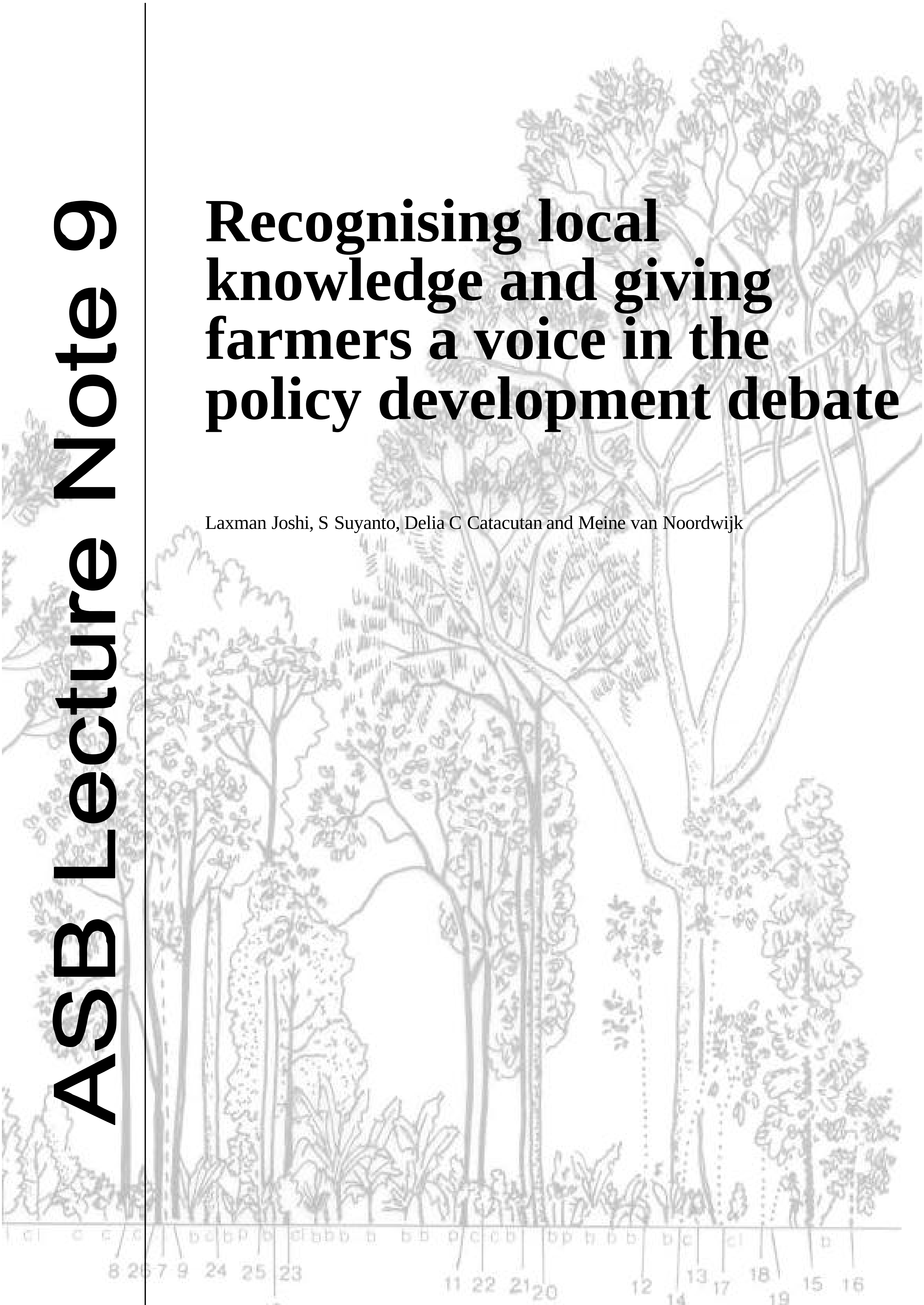
ASB Lecture Note 9



Recognising local knowledge and giving farmers a voice in the policy development debate

Laxman Joshi, S Suyanto, Delia C Catacutan and Meine van Noordwijk

INTERNATIONAL CENTRE FOR RESEARCH IN AGROFORESTRY

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Towards integrated natural resource management in forest margins of the humid tropics: local action and global concerns

Meine van Noordwijk, Sandy Williams and Bruno Verbist (Editors)

Humanity stands at a defining moment in history. We are confronted with a perpetuation of disparities between and within nations, a worsening of poverty, hunger, ill health and illiteracy, and the continuing deterioration of the ecosystems on which we depend for our well-being. However, integration of environment and development concerns and greater attention to them will lead to the fulfilment of basic needs, improved living standards for all, better protected and managed ecosystems and a safer, more prosperous future. No nation can achieve this on its own; but together we can - in a global partnership for sustainable development. (Preamble to the United Nations' Agenda21 on Sustainable Development; http://www.un.org/esa/sustdev/agenda21chapter1.htm).

Background to this series of lecture notes

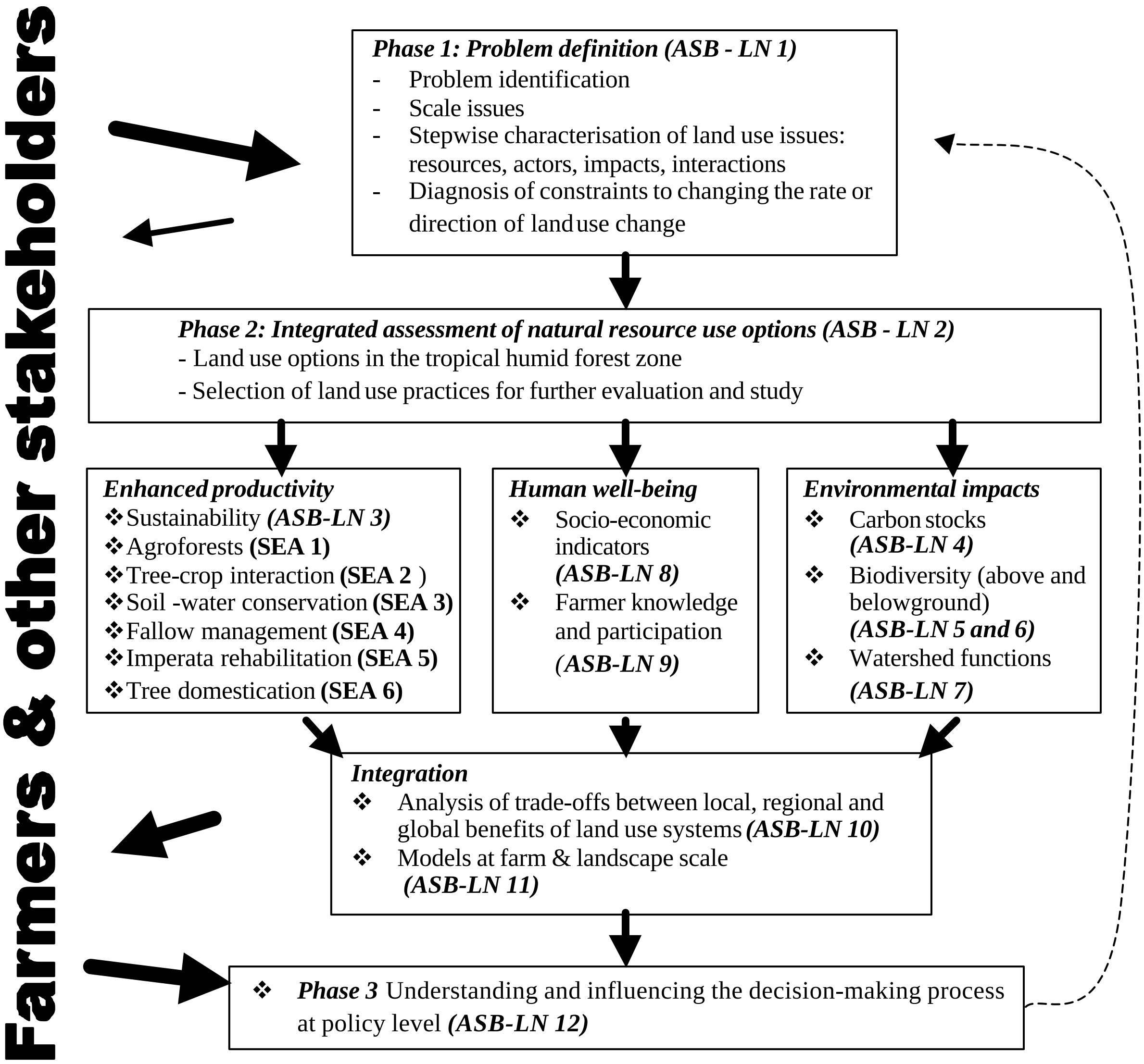
Much of the international debate on natural resource management in the humid tropics revolves around forests, deforestation or forest conversion, the consequences it has and the way the process of change can be managed. These issues involve many actors and aspects, and thus can benefit from many disciplinary perspectives. Yet, no single discipline can provide all the insights necessary to fully understand the problem as a first step towards finding solutions that can work in the real world. Professional and academic education is still largely based on disciplines – and a solid background in the intellectual capital accumulated in any of the disciplines is of great value. If one wants to make a real contribution to natural resource management issues, however, one should at least have some basic understanding of the contributions other disciplines can make as well. Increasingly, universities are recognising the need for the next generation of scientists and policymakers to be prepared for interdisciplinary approaches. Thus, this series of lecture notes on integrated natural resource management in the humid tropics was developed.

