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Decision Tools for Sustainable Development

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DFID Department for International Development

Natural Resources Institute
the University of Greenwich

Decision Tools for Sustainable Development

Edited by

Ian F. Grant and Chris Sear

DFID Department for International Development

Natural Resources Institute

The Natural Resources Institute (NRI) of the University of Greenwich is an internationally recognized centre of expertise in research and consultancy in the environment and natural resources sector. The Institute carries out research and development and training to promote efficient management and use of renewable natural resources in support of sustainable livelihoods.

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CONTENTS

Chapter 3

LOCAL PEOPLE'S KNOWLEDGE: ITS CONTRIBUTION TO NATURAL RESOURCE RESEARCH AND DEVELOPMENT

Hilary Warburton and Adrienne Martin

INTRODUCTION

The generation, transmission and application of knowledge are vital to the development of strategies for sustainable natural resource (NR) management. Changing pressures on NR use, the complexity of agricultural systems and the risks inherent in surviving in fragile ecosystems mean that local people need relevant knowledge and information systems to make informed decisions over NR management.

Advances, for example, in data processing techniques such as geographical information systems (GIS) or genetics, provide opportunities for the application of new technologies to the problems of rural poverty. However, knowledge about natural resources is not the sole preserve of scientists. Farmers have been developing agricultural systems, domesticating animals, breeding new crop varieties, constructing irrigation systems, etc., throughout the centuries without the aid of formalized scientific approaches and agricultural extension systems. Also, the application of new scientific knowledge does not occur in a vacuum but has to be incorporated into a specific context.

In this chapter the importance and relevance of the knowledge systems of local people are discussed in relation to NR research and development. The first section considers what is meant by local knowledge, how it relates to scientific knowledge and some of the theoretical issues in looking at knowledge systems. The second section looks at approaches and methods that can be used to incorporate local knowledge into research and development projects. Lastly, case studies taken from Department for International Development (DFID)-funded projects illustrate aspects of local knowledge related to different natural resources.

APPROACHES TO UNDERSTANDING LOCAL PEOPLE'S KNOWLEDGE

A variety of terms have been used in development literature to refer to the collective knowledge of local people: indigenous knowledge, indigenous technical knowledge, 'traditional' knowledge or rural people's knowledge. The term 'local people's knowledge' (LPK) is used here to include local knowledge of people in both rural, peri-urban and urban communities who use natural resources in some way. Many may be farmers, but those with other occupations, such as pastoralists, foresters, hunters and gatherers, fisherfolk, artisans, food processors and traders, should not be forgotten. Many are likely to be poor, relatively powerless and marginalized. Local knowledge is also held by those in the government and private sectors.

There have been a number of different approaches to looking at LPK and its relationship to development issues. Prior to the 1970s, the study of local knowledge systems tended to be thought of as mainly of academic interest – the preserve of anthropologists and ethnoscientists – rather than of relevance to development specialists. Since then there has been a growing interest in the role of local knowledge in development, initially focusing on indigenous technical knowledge (ITK) and emphasizing the differences between western science and ITK. Over subsequent years the debate on LPK has widened and the emphasis changed from one concerned with technical knowledge *per se* to an emphasis on the processes of knowledge generation itself and the interactions of those involved in development, adoption and diffusion of knowledge.

Transfer of technology approach

In the 1950s and 1960s a prevailing view was that scientific research applied to problems of rural poverty would provide the new knowledge needed to transform rural people's lives and improve their welfare. New technologies were generated, then transferred to extension services for dissemination onwards to farmers. The flow of knowledge was one-way, from scientifically trained researchers via extension to farmers. This transfer of technology (TOT) model (Chambers, 1983), implicitly assumed that the source of all useful knowledge lay with scientists, and that rural people had nothing to contribute, their knowledge being inadequate and unscientific (which was the reason why they remained poor) or, at best, irrelevant and only of interest to a few anthropologists. Farmers were regarded as passive recipients of new knowledge and were either adopters or non-adopters of the new technologies. Although the debate on LPK has moved on from this view, in practice, the TOT model continues to exercise a strong hold in many development projects and in research and extension systems.

Criticism of the TOT model was prompted partly by the growing evidence that many development projects were not working well and farmers were not adopting recommendations. Instead of the non-adopting farmer being regarded as inherently conservative or irrational, it was argued that the recommendations and technologies were not always appropriate to the farmer's circumstances (Brokensha *et al*., 1980, Chambers, 1983). There was also a concern that local knowledge was being displaced by the prestige and arrogance of formal science and therefore, the capacity to produce it would wither away.

Studies of indigenous technical knowledge

These concerns over the TOT model led to an increased interest by those involved in development in looking at the social and economic situation of resource-poor farmers and their knowledge of their own environment and farming systems.

Many studies of ITK have pointed out the richness and depth of local people's knowledge (for example, Brokensha *et al.,* 1980; IDS 1979). Instead of farmers learning from scientists, there were many things that scientists could learn from farmers. For example, Hanunoo farmers in the Philippines could identify 400 more varieties of rice than taxonomists (Conklin, 1957, cited in Brokensha *et al.,* 1980); Iko bushmen used observation, touch and smell to distinquish between plant species (Heinz and Maguire, n. d., cited in Brokensha *et al.,* 1980); Kenyan farmers described aspects of the life cycle of variegated grasshoppers of which scientists were unaware (Richards 1980); farmers in East Africa knew there was an association between rainfall and lunar phase, an observation at first denied by scientists then subsequently found to be true after analysing climate data (Reed, 1970, cited in Chambers, 1983). The studies demonstrated that farmers could be keen ecologists, with detailed knowledge of their local environment and observation of natural phenomena over many seasons.

LPK does not only relate to knowledge of the environment and farming systems but also to the active process of innovation. Farmers experiment and develop technologies to fit their own environment (for example, Chambers *et al*., 1989). Richards (1985) detailed many forms of experimentation and innovation by farmers in Africa. Farmers in Bangladesh showed Brammer (1980) how they had developed horticultural-type methods for growing cereals in areas he thought unsuitable for growing such crops. Farmers in the Andes modified storage for potatoes (Brush, 1980). Experiments may be undertaken as part of normal farming practices and can be divided into those aimed at solving particular problems, those aimed at adapting technologies to local circumstances, and those simply undertaken out of curiosity, to see what happens.

The literature on ITK demonstrated the rationality of rural people's knowledge and its usefulness in inventing and adapting technologies to local conditions. One of the main strengths of ITK was the ability to place technologies in both their social and ecological contexts. It was argued that ITK was a valuable resource and could complement scientific knowledge. As such it should be studied and incorporated into formal research to make development projects more appropriate to local people's needs and more sustainable. Instead of a one-way flow from scientists to rural people, a much more equitable partnership was envisaged between them.

