic contamination if trade is poorly managed
Medicinals	Plants, animals and soils	Level of consumption critical and related to degree of commercialization
Farming system	Native plants and animals or introduced species	Risk of alien species dispersal Increase in biodiversity through development of more complex environments
Field patterns	Contiguous/clustered or scattered	Level of patchiness in landscape with impacts on habitat size and population stability
Use of fire in agriculture	Managed/controlled Not managed	Negative community impacts from fire included forest loss and decreased economic security
Solid waste	Disposal contained Disposal randomized	Implications for water quality and stream biota Alien species dispersal Soil improvement with night soil and compost

Human societies have cultural memories of experiences that have been handed down orally from generation to generation. When a culture first moves into a new environment, the collective memory that is brought may help people to survive and to make decisions about management of resources. Over time, as members of a culture live in a particular environment, they develop an understanding of plants, animals, and ecosystems of that area. Survival of new colonies of humans is dependent upon a mixture of transported knowledge and *in situ* formation of knowledge about specifics of the new environment.

Postulate 4. Cultural longevity is related to resource sustainability

Table 9.2. Examples of cultural beliefs related to biodiversity.

Customs, Beliefs & Values	Variations	Implications for Biodiversity
Land tenure system	Leasehold	Fosters low level of care/maintenance of land resources
	Fee simple (individual or community ownership)	Encourages value adding inputs on land (such as planting trees, safeguarding against soil loss)
Land inheritance system	Primogeniture	? Preservation
	Subdivision	Land fragmentation that may cause land use intensification leading to loss of stability (owenership and ecology)
Religious ideology	Otherworldliness	Promotes low level of concern for future users, limited conservation efforts
	Continuity of life on Earth	Promotes stewardship in support of future land users
Sacred space	Sacred groves of trees Burial places Spirits in nature	Fosters reverence, respect and preservation of valued species
Fear of wilderness	Fear of wild animals	Creates support for removal of forest inorder to remove the threat/fear
Love of nature	Appreciation of nature's beauty and diveristy	Implies attitudes supportive of environmental protection, love of intangible natural assets

As human populations increase in an area, cultural experiences and assumptions are put to the test. If cultural assumptions and facts about the biological environment are sound, then the culture will have the knowledge needed to behave in a manner consistent with the carrying capacity of the land. If the cultural assumptions and facts about the biological environment are not sound, then the culture is not likely to understand enough about the environment to avoid environmental degradation and undermining of their own survival at a place (c.f., the case of Rapanui).

Postulate 5. The longer that a culture has lived in a particular environment, the more likely it is that the culture is living sustainably within the bounds of the resources of the particular environment

Cultures that have occupied a particular environment for extended periods of time are likely to be maintaining their population levels at or below the environmental carrying capacity. Alternatively, they may have devised methods for enhancing the natural productivity of the land and hence the ability of the area to support the population. Traditional decision-making patterns for resource use are therefore sustainable for a specific environment; however, the penetration of foreign technologies and new demands on resources, have the effect of destabilizing these traditional systems.

Much of the breadth of ecosystem services (Costanza et al. 1997) are recognized by indigenous people (although the services are explained with a different rationale) including natural resources that function as 1) protectors of humans, 2) providers of human needs, and 3) potential resources that are yet poorly understood. Typically, absolutely everything is considered to be of value and it is out of this valuation of all things that a sustainable ethic of biodiversity emerges. The ethic of biodiversity (Figure 9.1) may be openly stated and discussed or may be cryptic/unspoken and learned only through observation of the actions of residents rather than their explicit statements. Researchers must develop the savvy to "hear" what is implied and the ability to verify the conclusions they make.

Postulate 6. Diversity supports cultural survival

Diverse food gardens support long-term cultural survival by avoiding crop disasters and subsequent malnutrition and famine that are associated with the risks of increased specialization in one or a few species or cultivars. Biologically, species (plants or animals)

may specialize in interactions with one or only a few other species (plants or animals) as an optimizing survival strategy. Human cultures follow similar patterns of specialization or generalization in their usage of biological resources. Major agricultural and pastoral societies are examples of specialists. Most other cultures have chosen to become generalists. Prime examples of generalist behaviors are found in traditional Pacific island gardens. In these gardens, high diversity of plant species and varieties is cultivated. Individual gardeners traditionally trade plants with each other and are very proud of the numbers of varieties that their gardens contain. These gardens are not managed for maximum productivity but rather for maximum stability. Diversity includes many plants of marginal usefulness, lesser quality cultivars, inedible ornamentals, and semi-domesticated "famine" foods that are rarely eaten. No one has yet explained why people would cognitively choose to develop these systems rather than ones that optimize productivity.

Postulate 7. Culture-species relationships are based on either evolutionary or cultural pressures

There are two viewpoints in cultural sciences such as ethnobiology. One emphasizes the adaptation or acclimation of settlers to their new environment. This is an evolutionary model.

The second viewpoint suggests that settlers arriving in a new environment bring their cultural practices developed elsewhere and may or may not change their practices in regard to the local conditions. Future research will clarify which of these views is a more accurate description of the history of a particular community.

Part III: Basic Ethnobiology Methods

The range of ethnobiological research methods is too broad to discuss in a single chapter. Therefore, one method that we have successfully employed in PABITRA field sites is here described. Other sources of methods that are available include: Alexiades (1996), Berlin (1992), Bernard (1994), Campbell & Luckert (2002),Cunningham (2001), Etkin (1993), Gollin (2001), Laird (2002), Martin (1995), Ticktin (2003, 2004), Thomas et al. (2001), and Womersley (1976).

The inventory and monitoring of biodiversity in the Pacific Islands ought to incorporate methods that convey an understanding of the human communities that use the local ecosystems including; their demography, economy, environment ethics and system of governance. The human perspective is important because people are part of local ecosystems and their actions of environmental stewardship and transformation are vitally important for assessing the sustainability of the islands' biodiversity. Human biodiversity studies should therefore identify human environmental actions as well as their knowledge, their attitudes and perceptions, beliefs and values that produce positive or negative consequences for natural biodiversity. Ultimately these studies should also point to the types of incentives that may be applied in the local economy, governance or educational situation, that are capable of restoring, supporting or conserving local biodiversity. This section (Part III) not only develops a rationale for the study of human interaction with natural biodiversity, it also outlines protocols and a set of methods suitable for data collection and storage, and retrieval of ethnobiological information. Although it is not possible to present an exhaustive set of methodologies for the collection of information on every facet of ethnobiodiversity the discussion of rationale and methodology presents tested guidelines that will be useful in biodiversity studies.

Study of human interactions with biodiversity

Studies of human environmental interactions in island landscapes must be community based. They are designed to gather relatively in-depth information about the nature and status of biodiversity in local ecosystems from the perspective of the local communities who live in, and use, the resources of the area. The studies are designed to gather information with as much authenticity as possible, but also to identify the resources about which local communities are concerned or are most cognizant. The studies are participatory in nature and use groups of community members as the focus of data collection efforts. The data are collected systematically and therefore reproducible through questions, field surveys and collection efforts, and electronic documentation. The results may be used to document a community's biological and environmental diversity as well as the variety of human interactions with the environment.

The following discussion outlines ten basic elements for community-based biodiversity (here after called ethnobiological) research methodology.

1. Obtain permission from local community leaders/ elders and other necessary research permits including "humans subjects" research permit where required by the researcher's home institution
2. Gain familiarity with the local community using ethnographic observations
3. Identify local research associates/collaborators
4. Train community researchers
5. Discuss with community members goals and expected end results
6. Specify the categories of information to be gathered and related questions
7. Conduct surveys and administer questionnaires (structured and unstructured)
8. Verify data
9. Document results
10. Share/return information with the community

1. Obtain permission and informed consent

Obtaining permission to do research can be a time consuming and uncertain process. Many culture groups have grown weary of outsiders setting the agenda for what is studied in their communities. They also have lost trust in the ability of non-locals to objectively represent local social processes, or interpret the nature and meaning of interactions be they interactions among people or human interactions with the natural environment. In addition some communities feel over studied and on balance the costs they experience outweigh the benefits. Instead, the perception in many local communities is that the benefits accrue to outsiders who interests are not consistent with those of the local population. In this context, researchers should be prepared for refusal of their requests to conduct research. On the other hand a well thought out research plan that is based on collaboration to achieve results desired by the local community may receive full support. However, the prospective researcher must be cognizant of the time that it will take to create authentic collaborations; to learn local protocols surrounding research requests; and for deliberations by local decision makers. A genuine approval process may take months or even years.

Human subjects research permits are required for any investigation involving human beings. Associated with the issuance of these permits is the obligation for researchers to obtain the consent of each individual who participates in the research. Most often this is written consent, however oral consent may be sufficient. Informed consent is a practice that is essential to all ethnobiological research. Informed consent involves two elements: 1) complete disclosure of the reasons for conducting research, potential benefits, methods to be employed, ultimate disposition of research data and publication, and 2) receiving clear consent to undertake the project by all who will be affected.