The lecture notes were developed on the basis of the experiences of the Alternatives to Slash and Burn (ASB) consortium. This consortium was set up to gain a better understanding of the current land use decisions that lead to ***rapid*** conversion of tropical forests, shifting the forest margin, and of the ***slow*** process of rehabilitation and development of sustainable land use practices on lands deforested in the past. The consortium aims to relate local activities as they currently exist to the global concerns that they raise, and to explore ways by which these global concerns can be more effectively reflected in attempts to modify local activities that stabilise forest margins.

The Rio de Janeiro Environment Conference of 1992 identified deforestation, desertification, ozone depletion, atmospheric CO_2 emissions and biodiversity as the major global environmental issues of concern. In response to these concerns, the ASB consortium was formed as a system-wide initiative of the Consultative Group on International Agricultural Research (CGIAR), involving national and international research institutes. ASB's objectives are the development of improved land-use systems and policy recommendations capable of alleviating the pressures on forest resources that are associated with slash-and-burn agricultural techniques. Research has been mainly concentrated on the western Amazon (Brazil and Peru), the humid dipterocarp forests of Sumatra in Indonesia, the drier dipterocarp forests of northern Thailand in mainland

Southeast Asia, the formerly forested island of Mindanao (the Philippines) and the Atlantic Congolese forests of southern Cameroon.

The general structure of this series is



This latest series of ASB Lecture Notes (**ASB-LN 1 to 12**) enlarges the scope and embeddes the earlier developed ICRAF-SEA lecture notes (**SEA 1-6**) in a larger framework. These lecture notes are already accessible on the website of ICRAF in Southeast Asia: http://www.icraf.cgiar.org/sea

In this series of lecture notes we want to help young researchers and students, via the lecturers and professors that facilitate their education and training, to grasp natural resource management issues as complex as that of land use change in the margins of tropical forests. We believe that the issues, approaches, concepts and methods of the ASB program will be relevant to a wider audience. We have tried to repackage our research results in the form of these lecture notes, including non-ASB material where we thought this might be relevant. The series of lecture notes can be used as a basis for a full course, but the various parts can also ‘stand alone’ in the context of more specialised courses.

Acknowledgements

A range of investors (or 'donors') have made the work of the ASB consortium possible over the past years, some by supporting specific parts of the program, others by providing core support to the program as a whole. These lecture notes build on all these investments, but were specifically supported by the ASB Global Steering Group, with funds provided by the Asian Development Bank, the World Bank via the CGIAR, by ICRAF core funds, by the Netherlands' Government through the Direct Support to Training Institutions in Developing Countries Programme (DSO)-project and by the Flemish Office for Development Cooperation and Technical Assistance (VVOB). Both biophysical and policy research was supported by a Regional Assistance Grant from the Asian Development Bank. Many researchers and organisations have contributed to the development of ideas, collection and synthesis of data, and otherwise making the program what it is today. A team at the International Centre for Research in Agroforestry (ICRAF), consisting of Kurniatun Hairiah, Pendo Maro Susswein, Sandy Williams, SM Sitompul, Marieke Kragten, Bruno Verbist and Meine van Noordwijk developed these lecture notes. A first test of their suitability was provided by a course on 'Ecology for Economists' organised by the Economy and Environment Program for Southeast Asia (EEPSEA) program – we thank David Glover, Hermi Francisco and all participants to that course for their suggestions. Key researchers within the consortium provided support and agreed to act as co-authors on the various chapters. Editorial comments on draft forms of the various lecture notes were obtained from Fahmuddin Agus, Georg Cadisch, Min Ha Fagerström, Merle Faminow, Roeland Kindt, Chun Lai, Ard Lengkeek, Jessa Lewis, Chin Ong, Per Rudebjer, Goetz Schroth, Douglas Sheil, Fergus Sinclair, Sven Wunder and others. Overall responsibility for any shortcomings in the lecture notes remains with the editorial team.

ASB-consortium members

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Lecture Note 9

RECOGNISING LOCAL KNOWLEDGE AND GIVING FARMERS A VOICE IN THE POLICY DEVELOPMENT DEBATE

By Laxman Joshi, S. Suyanto, Delia C. Catacutan and Meine van Noordwijk

Contents

I. Objectives

- To provide a balance between the ‘farmers know it all’ paradigm and the previous one that completely ignored farmers’ knowledge.
- To discuss ways to promote participation of farmers and integration of their knowledge and views in the analysis of problems and exploration of solutions.

II. Lecture

1. Introduction

One of the aspects of poverty as currently defined is the lack of voice or the lack of empowerment and the feeling of not being able to take events into one’s own hands. This aspect of poverty is difficult to quantify as yet, but it is an important element in the debate on the rural poor, deforestation and natural resource management.

In this lecture note we will introduce:

- methods to collect and appraise farmers’ ecological knowledge in a formal manner and analyse the way this knowledge and value system complements the more formalised science we have discussed in other Lecture Notes;
- methods to get the views of local communities on the options they have and the constraints they face more explicitly represented, and
- ways to get the farmer’s ‘voice’ heard in dialogues with local and national policymakers.

Firstly, we shall give a general overview of how some processes of ‘modernisation’ can affect the ways that people think about and value traditional local knowledge.

BUT WHY?
Why could this be important? How did some farmers come to lose their voice anyway? Does it matter? What can ‘primitive’ uneducated farmers tell to well-trained highly-educated scientists, researchers and government officials about anything?
Keep these questions in mind as you read on…

2. Modernisation and ideology

Human societies that have been stable and successful in dealing with the challenges of the local environment generally have a strong sense of identity, self-esteem and culture, and a system of knowledge and values that is sufficient to transfer their lifestyles and coping strategies to future generations. In these societies, most new or ‘wild’ ideas do not lead to improvements of the livelihood system, and the societies have effective ways of dealing with deviations from the norm. Any further innovations that the societies might adopt usually involve fine-tuning of the current systems and do not involve radical change.

Radical changes are often triggered by contact with outside groups, coming in to trade and exchange, or to occupy the area and impose their will based on military superiority. If a ‘new’ society takes over, the old system of norms, knowledge and values can lose its immediate relevance for the individuals in the society and it can tend to become ignored. Worse, the old system may come to be seen as an obstacle for progress and a politically subversive element that is to be eradicated by the powers that be. Education systems built on new paradigms of the ‘modern’, superior culture can lead to neglect or deliberate defiance of ‘traditional’ knowledge, views and values.

Very often, this leads to situations of top-down transfers of wisdom from the ‘educated’ to the ‘uneducated’. In fact, this is still the predominant mode of rural extension and development. Client conservatism is often blamed for a lack of adoption of technology. The way the ‘old’ society dealt with innovations is now seen as an obstacle to progress. Shifting cultivation is a typical example of a system that becomes seen as backwards and something of the past that should be stopped.

After a while, however, the balance may shift. Individuals in the ‘new’ society may discover traditional wisdom among traditional societies and recognise that some of the current problems did not exist in the past, or that effective ways to deal with them were once part of the culture. Where these insights develop, the balance may easily swing back to a romantic view of the ‘rustic’ past, a view that is idealised and seen not just as a norm and standard but as a source of inspiration. In reality, this new recognition may do little to give the people and their priorities a real voice, as it tends to assume that they want to stick to the old ways and not find their own blend of old and new.

A more balanced view, however, can emerge from this debate. It can lead to a serious attempt to articulate farmers’ ecological knowledge, their norms and values and their coping strategies. It can also lead to an analysis of:

- where this knowledge system complements the currently dominant paradigms,
- where it agrees (but simply uses other words or terms),
- where the two views contradict each other and provide challenges for further research, and
- where the ‘local’ knowledge can indeed benefit from and be complemented by ‘modern’ ideas.

The first step in this process is an attempt to overcome the language barrier and explore what the local knowledge has to offer. Two aspects of such knowledge are:

- the recognition of components of the landscape, climate, soil, vegetation and fauna, and
- the knowledge of dynamic relationships between these elements, including the response to human management efforts.

Some definitions

KNOWLEDGE: the outcome (independent of the interpreter) of the interpretation of data or information.
ECOLOGICAL KNOWLEDGE: knowledge about organisms, interactions amongst organisms and between them and their environment.
SCIENTIFIC KNOWLEDGE: knowledge generated in a formal manner by universities, research and other institutions.
INDIGENOUS KNOWLEDGE: the sum of experience and knowledge of a given ethnic group, that forms the basis for decision-making in the face of familiar and unfamiliar problems and challenges.