From ITK to a wider perspective on local knowledge systems

Much of the original focus of studies on local knowledge was on technical knowledge. More recently there has been a move amongst development specialists towards a wider definition of local knowledge which includes cultural as well as

technical knowledge (Scoones and Thompson, 1994; Bebbington *et al*., 1993). This move to rural people's knowledge (RPK) from ITK recognizes that local technical knowledge is interlinked with social and political knowledge and skills. (A view closer to the anthropological perspective.)

There has also been increased recognition that LPK is not just a discrete and fixed pool of knowledge belonging to one community. It is a dynamic process. Knowledge is generated and diffused through the interactions of people within specific social and agro-ecological contexts. Within a community there is not one set of accepted knowledge, but many people with differing objectives, interests, perceptions, beliefs and access to information and resources. "Knowledge which is diffuse and fragmentary, emerges as a product of the discontinuous inequitable interactions between these competing actors" (Scoones and Thompson, 1994). This process is sometimes referred to as the 'social construction of knowledge'. It is in the confrontation between different knowledge and social systems that innovation and generation of knowledge occur.

This more complex view of local knowledge focuses not just on what people know, but on how local knowledge is generated, shared and transmitted. It recognizes that knowledge and access to knowledge are not spread evenly though a community, neither are they unchanging. Knowledge systems are not objective, detached and value free, but inextricably linked with the social, political and agro-ecological context in which they arise. This applies as much to western science as to any system of local knowledge.

Issues of power and social relations are, therefore, not irrelevant to local knowledge but are fundamental to it. Instead of just gathering knowledge from local people and incorporating it into development projects, the emphasis is on the active participation and negotiation by local people in knowledge generation and use. Approaches such as participatory action research (PAR) are used as a means whereby researchers can act as facilitators in encouraging local learning and action.

Knowledge is much more than a collection of facts: it relates to the whole system of concepts, beliefs and perceptions that people can hold about the world around them. This includes the way people observe and measure what is around them, how they set about solving problems, and how they validate new information. It also includes the process whereby knowledge is generated, stored, applied and transmitted to others.

The main points arising from this can be summarized as follows:

- LPK includes cultural as well as technical knowledge
- LPK is not independent of social and agro-ecological conditions

- LPK depends on the interaction of people, therefore, issues of power and social relations are relevant when looking at LPK
- LPK is a dynamic process, not a fixed pool of knowledge.

Who has knowledge and whose knowledge counts?

One consequence of this view of LPK is that it is important to find out who has knowledge and of what type, and whose knowledge counts within the community.

The depth of knowledge about natural resources amongst local people may vary depending on their familiarity with the resources, the differences in responsibilities and the differences in individual interest and intellect. Brokensha and Riley (1980) provide an example from the Mbeere people of central Kenya:

> "Generally, the best information about the small annual herbs is obtained from older women; herd-boys, being always hungry and also experimental, are experts on the range of wild edible fruits; honey-collectors show the most detailed knowledge of flowering sequences, and indeed know most differential characteristics of their local plants. Yet even within a group, one individual will stand out because of keen powers of observation, prodigious memory, curiosity and intellect."

It has already been noted that knowledge and power are interlinked. Differences in social status can affect perceptions, access to knowledge and, crucially, the importance and credibility attached to what someone knows. Differences in relations of power affect which knowledge system becomes openly accepted. For example, Chambers (1983) argues that it is the linkages between modern scientific knowledge and power that condition those with formal education (teachers, extensionists, health workers) to believe that their knowledge and skills are superior to uneducated rural people. It is the knowledge of the most marginalized people that is likely to be disregarded. Power structures may mean that those who have a more in-depth knowledge may be ignored in favour of those with higher status. For example, landless labourers in South East Asia may know more about non-rice food sources in the paddy than the farmers who own the land; in West Africa, the knowledge of a Fulani herdsman about cattle may be ignored because he is an outsider and not fully integrated into the local community, despite the cattle owner delegating responsibility for looking after the cattle to him. When asking for a farmer who is knowledgeable about cropping systems, the researcher may well be taken to the largest and richest farmer (who has sufficient money to solve any technical problems) rather than to the poorer, more knowledgeable individuals who have to rely on their own ingenuity to solve problems.

Gender differences in knowledge

One area where the differences in knowledge and the effects of power relations can often be seen is differences between men and women's knowledge (Fernandez,

1994). Women's knowledge may differ from men's because of gender-based differences in the division of labour. For example, women may be responsible for certain crops or certain operations, such as post-harvest processing. In addition, differences in power relations between men and women may affect their access to knowledge. For example, women may have less access to formal modes of knowledge transmission, such as formal education or village meetings with agricultural extension officers.

In summarizing the possible differences, Norem *et al.* (1989) argue that women and men may have:

- a different knowledge of similar things
- a different knowledge of different things
- a different way of organizing knowledge
- a different way of preserving and transferring knowledge.

It should always be borne in mind that women and men are not undifferentiated groups. There may well be many groupings within each gender. Such differences could also be applied to other social groups (differentiated by age, status, wealth, etc.).

STATIC VS. DYNAMIC: 'TRADITIONAL' AND 'MODERN' KNOWLEDGE

Local people's knowledge is sometimes referred to as 'traditional' knowledge. If LPK is a dynamic process, the concept of 'traditional' knowledge can be problematic.

In certain societies where there has been little change within the farming system over many years, it may be possible to identify knowledge systems which can be considered 'traditional', i.e. a discrete stock of knowledge generated at some (unspecified) time in the past. However, in most rural areas, the use of the term 'traditional' knowledge to distinquish LPK from western science or 'modern' knowledge is misleading as it tends to imply a static, unchanging system. people adapt to changes in their environment and absorb and assimilate ideas from a variety of diferent sources around them. Rural societies are not completely isolated from western or any other types of knowledge systems and within each society there are multiple sources of innovation (Biggs, 1989). Drawing a line between 'traditional' and 'modern' knowledge is very difficult in practice and care is needed in using these terms.

CHARACTERISTICS OF LOCAL PEOPLE'S KNOWLEDGE

It has been argued that LPK has different characteristics to western science due to differences in subject matter, ways of observing and understanding the world (epistomology) and the local context.

LPK tends to be based on observation and detailed knowledge of the local environment over time. It is shaped by the ecological system in which it is located, so is specific to that area, whereas western science tends to generate knowledge with more universal application. Farmers take a more holistic approach to knowledge and problem solving rather than the reductionist approach of western science. For example, a farmer may look at the overall health of the plant, whereas a plant pathologist focuses only on specific disease pathogens. NR-related problems are not just 'technical' problems but part of rural peoples' overall social world with implications for food security, incomes, labour use and relationships with family, kin and neighbours.