Obtaining consent may seem like an easy task, however if done properly, this is very time consuming and must be detailed to be fair. In conducting ethnobiological field research it is sometimes difficult to clearly explain why research is necessary. Equally difficult is providing convincing rationale for using methods that appear to be odd or alien to the average person. Furthermore, communities and governments often jump to the false conclusion that research is being conducted for the financial enrichment of the researchers. As this attitude develops and researchers are encountered, it is assumed that all researchers are driven by the same motivations and that they have access to large sums of money to distribute locally. Time and careful explanation are required to get people to understand that most scientists are not motivated to get rich off their ethnobiological research. Hence, any effective strategy ought to provide ample time for researchers to work with communities to develop shared understandings of the goals of research that will allow for true informed consent.

Consent often is given with provisions. Researchers must honor these provisions from the start or choose not to conduct any research. Failure to do so constitutes unethical behavior. All consent and provisions should be clearly documented so that no problems arise later. Ethnobiologist, Brad Bennett (personal communication 1994 with McClatchey) asserted the simple truth that successful ethnobiological research requires only two skills: courtesy and common sense. This is the basis of informed consent and will create a firm foundation for all research that follows.

2. Gain familiarity with the local community using ethnographic observations

Ethnographic research may be conducted using traditional direct observation strategies of social scientists

or may be conducted with interactive or participant observation strategies.

Direct observation involves working in a culture, asking questions about cultural activities, and gathering data from watching how and when people do what they do. Researchers employing direct observation methods need to spend considerable time living within a specific cultural setting before beginning to make their primary observations. Time is needed for people to adjust to the researchers presence and for life to return to the normal routine that needs to be observed. If specific rituals or events are the focus of research observations, then the researcher(s) need to enter the community well in advance (weeks to months prior) in order to prepare themselves and the community for their observation period. Questions that will be asked within the observation period may be structured (outlined in advance and asked of specific members of the community), unstructured (developed as situations unfold), open or close-ended. Direct observations usually follow the flow of the community with slight modifications for the researchers presence, questions, and interests. Researchers must be very attentive to detail, observing what is done/not done and said/not said. Interpretation of observations requires much discussion with cultural confidants and other experts as well as follow-up questions with key members of the community.

Participant observers learn by doing cultural tasks in a hands-on way. Research is conducted in such a way that the researcher attempts to do the task that is being documented under the instruction of one or more people from the culture who already knows how to do the task. The researchers mistakes and successes contribute to an overall understanding of the activity. Since this is closer to a "normal" way of learning within a culture, it is preferred by many ethnobiologists. Participant methods still require the attention to detail that is involved in direct observations, however because of the hands-on, normal approach to learning, it is assumed that accurate understanding will take place more easily. As with any form of research, all forms of observation need to be discussed with the community in advance and permission requested and granted before the observation period is initiated.

Participant observation (hands-on) methodologies used to address narrowly focused topics, may be used without extensive time commitments to the community. In these cases, questions are more likely to be structured and close-ended for brevity. Examples of narrowly focused ethnobiological research questions that are appropriate for participant observation methods are: "How much time is needed to cut-down and process a sago palm into edible starch?", "Which trees are preferred for house construction timber?", "Are there differences in root crop planting techniques between farmers in one community?". These questions can be addressed with little preliminary time in the community because of their simplicity. Examples of less focused ethnobiological research questions that may still employ participant observation methods are: "What are the criteria used for selection and establishment of a new garden site in the forest?", "What are the vegetation zones recognized in a culture and how are these recognized in community resource utilization activities?", "How are traditional herbal remedies prepared and administered?" These questions require a greater depth of understanding of the culture as a whole and therefore the researcher is obligated to spend more time within the community learning the broad patterns of normal behavior and activities before commencing research.

Indirect observation is a third form of observation emerging as a possibility. Indirect observation includes observing cultural activities from hidden cameras, recording devices, satellites, and other sensing devices. These methods remove the distraction of the researcher within the cultural setting and therefore allow for a more objective observation of cultural activities. These methods should be completely rejected unless all individuals who are to be observed agree and fully understand that they are being documented in these ways. Since these methods are clearly forms of spying on people, they should only be considered in special instances when members of the culture desire an alternative to direct or participant methodologies.

3. Identify local research associates/collaborators

When working in a culture other than one's own, it is important to identify one or more persons who are members of the culture who are able to provide advise, serve as a sounding board for new ideas, and work as equal partners in the research process. These persons serve as cultural confidants or advisors and are able to insure that research is conducted respectfully, in a timely manner, and that results gathered actually address the underlying issues in the questions or hypotheses. Cultural confidants are characterized by their ability to easily move between cultural worldviews

and to bridge the gap between external and internal perspectives and values.

A cultural confidant is not one of the cultural informants or research participants, but is rather one of the researchers. This distinction is important because data gathered from confidants is likely to be affected by the external researcher's opinions and other ideas that may change the authenticity of their perspective as a cultural insider. Although it would be silly to assume that a "pure" cultural perspective can be learned through any interview, it is more natural to learn traditional perspectives from individuals who have not been closely involved in the development of the research questions, directions, as would the cultural confidant. Therefore the selection process requires another step, which is the identification of research participants. Although ethnobiological research may be conducted with any member of a culture, research with local or traditional experts is of most pressing need because these individuals and their knowledge are generally disappearing and being replaced by expatriate individuals and external ideas. For instance, traditional health care workers are often replaced by people trained in foreign medicine, while traditional navigators are replaced with people trained in modern navigation or usage of motorized boats. Since these experts are the scientists of their cultures, it is essential that their understanding of their environments be recorded, valued, and understood before their knowledge is lost and before decisions are made about alternative uses of their environments.

Who to involve in the collection of data is an important issue for the reliability of the research. The local research associates must also have the approval of the group as a whole. Research is often conducted in the most expedient way, involving individuals who are the most highly trained and the best connected within existing power structures. If one of the goals of a research project is to provide broad based training, then these strategies need to be modified. Careful field and laboratory research planning should include initiatives to enroll participation by those who are less educated, impoverished, underrepresented segments of populations or not otherwise considered knowledgeable of the subject (i.e., experts). Although some aspects of the research process will always require highly trained individuals, it is recognized that in most projects there are potential roles for a full spectrum of individuals including entry level and untrained workers.

It is also critical to involve researchers and students from educational institutions and non-government organizations in work that is being conducted in their own country. This is not simply a courtesy but is essential for long-term infrastructure development strategies and long-term resource accounting and monitoring activities. These same individuals should be actively encouraged to participate in elements of research that occur outside of their home countries through laboratory and theoretical work, presentations at international meetings, and publication of research results. Once research associates have been identified other matters need to be discussed such as: timing of research, development of team activity schedules, training, confidentiality requirement and compensation.

Timing of research has consequences for availability of research associates and implications for local communities and therefore is something that must be researched before the start of fieldwork. Local leaders must be consulted about normal amounts of time that workers can contribute, local restrictions to be imposed on the research as well as religious concerns. For instance, research should not conflict with or interfere with local holidays or festivals, and ideally the research should be conducted at times that will facilitate participation of local educators and students.

Development of research team activity schedules for efficient usage of time in the research site needs to be carried out with an understanding of each team member's goals and the research questions to be answered. Coordinated research is very efficient, especially when the researchers are sharing information with one another throughout the research period. A shared database (or database backup) for photographic and other digital data is useful to avoid duplication of effort. A cultural confidant will be able to examine each researchers plan and through discussion, help to coordinate appropriate schedules that will fit community agendas.

4. Train community researchers

Research capacity building is one of the goals of the PABITRA network. The ideal approach being pursued is to use a combination of international scientists and national scientists to train parascientists and community leaders in basic methods for collection and monitoring of biodiversity data that can be used to address intra-community and extra-community questions and needs. The partnership is built upon the assumptions

that national scientists are few in number with great responsibilities in their home countries for overseeing research, development, and coordination of training of new national scientists, while international scientists are interested in providing research training assistance supporting national scientists efforts. International scientists (which includes many of the same national scientists when they work in a country that is not their home) are participating in the PABITRA network in order to gather sets of comparable data across a wide range of communities in different Pacific Island nations. Success of the collaboration, particularly when gathering information about traditional environmental knowledge is dependent upon training that insures that all participants are working toward the same goals and using the same or compatible methods.

During the informal pre-study meeting in communities that seem to hold interest, individuals should be identified who are able to fluently read and write the community's vernacular language as well as international language of science (English, French, Japanese, etc.). These people should be hired to assist in the following step of development and modification of questionnaires. During these same meetings, individuals may come forward who are leaders in the community, students, or others who stand out for their ability and desire to learn. As many as possible should be trained as parascientists so that potential work in the community may be conducted by a range of members of the community.

Parascientists are individuals who have been narrowly trained in the collection of data using specific protocol, but may not have been trained more broadly in science. These individuals should be at the heart of long-term planning for PABITRA sites. It is hoped that as each site develops, some of those trained as parascientists will elect to receive further training as ecosystems scientists. Local community experts whom are functionally the traditional scientists of each community will serve as critical advisors, parascientists, and group participants in the data gathering portions of the projects. Once data are gathered, it is assumed that the national scientists will work in conjunction with community leaders to make decisions about how to best use the information that has been gathered.

The training of parascientists usually takes the form of a workshop which organized by national and international scientists and others who are interested in conducting research prior to administering questionnaires and conducting surveys. The purpose of the workshop is to brief these individuals in the methods and purposes of the field investigations, administering a questionnaire, and conducting follow-up surveys. By the conclusion of the workshop each parascientist should be able to demonstrate the processes of: 1) appropriate research protocol such as introductions and properly opening the questionnaire process, 2) conducting informed consent with a group of participants, 3) asking questions, recording responses, and verifying information as it is recorded, 4) thanking each participant and properly concluding the process, and 5) entering resulting data into a computer database for later group analysis and redistribution to the community.