3. Farmers' typology of their environments

In Lecture Note 2, a typology of land use systems was developed that allows global comparisons of land use systems. At a local scale, however, not only will the systems be given different names, but the local way of classifying these systems is also likely to be different. So, a translation is needed between the concepts as they exist in 'science' and those in local knowledge. Part of this is literally a problem of translation, of seeking equivalent words for objects and concepts. It is rare to find a direct correspondence between words in two languages, where both have the same boundaries of meaning and use. Usually there is only a partial overlap, and correct translation of a term depends on the context. If the researcher or other outside agent is not fluent in the local language and depends on 'interpreters' it is quite likely that their 'interpretation' colours the information exchange more than they would like (or acknowledge).

The **first step** in accurately representing farmers' knowledge of their environment is to explore their typology for landscape components such as land cover types, soils, trees, and vegetation (see Box 1 on landscape elements in N. Thailand and Box 2 on 'cool soil' in Indonesia).

A **second step** is to separate knowledge of components from the actual decisions made. A common error of outsiders/newcomers who see that farmers do not apply practices that are considered to be beneficial, is to assume that these practices are not applied for lack of knowledge. Often knowledge does exist, but there are valid reasons for non-adoption of recommended practices. Socio-economic constraints or priorities may outweigh ecological 'rationality', particularly if quick returns are necessary. Farmers in North Lampung (Indonesia), for example, readily acknowledge that maintaining a surface mulch layer reduces soil erosion on slopes and helps to maintain soil fertility, but they are also convinced that it leads to more rats and snakes in their field. Removing all mulch, for example by burning crop residues, makes the fields safer to work in.

Another example of this apparent mismatch between farmers' practices and scientific 'rationale' is the traditional set of rules determining the times that certain crops may be planted in the Philippines (Box 3).

Box 1. Landscape elements in N. Thailand as recognised by a Karen village

An example of farmer classification in North Thailand (Table 1) shows a number of forest types, primarily defined by their function in the local livelihood system, rather than by the actual vegetation. Categories such as 'forest above rice field' do not translate well into English, yet ensure lateral flows of water, nutrients and soil into the rice paddies. As such forests are normally owned by the same families who own the paddies, however, these lateral flows do not entail an 'externality' in the economic sense. Riparian forests are important for providing *cool* water that is deemed essential for the life of the local 'spirit owners' of the land and the water, e.g. crabs, fish, and frogs that should be found living in a healthy paddy. Other landscape relations and lateral flows recognised in the local knowledge system again refer to the biotic relations of pests in the main food crops. Snakes and the few remaining leopard cats and civets in the still-forested landscape are recognised as keeping rat populations under control. In years that the bamboo flowers and sets fruit, rats and mice multiply rapidly and the following cropping season rice crops may fail, leading to famine.

Box 1. Landscape elements in N. Thailand as recognised by a Karen village (continued)

Table 1. Landscape elements recognised by a Karen community example in the upper Mae Chaem watershed, N. Thailand (James R. Peters, pers. comm.)

Landscape element	Location	Function	Accessible to:	Resource use
Watershed (ridge) forest	On the mountain ridge separating one village's territory from the next	Providing clean drinking water (piped to the village) and main water source for rice-fields	All	Cattle grazing and collection of food, and medicinal plants, hunting area, NTFP collection
Conservation forest	(New category in village rules)	Conserving wild animals and plants	All, but no hunting	Cattle grazing
Open access forest	Hills surrounding village	Providing forest products	All, with permission from village elders	Construction wood (for house building, not for sale), grazing and NTFP collection
Community forest	idem, but closer to the village than previous category	idem, for community activities	Community groups	Wood for community structures, grazing and NTFP collection
Bush fallow ('revolving forest')	Closer to the village than previous category	Crop production, grazing land	Privately controlled in cropping years, open access grazing in fallow years	Crop yields, fodder, manure transferred to homegardens, grazing and NTFP collection
Riparian forest	Along the streams and rivers	Providing clean and cool water for irrigation, maintaining the spirit owners (e.g. crabs, fish and frogs) in the paddy fields	All	NTFPs (Non-timber forest products)
'Forest above paddy field'	Forest land adjacent to a landowner's paddy field	Reserved for the exclusive use of the paddy owner.	Private	Commercial or subsistence gardens or useful tree species
'Paddy field'	Between streams and previous forest category	Rice production (+ dry season vegetable crop)	Private	Rice and dry season crops; cattle/ buffalo grazing in dry season
Burial forest	Close to village	Cemetery	All	-
Birth forest	Close to village	Burial of umbilical cords for spiritual security	All	-
Homegarden	Around house in village	Household needs	Private	Fruit, vegetables, fodder, medicine (human and animal)

Box 2. Keeping the soil 'cool': farmer notions of soil fertility

Farmers in Lampung (Indonesia) have learned to value dark coloured soil, rich in organic matter. Such a soil is considered 'cool', in contrast to the 'hot' soil that has been exposed to the sun and that has been degraded. 'Cool soil' is a fertile soil, easy to till, and is always moist and favourable for plant growth. To keep a soil 'cool' it should have a litter layer on top of the mineral soil, just as is the case in a forest. This ‘hot’ and ‘cool’ classification of soil exists in many other farming communities.

The ‘coolness’ of a soil as recognised by farmers does not directly match the soil properties that soil scientists use in their soil classification nor with any measurements in the laboratory that support soil fertility research. After analysis of the way the term is used, however, it appears that the farmers notion of soil 'coolness' can be directly related to the functions of organic matter in the soil, though not to its measurement in the organic C content. It seems that the coolness can match the C_{org}/C_{ref} ratio, as was described in Lecture Notes 3 and 6, and which reflects the more active soil organic matter fractions, corrected for the influence of soil texture. The soil functions of coolness include the supply of nutrients and increase of soil cation exchange capacity, water holding capacity, aggregate stability and porosity. Improvement of soil properties by the organic matter indirectly decreases erosion and nutrient leaching. Organic matter can also alleviate aluminium toxicity in the soil. Farmers know that a 'cool' soil is desirable. However, keeping a soil in that condition is not always easy when growing food crops, especially if soil tillage is used to control weeds, or to make a seedbed for the crop. Soil tillage will destroy the protective litter layer on top of the soil. To keep the soil undisturbed, a 'no-till' system where crops are established by dibbling seeds into holes -- a traditional planting system for 'shifting cultivators' but now often replaced by more intensive soil cultivation – can be applied.

If we want to bridge the gap between the farmers’ terminology and concepts, and those used in soil and crop science, the C_{org}/C_{ref} ratio can be used. Figure 1 gives results for a model simulation of the response of a maize crop to N and P fertilizer, after a two year bush fallow. A C_{org}/C_{ref} ratio of 1 is a soil just derived from forest, called ‘***cool***’ by farmers; values towards 0 are increasingly ‘***hot***’, while values above 1 are ***‘cooler than cool’***…. The results of simulation show that predicted maize yield after a two-year fallow strongly responds to the soil '*coolness*' at the start of the fallow period. A two-year fallow cannot do wonders on a soil that is already '*hot*' with a C_{org}/C_{ref} value less than 0.5 (Figure 1). Part of this effect can be explained by the fact that the trees themselves don't grow well. A target ratio of C_{org}/C_{ref} of about 0.8 is needed for attractive crop yields, in the absence of fertilizer.

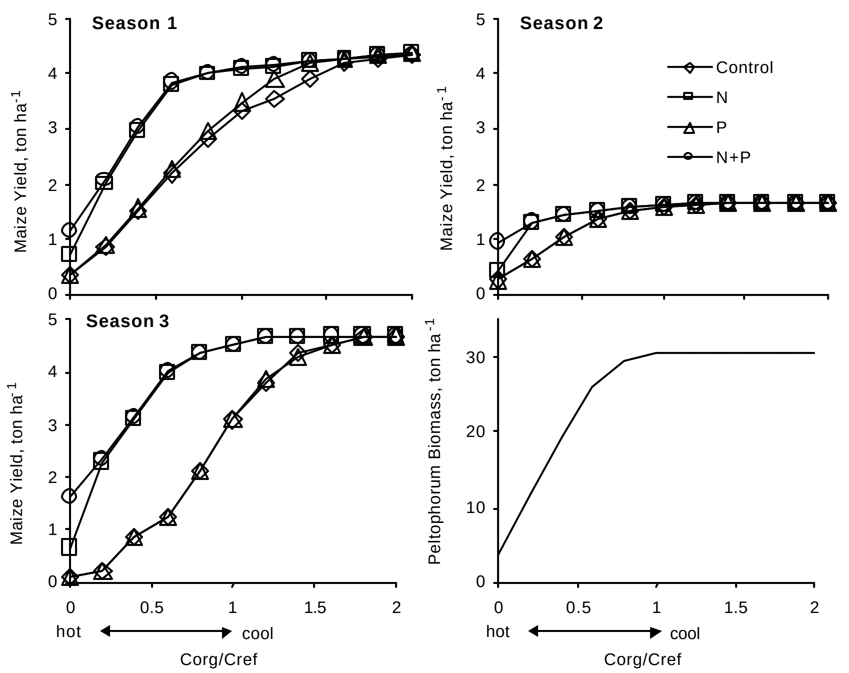

Figure 1. Predicted yield of maize over three seasons (season 1 and 3 in the wettest part of the year (December – March) for two subsequent years, season 2 in the drier April – June period, after two years of fallow dominated by the local tree *Peltophorum*, as a function of the initial organic matter content of the soil, with or without the use of N and/or P fertilizer. The link between ‘coolness’ of a soil and the C_{org}/C_{ref} ratio used in soil science needs further corroboration, but allows for easier communication between scientists and farmers.