Strengths of LPK lie in local people's ability to observe events over a sustained period of time and focus on what directly affects their lives. Many societies using low external inputs tend to adapt to their environment, rather than trying to control it. This gives them an intimate knowledge and understanding of their own environment. Such adaptation to the environment may also be more compatible with conservation. Farmers often have detailed knowledge of aspects such as micro-climates and details of observable phenomena such as plant growth stages and plant associations, seasons and location.

Methods of experimentation may differ with local people relying more on observation, experience and trial and error. Their methods may not be systematic or analytical compared with scientific methods. However, this is not always the case. Richards (1994) provides an example of farmers using sound empirical methodology in evaluating rice germplasm; Fairhead and Leach (1994) argue that rural people do theorize about agro-ecosystem processes. On the other hand, there are also cases where scientific knowledge is not applied in an objective way and where many advances are made on the basis of trial and error and good luck.

Comparisons between knowledge systems

Although such differences can be identified between LPK and western science, drawing a clear line between the two systems is difficult. Authors such as Agrawal (1997) argue that such a dichotomy is misleading. There is great diversity within knowledge systems, whether labelled as 'indigenous' or 'western', 'local' or 'scientific'. The knowledge systems of Bolivian campesinos may vary considerably from those of Somali pastoralists. In addition, many types of knowledge coexist within the community, for example, western scientific ideas exist together with many forms of local knowledge. Rather than perceiving LPK and western science as opposites, it is better to be aware of the possible multiple

domains and types of knowledge and to look for the differences and similarities between each type. Norgaard (1988) argues that all knowledge systems, including western science, are embedded in their own cultural settings and, as such, all systems are relative.

Comparisons between LPK and science are, therefore, comparisons between different knowledge systems, rather than an evaluation of LPK against the absolute, objective standard of western science. This does not mean that comparing local perceptions and beliefs with scientific research is invalid or useless. Such comparisons (which are often undertaken in studies of LPK) can be extremely useful. However, simply labelling any LPK that does not conform with scientific research as 'wrong' without trying to understand why the differences arose is unlikely to be helpful in developing useful research that can build on what people already know.

Differences in concepts, classification and language

When studying LPK, researchers need to be aware that local people may use very different concepts to them in understanding natural phenomena, and in their classification systems and the language they use to express these.

In western science the key concepts of natural resources and agricultural systems contain a number of commonly used related concepts to aid further understanding, such as soil fertility, disease, natural enemies and plant resistance. It should not be assumed that any of these necessarily relate directly to equivalent concepts of local people who may have their own concepts and terms to understand and describe the world around them, for example, concepts of soil softening and warming (Fairhead, 1992). Research and extension messages based on scientific explanations are likely to be reinterpreted by local people in the light of their own concepts. Local ideas of cause and effect may vary from place to place, for example, in some communities, incorporating moral or supernatural causal agents in addition to natural phenomena.

Local classification systems may vary both in the characteristics used to classify and in the detail and depth of classification. In some cases the classification relates closely to the practical use. For example, soil types may be classified by the use that can be made of them such as, 'good for yam', 'good for cassava', rather than the soil structure and nutrient content. Bentley (1992) observes that farmers tend to have more detailed and in-depth classifications and knowledge about important and visible phenomena, but limited knowledge of things which are considered to be unimportant or are difficult to observe (Figure 1).

Local classification systems vary in the extent to which they are widely used or specific to a particular district, village or sub-group and in the degree to which classifications and explanations are consistent or diverge. Local names may be very specific to location. For example, the word, *osa,* is used in certain villages in Ghana to mean specific types of caterpillar only; in other villages where the same

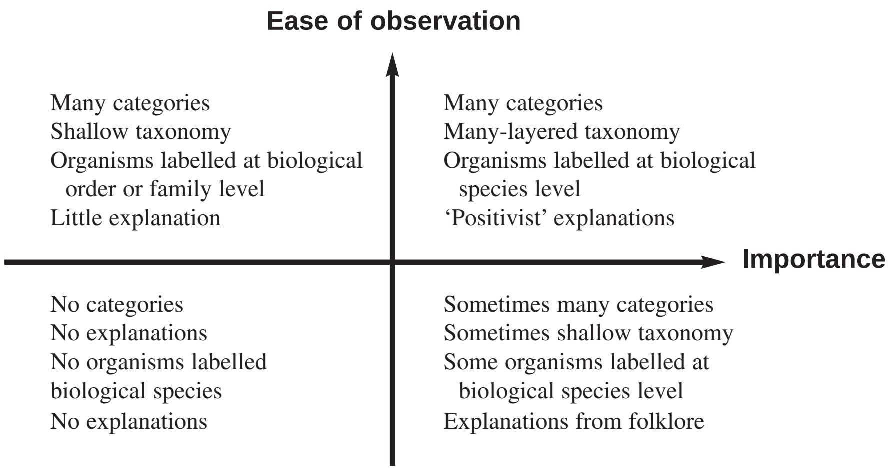

Figure 1 Characteristics of four classes of farmer knowledge (from Bentley, 1992).

local language (*Twi*) is spoken, *osa* has a more general meaning including stemborers and other larvae (Sarfo-Mensah, personal communication).

The language to describe local concepts and classifications often has no direct translation into English or other languages. The complex task of interpreting categories expressed in local languages is well illustrated by examples from a project investigating local knowledge of soils in Tanzania and Uganda. When farmers were asked about their different 'soil types', a long list of categories was produced. However, on closer discussion it became clear that this contained local terms describing land in multiple senses, including terms referring to land use, for example, cultivatable and non-cultivatable land, plots growing food or cash crops, grazing areas, open spaces, etc., as well as physical descriptions of the soils. Categories overlap and coexist rather than being exclusive and their boundaries are blurred rather than fixed and definite, for example, three different terms were given for 'sandy' soils in a village in Katakwi district of Uganda. These were loosely distinguished by different sand grain size, colour, fertility, subsoil, but all were more or less sandy.

LIMITATIONS OF LOCAL PEOPLE'S KNOWLEDGE

In highlighting the strengths of LPK, it is important not to over-romanticize it. Farmers know a lot, but not everything. Chambers (1983) notes that farmers may know much about agricultural cropping systems but their beliefs on health may may be wrong or even dangerous. Bentley (1992) points out that what farmers do not know cannot help them. In his classification of the four types of farmer knowledge (Figure 1), he notes that scientists may well learn from farmers about the important, conspicuous phenomena, but farmers, who lack the means to

observe microscopic elements, can learn from scientists about the less easily observed phenomena.