Compensation for workshop participants can take several forms including transportation to and from the workshop site, meals throughout the workshop period, and a reasonable living wage in parity with the local economy. It is easiest if workshops are held within communities where participants so not need to travel though this may be unavoidable. If food is to be prepared, it is a good plan to arrange to pay for food to be prepared within the community. In the case of remote sites, some food will need to be brought to the community by the outside researchers.

Confidentiality is respect for confidences shared. Individual and group desires for confidentiality of information should be solicited and observed. PABITRA researchers must discuss their publications and database distribution plans with local community leaders, asking if there are any issues of confidentiality. If certain elements of the research results are determined to be of a confidential nature, then these data must be secured and not published without explicit consent from those affected or concerned. Since the goals of scientific research include publication and other forms of distribution of knowledge, it is important that researchers discuss these issues as soon as possible during the field research efforts.

Compensation for work and intellectual property of traditional peoples have been heavily debated in many reviews dealing with this issue (Balick et al. 1996, Posey et al. 1994, Reid et al. 1993, Siebeck et al 1990). Regional and national standards or practice have been and are being developed for most nations in the Pacific. PABITRA researchers should work closely with national ministries and departments responsible for conservation of biological diversity and intellectual property rights. Agreements should be reached in ad-

vance that guarantee the control of indigenous knowledge and either limit the intellectual property rights of researchers or waive the rights of foreign researchers to economic development of new intellectual property. PABITRA will specifically avoid participation in "bioprospecting" projects that have lead to so many misunderstandings and false expectations about the value of traditional medicine to international communities In order to do this, information about usage of specific plants for specific indications will be decoupled and not maintained as linked in any of the databases. Also, no samples will be prepared for chemical analysis. One exception to this should be the recognition that researchers need to be free to publish scientific results as part of their work if these results will not infringe upon potential benefits for local people's. Outside researchers should however endeavor to publish research results in local language or local journal, bulletins or newspaper accessible to the community in which the research was conducted.

5. Discuss with community members goals and expected end results

Prior to initiating research in an area, researchers, members of the government, and other local collaborators should spend a few weeks visiting communities and discussing some of the possible research projects being considered. If, during these informal meetings, one or more communities seems to express an interest in participating in a PABITRA research project, then arrangements should be made for a formal community meeting in which the researchers can discuss their project with the community and can formally ask for permission to work in the area. The important point to remember is that open community meetings are preferred over meetings with big men or other leaders only.

Determination of likely cultural goals compatible with research agenda is important in each PABITRA project, since community infrastructure development and educational advancement are important parts of the program. Community goals should be discussed within community meetings or other open forum. In the Pacific islands, most communities have developed around traditional clan or chiefly leadership structures. Modified versions of this structure have more recently evolved with Christian churches at the core. Therefore, researchers need to work closely with these core elements of the community to insure that work progresses to everyone's satisfaction.

Community meetings can, and perhaps, should lead to modification of the initial research goals. Research in an area should not only be conducted with full informed consent, but should also be modified as much as possible to meet local community goals. Researchers should plan on spending up to half of their field research time participating in local community development projects, particularly when these can be accomplished in conjunction with training of local workers and/or collection of basic research data.

6. Specify categories of information to be gathered and related questions

Table 9.3 is a listing of categories of information that can be gathered to catalog and assess the level of knowledge about local biodiversity as well as people's understanding of environmental cause effect relationships. The information obtained will allow for two way learning; researchers will learn from community member and vice versa. This data can also be used in the development of modules for ecological education.

7. Conduct surveys and administer questionnaires

PABITRA researchers should attempt to involve as wide a range of cultures, communities, and environments in their research as possible. Successful infrastructure development needs to include as many different groups of people as possible and to provide opportunities as equally as possible. There is a strong tendency to conduct research in areas where research has already been conducted in order to produce long-term, comparable results. This is useful but can be detrimental to communities who are external to this process. PABITRA researchers should therefore attempt to conduct research in gateway sites and also in new areas where training and educational activities will be new with profound impacts. Spreading the benefit will, in the long run, create the best environment for researchers within and without the areas under study.

Another important concern of any researcher is that the information collected is as truthful and as accurate as possible. Therefore informant reliability (inter-group consistency) is of utmost importance. Great care must be taken when conducting research of any kind to insure that trust between researchers and the community is developed and maintained. Researchers who are honest with community members will be re-

warded with honesty. Researchers who seek to obtain information through less honorable methods will encounter resistance and may be misled. Accurate representation of people's knowledge is essential for successful ethnobiological field research However, it is important to keep in mind that not all members of a culture will share the same opinion or will have been trained in the same way. Because of this, there are differences in the basic information that is learned from members of a culture. The intersection of this knowledge is that which is held in common by the community and the outlying information is that of specialists or unreliable informants. The community itself is the best source of differentiation of these two sources of disparate information. Information that is provided by individuals who are recognized by the community as experts should be accepted as such, even if other members of the group cannot confirm it.

There are several approaches available for obtaining authentic information about a community and the natural environment with which individuals interact. Researchers may choose to hear from individuals or groups and they may wish to hear from women separately from men. When information is collected in a group setting focus groups may be used while surveys and questionnaires may be used for groups or individuals. These and other methods of gathering information are outlined below.

Focus groups—Focus groups consist of a subset of a community (e.g.; youth versus elders; women versus men; church leaders and other community leaders) who are brought together to discuss a particular topic, respond as a group to questions, or to develop a plan for a project. Focus groups can be very powerful tools, however they can also be problematic since they can cause false impressions about the community as a whole to be recorded. Focus groups work well when the group is:

1. small (about 2-5 individuals),
2. homogeneous (composed of men or women, of similar age and social status),
3. interest based (all members of the group having interest in the topic to be discussed),
4. consists of individuals who are prepared (the group knows what is expected of them), and
5. open to all voices; i.e.: each member of the group feels that they can contribute as little or as much as they know without pressure to conform/agree, or produce.

Focus groups need to be small or else natural leadership structures will take over with dominant personalities or individuals in leadership positions taking the lead and others fading into obscurity. Focus groups should be homogenous or else some participants may defer to one or a few others out of respect even if they have a differing position to bring forth.

Information that is held in common by the members of the culture should be discussed and appraised in that context. It should be treated as group information and group intellectual property. Information that is held by single individuals (or in some cases families) should be documented as individual or family knowledge and appraised in that context. Cultures have good reason to become concerned when ownership of cultural knowledge is assigned to single individuals and likewise individuals have reason to become concerned when their personal knowledge is assigned to the culture as a whole.

Upon completion of the survey, the results should be reviewed with the group members checking for accuracy. The group should be asked if there is any of the data that should be withheld from distribution for any reason. If so, this information should be segregated, and not distributed nor used in subsequent publications or reports. Members of the group should be advised that they will receive copies of the resulting data and processed results as soon as they are available. The group should be appropriately thanked for their efforts and given any final compensation that is due.

Surveys—This approach involves the researchers posing questions to individuals in an attempt to gain information about a particular topic. This is the quickest and most accurate way to identify experts and to collect information. Individuals within a community know individuals in the area who are healers, shipwrights, foresters, expert farmers, and weavers. A simple initial survey of the community would ask questions such as: "Who is the best weaver in the area?", followed by "Please list all other weavers whom you know." The first, close-ended question focuses the person being questioned upon providing the best weaver by reputation. The second, open-ended question allows the person to free-list all weavers that they know, although usually they will list first those they feel are best or know best. When these simple questions are asked of a significant percentage of the population of a community, it rapidly becomes clear who should be con-

sidered as an expert. Typically, all who are questioned will name one or a few individuals. Other individuals may be named by many but not all, and some will only be named once or twice.

Selected surveys should be executed using the same set of procedures outlined for the identification of community group participants. However, most of the surveys involve large time commitments and physical labor so not all individuals in a community will be able to participate. These surveys differ greatly from questionnaires in that the survey participants will need to access biological diversity in a variety of locations throughout the community and will need permission to collect voucher samples. Either blanket permission or permission to access specific places and resources should be solicited and received before survey activities are initiated.

Once a survey has been selected, the purpose, estimated time and access commitments, and potential results should be discussed with the community. The community should select one or more groups of individuals to participate in the survey. It is important that the group include some individuals with appropriate knowledge levels, some with appropriate work skills, and some with appropriate access to areas of the community where survey work will need to occur.

Table 9.3. Categories of traditional ecological knowledge.