Box 3. Pest management rules of the Talaandig Tribe, Manupali Watershed, Lantapan, Bukidnon, Philippines.

Talaandig farmers in Lantapan (Bukidnon, Philippines) traditionally plant seeds of corn in line with the lunar cycle, at the start of a high tide event. This local practice is perceived to be effective in preventing pest infestations "because the pests have gone out to the ocean". On the other hand, farmers say that in order to get a good harvest, legumes (beans) and root crops (sweet potato, taro, etc.) should be planted early in the morning, after a full moon.

Similar rules for determining the appropriate start of a new growing season exist elsewhere, for example linked to the observation of migratory birds in Kalimantan (Indonesia). Rules such as this may be interpreted in different ways:

- it may be that the practice is valid for reasons other than the one provided,
- it may be that the explanation as well as the practice is valid,
- it may be that neither the practice nor the explanation lives up to scrutiny,
- it may be that the explanation is valid but the practice is not….

Whatever the interpretation, however, the local knowledge and perceptions are important if one wants to communicate with the farmers. How can we distinguish between the four interpretations?

In the Lantapan area, scientific research on the effect of different planting times concluded that the farmers' practice was not the best from an agronomic point of view. The experiments suggested that farmers should plant corn at the onset of the rainy season (March to May) when there is not too much cloud and when sufficient solar radiation can still be intercepted. However, farmers did not change their practices, and continued to plant during a high tide or after a full moon, regardless of the amounts of rainfall or solar radiation.

Taking a broader view…

Pests (as well as the organisms that control them) can move around throughout the landscape, so the results from a small-scale experiment may not tell us the whole story. In a number of situations research has shown that pest problems are lower if crops are planted simultaneously over a large area – this prevents the pest organisms finding some crops at the development stage that they like best as they move from field to field. If this were the case in the Talaandig situation, then it might explain why the local rules (leading to synchrony in planting, based on an easily observed trigger) are relevant. It would also explain why a small-scale experiment would not provide conclusions that support these rules. For example, if one small plot was not planted at the same time as the majority of the fields, then it may still be able to escape from pests, but if all farmers plant at different times then pest problems may increase considerably.

This example shows that it is not always easy to reconcile local practices and local knowledge and its interpretation, with what can be observed in empirical ('scientific') tests. In this type of situation, researchers should learn to think laterally about the practical consequences of the farmers' rationale (and not to dismiss immediately this rationale and practice as illogical and hence worthless). The issue is not to challenge local knowledge, but to complement it with 'modern' empirical knowledge, to enable better decision-making.

4. Farmers’ ecological knowledge

4.1 Why consider farmer knowledge?

Although agroforestry practices are not new to farmers, agroforestry is new to science. Hence scientific understanding of complex agro-ecosystems such as traditional agroforestry practices is still weak. However, it is now known that farmers and local communities who have been managing different traditional agro-ecosystems have gathered a lot of knowledge from their experience and from deliberate experimentation. This gathered knowledge is complex, sophisticated and applicable to the farming context (Sinclair and Walker, 1998).

In the past, farmer knowledge was regarded among development professionals as having little value for overall rural development. However, recognition of the existence and value of local knowledge, often collected over generations, as well as the need for its effective integration into development, have grown immensely in the last two decades. This growing interest can be attributed to:

1. the need to target research to farmers’ needs more effectively to produce technology more appropriate to farmers;
2. the growing importance of farmer participation in defining research agendas and technology generation; and
3. the realisation that local knowledge is a useful resource which can be complementary to scientific knowledge.

(Source: Walker *et al.*, 1995).

In recent years, there has also been a growing consensus among professionals that different farmers have very different types and depths of knowledge. It is likely that their interests, objectives and available resources also differ between and within farming communities (Scoones and Thompson, 1994). Although some local knowledge may be based on ‘heuristics’ (i.e. without clear logic or explanation), there is a large amount of knowledge among farmers about the ecology of the systems they are using. It is possible to articulate and use this knowledge explicitly in development initiatives. This is in contrast to a common perception among some social scientists and anthropologists that farmer knowledge is often static and inextricably embedded in cultural beliefs and values. However, farmers’ knowledge, like that of scientists, is incomplete and dynamic, and is continuously being influenced and modified by external and internal factors. This knowledge can be complex, qualitative, explanatory and sometimes conflicting.

It has been suggested that the role of scientists in strengthening farmer knowledge is to generate knowledge that the farmers themselves are unable to produce; this has been reported in the literature (Clarke, 1991; den Biggelaar, 1991; Ruddell *et al.*, 1997). However, farmers are also experimenters; they are capable of conducting simple but effective adaptive research (Veldhuizen *et al.*, 1997) and learn from their experiments. It is now agreed that farmer knowledge, often based on observations and deliberate experimentation (although acquired through non-scientific methods) has a critical role in development initiatives.

4.2 Approaches for involving local knowledge and perception

Broadly, approaches for integrating local knowledge and perspectives into development programmes can be done in three ways:

- by actively involving local experts in development projects without a need to understand their knowledge explicitly;
- by using local people as informants of their system, practice and constraints, again without explicit understanding of their knowledge; and
- by investigating local knowledge about ecological functions and processes taking place in the fields; the explicit local knowledge can then be used in objective assessment and evaluation and in promoting effective integration with scientific knowledge.

(Source: Walker *et al.*, 1995)

These approaches have different strengths and weaknesses, and these have been reviewed by Walker *et al.* (1995). Nonetheless, the third number on the list, an in-depth investigation of local ecological knowledge, is now receiving wider attention. Compared with the first two types, this requires a much more rigorous analysis of indigenous explanations of ecosystem functioning. A rigorous analysis (i.e. objective assessment and evaluation) also requires that farmers articulate their knowledge in detail.

Explicit analysis enables evaluation but requires a methodology for explicit knowledge representation and analysis. The analysis also helps to highlight farmers' underlying assumptions and reasoning that may otherwise be easily missed. A comprehensive and explicit representation or model of local knowledge is required. In the following section we describe a **'knowledge-based systems'**, or **'KBS'**, methodology that was developed for this purpose.

4.3 Collecting and using local farmer knowledge

Effective integration of local knowledge with scientific knowledge for a combined, and so better, understanding of ecological processes requires efficient collection and collation of knowledge from local communities.

To be useful, this knowledge should be in a form that allows its effective **storage**, **access** and **analysis**. In the application of a KBS approach, local ecological knowledge is articulated and represented as **unitary statements** (see examples below). Conditional information where necessary is also included in the statements. Local terms and their hierarchical relationships can be captured and represented. With the help of computer technology it is possible to process these basic unitary statements to explore and understand farmers' ecological knowledge systems.

<u>Examples of unitary statements</u>

Lopping a tree makes its crown light.
Heavy rainfall increases speed of water flow if the site is on a slope.
Fast flowing water causes intensity of soil erosion to increase.
A light crown allows more sunlight to pass through.
An increase in leaf number increases the thickness of crown.
A decrease in the rate of germination of crop seed decreases the population of crop.
Uprooting a seedling damages its root system.
Growth of seedling is slow if its root system is damaged.

Experience from studies carried out across a number of agro-ecosystems shows that the majority of articulated and useful local ecological knowledge can be adequately represented using a simple grammar that restricts the syntax of statements. A great strength of this approach, is that we can use computer technology to store, access, update and use the knowledge held in the **knowledge base.** (The knowledge base is the store of sets of unitary statements on particular topics or domains, along with information about sources, topics and hierarchies.) This allows us to collect knowledge from many different people and literature sources about an interdisciplinary topic, to create an encyclopaedic store, which can be a durable, dynamic and updateable record of what is known.

In the KBS approach, articulation of local knowledge involves extended dialogues with knowledgeable informants about their understanding of the ecosystem components and functions as well as the interactions between these. The result is a description of the individual's interpretation or understanding from their experience and observation of various processes and components within an agro-ecosystem. Therefore, knowledge articulation goes far beyond the simple description of practices or actions.