Knowledge of indigenous peoples is important in managing and conserving natural resources, and this has led to a view that such knowledge leads to sustainable practices and reflects a balance of people's needs and nature evolved over time. Although such linkages between environmental conservation, local knowledge and practices of indigenous societies may certainly exist and be of great value, a completely uncritical acceptance of LPK as always synonymous with conservation can be misleading. In the case of tropical forest conservation, for example, Browder (1995) argues that such a view is overstated. Local knowledge systems change over time, and non-indigenous people coming into an area can adapt to new environments and develop local knowledge over time. Also he argues that assuming contemporary indigenous people behave in an ecologically appropriate manner, unlike others, is both hypocritical and culturally insensitive.

WHY IS LOCAL PEOPLE'S KNOWLEDGE IMPORTANT FOR DEVELOPMENT?

Having discussed issues in the study of LPK, its characteristics and limitations, we can identify the following areas in which LPK is important for development:

- an essential first step for any development project
- better innovation and adaptation of technologies to local conditions
- adds to scientific knowledge
- increases understanding between researchers and local people
- increases the local capacity to experiment and innovate
- helps to empower local people.

An essential first step for any development project

As a basic requirement, any project which seeks to introduce new knowledge and new technologies, should find out first what people know. Not to do so is firstly, arrogant and discourteous, and secondly risks the possibility of introducing elements which are known already, or not appropriate. New innovation should build on what people already know and enhance it; it should not ignore what is already there.

Better innovation and adaptation of technologies to local conditions

Local people's knowledge of their own agro-ecological and social environment means that their knowledge can contribute to developing appropriate solutions.

Adds to scientific knowledge

Local people's knowledge may be more extensive or in-depth than that of scientists. There may be much to be learnt, especially about how to survive in harsh and marginal environments. Therefore, knowledge gained from local people can add to knowledge which may be of use elsewhere. In addition, valuable local knowledge can be recorded and preserved.

Increases understanding between researchers and local people

An increased understanding of the farmers' knowledge systems allows a better understanding of the rationale behind the farmers' actions and may allow better communication between both. It can also facilitate information exchange and local people's access to sources of information.

Increases the local capacity to experiment and innovate

In a changing environment, the capacity to innovate to find solutions for new problems is vital. Incorporating LPK into development projects is a means of supporting this by encouraging community self-diagnosis and raising awareness.

Helps to empower local people

More local participation in research and increased respect for local knowledge may help in focusing attention more clearly on the needs and priorities of the poor, and also add to their self-esteem. Instead of their knowledge being considered 'old-fashioned', 'ignorant' or 'irrelevant', such knowledge is respected.

HOW CAN LOCAL PEOPLE'S KNOWLEDGE CONTRIBUTE TO NR RESEARCH AND DEVELOPMENT?

Ways of finding out about and incorporating LPK in NR research and development will depend on the objectives, scope and resources available in the project. Whatever the approach taken, there are a number of key questions that should be considered. These include:

- who knows or needs to know?
- what do they know?
- how is knowledge generated, held, changed and transmitted?
- how does knowledge relate to action?
- how can local knowledge be incorporated and enhanced by the project?

Who knows or needs to know?

It may appear obvious who should be involved in studies of LPK. In many cases the key person will be the farmer, but it should not be assumed that s/he is the only person worth talking to. A useful first step is to identify all the different groups or individuals who use or have some dealings with the subject in question. Two examples from different NR projects (non-timber forest products and weed control) are shown in Box 1. In each case, individual stakeholders may have differing but pertinent knowledge. For example, gatherers may know a lot about where different fruit or other species of plant grow, but little about economic timber trees. In weed control, if women are responsible for weeding, they may know more about types of weeds than the (male) farmer. Labourers may observe more about pests and diseases of the crop if they are in the field every day than a farmer who visits once a week.

What the researcher should try to avoid is talking to individuals about subjects with which they are not familiar and missing those who may have more detailed knowledge. However, it can be difficult involving some of the people identified. There can often be some reluctance, both on the part of the researcher and local people. There may be pressure to ignore certain individuals because they are not educated. Local farmers may prefer to answer for their labourers or family; men often try to answer for women. Farmers themselves may feel embarrassed and reluctant to talk to the researcher.

Box 1 Example stakeholders

Non-timber Forest Products	**Weed Control**
Farmers	Farmers
Hunters	Women labourers (weeding)
Herbalists	Male labourers (pesticide application)
Fuelwood collectors	Pesticide dealers
Wood carvers	Extension staff
Gatherers (fruit, snails, etc.)	
Loggers	
Wildlife officers	

What do they know?

Researchers should be clear about their objectives here. There is a large difference between (a) finding out whether local people comprehend scientific knowledge and recommendations, and, (b) finding out local people's own understanding of the world around them.

Many studies of farmers' knowledge concentrate on the first objective and effectively set out to assess farmers' knowledge of scientific terms and practices. These can be useful, but they only investigate what the farmer knows in terms of western science and not in terms of his or her own concepts. If the farmer's answer differs from the researcher's knowledge, then it is often assumed s/he is wrong and has no knowledge. However, the farmer may have different knowledge expressed through different terms and concepts.

Finding out about local people's own knowledge requires the researcher to be open to different ways of viewing the world, and not to assume that local people automatically use the same set of concepts as they do. Main areas where there may be differences between local people and researchers include:

- classification and identification of natural phenomena
- concepts of cause and effect
- concepts of NR processes.

How is knowledge generated, held, changed and transmitted?

There are a number of questions that are useful to consider:

- what are people's sources of knowledge?
- who has access to what information?
- who learns from whom?
- what influences/changes existing knowledge?
- how is new knowledge validated?

People are likely to obtain information both from their own observations, experimentation and from many other sources. Mapping out all sources of information and the linkages (theoretical and actual) between such sources and local people can illustrate where the main channels of information are and who has access to them. There is sometimes a tendency for researchers to ignore sources of information outside the formal research–extension linkages, but sources, such as advice from other farmers, need to be considered as well as formal sources. Such local, informal sources may well be held in higher regard than that from outsiders who are not 'real' farmers. Commercial sources, for example, agrochemical dealers or traders, can also be very important and influential. Information via the media can add to farmers' knowledge. Ideas on nutrition, health, the environment may be incorporated into ideas about agriculture and natural resources.

Validation and acceptance of new knowledge is important, especially in assessing how new ideas are taken up. Researchers may validate new information by replicated trials and so on. Farmers may not have such a formal method, but may still carry out their own experiments. Widespread acceptance may also depend on the endorsement of certain key people, for example, chiefs or large farmers.

Participatory research is one way of incorporating knowledge generation directly into the project. Rather than the local people being the objects of research, they are actively involved in the process of research (see Chapter 1).

How does knowledge relate to action?