Plant species and their:
- local names
- spatial distribution
- species growth habit and reproductive behavior
- economic uses (food, medicine, trade, other)
- relationship to folk lore/mythology

Marine and coastal environments:
- imporance/significance of coastal ecosystems (mangroves, estuaries, etc.)
- fish life cycles
- indicators of over-fishing
- effects of over-fishing on sustainability of supply
- effects of soil pollution
- impacts of chemical pollution (fertilizer, pesticides and oil)
- observations of changes in sea level
- reasons for changes in sea level (local or global)

Fauna:
- which birds are hunted, by whom and when
- what wild animals are hunted, by whom and when
- names of economic fauna
- knowledge of other fauna
- attitudes about exhaustion of wild fauna
- special hunting taboos to allow species population recovery
- do individuals distinguish between the species that are native or endemic and ones that are introduced
- is there awareness of increase or decline in the numbers of individual species
- reasons given for decline or increase in animal populations

Ecological zones:
- changes in plants and animals found along altitudinal gradient
- changes in plant/crop porductivity at different elevations
- plant/sopecies response to slope or aspect
- microclimate influence on species distribution and community structure

Parascientists or scientists should serve as the survey group leaders. Copies of the survey forms and informed consent forms should be distributed to all concerned parties including each participant in the survey group. The group leader should discuss with the group the kinds of data and work that will be conducted in the survey. The survey group leader should then consult the group about the consent and demographic information at the top of the survey and then record the results. Once all members of the group have consented to continue, the survey should be initiated as instructed on the form. Voucher specimens and other data should be gathered accordingly. Most of the surveys will need to be conducted, in part, using methods outlined in other chapters of this manual.

Questionnaires—In order for the results of PABITRA questionnaires to be useful in examination of Pacific-wide patterns, the questions used in different communities must be largely the same and administered in the same way and same order. However, some modifications need to be made and carefully recorded for the following reasons:

1. Protection of sacred or secret information
2. Politeness and appropriateness of the phrasing of questions
3. Need to limit time taken away from the community for other important purposes
4. Lack of knowledge of a particular topic in a community
5. Depth of knowledge of a particular topic in a community

Questions used to gather information about the traditional environmental knowledge of each community need to be asked politely and in clear statements preferably in the local language. Questions should be posed to appropriate small groups of individuals and in a timely way that respects the communities and individuals overall daily activity schedule. Questions should be grouped by subject areas as is shown in questionnaires 1-8f below; and administered by local speakers participating in the research project. This set of questionnaires gather data about community perspectives and wisdom. Additional related data should be gathered through surveys (surveys 1-8) that involve collection of biological data based largely upon the information collected in earlier questionnaires. Questionnaire and survey data, when combined with results of other biological research activities (see other chapters) will provide a contextual outline of the traditional environmental knowledge and impacts of the community participating in the PABITRA network.

Questionnaires should be administered to small groups of individuals with common characteristics: age, gender, lineage, or faith. The best results tend to emerge when a variety of groups work independently on the same questionnaires with the results pooled later. When time is limited it is recommended that questionnaires 1-7 be administered separately to one group of adult women and one group of adult men. Similarly, when under time constraints, questionnaires 8a-f should be administered to one group of adult men or women with known community expertise in the particular specialty. Some questions are the same or similar on different questionnaires. This is for gathering similar information from different groups of people or from the same people considering different topics. The experience of the authors has shown that slightly different information emerges each time a question is asked or the participants in a group are different.

Questionnaires for human interactions with plants are intended to gather baseline ethnobiological elements for each PABITRA site. When questionnaires are first prepared in foreign language they should be carefully translated into the vernacular language used in the community. This is important for two reasons. The information that is to be gathered exists in the vernacular language and many of the individuals who will serve as group participants and parascientists (those who administer the questionnaires and conduct surveys) will be able to best understand the questions if they are presented in their own language Copies of both the vernacular and English questionnaires should be taken to communities since some individuals may not be able to read their own spoken language but may be able to read English.

The following minimum information is needed to ask scientific questions about human cultural interactions with plants. This same information may contribute to production of vernacular curricula, regional planning models, and resource policy legislation at local and national levels. Together these elements comprise the science of biology as practiced by members of the culture being studied.

Nomenclatures—Cultural species lists (with Latin equivalents when possible) citing voucher specimens, specific source information, participant groups or indi-

viduals, digital images, and recordings of pronunciation and usage of the species name in context. Lists of macro- and micro-landscape terms should be included as a separate category.

Taxonomies—Cultural species lists (above) defined based upon a range of physical characteristics or species descriptions using local recognition terms and circumscriptions. Landscape categories should also be described using appropriate local language terms and circumscriptions.

Classifications—Cultural hierarchical system of "relationships" or groupings of species. This should include higher-level terms (e.g., plants, grasses, snails, palms, fish, ferns, birds) as they are used for higher-level categories. A hierarchical classification of landscape terms should be determined and, if appropriate, listed with key cultural species of plants.

Vocabularies—Terminology used to describe the biological diversity, parts of organisms, usages, growth stages, soils, landscapes, etc.

Indigenous interpretations and postulates—Cultural interpretive understandings about how biological systems work, origin stories, and other explanations of the roles of biological diversity in culture and the environment.

It is important that these scientific concepts be kept in mind as questionnaires are modified and translated. Separate questionnaires should be used to gather data that is of specific interest to the local community. The questionnaires should not address only the needs of the community; the more that are completed, the greater the level of scientific comparability between PABITRA sites.

The list of possible questionnaires below is provided as a guide to the information that should be collected in an ethnobiological survey. These examples deal only with the biological components of the ecosystem. For the first four a set of questionnaires is included in Appendix 1. Further questionnaires are provided on the PABITRA web site: www.botany.hawaii.edu/pabitra/

Questionnaire 1: Terrestrial and marine plants and fungi—Gather data about the nomenclature, taxonomy, classifications, cultural roles, economic impacts, and relative abundances of plants and fungi. In Pacific Island communities, plants make up the dominant element of biological diversity on land. In the ocean, although plants are far less important than fishes and shellfish, they are still an important feature of that ecological zone. Knowledge of fungi is variable with some communities recognizing and using many fungi, while others recognize very few.

Questionnaire 2: Terrestrial and marine animals—Gathers data about the nomenclature, taxonomy, classifications, cultural roles, economic impacts, and relative abundances of species. In Pacific Island communities, fish, shellfish, and birds are often very important foods, indicator species, and symbols of human relationships with biological diversity. Non-avian land animals tend to be far less important except for domesticated pigs, dogs, and rats. Levels of knowledge of animals vary from community to community based upon the kinds of environments that are nearby, dietary preferences, and the history of inhabitation.

Questionnaire 3: Food and food preparation resources—Gathers data about the nomenclature, taxonomy, classifications, cultural roles, economic impacts, and relative abundances. The resources include plants and animals that are eaten, plant materials used in harvesting, cooking, serving, and storage of foods, and service ecosystems that are needed for preservation of wild harvested foods. Production of food is such an important activity and has such a large impact on vegetation and distributions of wild plants and animals that chapter 6 has been dedicated to this purpose. This questionnaire is therefore intended to supplement the data gathering methods outlined in chapter 6.

Questionnaire 4: Ecosystems and vegetation usage zones—Gathers data about the nomenclature, taxonomy, classifications, cultural roles, economic impacts, and relative abundances of. Ecosystems and vegetation zones as recognized by local communities are the basis for larger scale decision-making systems. These are often very similar to externally defined scientific ecosystems and vegetation zones with differences reflecting important local observations about vegetation structure and ecosystem functions.

Questionnaire 5: Land tenure and resource access systems—Gathers data about local resource base. These systems provide sets of rules that have been developed over long periods of time and are likely allow for sustainable usage. The systems incorporate limits of access to and harvesting of biological resources as

well as redistribution of surpluses that are periodically obtained. Elaboration and execution of these rules may serve to support traditional political and religious systems as well as conservation of traditional environmental knowledge.

Questionnaire 6: Biodiversity that is of commercial importance—Gathers data about the economic impacts, and relative abundances of. Pacific Island communities usually have had limited or no traditions of trade in species or products. Each community has generally been self-sustaining or has traded certain items with other nearby communities that have access to other kinds of resources. All of the communities located in PABITRA sites participate in modern cash economies to varying degrees. Shifting to cash economies has had major, often negative, impacts on local biological diversity. Traditional systems for land tenure and resource access have not always been able to address problems associated with modern market economies. The purpose of this questionnaire is to better understand the levels of impacts of commercialization of biological diversity and to provide data that can be factored into community land management systems.

Questionnaire 7: Individual activities in different parts of the environment—Gathers data about how much time members of the community spend conducting different kinds of tasks. Not all community activities are conducted in the same location. Human impacts on biological diversity are to some extent dependent upon the amount of time people spend in different parts of the environment. This is particularly important information for PABITRA sites where this can serve as a measure of the intensity of human modification of base environments.

Questionnaire 8—Focused on gathering information about specific activities such as health care, fishing, commercial activities, etc.

Development of appropriate questions

Agreement about the categories of information to be gathered is critical to any social science research. However, the information sought must address the problems and issues of concern to local community residents. Cultural confidants should help in consultations with community leaders, groups and individuals to discern matters of importance to the community. As such cultural confidants participate in designing research goals, methods, interpretations, and publications that do the following:

- Address research interests without offending local sensitivities/sensibilities.
- Provide clarity in each question without implying specific answers (leading the witness).
- Minimize the numbers of questions and sub-questions.
- Maximize community education about the research process.
- Maximize questionnaire participation.
- Maximize quantitative and qualitative research results.
- Provide the community with a clear sense that they control their own knowledge.