To assist in the formal representation, storage, access and analysis of unitary statements, a tailor-made software package, **WinAKT** (Agroforestry Knowledge Toolkit for Windows, see Box 4) was developed by the University of Wales, Bangor (UK). For details on construction of an electronic knowledge base, please refer to Dixon *et al.*, 2000.

Theoretically, the development of topical knowledge bases consists of four distinct but overlapping stages: scoping, definition, compilation and generalisation (Figure 2).

Box 4. The 'Agroforestry Knowledge Toolkit for Windows' (WinAKT)

WinAKT is a computer software package developed at the University of Wales in Bangor, UK, (with funding from the UK Department for International Development) to provide users with an environment in which to create knowledge bases about a user-selected topic by collating knowledge from a range of sources. It facilitates the synthesis of knowledge and its valuation, and thereby promotes its use in planning research and extension. This gives a powerful alternative to existing, less formal approaches to evaluating the current state of knowledge.

WinAKT software provides:-

1. A knowledge base structure for storing ecological statements of fact in both natural language and formal representations.
2. A choice of text based diagrammatic input for entering facts into the knowledge base.
3. A set of interfaces for on-line access to the contents of the knowledge base.
4. A set of mechanisms for reasoning with the contents of the knowledge base.
5. A 'toolkit' which allows the user to specify his/her own set of functions for accessing and manipulating the knowledge base.
6. A set of mechanisms for producing printed output from the knowledge base in both diagrammatic and text based forms.

During knowledge representation, qualitative knowledge is translated into unitary statements and represented in a restricted formal syntax, together with contextual information about who articulated the knowledge, the local classification of terms and the conditionality of each statement. A knowledge base is developed that contains these basic units of knowledge with contextual information as well as representation of hierarchical organisation of statements and terms, their definitions and synonyms.

Box 4. The 'Agroforestry Knowledge Toolkit for Windows' (WinAKT) (continued.)

Formal representation as basic unitary statements allows **automated reasoning** of knowledge, a powerful analysis procedure commonly applied in the science of artificial intelligence. Conventional approaches to accessing information, through database functions, are also available. Diagrammatic representation of knowledge statements and the relationship between these is also possible.

- **WinAKT software** and manual are freely available for download from: ftp://ftp.bangor.ac.uk/pub/departments/af/WinAKT/ and further information may be requested from winakt@bangor.ac.uk.

Publications: Details of the stages in knowledge articulation and representation including development of coherent knowledge bases and their use are described in Dixon et al., 2000. Rationale and principles behind a KBS approach in incorporating local knowledge in development initiatives are described by Sinclair and Walker, 1999. Examples of application of automated reasoning tools in WinAKT are provided in Joshi and Sinclair (in preparation). Formal representation as basic unitary statements allows **automated reasoning** of knowledge, a powerful analysis procedure commonly applied in the science of artificial intelligence. Conventional approaches to accessing information, through database functions, are also available. Diagrammatic representation of knowledge statements and the relationship between these is also possible.

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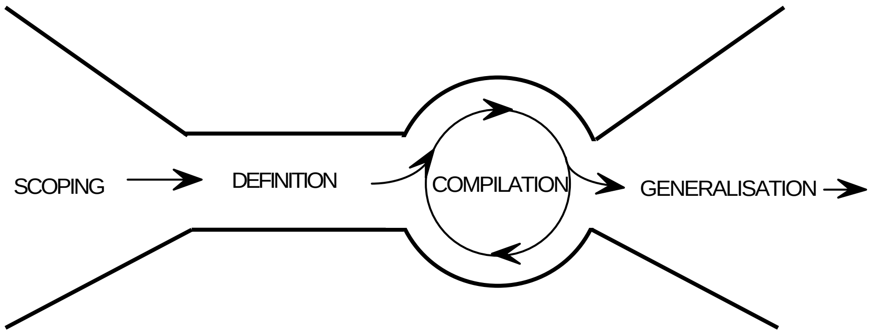
In the first stage, **scoping**, the primary objective is to clarify the purpose of knowledge gathering. Marking out the domain of interest, understanding local concepts of ecological processes and interactions, and setting definitions for local terms are done in the **definition** stage. The third stage, **compilation**, is when actual knowledge elicitation is carried out by a small number of purposively selected “knowledgeable” people. This is usually done in semi-structured interviews, either with individual farmers or in small farmer groups. The process is iterative and intensive where several visits to a key informant may be necessary to elucidate and clarify his/her knowledge. A knowledge base is progressively developed. Knowledge statements are extracted from discussions and represented using WinAKT. After a sufficient amount of information has been gathered and a fairly robust knowledge base developed, subsets of knowledge statements are compiled into a questionnaire and the knowledge distribution is tested across large randomised sample of people from the target community. This is the fourth stage, **generalisation**. This is necessary to explore how representative the knowledge base is. Data from the generality testing can be statistically analysed.



Objective	To refine knowledge acquisition objectives	To generate a broad understanding of domain & define boundaries & terms	To create a coherent and comprehensive knowledge base	To test how representative the knowledge base is of farmers generally
Informants and activities	A broad range of activities across the community	One or two intensive interactions with a small number of purposively selected informants	Iterative cycle: repeated interaction with stratified sample of key informants, knowledge representation and evaluation of emerging knowledge base	A variety of questionnaire-based survey approaches on a sufficiently large and randomly selected sample of informants from the community

Figure 2. The four stages of knowledge acquisition shown diagrammatically (top) with further information on each stage underneath in a tabular form (Source: Sinclair and Walker, 1999).

Development of knowledge bases leads to better understanding of farmers' knowledge, perceptions and constraints within their knowledge system. Research and extension topics can thus be formulated based on an objective analysis of what farmers already know and what they don't, in order to increase their resource base for making decisions. Scientific research programmes that follow are more likely to be more relevant and need-oriented than those developed without consideration of local knowledge. Moreover, comparable knowledge bases can be developed from scientific communities, which can then be synthesised to develop truly encyclopaedic knowledge bases.

The process of knowledge base development is usually extremely revealing with respect to the amount and depth of ecological knowledge farmers already possess. This has the potential to enhance the scientific understanding of relevant agro-ecosystems. The methodology described above has been used successfully in Kenya, Sri Lanka, Nepal, Thailand and Indonesia. An example of the insights gained and the type of output diagram produced can be seen in Box 5 and Figure 3.

Box 5. Local ecological knowledge about rubber seedling growth in jungle rubber agroforests – an example.

Until recently it was believed that jungle rubber agroforests, that exist in Jambi and Kalimantan provinces in Indonesia, are essentially cyclical, with slashing and burning of previous tree crops followed by a new cycle of rubber planting. However, the practice of gap-level replanting, locally called *sisipan*, within existing jungle rubber agroforest plots in Jambi is quite common (Joshi *et al*., 2000). This offers an alternative to the destructive approach of slash, burn and replant for rejuvenation of old and unproductive rubber trees. As the *sisipan* method is relatively new to the scientific community, little is known about growth and survival of rubber seedlings within the system. On the other hand, many farmers have considerable experience of *sisipan* and have accumulated a wealth of knowledge through practice and observation. This local knowledge has been investigated using KBS methodology and a knowledge base has been developed. Farmers' local knowledge is being used as a basis for developing improvement pathways for higher productivity jungle rubber agroforests and for enhancing their environmental functions.

Local knowledge about various components within jungle rubber agroforests is represented in Figure 3. Farmers have a clear understanding about the essential role of gaps for rubber seedling growth, both at canopy level for sunlight and at ground level for nutrients and moisture. Gaps in a forest often develop naturally through death of trees and other vegetation. Farmers often create gaps deliberately by selective killing, through ring barking, of undesired trees and/or pruning of branches of existing trees to increase light infiltration through the canopy. At ground level, light weeding is carried out to reduce competition from weeds; this again is essential for proper growth and survival of rubber seedlings. However, too much light passing through the canopy may encourage weed proliferation.

Rubber seedlings are relatively 'weak' at competing against more aggressive weeds and other vegetation in the system. Farmers therefore weed around selected or planted rubber seedlings, and this is essential until the seedlings have developed a sound root system. This is particularly important for transplanted seedlings whose root systems are cut back drastically when the plants are uprooted and their roots trimmed prior to transplanting. Farmers perceive that the intensity of transplanting stress depends on the extant root system, which again is influenced by seedling size. The larger the seedling size (girth), the greater the transplanting stress to the seedling and the lower its chances of survival. Equally important is the need to reduce the chance of damage to transplanted seedlings from pigs, the most notorious pest during rubber tree establishment. Larger seedlings are less likely to be affected. This reflects the dilemma faced by farmers regarding the size of seedlings to be planted. It is an example whereby detailed investigation of local ecological knowledge revealed researchable constraints. As a result, ICRAF researchers are currently testing a method of improving the productivity of *sisipan* whilst reducing the risk of early seedling mortality which can arise from both transplanting and pest damage. Large-diameter local seedlings which have already been successfully established by farmers, using their traditional *sisipan* practices, are being grafted, *in situ*, with buds of high yielding clonal rubber.