The relationship between knowledge and practice is not straightforward. For example, knowledge that cigarette smoking is harmful does not always lead to

giving up cigarettes. The researcher cannot assume that knowledge of something will lead to a change in practice. Conversely, the researcher cannot assume that a practice is not adopted because local people have insufficient knowledge. For changes to occur, people need the relevant knowledge, but also the social and economic ability to change, plus an attitude of wanting to change.

For example, farmers in Ghana were aware of the benefits of soil from rubbish tips on plant growth, but did not use such compost on their farms despite its free availability. The costs of transporting the compost to the farm, and the slow action of the compost were perceived as not worthwhile by farmers who had very short-term access to land. There was also a stigma attached to using dump soil containing untreated waste (Warburton and Sarfo-Mensah, 1998).

How can local knowledge be incorporated and enhanced by the project?

Advantages of incorporating local knowledge into research and development have been outlined above. Practical applications may include:

- changing research priorities and directing research into areas highlighted by LPK
- allowing better adaptation of research to the local environment
- identifying what farmers know and do not know, hence developing appropriate information and extension to fill in knowledge gaps
- enhancing local people's capacity to innovate.

METHODS FOR EXPLORING LOCAL PEOPLE'S KNOWLEDGE

Many methods have been used in eliciting LPK. Choice of method will depend on the objectives, scope and resources of the project and how much is known already. To gain an in-depth understanding of local knowledge systems requires detailed study. Techniques of cognitive anthropology, systematic studies of perceptions and folk taxonomies have all been used (see Brokensha *et al.* (1980) for examples). For the researcher without specialist, anthropological training, rural appraisal approaches can yield considerable insights if used with care. However, it should be borne in mind that short studies, even if well-conducted, are unlikely to produce the same level of understanding as that obtained through sustained, specialist study.

Existing studies

Before starting on any fieldwork, it is worth checking secondary data sources, including those outside the immediate scope of the project. For example, in-depth studies carried out in areas such as perceptions of human health can yield useful insights into how people view their world, and how they consider cause and effect.

Participatory approaches to exploring LPK

Participatory approaches involve local people in working with researchers in assessing their own situation, diagnosing and prioritizing problems and developing solutions. Qualitative research methods are used, such as semi-structured interviews, mapping, diagramming and ranking techniques, to enable local people to describe and discuss their situation. As this involves an emphasis on local people's own knowledge and practices and is situated within the community, use of such an approach can yield many insights into LPK. Qualitative research methods are more flexible than highly structured, quantitative methods such as questionnaire surveys, and can be better suited for finding out what, how and why people think and know about natural resources.

Use of qualitative, 'informal' methods is not a soft option, and requires as much or more skill from the researchers as for structured surveys. Poorly conducted PRAs can produce superficial results or be used to confirm what the researcher already thinks, without investigating in more depth. They also can be subject to interviewer bias, respondent bias and problems in translation in similar ways to structured surveys.

Examples of methods for exploring LPK

Semi-structured interviews

If it is not known what people know, then it is difficult to determine exactly the questions to ask and how to ask them from the outset, as would be required for a structured questionnaire. Semi-structured interviews allow the participants more scope to investigate what people know and to follow up in topics of interest as they arise in the discussion. They can be used with groups and individuals.

Group (focus) interviews

In a group interview, exchanges between participants with differences of opinion can often lead to greater insights into people's perceptions. Thought has to be given to the composition of the group so that as many participants as possible feel free to express their opinions. Those with less status may be hesitant to reveal what they know or to contradict others, and may be better interviewed in a separate group or individually.

Key informant interviews

It may be useful to find out and interview experts (those identified by local people as having specialist knowledge). Take care that such 'experts' do not only include those with formal education and access to scientific knowledge.

Field visits and transects

These are useful in allowing the farmer or informant to point things out *in situ*. Many aspects of agriculture and NR management cannot be described easily in interviews in the village. Also, such visits often provide a more relaxed atmosphere than a group meeting, making communication easier.

Mapping, diagramming, ranking exercises and games

These can be used in many different ways to elicit farmers' perceptions of important characteristics of natural resources, including spatial conceptions, definitions, classifications and boundaries. Examples are listed in Box 2. There is no finite list of techniques. The choice is dependent on the preferences and imagination of researchers and local people. Further ideas can be gained from literature such as *PLA Notes* (IIED).

Box 2 Examples of methods for exploring local knowledge

Participatory mapping of watersheds
Ranking of importance of pests and weeds using traditional board games (Barker, 1980)
Comparing characteristics of different soils using pairwise ranking diagrams
Seasonal calendars of rainfall patterns
Network diagramming of knowledge sources

Structured questionnaires and knowledge tests

Structured questionnaires and knowledge tests have often been used by agricultural extension researchers and others to find out how much local people know. However, such a quantitative approach is not usually a good starting point for studies of LPK, unless the researcher already has an in-depth knowledge of local perceptions and practices. Imposing the rigid structure of a questionnaire implies that the researcher already knows enough about people's perceptions and practices to be able to write specific, unambiguous and comprehensible questions (see Box 3). In practice, these questionnaires may reveal whether the respondents understand scientific terms but provide little information on what the respondents' own ideas might be. Knowledge, Attitude and Practice (KAP) surveys is the name given to these surveys which relate the respondent's knowledge and attitude to their resulting practices. Often the results are scored like a knowledge test. If the respondent's answer differs from scientific knowledge or recommended practice they may be classed as 'wrong' and as having no knowledge.

In general, structured surveys are not good for finding out about what, how and why local people think about natural phenomena and forming hypotheses about LPK. They can, however, have a useful role in following up on, and verifying, hypotheses generated using rural appraisal and other qualitative methods. For example, if it has been found from group interviews that farmers think that certain

Box 3 Example knowledge questions

Example KAP question	Comment
1. When should you apply pesticide in your field?	Complicated question which does not allow for other options.
• when there are a few butterflies in the field ____	Assumes the farmer associates butterflies with caterpillars or other pests.
• when the economic threshold level is reached ____	Assumes the farmer understands the concepts of economic threshold level and natural enemies.
• when there is an equal number of insect pests and natural enemies in your field ____	
2. When should fertilizer be applied to the crop?	Does not allow for other options.
• basal application and during panicle initiation ____	Does not allow for variation depending on the variety, weather conditions, condition of soil, etc.
• 10 days and during panicle initiation ____	Assumes that one answer is correct for all farmers' fields.
• 15–30 days and during panicle initiation ____	

weeds are good indicators of soil fertility, then a carefully worded questionnaire can be used to determine how widespread this knowledge is.

Some practical considerations

Change of attitude

The most important aspect in exploring LPK is not the variety or sophistication of the technique used, but the attitude of the researcher in listening, observing and not imposing their own ideas on those of the local people. This can prove difficult for researchers used to giving recommendations and trained to regard a scientific approach as the only way forward. Keeping an open mind, and recording differences between local people's perceptions and researchers' perceptions, together with the reasons for this, are more useful than simply recording local people's knowledge as 'wrong' or conversely, as always 'right' and 'in tune with nature'.