Cultural confidants are able to do the above because of their intimate understanding of acceptable social behavior in their own community. Within the process, the confidant should be encouraged to take the lead in question formulation. Questions that are developed should not imply an answer nor should they provide information or an indication of the answer the researcher might want. Questions may be formulated as open or close-ended. Close-ended questions usually require a yes or no answer, but may also be those with a small number of options such as in a multiple-choice question. If quantitative or focused data is required to address hypotheses, then closed ended questions will be needed. Open-ended questions are those that can have long answers or have no limited end. If qualitative data or a more broad perspective of cultural interactions is needed, then open-ended questions will be needed. In many situations, elements of each are desired so both types of questions are employed.

The following examples show the differences between close- and open-ended questions:

Close-ended question:

a) "Does this plant have a name?"

Open ended questions:

a) "What is the name of this plant?"
b) "Please tell me about the use of this plant."

In the case of the close-ended question, if the answer "yes," it will probably be followed by a name: "Yes, this is called '*ohia lehua*." On the other hand open ended questions such as: "Please tell me about the uses of this plant." may result in a very long, detailed dis-

cussion that is more desirable from the perspective of the biodiversity

Administration of questionnaires

After permission to work in the community has been granted questionnaires should be administered by parascientists and other members of the research team using the following steps that are outlined for a sample questionnaire. The person administering the questionnaire (the "group leader") has responsibility to:

1. Arrange for time and place to meet with the community determined questionnaire response group.
2. Upon meeting with the group, the group leader thanks them for coming and indicate how long the session is likely to take (for instance: 6 hours). Indicate that they will be served some snacks and two meals. Participants may work longer if they wish but compensation will be a fixed amount agreed upon earlier.
3. The group leader will read aloud (and distribute) in the vernacular language each of the following documents that should also be distributed to each participant for their own records.

    i. The Informed Consent General Statement Handout that clarifies the goals, purposes and scope of the proposed research (See Appendix 2).
    ii. The Informed Consent Question Sheet (See Appendix 3).
    iii. The specific Questionnaire that will be used to lead the discussion for the day.

4. The group leader should discuss with the group the kinds of data and work that will be conducted in the particular survey. The group leader should then ask for and receive an affirmative response for the informed consent question.
5. The group leader will fill in the top portion (above the line) on the Questionnaire gathering information from the group and confirming each entry with the group.
6. Begin with the first question (**in bold**) following any instructions that are not in bold See Appendix 1).
7. Record responses until the group feels that they are finished with the question.
8. Ask each subsequent question, recording answers until the group has spent about 2 hours of time.
9. Take a break for 15-30 minutes and then resume asking questions.
10. After 3-4 hours, take a longer break to provide the group with a meal.
11. Continue to address questions until all have been answered to the satisfaction of the group.
12. Upon completion of the survey, the results should be reviewed with the group members checking for accuracy. The group should be asked if there is any of the data that should be withheld from distribution for any reason. If consent is withheld for any portion of the data, this information should be marked and destroyed. Information not approved should not be distributed nor used in subsequent publications or reports.
13. Members of the group should be advised that they will receive copies of the resulting data and processed results as soon as they are available. The group should be appropriately thanked for their efforts and given any final compensation that is due.

In some communities, teachers and parents may elect to have children participate in groups. If this is done, it is important that the child be accompanied by an adult (parent or close relative) who can assist them if questions become difficult or are of a sensitive nature. An option that allows children to participate is to work with local schoolteachers to arrange for the children to learn through an "information scavenge hunt" competition based upon each of the questionnaires. Children in a school can use a modified version of one or more questionnaires to gather information from their own family. Children can be rewarded for returning with the largest list of names, the most complete list, or the most diverse stories about biodiversity. If this option is used, it is important to make the task exciting and fun for the children rather than a form of work that prejudices the young person against scientific research. If the children can become excited about this kind of work, it may help them to become excited about learning and preserving traditional knowledge and biological diversity.

Follow-up field surveys related to each questionnaire

Questionnaires gather basic information about community perspectives without physical documentation of the biological diversity being discussed. In most cases, the community, researchers, and government will benefit from additional surveys that provide both

physical evidence of the resources being discussed as well as quantitative evaluations of the distribution and abundance of different kinds of biological diversity in the areas controlled by the community. Similar information may be gathered using methods discussed in the other chapters of this volume, however Survey Forms 1-8 are specifically intended to provide documentation and quantitative data that complements the results of the questionnaires. Parts 1a. and 1b. are provided in Appendix 4 as examples of verification surveys. Further examples are available at the PABITRA web site: www.botany.hawaii.edu/pabitra/

- **Survey 1** is intended to document the diversity and distributions of terrestrial and marine plants and fungi. The survey involves production of voucher specimens of each species identified in questionnaire 1 and their distributions in ecosystems and vegetation usage zones identified in questionnaire 4. Therefore, both questionnaires 1 and 4 will need to be completed first.
- **Survey 2** is intended to document the diversity and distributions of terrestrial and marine animals. The survey involves production of voucher specimens of each species identified in questionnaire 2 and their distributions in ecosystems and vegetation usage zones identified in questionnaire 4. Therefore, both questionnaires 2 and 4 will need to be completed first.
- **Survey 3** is intended to document the diversity and range of community diets. The survey involves production of voucher specimens of each species and variety of food and food processing resources and their distributions in ecosystems and vegetation zones identified in questionnaire 4. Therefore both questionnaires 3 and 4 will need to be completed first.
- **Survey 4** is intended to document the diversity and distributions of ecosystems and vegetation usage zones. Systematically located transects of community territories are used to produce vegetation maps and species density data.
- **Survey 5** is intended to document the diversity and distributions of community land resources. The survey involves global positioning system mapping of individual or community property boundaries, or boundaries of community recognized resource zone (*sensu* questionnaire and survey 4). Although the technology exists to conduct this kind of survey, care should be used in initiating it unless the community has considered the implications and potential conflicts that often result for land surveys.
- **Survey 6** is intended to document the diversity and distributions of biodiversity extraction activities. Systematically located transects of areas under different forms of extraction, margins of extraction areas, and matching vegetation, non-extracted areas are used to produce comparative data on the positive/negative impacts of biodiversity extraction.
- **Survey 7** is intended to document the diversity and distributions of community time commitments and activities in the environment.
- **Survey 8a** is intended to document the diversity and distributions of health care resources and the impacts of their usage on the environment.
- **Survey 8b** is intended to document the diversity and distributions of fish and fishing resource and the impacts of their usage on the environment.
- **Survey 8c** is intended to document the diversity and actual applications of resource management practices and the impacts of their usage on the environment.
- **Survey 8d** is intended to document the diversity and distributions of weaving and craft resources and the impacts of their usage on the environment.
- **Survey 8e** is intended to document the diversity and distributions of carpentry and housing resources and the impacts of their usage on the environment.
- **Survey 8f** is intended to document the diversity and distributions of canoe construction and carving resources and the impacts of their usage on the environment.

8. Verify data

Information/data gathered are verified through one or more community meetings wherein the data gathered is presented and the interpretations of the researchers are questioned and considered by members of the community. This is essential to avoid misunderstandings and to uncover deeper meanings that external researchers might never understand but can at least document correctly.

9. Document results

Fieldwork records form a historical documentation of a community for a particular period in time. As such there will be no exact replica of the data due to the dy-

namic nature of the varied interactions taking place in time and place. Therefore researchers must strive to achieve the highest degree of accuracy possible in recording the data. They also should document the methodology applied for each event recorded. The following present some standard means of documenting bioethnographic information. Although this is presented as step 9, accurate documentation is used throughout the steps of the research process.

Photographic records—Photographic recordation of objects is an essential element of modern field research. Digital photography has become relatively cheap and is the best means for rapidly sharing data among the local group of researchers as well as the global community. Researchers should gather photographic information from three levels: community/system, populations/zones, and individuals/cases. Photographs in particular research sites should be taken in such ways that they provide overlapping detail between levels as described below. In order to build databases that can be utilized by other researchers, it is important to be explicit about scale, location, date/time, and photographic contents in the record tags that are embedded within each digital photograph. The size and clarity of digital photographs are constantly improving. In addition, the cost of computer storage is constantly decreasing and speed of access is constantly increasing. With these aspects in mind, researchers should record pictures with the highest resolution of the equipment available. Researchers may wish to modify picture size and other characteristics for individual publication or web site development, but copies of original large formats should be archived as permanent records of the research.

Community or system level photographs illustrate the maximal size of the area or landscape under study. Community photographs include entire ecosystems and are often taken from space or air. These photographs are of a scale that individuals (e.g., people, plants) cannot usually be distinguished, although some populations or vegetation zones should be identifiable. In some settings, the community may be small enough to be photographed from a high geographic point, from an offshore island or boat or from the ground. Community level photos should be marked with compass directions, date of photo and names of prominent features presented. Researchers should computer edit copies of community photographs to include outlines of research sites and other points that were important in the research process, such as boundaries (political, vegetation zone, geological, usage area, etc.), culturally important sites (sacred sites, community work and living areas, resource areas, etc.), and human access routes (trails, roads, waterways, etc.). Population or zone level photographs illustrate parts of the area or landscape under study. Photos may be taken of sections of vegetation zones or of entire zones, with the emphasis upon the zone and not individuals within the zone. However, these photographs need to be taken in such ways that individuals (at least some) are clearly distinguishable despite the middle level scale that is desired. Population photographs, particularly those illustrating specific research sites, should include embedded descriptions of the population or zone. GPS coordinates of the photographer's location and compass bearing should be included so that future researchers can produce comparative images that visually illustrate population change over time.