In summary…

This knowledge-based systems (KBS) approach is particularly useful for exploring farmers' explanatory ecological knowledge on **specific topics**, as information is converted to clear and concise statements. The representation of knowledge as unitary statements:

- reduces ambiguity and mis-interpretation
- allows easy access to information
- allows explicit analysis and synthesis of information on related topics
- facilitates rigorous analysis of these unitary statements using techniques of automated reasoning and artificial intelligence
- enables quick updating of knowledge bases in an electronic form by modifying existing statements and by adding relevant new statements.

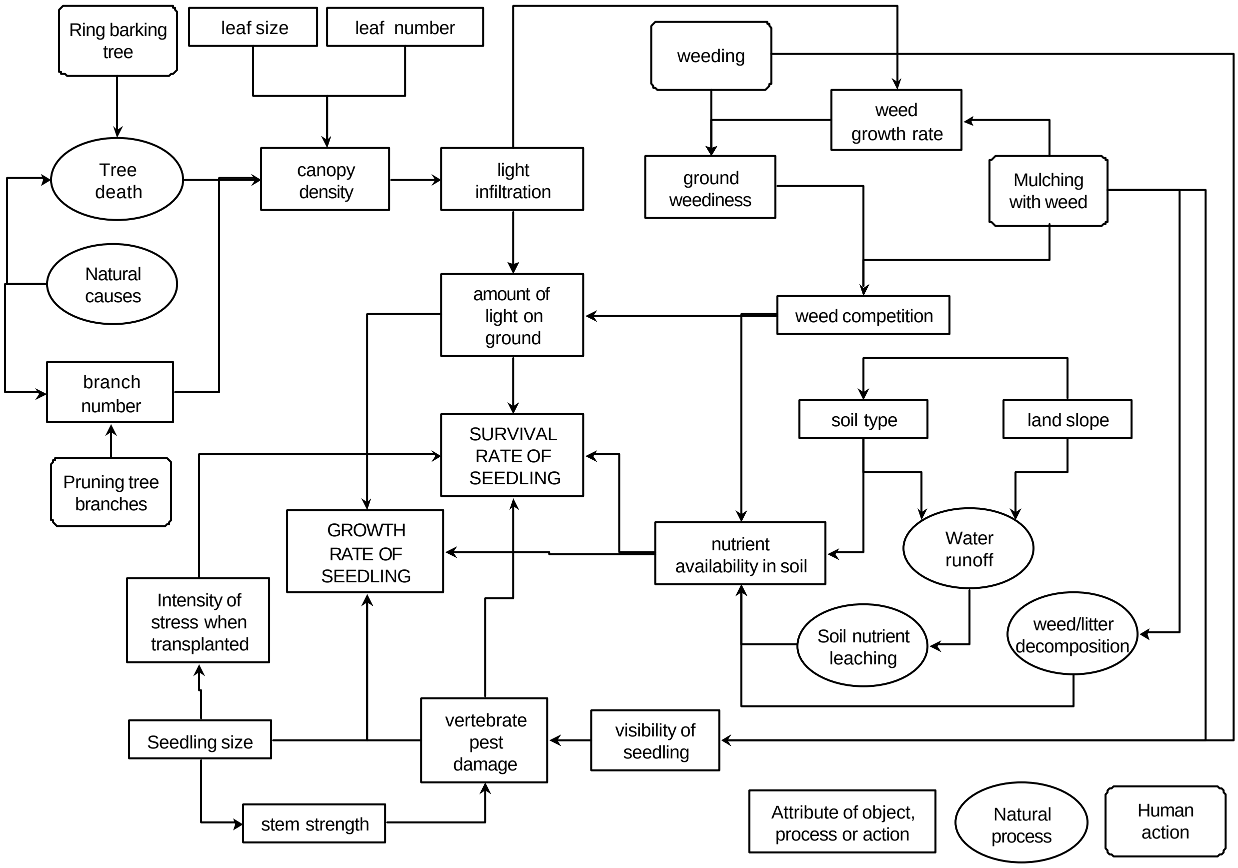


Figure 3. Local knowledge about ecological relationships related to rubber seedling growth in a sisipan system. Arrows indicate direction of cause-effect relation between connected nodes. This is a WinAKT-type diagrammatic representation of a local knowledge system.

The KBS approach we have learned about above is just one method that we can use to recognise and record local knowledge. There are many more ways of documenting and recognising the importance of local knowledge. Participatory methods, for example, can be used to collect, synthesise and illustrate information on broader or more general topics, including background information on cultural and social contexts and on people's opinions. Some examples of how different participatory techniques can be used within a research project are given in the next section, with reference to a case study.

5. Participatory methods in characterisation and diagnosis

Rapid Rural Appraisal (RRA) and Participatory Rural Appraisal (PRA) methods have been developed as alternatives to conventional survey methods[1], as tools for characterisation and diagnosis of opportunities and constraints (see also Lecture Note 1). Unlike conventional social science methods of the past that may take a long time to produce results of little direct value for policy formulation and development planning, RRA and PRA methods can produce results quickly, be more based on the perceptions and views of the local communities involved, and therefore be more applicable for policy formulation and setting of a development agenda. Of course, conventional social science research methods remain valuable for developing and testing hypotheses and generalisations, and for in-depth, longer-term investigations on particular topics.

RRA and PRA methods were developed during the 1980s and the sometimes bewildering array of variations on the methods and names reflects the diversity of situations where the tools have been used. The common principle, as Gill (1994) pointed out, is that in RRA and PRA methods, **researchers make explicit efforts to treat the local people as equal partners in the process of identifying problems and potential solutions**. Moreover, the use of formal questionnaires is avoided.

Common techniques from the participatory method 'tool box' include the tabulation of the village's history ('time line', see also Lecture Note 12 for an example), walking and drawing transects through the village and the use of sketch maps drawn by villagers to describe spatial patterns.

Participatory methods are most relevant for questions where local perceptions play a dominant role. They can also be combined well with other methods. For example, ICRAF and CIFOR, in their joint research project on the causes of the 1997/1998 fires in Indonesia, used participatory methods (RRA and PRA) to complement remote sensing and 'hot spot' analysis using GIS (Geographical Information Systems) techniques for spatial analysis. The data obtained through RRA and PRA methods was largely **qualitative**, so its integration with the **quantitative** data from the remote sensing imagery of land cover change and the analysis of spatial patterns of hotspot occurrence strengthened the study.

In this project, which we will use here as a case study, the focus was on integrating local people's narratives and sketch maps with land cover change maps and burn scar maps. Using the GIS, it was possible to calculate the types and size of land cover changes. In addition, local people's accounts could be added to the land cover change results to provide an insight into **how** and **why** these changes occurred. For the 1997 fires, sketch maps were overlaid with the burn scar maps and compared, to provide both a quantitative and qualitative assessment of the fires. The different participatory methods that were used in the fire project are described below, with examples of the type of output that was obtained and the practicalities involved (when implementing the methods and interpreting the results).

The following steps were taken as part of the participatory investigation of the underlying causes of fire in Sumatra:

A. Participatory group meeting to clarify perceptions and views on fires and the various levels of causation,

[1] Surveys, usually involving questionnaires, are key tools in social science research, which allow the systematic collection of standardised data. Their advantage is that they can be rigorous and comprehensive, but a disadvantage is that they can take a lot of time to conduct and data analysis can also be very time-consuming.

B. Reconstructing recent land use change in a typical landscape transect from oral history,
C. Using Sketch Maps to describe the spatial patterns that relate to land use change and fire incidence,
D. Collecting quantitative data through semi-structured group interviews,
E. Integrating local maps with remote sensing analysis, using GIS.

From the very beginning, and throughout the first three stages (above), the project deliberately did not classify farmers into different 'types' or 'groups'; discussions included all members of the community and were wide-ranging, with no restrictions on the topics that could be considered. Thus, all farmers could participate equally, and the problem was not prematurely 'framed' (see Lecture Note 1) by the researchers before they had obtained the 'big picture'. This was crucial when dealing with a subject as complex as that of fire, as the numbers of stakeholders and the range of issues involved have not always been recognised or understood in the past, and this has led to incorrect perceptions of the problem. In addition, it had to be made clear from the start that the objectives of the exercise were to get the local voice heard at higher policy levels, and not to plan specific interventions or development projects for the villages themselves.

The project staff encouraged farmers to participate fully in the diagnosis of causes and characterisation of actual changes and relations, by first of all building a good relationship with them. Trust is a key element in the successful use of any participatory approach to research, and this may mean that the 'R' of 'Rapid' may have to be taken with a pinch of salt.

Figure 4. Farmers actively participated in drawing a sketch map during a group meeting.

5.1 Participatory group meetings

Participatory group meetings can be used to gather information effectively from respondents on issues that do not require 'privacy' and where group views rather than individual perceptions are important. At the same time, one should not be naïve in ignoring the hierarchical structure in any group and the constraints that this puts on the expression of individual perceptions.