There is a need to look critically at the researchers' and extensionists' own 'knowledge' as much as that of the farmers.

Power relations

Rural people, especially the poor and marginalized, may be hesitant to explain to richer and more educated researchers what they do and why, preferring to defer to the more powerful and accept recommendations passively without comment. They may regard their own knowledge as so obvious that it does not need to be explained, or that it would be regarded as ignorant or irrelevant.

Problems in concepts and language

Differences in concepts and the language to explain them may hamper communication. Local terms describing natural phenomena may have no direct translation into English. The researcher has to be aware that the full meaning of the concept can easily be lost or distorted when translated. Noting the local name is often useful. Even researchers who speak the local language may find it difficult to translate local terms as they may never have used them in their 'scientific' work.

Context

Observation within the appropriate situation can be important. For example, farmers shown pictures or samples of insect pests in bottles may have great difficulty in recognizing them. This may not be because the farmers do not know the insect, but because the insects are being shown out of their natural context. Farmers (who are not used to looking under microscopes at tiny differences in shape or patterning) may normally distinguish between insects by their location, choice of host, position on the plant, type of flight, etc. A single dead leafhopper in a bottle is very different from several of them fluttering around the leaves of rice plants.

CASE STUDIES

The following case studies are taken from a number of projects funded by DFID. They cover three main areas of NR research: agroforestry, management of pests and diseases and soil fertility. The objectives and approaches varied among the studies, but they illustrate many of the issues discussed above about the contribution of LPK to research and development.

Agroforestry and tree fodder research

(refer to: Thapa *et al*., 1995, 1997; Thorne *et al*., 1997, in review; Walker *et al.*, 1997)

A research project on agroforestry and tree fodder was carried out in Nepal, in collaboration with Pakhribas Agricultural Centre; farmers' knowledge was studied as part of the research. The studies demonstrated that:

- farmers had knowledge that scientists did not have
- farmers had specific concepts for NR processes
- farmers had different classification systems.

Background

In the mid-hills of Nepal, agroforestry, crop and livestock production are closely interlinked. Animals provide draught power and manure for crop production and tree fodder provides feed for the livestock. Decreasing common property forest resources and decreasing farm sizes, due to land fragmentation, are causing farmers to incorporate more fodder trees on their farmland. However, farmers need to maintain a balance between providing sufficient high quality tree fodder for their livestock and minimizing the competitive effects of trees on staple food crops (trees compete with crops for light, water and nutrients, and also influence soil erosion through leaf drip effects).

Researchers aimed to improve the effectiveness of fodder research by making it more relevant to the priorities and existing knowledge of farmers and secondly, making more effective use of previous research findings. The specific aims of this research were to investigate and elicit farmers' knowledge of tree–crop interactions and tree fodder, and then record this information in a form which would be useful to other researchers.

Both questionnaire surveys and semi-structured interviews were used. Sixty farmers randomly selected were interviewed and a detailed tree inventory undertaken on half of the farms. Semi-structured interviews were carried out with 40 informants, purposively selected to include differences in gender, ethnicity and altitude of farm. Each informant was interviewed on average four times, with knowledge entered into a database after each interview. A follow-up survey was used to test the representiveness of the knowledge base against the knowledge of 50 other randomly selected farmers. Farmers' descriptions and classification of tree fodders were compared with chemical analyses to see if there was any correlation between the two systems.

In addition, information gained from the farmers was synthesized with scientific knowledge and researchers translated this into a structured knowledge base for wider use. This was done by means of a knowledge-based computer system called the Agroforestry Knowledge Toolkits (Walker *et al*., 1995).

Results

Tree-crop interactions. Farmers knew over 90 different tree species. They had detailed knowledge of tree–crop interactions, many of which had not been appreciated previously by the researchers. Farmers deliberately managed natural regrowth of trees on crop terrace risers and, therefore, did not need the provision of nursery-grown seedlings or tree planting schemes.

Farmers understood that shade and splash erosion caused by leaf droplets reduced crop yield and had a specific name for the process, *tapkan.* This term has no exact translation and local researchers were unaware of it. Farmers knew that attributes such as leaf size, texture, crown density, size, tree height and leaf inclination angle influenced the shade and/or leaf drip effects and, therefore, they considered tree crown architecture an important factor in choice of tree to integrate into their farming system. This factor had previously been ignored by researchers who had concentrated on such factors as survival rates, above-ground growth rates and total foliage production.

Farmers' understanding of *tapkan* also led to a re-evaluation of the process of soil erosion and resulting crop yield reduction caused by leaf drip. Farmers' assertions that leaf size and texture affected the size of droplets falling from leaves were in contradiction to prevailing scientific literature which held that droplet size was independent of canopy morphology. However, new evidence, using more accurate measurement instruments has found a difference in rainfall drop size under different tree canopies, thus suggesting that farmers' explanations may be valid scientifically.

The depth and spread of root systems were considered by farmers in managing below-ground interactions. Many tree species were classified either as *rukho,* which were thought to exhibit competitive effects which inhibited crop germination and growth, or *malilo* which were thought to contribute to soil fertility through decomposing litter and have less competitive root systems. There had been little research in Nepal on effects of root interactions, but this is one area which farmers consider important but know relatively little about (it is difficult to observe and research root systems) and may have potential for more research.

Fodder classification. Farmers were found to classify tree fodder according to two systems known locally as *posilopan* and *obanopan*. In the first system, fodders are described as *posilo* – nutritious or *kam posilo* – low nutrition. *Posilo* fodders are considered to promote milk production and high butter fat content, rapid live weight gain and animal health and to be palatable. In the second system, fodders are described as *obano* – 'dry and warm' or *chiso* – 'cold and wet'. Farmers consider *obano* fodders to be very palatable, particularly during cold months and associated with animal health, whereas *chiso* fodders were less palatable, and could cause animals to produce watery dung if fed during cold months. Fodders may vary in how they are classified depending on the species of animal to which they are being fed and factors such as season and age of fodder. Farmers assessed the fodder qualities for different trees and were able to differentiate variations in fodder in several, previously undifferentiated species. They also knew how the timing, extent and technique of fodder lopping affected the amount and quality of fodder production from different species.

The farmers' indigenous classification system was compared with laboratory assessments of nutritive value of fodders. These showed that the local classification systems were consistently applied by farmers and that there was some correspondence between local and scientific classifications, for example, between *posilopan* status and protein supply, and between *obano* and overall dry matter digestibility. These relationships were used in constructing a model of feed requirements based on farmers knowledge of the attributes of different fodder species.