Individual or case level photographs illustrate detail of individual plants, people, interactions, or groups of each. Photos will need to be labeled with notes about the vegetation zone or population since it may not be immediately obvious. Activities shown within the photograph should be described in detail within the imbedded tag along with the full names of any individuals shown. Photographs of plants, animals, soils, and other items should include detailed descriptions of their usage/importance and a sound file recording of a native speaker saying the: 1) name of their language, 2) name of the item clearly repeated three times, 3) name of the item used in a sentence in their language, 4) a translation of the sentence, and 5) the full name of the person providing the sound file in their native tongue.

Researchers should include photographic images of themselves and people from the communities in which they are working. However, researchers must seek permission from persons shown to have their images shared in databases and/or used for publication. Those photographed should be shown in dignified ways with clean clothing, pleasing facial expressions, conducting tasks that are important to them. Candid photographs that are humorous or "catch" people in action should be avoided if they are disrespectful of the ways in which people wish to have themselves represented.

Digital video should be taken of all three levels discussed above and should be augmented with audio discussions of what is being shown. As with other forms of media, tags should be imbedded for dates,

locations, etc. and permission to distribute the footage should be clearly obtained.

Herbarium records—Samples of plants are the most essential element of field data collected in basic ethnobotanical research. The physical evidence of species are essential for researchers who wish to avoid antiquated, authoritarian research strategies that assume that researchers are perfect taxonomists and that identifications will never need to be changed. This is particularly important for researchers who may be uncertain of the taxonomic identifications of the plants being studied (Wommersley 1976). How to properly prepare voucher specimens of plants is explained in detail in Appendix 4.

When conducting ethnobiological research, plant specimens must be collected for each interview-identification. This will usually result in collection of many specimens of the same plant if many different people are interviewed, however this is essential for clear discussion of knowledge held by individuals and determination of variation in knowledge within the group. Data that should be collected in the field with each specimens include: local name of the plant (and language in which it is provided), name of the person interviewed who provided local name (researchers should not "assign" local names to plant specimens unless they are independently provided by a native speaker), date of collection, description of plant and its environment, location of collection in local terminology and GPS coordinates. Traditional usage data should be included if approved by members of the community. Some information such as medicinal or ceremonial usage may be restricted to certain individuals and therefore inappropriate for distribution to a wider audience. It is also desirable to reference specific digital photographs of the same individual plant from which the collection was made. It is not important to determine Latin scientific names in the field although if possible biological keys to families and genera should be used with fresh plant material to come as close as possible to a determination.

Researchers should always attempt to collect samples from the same individual plants that are identified by local experts. Researchers should not assume that all individual plants are the same species and mix specimens with parts from different individuals. Samples taken from different individuals should be labeled with different collection numbers and separate data even when experts declare that they are the same species.

Unique voucher specimens of each species of interest should be collected from each plot or transect study that is conducted. Although it is unrealistic for researchers to collect voucher specimens from each and every individual of a species that is encountered, researchers should watch carefully for variation and collect samples of each variant. Local taxonomic systems will often provide binomial terms for variance that is seen within plant populations or for morphologically similar species. It is very important to pay attention to local taxonomic experts and to collect samples of variance that *they* recognize. Commonality of variance that is sampled should be noted on the herbarium sheet labels.

Mapped, distribution and density records—Maps and profile diagrams are powerful graphic devices for summarizing large amounts of data and should be used liberally. A variety of computer software for mapping exists and are easy to use. But the fieldworker who is not fully trained in this technology should take advantage of the service of individuals who are graphics specialists. Entry of data in electronic format is a must for the easy analysis, display, storage, retrieval and dissemination of information. Digital mapping and data storage also greatly assist identification of spatial variation in distribution of species and of potential environmental variables that may warrant follow up investigation. Records need to include sufficient detail for other researchers to locate plots/transects, and if need be, reproduce the research in precisely the same location. Global Positioning System (GPS) devices are now accurate enough to provide locations for even the smallest of research plots, therefore GPS coordinates as well as local, specific place names of research locations, need to be included in the data set being recorded. Distribution and density records should reference herbarium voucher specimen numbers rather than species names (although these should be included as well) so that data is not limited by the individual researcher's authority or judgment. Since some researchers recognize species in a broad sense and others in a more narrow sense, voucher specimens allow both to utilize the same data with differing interpretations.

10. Share/return information with the community

The local community that has hosted outsider researchers and shared resources of stories, beliefs, attitudes, specific knowledge and time in myriad ways necessarily will have heightened expectations about the re-

sults of the research. It is good practice to share the preliminary results/observations with the community as far as possible especially because there is usually a substantial time lag between completion of fieldwork and completion of final report. If possible the results should be shared in the same groupings of individuals (such as the focus groups) that provided original data. It is possible that new information, elaboration or clarification may be forthcoming at these sessions. The important point is that preliminary results are shared and sense of accomplishment and closure is achieved. It goes without saying that all finished products must be shared with the local community.

Every host who shares hospitality with a guest gives up something tangible or intangible in the process. Pacific Islands communities share similar reputations for readily embracing outsiders and welcoming then into their homes. This island hospitality which in Hawai`i is expressed as *aloha* and experienced in `*ohana* (family, clan) binds individuals. An outgrowth of this is that both outsider and insider develop expectations for continued caring for the other. Researchers must find ways to demonstrate their gratitude to individuals and the communities from which they learn so much. This could take the form of correspondence, appropriate gifts, assistance with community projects, or other means that are appropriate to the circumstances and experiences encountered.

Conclusions

Research on human/ecosystem relationships in form of community-based ethnobiodiversity surveys is rather complex. To unravel this complexity it appears necessary to first clarify the process elements that drive human communities to impact biodiversity in their home island environments. In spite of the relative isolation of island communities, external influences have significant impacts on values, ethics, and local economies which combine to guide the logic of managing local biodiversity. This was explained by a simple model emphasizing the relationship among four human fields of influence.

Manifestations of human/ecosystem relationships were brought out in three ways, by focusing on human artifacts relating to biodiversity, mentifacts or human belief systems, and systems of governance. These all impact the valuation and use of biodiversity.

A second important aspect relates to research guidelines that evolved from experiences with ethnobiological research. The guidelines are here presented in the form of postulates that ask for further elaboration and testing. By thirdly focusing on the actual survey methods with questionnaires, we suggest that there are still many time consuming steps to be observed before one can actually collect adequate data on ethnobiodiversity. This is so because there is great sensitivity in investigating biodiversity management in human cultures. Members of human communities must be approached with respect and common sense. This relates in particular to the questions being asked. It is important to understand how they can be asked and evaluated to achieve realistic results without compromising the goal of learning about the uses and valuation of biodiversity as they have evolved in different human cultures and environmental settings.

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Appendix 1. Example questionnaires 1-4 for ethnobiological surveys.

(Further questionnaires are available on the PABITRA web site: www.botany.hawaii.edu/pabitra/)

Questionnaire 1: Part 1. Terrestrial and Marine Plant & Fungi Diversity

Reviewed Informed Consent Handout in English __ Other (Indicate) _____
Received Informed Consent Handout in English __ Other (Indicate) _____
Language used to Administer Questionnaire English __ Other (Indicate) _____

Questionnaire Group Interviewer _____
in Group _____ Location/Setting _____ Date _____
Circle all that describe at least one person in the group who will respond to questions:
child youth adult parent man woman grandparent
Other important descriptions of the group: _____

Responses to each of the following questions should be recorded in a notebook under the interviewers name, group, date and question number.

1. **Please list the names of all foods that are grown in gardens and villages.**
2. **Please list the names of all foods that are collected from forests, swamps, and other land places.**
3. **Please list the names of all foods collected from reefs and rivers.**
4. **Please list the names of all plants used in building construction.**
5. **Please list the names of all plants used in making canoes.**
6. **Please list the names of all plants used for making fishing equipment or for catching fish.**
7. **Please list the names of all plants used as poisons.**
8. **Please list the names of all plants used for clothing, weaving and crafts.**
9. **Please list the names of all plants used for ceremonial purposes (weddings, church activities, funerals, ancient activities).**
10. **Please list the names of all plants used for medicine, disease prevention, and hygiene.**
11. **Please list the names of any plants that have not yet been mentioned such as those without a use or those having uses not yet discussed.**

For each of the plants named for a specific purpose, ask:

- **Are there different varieties of that kind of plant?**
- **Is there another plant that can be used if the named plant is not available? If so, what is its name?**

Questionnaire 1: Part 2. Terrestrial & Marine Plant & Fungi Descriptions

Reviewed Informed Consent Handout in English __ Other (Indicate) _____
Received Informed Consent Handout in English __ Other (Indicate) _____
Language used to Administer Questionnaire English __ Other (Indicate) _____

Questionnaire Group Interviewer _____
in Group _____ Location/Setting _____ Date _____
Circle all that describe at least one person in the group who will respond to questions:
child youth adult parent man woman grandparent
Other important descriptions of the group: _____

Responses to each of the following questions should be recorded in a notebook under the interviewers name, group, date and question number.

Using the list of plant and fungi names recorded from Questionnaire 1 Part 1, write the name of each plant or fungi on a card or piece of paper. Ask the following questions for each plant or fungi and record the information on the card or piece of paper. For some plants or fungi additional pieces of paper may need to be attached to the first because of large amounts of information. For some plants or fungi almost no information will exist. This is ok.