The fire project invited farmers to attend several meetings, each one to discuss a specific issue, for example land use/land cover change or the history of the village. As much as possible the project invited all representatives of farmers in each village, including formal and non-formal leaders and farmers of different ethnic backgrounds and also made specific efforts to include women in the process.

5.2 Landscape transects and oral history in reconstructing land use change

In the fire project, as in other studies of land use change, discussions of the history of the village are a very important entry point for characterisation and diagnosis. Usually, farmers like to tell the history of their village and a group process is non-threatening in this respect. Using the table of the history of the village, we asked farmers to list the important events in the village from its establishment of the village until the present day.

To represent this oral history, we reconstructed typical landscape transects at key points in time. Figure 5 gives an example of such transects focusing on land use change, demography and fire. Making the drawings together with the villagers allowed us to re-check information and to clarify points that may have been glossed-over in the first account of village history.

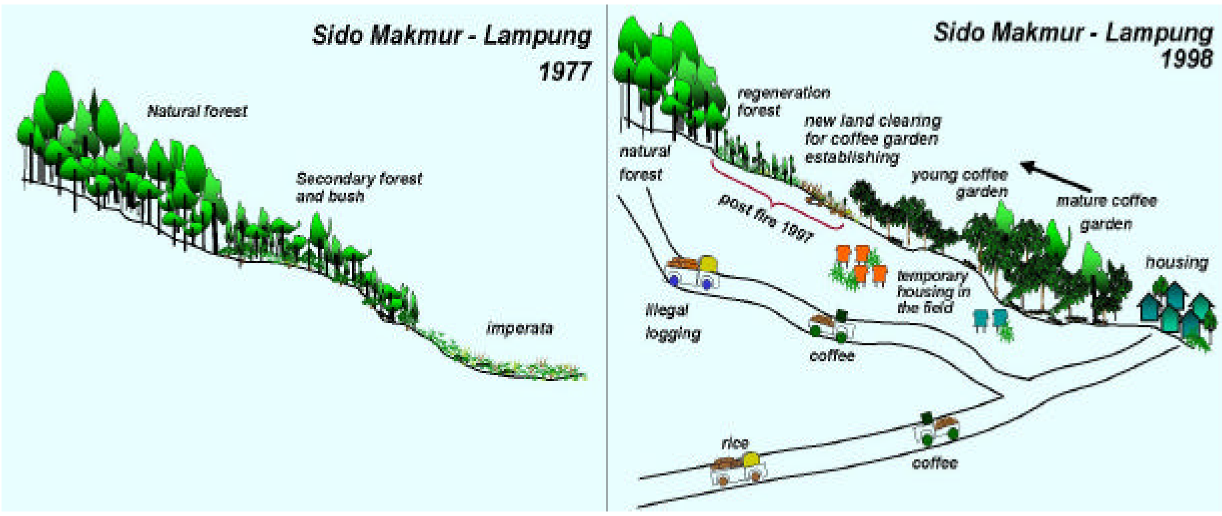


Figure 5. Typical transects through the landscape that represent the history of land use change in one of the villages studied in an interdisciplinary project on the causes of the 1997/1998 fires in Indonesia.

5.3 Participatory mapping

As a third technique, sketch maps were used in the fire project. Firstly, we needed to decide on a unit of analysis for drawing a sketch map. Most people use a village or sub-village as the unit of representation and for subsequent analysis. However, the village level analysis does not work well for characterising the underlying causes of fires. Since fire occurs in different land use patterns, and is caused by different actors, we needed to enlarge the unit of analysis from the village to the landscape level. The size of the 'landscape' was dependent on the diversity of land uses and actors. For example, in one site studied by the fire project (Sido Makmur in Lampung Province), land use patterns were not very complex and an area of 3 x 7 km^2 was chosen as a 'representative' area. By contrast, however, another site studied covered various land use/cover types including swamp, forest, tree crop estates, timber plantations and smallholder agricultural and transmigration settlements, so a landscape unit of 50 x 50 km^2 was considered to be the smallest unit that contained all relevant processes. For integration with remote sensing analysis, larger areas are generally desirable as the unit of analysis.

Using the participatory mapping method in Sido Makmur (see Figure 6) and using information gained in the landscape transect and oral history exercises, the fire project came to the conclusions that:

1. The high rate of local deforestation was due to establishment of smallholder coffee gardens and illegal logging activities.
2. A high rate of migration into this site was responsible for most of the land cover change.
3. Most of the new coffee gardens are located within the National Park, and farmers face much insecurity regarding land tenure.
4. Improvement of roads and the profitability of coffee attract more people to establish coffee gardens.
5. A big fire in 1997 destroyed natural forest.
6. Farmers subsequently extended coffee gardens in the burned areas.

Results from the participatory group meetings were largely in the form of qualitative data and people's views. To explore more quantitative data, we extended the method with semi-structured interviews (Section D) and integrated it with remote sensing analysis (Section E).

5.4 Semi-structured interviews

In the fire project, two important results from the participatory group meeting (establishment of coffee gardens and migration) were identified for further quantification and analysis. First, we used semi-structured interviews to collect the data on coffee gardens and migration patterns. The steps used in the semi-structured interviews were as follows:

1. Identification of all sub-villages or settlements in the site.
2. Interviews with 3 to 4 formal and informal leaders in each sub-village.
3. Asking respondents to list all households in each sub-village.
4. Asking for information on demography, number of coffee fields, area of each coffee plot, age of coffee trees per plot, people's time of arrival in the area, type of migrants, etc.

Tables 2 and 3 are examples of quantitative results from the semi-structured group interviews, and which also support the results from the participatory group meetings.

Table 2. Percentage of households arriving in the village at different times. (See Figure 6 for locations of sub-sites A to E.)

Sido Makmur area	Number of Households	Year of arrival in the village				
		1970-80 (%)	1981-85 (%)	1986-90 (%)	1991-95 (%)	>1995 (%)
Total	697	17	10	27	27	19
Sub-site A	157	49	6	17	18	10
Sub-site B	41	15	44	15	10	17
Sub-site C	71	17	24	30	23	7
Sub-site D	126	3	10	43	35	9
Sub-site E	302	6	4	27	32	31