Discussion

The research in Nepal not only demonstrated that farmers had detailed knowledge of agroforestry, but the process of research also had an impact on the way researchers thought about research priorities and interactions with farmers. Some of the advantages of this research were that it:

- added to scientists' understanding of tree–crop interactions
- helped scientists reorientate research towards topics of more relevance to farmers
- helped researchers develop a better appreciation of farmers' knowledge
- helped clarify, by recording knowledge in a logical way, what was and was not known and identified information gaps.

Farmers' perceptions of plant diseases

(refer to: Otim-Nape *et al*., 1997; Warburton, 1994; Warburton *et al*., in press)

Farmers' perceptions of pests and diseases, that is the identification of pests and plant symptoms, causal agents, relative importance and risks of crop damage, influence the type of plant protection measures they adopt. This case study draws on two research projects which have been looking at ways to develop more sustainable management of plant virus diseases: management of rice tungro virus disease, based in the Philippines, and management of cassava mosaic disease (CMD), based in Uganda.

Results from the two projects demonstrated that:

- farmers' knowledge is uneven
- scientists need to know what farmers know to provide useful help
- knowledge is not static but absorbs new ideas.

Rice tungro in the Philippines

Tungro is a virus disease spread mainly by green leafhoppers (*Nephotettix virescens*). Once a rice plant becomes infected, the leaves become yellow and stunted and the plant eventually dies. Tungro tends to occur in sporadic outbreaks and can cause major crop losses. In the Philippines, the Department of Agriculture in the 1970s and 1980s recommended farmers to spray insecticides to control the leafhopper vectors. More recently, the Department of Agriculture has emphasized non-chemical methods, such as the use of tungro-resistant rice varieties and removal of infected plants.

A collaborative project between the International Rice Research Institute (IRRI) and NRI aimed to research and develop sustainable ways of managing tungro. This included research into farmers' knowledge of tungro to find out whether farmers could recognize tungro and knew what caused it, how they managed the disease, and how their perceptions of tungro might affect their practices. Focused group interviews with farmers in villages which had varying outbreaks of tungro were undertaken first to gain an understanding of the issues surrounding tungro and to explore the reasons behind farmers' perceptions and practices. This was followed by a questionnaire survey of 242 farmers to cover a wider range of farmers.

Results

Farmers' observations of tungro symptoms were similar to those of scientists, but they were much less sure of the causes and mode of spread. About a third said that they did not know how tungro spread. Just over a third thought that insects were involved in spreading tungro but many thought that there were other modes of transmission as well, such as through the air, soil or water. Some thought that the virus was like 'micro-worms' in the plant. Even the farmers who knew that tungro was a virus disease spread by green leafhoppers did not realize the role of diseased plants in providing a source of inoculum for the leafhoppers to spread to other plants. There was no significant difference in knowledge of the disease depending on education, age or gender.

Farmers knew a lot about the differences in susceptibility to tungro of different rice varieties. In tungro-endemic areas, they actively experimented with, and sought out, resistant varieties. However, this observation led some farmers to conclude that tungro must be seed-borne, which is not the case.

Farmers' understanding of tungro and how it is spread did affect the control practices adopted. Spraying insects was a common practice, although this was not always targeted specifically at green leafhoppers. Careful choice of rice varieties thought to be resistant was a common strategy in tungro-endemic areas. However, farmers paid little attention to diseased plants left in the field. Without understanding the risks of leaving such plants, farmers lacked a rationale to adopt measures such as ploughing under infected stubble or leaving fallow periods.

Farmers' knowledge was influenced by information from a variety of sources. Extension messages associated with the drive to rice intensification emphasized the role of insects in damaging crops. Whereas older ideas tended to focus on climatic factors in explaining plant diseases, farmers now are very insect-conscious. Pesticide dealers reinforce the message against insects. Farmers are also 'germ'-conscious. Terms such as 'virus' and 'bacteria' are known to most through the widespread advertisements in the media for drugs. However, the fact that some farmers thought that viruses were like small worms implies that, although the terms are familiar, the way in which they are understood will depend on how they are incorporated into existing notions of plant diseases. Similarities in thinking about plant disease and human disease were expressed by farmers in several ways. The same words were used to describe plant and human sickness (*sakit*). Tungro was described as like AIDS or cancer because it was incurable once the plant was infected.

Cassava mosaic disease

Farmers' knowledge and perceptions of cassava mosaic disease (CMD) provide an interesting comparison to the case of rice tungro. Cassava mosaic disease is caused by gemini viruses which are transmitted by whitefly and spread by using infected stem cuttings for propagation. Although CMD occurs throughout the cassava-growing areas in Africa, its importance in Uganda has drastically increased in recent years, with rapid rates of spread and high levels of severity. As a result of this epidemic, cassava production has been seriously affected and food shortages have occurred in major cassava-producing areas.

NRI has been working with the Ugandan National Agricultural Research Organization since 1991 to develop strategies for CMD control, including the development, multiplication and distribution of resistant material. Surveys of the affected areas were followed by a number of interventions, distribution of virus-free, CMD-tolerant planting material to individuals and groups for multiplication, on-farm trials for farmers to evaluate resistant varieties, and training for extension workers, opinion leaders and farmers on CMD control, improved production methods and rapid multiplication and distribution.

Social scientists focused on farmers practices and knowledge and the socio-economic feasibility of different multiplication and distribution strategies. Methods used were village meetings, meetings with farmers' groups, and interviews with individual farmers, key informants and NGOs, in eleven districts of Uganda. The studies were conducted over several years, so it was possible to trace changes in farmers perceptions and practices, illustrating how farmers knowledge and practice develops and changes over time through observation, practical experience, and interaction with different sources of information. At the same time, because of the unprecedented nature of the epidemic, it was also a learning process for research and extension.

Results

In the early stages of the epidemic, farmers' understanding of the disease differed markedly from those of researchers and extensionists. Farmers' theories and explanations for disease transmission attributed the disease to problems in the soil (e.g. low fertility or soil pests) or to the weakness of 'old' varieties. However, in some regions, farmers theories referred to the moral and supernatural dimensions mentioned above, and associated the destruction of the cassava crop by disease with the socially destructive impact of raiding in their area by a neighbouring ethnic group.

Unlike the tungro case, there was not always a clear recognition of the disease symptoms, which tended to be confused with leaf damage caused by cassava green mite. Farmers were unaware of the role of whiteflies, or the consequences of planting cuttings from infected stems. On the basis of this understanding, the farmers' logical course of action was to open plots on new land where possible, and to try to access different varieties of cassava through informal channels. There was little or no removal of infected plants. In contrast, the extension recommendations were to remove and destroy infected plants, and to replace them with clean planting material and resistant varieties. However, as the epidemic grew in severity, farmers learned that planting infected cuttings produced infected plants, and that cuttings of uninfected (but not resistant) varieties became rapidly infected even when planted in newly opened fields. In the worst affected areas, cassava was almost entirely wiped out. The demand for resistant materials became acute.