1. **Please describe the important features of the plant or fungi.**

2. **Please list any uses for the plant or fungi.**

3. **Please list the kinds of places where the plant or fungi is found.**

4. **Please list the kinds of places where the plant of fungi is never found.**

5. **Please consider the plant or fungi and its origin. Where do new plants/fungi come from?**

6. **Are there stories that involve the plant or fungi? If so, please relate and record them.**

7. **Are there traditional rules for using the plant of fungi? If so, what are they?**

8. **Is the plant or fungi from this community, or is it considered to have come from elsewhere? If from somewhere else, is it known where and how it got to this location?** (If it is known, then record where it is from and how it got to this location.)

9. **Is the plant or fungi easy or hard to find? Is the plant or fungi more or less common than it was 20 or 60 years ago?**

Questionnaire 2: Part 1 Terrestrial and Marine Animal Diversity

Reviewed Informed Consent Handout in English __ Other (Indicate) _____
Received Informed Consent Handout in English __ Other (Indicate) _____
Language used to Administer Questionnaire English __ Other (Indicate) _____

Questionnaire Group Interviewer _____
in Group _____ Location/Setting _____ Date _____
Circle all that describe at least one person in the group who will respond to questions:
child youth adult parent man woman grandparent
Other important descriptions of the group: _____

Responses to each of the following questions should be recorded in a notebook under the interviewers name, group, date and question number.

1. **Please list the names of all birds, bats and other flying animals with which you are familiar.**

2. **Please list the names of all animals that are collected to eat from the forests, gardens, reefs and rivers.**

3. **Please list the names of all fish that are in the open ocean.**

4. **Please list the names of all fish or other ocean animals that are poisonous.**

5. **Please list the names of all fish that can be sold to obtain money.**

6. **Please list the names of all crustaceans, shellfish, worms, and other animals from the ocean that are eaten.**

7. **Please list the names of all crustaceans, shellfish, worms, and other animals from the ocean that cannot be eaten.**

8. **Please list the names of all animals that are needed for ceremonial purposes (weddings, church activities, funerals, ancient activities).**

9. **Please list the names of any animals that are rarely seen or are spirit creatures.**

10. **Please list the names of any animals that have not yet been mentioned such as those without a use or those having uses not yet mentioned.**

For each of the named animals, ask:

- **Are there different varieties of that kind of animal?**

Questionnaire 2: Part 2 Terrestrial and Marine Animal Descriptions

Reviewed Informed Consent Handout in English __ Other (Indicate) _____
Received Informed Consent Handout in English __ Other (Indicate) _____
Language used to Administer Questionnaire English __ Other (Indicate) _____

Questionnaire Group Interviewer _____
in Group _____ Location/Setting _____ Date _____
Circle all that describe at least one person in the group who will respond to questions:
child youth adult parent man woman grandparent
Other important descriptions of the group: _____

Responses to each of the following questions should be recorded in a notebook under the interviewers name, group, date and question number.

Using the list of animal names recorded from Questionnaire 2 Part 1, write the name of each on a card or piece of paper. Ask the following questions for each animal and record the information on the card or piece of paper. For some animals additional pieces of paper may need to be attached to the first because of large amounts of information. For some animals almost no information will exist. This is ok.

1. **Please describe the important features and habits of the animal.**

2. **Please list any uses for the animal.**

3. **Please list the kinds of places where the animal is found.**

4. **Please list the kinds of places where the animal is never found.**

5. **Please consider the animal and its origin. Where do new (baby) animals come from?**

6. **Are there stories that involve the animal? If so, please relate and record them.**

7. **Are there traditional rules for using the animal? If so, what are they?**

8. **Is the animal from this community, or is it considered to have come from elsewhere? If from somewhere else, is it known where and how it got to this location?** (If it is known, then record where it is from and how it got to this location.)

9. **Is the animal easy or hard to find? Is the animal more or less common than it was 20 or 60 years ago?**

Questionnaire 3: Part 1. Dietary Diversity

Reviewed Informed Consent Handout in English __ Other (Indicate) _____
Received Informed Consent Handout in English __ Other (Indicate) _____
Language used to Administer Questionnaire English __ Other (Indicate) _____

Questionnaire Group Interviewer _____
in Group _____ Location/Setting _____ Date _____
Circle all that describe at least one person in the group who will respond to questions:
child youth adult parent man woman grandparent
Other important descriptions of the group: _____

Responses to each of the following questions should be recorded in a notebook under the interviewers name, group, date and question number.

1. **Please list the names of foods that are eaten by the community almost every day.**
2. **Please list the names of foods that are eaten about once a week.**
3. **Please list the names of foods that are eaten about once a month or during special occasions.**
4. **Please list the names of foods that are difficult to prepare or require much time to prepare.**
5. **Please list food that can be eaten raw or uncooked.**
6. **Please list the different ways in which food can be processed (baked, boiled, mashed, etc.)**
7. **Please list foods that must be processed before they may be eaten. For each, indicate the needed processing and the results of eating unprocessed food.**
8. **What kinds of foods are considered to be favorites in the community? Why?**
9. **What kinds of foods are considered to be distasteful or only eaten when nothing else is available?**

For each of the above named foods,

10. **Are there different varieties of each kind of food?**
11. **Is there another food that can be used if the named food is not available? If so, what is its name?**

Questionnaire 3: Part 2. Dietary Descriptions

Reviewed Informed Consent Handout in English __ Other (Indicate) _____
Received Informed Consent Handout in English __ Other (Indicate) _____
Language used to Administer Questionnaire English __ Other (Indicate) _____

Questionnaire Group Interviewer _____
in Group _____ Location/Setting _____ Date _____
Circle all that describe at least one person in the group who will respond to questions:
child youth adult parent man woman grandparent
Other important descriptions of the group: _____

Responses to each of the following questions should be recorded in a notebook under the interviewers name, group, date and question number.

Using the list of foods recorded from Questionnaire 3 Part 1, write the name of each on a card or piece of paper. Ask the following questions for each food and record the information on the card or piece of paper. For some foods additional pieces of paper may need to be attached to the first because of large amounts of information. For some foods almost no information will exist. This is ok.

1. **Please describe the important features the food when it is ready to eat.**

2. **Please list any additional uses for the food other than eating it.**

3. **Please list the kinds of places where the food (or its main ingredient) is found.**

4. **Please list if the food can be processed, and if so the way in which it is collected, processed, served, and eaten.**

5. **Please list the specific materials that are needed to collect, process, serve, and eat each food.** (Materials would include tools/utensils, containers, wrappings, ovens, water, etc.)

6. **Are there stories that involve the food? If so, please relate and record them.**

7. **Are there traditional rules for eating the food? If so, what are they?**

8. **Is the food from this community, or is it considered to have come from elsewhere? If from somewhere else, is it known where and how it got to this location?** (If it is known, then record where it is from and how it got to this location.)

9. **Are the ingredients for the food easy or hard to find? Is the food eaten more or less commonly than it was 20 or 60 years ago?**

Questionnaire 4: Ecosystems & Vegetation Usage Zone Diversity & Descriptions

Reviewed Informed Consent Handout in English __ Other (Indicate) _____
Received Informed Consent Handout in English __ Other (Indicate) _____
Language used to Administer Questionnaire English __ Other (Indicate) _____

Questionnaire Group Interviewer _____
in Group _____ Location/Setting _____ Date _____
Circle all that describe at least one person in the group who will respond to questions:
child youth adult parent man woman grandparent
Other important descriptions of the group: _____

Responses to each of the following questions should be recorded in a notebook under the interviewers name, group, date and question number.

For each of the following the goal is to learn about general kinds of places and not specifically names locations.

1. **Please list the names of kinds of places where people could gather food.**

2. **Please list the names of kinds of places with flowing water or where fish can be caught.**

3. **Please list the names of kinds of places where people live and work.**

4. **Please list the names of kinds of places where people almost never visit.**

5. **Consider land from the highest mountain tops to the deepest ocean. Please list the names of land forms and kinds of areas across the landscape.**

6. **Consider where plants and animals are collected, hunted, or grown on land and in the ocean. Please list the kinds of places where various animals and plants are found.**

Write the names and locations recorded from questions 1-7 above each on a small card or piece of paper. Ask the following questions and record the information on each card.

7. **Please list the most important plants and animals found in the area.**

8. **Please describe the area and other areas that are often adjacent to it.**

9. **Within the community, is the area more or less common than it was 20 or 60 years ago?**

10. **Please stack the cards into groups that belong together. Is there a name for the group of in each stack?** (repeat this process and record any higher levels that are observed and the cards that are members of that level.)

Appendix 2. Example Informed Consent General Statement Handout

Copies of this document should be distributed to members of the community attending a community meeting to consider participation as a PABITRA network study site. The entire document and each item referenced should be read aloud in the vernacular language of the community. Generous time should be allotted for consideration of the proposal. If the community is eager to proceed, then a decision may be made, preferably using the local traditional system of decision making. If the community would rather delay the decision, this should be honored until such time as the community asks for another meeting.

Why is the specific proposed research to be conducted?