Understanding farmers knowledge at different stages of the epidemic was important to guide researchers and extensionists in undertaking practical initiatives to combat the problem and to design effective training programmes for field extensionists and farmers. Examples of early activities were the distribution of tolerant varieties to individual farmers, and group multiplication schemes, initially of tolerant, then of resistant materials. Training for extensionists and farmers was designed to cover existing recommendations, but also included recognition of the disease in the field, observation and explanation of the role of whitefly and training on planting techniques to maximize production of planting material. The research effort to develop resistant materials placed great emphasis on farmers own criteria of assessment of the new varieties tested in on-farm trials.

Researchers also learnt important lessons; it became clear that the introduction of healthy tolerant varieties was only viable where the infection pressure had already been reduced by the disappearance of cassava in the region. Distribution of small quantities of clean material of tolerant varieties was inadequate for CMD control under epidemic conditions. The long-term solution was to develop and distribute CMD-resistant varieties.

The exchange of knowledge between farmers, extensionists and researchers was the foundation for farmer-managed multiplication and distribution of cassava planting materials. With additional knowledge of CMD acquired through training, from extension officers, from informal sources, and as the epidemic progressed, from national media, farmers were able to build on their existing experience of cassava propagation and their own distribution networks. Pre-formed groups with an established structure and leadership were particularly successful and undertook the multiplication and informal distribution of new varieties within their villages and between parishes. Implementation of the control recommendations, particularly sanitation measures, were more closely observed by groups compared to individual farmers' plots.These decentralized multiplication approaches have had an important influence on extensionists (both from government and collaborating NGOs) and researchers by demonstrating the capacity of farmers to manage local cassava multiplication and take decisions on distribution strategies.

Discussion

In both cases, farmers' knowledge was uneven: observation in the field allowed them to develop some effective strategies, such as selection of resistant varieties, without detailed knowledge of the causes of the disease. However, lack of knowledge over the nature of disease transmission meant that farmers put their rice and cassava crops at risk by leaving diseased plants in the field.

There are limits to how much farmers can observe in the field in terms of understanding the microscopic processes of disease transmission. Farmers do not require knowledge of every scientific detail, but scientists should be able to fill gaps in understanding. Scientists need to appreciate what farmers know and what they do not know so they can provide relevant information which will enable farmers to take more informed decisions.

Describing farmers' knowledge as 'traditional' is clearly misleading in these cases. Farmers continually learn from their own experience and experiments and draw on outside sources of information. It is understanding how new information is interpreted, incorporated and used that is important.

Farmers' perceptions of soil fertility

(refer to: Chadwick and Seeley, 1996)

Soil classification can be done in a number of ways based on different criteria, such as underlying rock, soil structure or chemical and organic content. There has been increasing interest in the way in which farmers classify their soils, and whether this is consistent across individuals and communities and is comparable with scientific classifications. In a study in Nepal, farmers' recognition of soil types and their classification was identified and analysed. The study is more than a subjective account of farmers' classification in one area, as it attempts to assess individual and regional differences in classification and also look at how these classifications compare with scientific ones (e.g. USDA soil classification). The study demonstrated that:

- farmers' classification includes practical management considerations
- farmers' classification and terms are not necessarily transferable to other areas.

Background

The main aims of this project were to increase the understanding of Nepalese soils, and specifically, to identify and record intra-regional and inter-regional variations in:

- the types of soil recognized by farmers
- the means by which they are differentiated
- if, and if so how, these diagnostic properties can be quantified
- the relative values placed on the soil types identified in relation to labour requirement, potential productivity, fertilizer requirement and erosion risk
- information on indigenous soil management practices in forest areas
- if feasible, identify the nearest approximation within the USDA soil classification for each soil type identified.

Three forest user groups were selected in different districts of Nepal. A number of different research methods were used, including both soil surveys and rapid rural appraisal (RRA) techniques, such as wealth ranking and focus group discussions. A semi-structured questionnaire was used for interviewing 87 household respondents about soils on their lands and soil–tree and soil–crop interactions. Respondents also ranked soils according to their labour requirements, potential productivity, fertilizer requirements and ease of erosion. Samples of soils identified by farmers were collected and analysed.

Results

Farmers in the three different areas had detailed knowledge of the soils in their area – in one area identifying up to 24 types. Farmers named the soils based on characteristics of the soil 'in the plough' (i.e. the upper horizon) and had a limited knowledge of the characteristics of the subsoil or layers below the plough layer. The indigenous classification, therefore, could not be linked directly to soil classifications such as the USDA soil classification.

Colour and texture were the main factors in classifying soils, but also management characteristics were used. There was agreement between respondents from different areas over the key criteria that determine each of the soil types and there was generally good agreement over the ranking of soils with respect to labour, production, fertilizer and erosion characteristics.

Farmers had a detailed understanding of soil–tree relationships for the main species used on their land and provided information on which soils were suited to different species, but opinions often differed between farmers. These differences were not related to differences in socio-economic characteristics, such as gender, age or wealth rank, but may have been more related to experience in different forest areas.

Results from soil analyses indicated that within each area, the different soil types did have a number of significantly different soil characteristics associated with them. For example, *kalo* and *kalo balaute* soils had higher levels of organic carbon than other soils in one village; *rato mato* soils had lower levels of phosphorus than all other soils except one; *balaute* soils had significantly higher sand percentage than other soils without *balaute* in their name.

When comparing soil types common to all areas, it was found that these also corresponded to some (but not all) similarities in soil variables, for example, *chimtaylo mato* soils had mean clay content which was not significantly different (but differed in other variables); *kalo mato* soils had similar organic carbon contents that did not differ significantly. Greater differences between the same soil type and its corresponding soil variables were found between the two hill communities. One notable result was that *balaute* soils had a significantly different sand content when compared across villages. This indicates that the determination of a *balaute* soil is relative, i.e. it is sandiest soil in the area, not necessarily a sandy soil.

Discussion

The study illustrates that farmers do have detailed knowledge of soils, and some of this is related to practical considerations of differences in management practices. However, the study also indicates that care is needed in understanding and translating from farmers' classifications to scientific classifications. Although farmers use similar criteria in assessing soil types, the results suggest that the values used are relative, not absolute. The typology used by farmers is, therefore, localized in some respects and cannot be translated directly from one area to another.

CONCLUSION

This chapter has tried to demonstrate that LPK has a vital role in NR research and development. However, such knowledge cannot be immediately picked up and used by researchers, independent of the situation in which it was generated. Understanding LPK requires that researchers are aware of possible differences and complexities in how people view the world around them, and in how they interact with each other.

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