1. The primary reason that the network of research sites has been developed is to address a set of scientific questions about how the complexity of biological diversity changes across the Pacific Islands with the most complex diversity tending to be found on larger islands and those closest to New Guinea and less complex diversity tending to be found on smaller islands and those farther from New Guinea.
2. The secondary reason that the network of research sites has been developed is to train community members in ways to document, monitor, and assess the biological diversity for which they are the stewards. It is hoped that new skills and tools will be combined with ancient skills, tools, and wisdom to generate good management practices that can stand up to modern challenges caused by commercial logging, fishing, mining, etc. and natural events such as global warming. Application of the results of this research should result in conservation of traditional knowledge and resources as well as overall protection of island landscapes from over or non-sustainable development.
3. The tertiary reason that the network of research sites has been developed is to provide a set of ongoing learning situations that can serve as sources of income for local communities, educational sites for students of all ages, and long-term experiments for scientists from within and outside of the community.

What is the research that is being proposed?

Copies of questionnaires and surveys that are being proposed for use in the community are being distributed at this meeting. These list the kinds of questions that the research would ask as well as the kinds of information that would be gathered. This same research is being conducted in other Pacific Island communities and contacts in those communities can be provided if references are desired.

Who are the scientists conducting this research?

Copies of biographical statements by each of the scientists involved in the proposed research are being distributed at this meeting. The scientists are interested in learning from the community and in sharing their knowledge with the community. Please feel free to ask the scientists any questions about themselves and their interests in living and working in this community.

How can members of the community benefit from the research?

Any member of the community who elects to serve as a parascientist, scientist, or group participant will be compensated with meals during the meetings, payment for their time spent on the project and for their travel expenses, if any. Parascientists are individuals using the methods of science without needing formal training in science. Scientists are individuals using the methods of science who have formal training through college or other learning venues.

How can a member of the community participate in the research?

Members of the community may participate in at least two different ways. First, men, women, and older boys or girls who are willing to commit greater amounts of time may receive training and serve as parascientists leading

group discussions, recording information, and leading in questionnaires and surveys. The community should select individuals who are serious, committed, and intelligent. Second, men, women, boys and girls can participate in two different kinds of focus group studies intended to gather information about traditional knowledge of biological diversity as well as a record of the diversity that is present.

The first kind of focus groups will primarily be talking about traditional knowledge. These groups will involve meetings that will range from two to eight hours long. The meetings will not involve going anywhere but can be held in a home or community building. Participants should be knowledgeable and willing to share their knowledge with the group.

The second kind of focus groups will primarily be gathering physical data about living things in the local environment. These groups will be making measurements and gathering examples of different kinds of biological diversity found throughout the community's area. Participants should be knowledgeable of the biological diversity, able to work hard, and able to go to different locations in the community.

The community should decide in its traditional way, who will participate. It is hoped that the most knowledgeable and a mixture of men and women will be able to participate in the different groups.

Can members of the community refuse to participate?

Yes. No person is expected to participate unless it is their sincere wish to do so.

Can a member of the community change their mind to participate or to not participate?

Yes. A participant may decide to stop participating at any time. People who initially decide not to participate may later join a group if the community determines that this is best for the success of the project.

What will happen to the information that is learned?

All information that is gathered will be compiled into a computer database. This will then be used to produce different kinds of documents. The first kind of document will be a basic checklist of information. Copies of the checklist will be distributed to the community. Community members will be asked to check the spelling, accuracy, and completeness of the information. A community meeting will then be held in which members of the community can provide corrections and further comments. The community will also be asked during the meeting if there is any information that should be considered as confidential. Any confidential information will then be strictly controlled and not released in any further documents. Corrected versions of the checklist will be returned to the community for personal, family, and cultural records.

The results of the research will also include digital photographs (of plants, plant environments, people using plants, and researchers/participants gathering data), written and electronic field notes of interviews and surveys, voucher specimens (of each plant and animal discussed), and artifact samples of objects produced as part of the research. The results will be stored in electronic databases and as paper printouts in local university and government offices as well as in the offices of the researchers. Results will be distributed to PABITRA network researchers, participants, and associated government agencies. Specific parts of the results will be written as scientific publications either as books or journal articles. None of the results will be used for profit making ventures. As much as possible, results will be used for production of locally requested science books and other documents that can assist in education and conservation of community knowledge and wisdom.

Will the researchers make money using the information that is learned?

No. In fact, the researchers will have to spend money to pay for the costs of publishing data and research papers. The readers of most of the publications are other scientists. The publishing scientist is not paid for writing the

research papers, but often does maintain their employment by continuing to publish new papers. The researchers involved in these projects are motivated by curiosity not the desire to become rich. The researchers hope to work with members of the community who are likewise curious and do not desire riches.

Is the proposed research acceptable to the government?

Yes. Before asking to hold a community meeting, all appropriate permits have been received. These include research and human subjects permits from the appropriate government agencies. Human subject permission is needed in all research where people will be asked questions. Lack of a human subject permit violates national and international laws. Copies of each permit are available for inspection at this meeting. The research will be conducted in ways that are consistent with international agreements such as the Convention on Biological Diversity as well as national laws governing research and collection and study of biological diversity. Approval by national governments and agencies is needed to conduct the research, however, each community has the right to agree to or refuse to participate in the research without penalty from the national government.

Appendix 3. Example Informed Consent Question Sheet

Informed Consent Question Sheet

Question 1: (preferably first posed to a community, then prior to each part of the study as groups of individual participants meet)

Would you be willing to let me read a statement about the research interests of the project we are proposing?

(If yes, then read the Informed Consent General Statement, Informed Consent Researcher Statements, and all Questionnaires and Surveys that will be used.)

Question 2: (preferably first posed to a community, then prior to each part of the study as groups of individual participants meet)

Would you be willing to participate in the study and share your knowledge with the researchers and other members of your community?

(If yes, then read the following and conduct first part of survey.)

Statement:

If at any time during the course of the survey, questions are asked you or the researchers do something that you do not feel is appropriate or makes you uncomfortable, please let us know and we will not continue. We want to be respectful of your personal and cultural views.

Appendix 4. Example surveys of biological diversity

Survey 1: Part 1a. Terrestrial and Marine Plant & Fungi Diversity Distributions

Reviewed Informed Consent Handout in English __ Other (Indicate) _____
Received Informed Consent Handout in English __ Other (Indicate) _____
Language used to Administer Questionnaire English __ Other (Indicate) _____

Survey Group Survey Leader _____
in Group _____ Location/Setting _____ Date _____
Circle all that describe at least one person in the group:
child youth adult parent man woman grandparent
Other important descriptions of the group: _____

Responses to each of the following questions should be recorded in a notebook under the interviewers name, group, date and question number.

Use the list of plant and fungi names and locations recorded from Questionnaire 1 Parts 1 & 2 and Questionnaire 4. Write the name of each plant or fungi on a small card or piece of paper. Write the names of each vegetation usage zone on two large envelopes (two envelopes for each vegetation zone). Begin the survey group meeting sitting at a table or other work space where all can participate. Be prepared with extra blank cards for writing more plant or fungi names.

Ask the group the do the following:

1. **Please sort each plant or fungi card into vegetation zones where it is found.**

If a plant or fungi is found in more than one zone, then prepare as many more cards as are needed. Place all of the cards for each zone into one of the two envelopes for the zone. Mark the other (empty) envelope with the word “completed”.

After all of the plants and fungi have been sorted (record and set aside any that are confusing or unknown), then hand each person 10-20 large plastic bags and a set of plant cutters and instruct the group to do the following:

2. **Please select one of the zones and go as a group or in twos or threes to a nearby example of that zone. Follow the directions for collection of voucher specimens and return with the specimen and the card in a plastic bag.**

As a group, prepare the voucher specimens and enter the appropriate data for production of labels into the database.

Repeat the above process for each vegetation zone.

Survey 1: Part 1b. Terrestrial & Marine Plant & Fungi Diversity Distributions

Reviewed Informed Consent Handout in English __ Other (Indicate) _____
Received Informed Consent Handout in English __ Other (Indicate) _____
Language used to Administer Questionnaire English __ Other (Indicate) _____

Survey Group Survey Leader _____
in Group _____ Location/Setting _____ Date _____
Circle all that describe at least one person in the group:
child youth adult parent man woman grandparent
Other important descriptions of the group: _____

Responses to each of the following questions should be recorded in a notebook under the interviewers name, group, date and question number.

Use the cards prepared for Survey 1a sorted by vegetation zone. Begin the survey group meeting sitting at a table or other work space where all can participate.

Lead the group the do the following:

1. **Please select one of the zones and go as a group or in twos or threes to a nearby example of that zone. Follow the directions for analysis of vegetation found in section 3.3 of the PABITRA manual. What is the diversity of vegetation as discovered by the relevé method? Does this relate to patterns of traditional land management?**

As a group, review the results of the vegetation analysis. If needed, revisit specific zones to gather missing data.

Repeat the above process for each vegetation zone.

The research team should have determined in advance which of the methods outlined in Chapter 3 will be used in the site. Conduct the following using the preselected methods.

2. **Please select one of the zones and go as a group or in twos or threes to a nearby example of that zone. Follow the directions for population sampling outlined in Chapter 3. What are the quantitative results determined from these methods?**

Lead the group in answering the following:

3. **What kinds of traditional activities are conducted in the vegetation zone? How often is each activity conducted? How many people participate each time?**