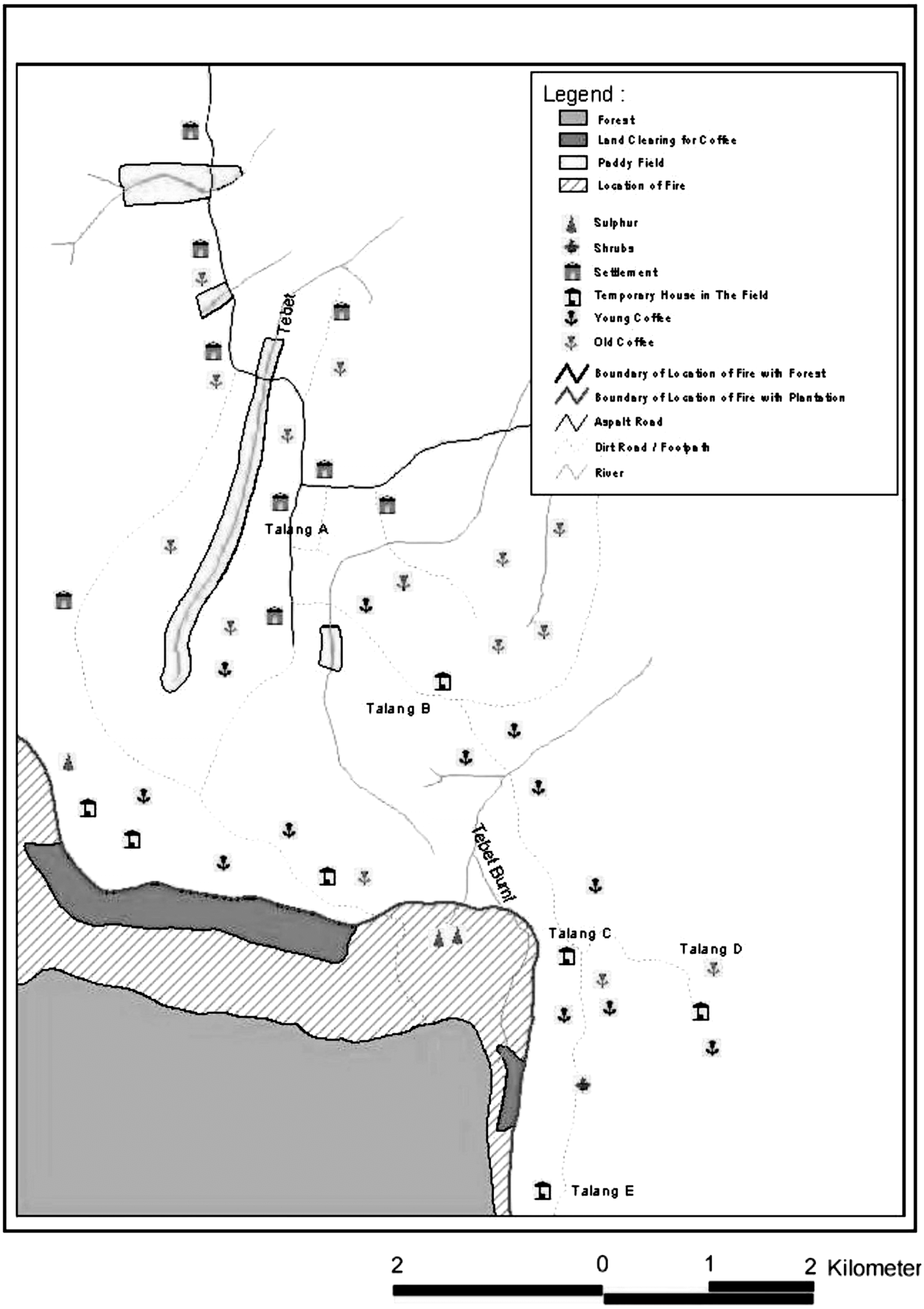


Figure 6. Sketch map of Sido Makmur, produced by the local community in a participatory mapping exercise. The main road lies just outside the top boundary of the figure. A transect taken from the top to the bottom of the figure crosses areas of older coffee, then areas of younger coffee then forest; this is equivalent to the cross-section shown in Figure 5. Elevation increases from the top to the bottom of the figure, reaching 1200 m in the forest.

Table 3. Areas of coffee plantations (ha) classified by sub-site and age of coffee (in years). (See Figure 6 for locations of sub-sites A to E.)

Sido Makmur area	Total area of coffee gardens (ha)	Age of coffee garden (years)						
		0-1	2	3	4	5-10	11-15	>15
Total	1273	139	162	77	52	535	173	135
Sub-site A	242	22	11	7	7	18	74	103
Sub-site B	47	9	1	3	0	31	3	0
Sub-site C	122	6	13	4	5	94	0	0
Sub-site D	215	6	1	1	2	205	0	0
Sub-site E	647	96	136	62	38	187	96	32

These tables indicate the following:

1. There is a relationship between year of arrival and distance of settlement, in kilometers, from the main road (Figure 6). The majority of migrants arrived at the sub-site nearest the road in earlier years and relatively few arrived at the sub-site farthest from the road in more recent years.
2. The age of coffee gardens at the site is relatively young. 75% of the total number of coffee gardens are less than 10 years old and only 11% of coffee areas are more than 15 years old. The oldest coffee gardens are located largely in sub-site A, whereas the youngest coffee gardens are located largely in sub-site E. Coffee gardens between the ages of 5 and 10 years are located largely in sub-sites B, C and D. This evidence suggest that the oldest coffee gardens are mainly located in the sub-sites that are nearest to the main road and the youngest coffee gardens are mainly located in the sub-sites that are farthest from the main road. This result is expected, because it is more costly, and so less profitable, to cultivate plots further from the market, as argued by Angelsen (1996). Moreover, the effect of distance to a main road in our study seems consistent with the finding of Chomitz and Gray (1994). Using data from Belize, Chomitz and Gray found a significant positive effect of development of rural roads on deforestation.
3. In 1998-99, the area of new coffee gardens developed was 139 ha. Most of the plantings were located in areas that had accidentally burned in 1997. It should be noted that most of these burned areas were claimed by farmers. If farmers slash the border of the areas and plant “andong” (*Cordyline fruticosa*) trees as a border marker, then the local societies recognise their use rights to this land. Farmers have already claimed much of the previously burned land. Accurate data, however, are difficult to obtain, since this area is clearly located in the National Park, and thus these informal claims are in direct conflict with state rules and regulations.

These findings corroborate the impressions captured in the transect drawings (Figure 5) developed at the participatory group meeting.

5.5 Integration of local maps with remote sensing data

More precise results can be obtained by integrating remote sensing analysis with the data on local perceptions. Suyanto *et al*. (2000) provided an example of a ‘burn-scar analysis’ that was used to distinguish between the spatial pattern where fire was used as a ‘tool’ in land clearing, and the pattern where fire was used as a ‘weapon’ in land tenure conflicts.

Visual analysis of the imagery identified three main zones of burning characterised by a distinctive burn scar pattern (coloured yellow in Figure 7). In Zone 1 (see Table 4 and

Figure 7), burn scars are small, 3 ha on average, widely scattered and only account for 1% of that zone. Overlaying the 1997 burn scar map with the land cover maps for 1985 and 1994 showed that much of this forest area had already been converted (to coffee gardens) in 1985. From field observations in this area, it was found that fire is regularly used on a small scale to clear land for cultivation.

Table 4. Burn scar statistics for a benchmark area in Lampung (Suyanto *et al.*, 2000).

Burn Scar Zone	1	2	3
Size of zone (ha)	13,371 ha	6,548 ha	3,286 ha
Number of burn scars	48	48	11
Total area of burn scars (ha)	142 ha	1,358 ha	960 ha
% area of burn scars in zone	1 %	21 %	29 %
Average size of burn scar (ha)	3 ha	28 ha	87 ha

In **Zone 2**, which contains the Sido Makmur area (Figure 7), burn scars are large, with an average size of 28 ha and account for as much as 21 % of the zone. The majority of scars are located near or adjacent to primary forest. Using the GIS, it was shown that much of the area covered by the 1997 burn scars in this zone was still natural forest in 1994. NB the data in Tables 2 and 3 were collected in this Zone.

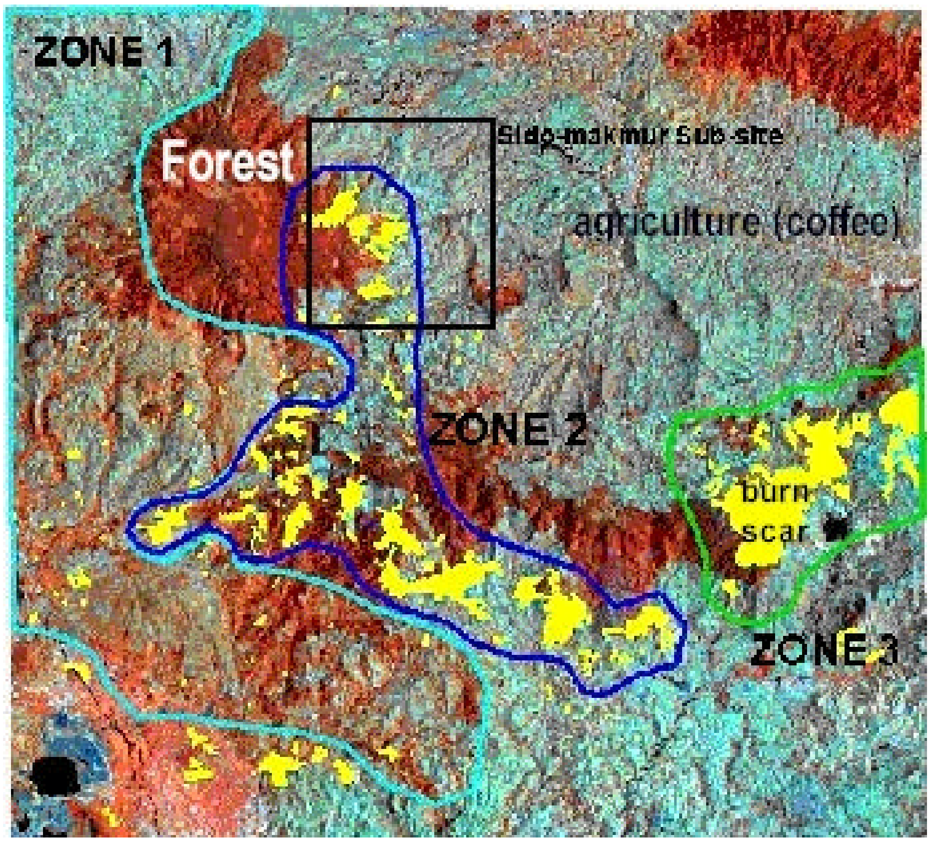


Figure 7. Burn scar zonation (Suyanto *et al*., 2000): the red (darkest) areas represent forest, the blue areas represent agriculture and the burn scars are a distinctive yellow (the lightest areas on the map). The boxed area corresponds roughly with the area represented in Figure 6.

Zone 3 exhibits very large burn scars. Although the number of burn scars is less than in other zones, the average size is much larger (87 ha) and accounts for 29 % of that zone. Historical imagery shows that this area has burned numerous times since 1994, and probably in earlier years as well. In 1985, this area was already cultivated. Interviews with local people in 1999 identified that this site is located in a Protection Forest in which a tenure conflict between local people and the Forestry Department has arisen. Since 1975, villagers who live around this area have planted coffee. However, in 1983, 1991, 1993 and 1996, the Forestry Department implemented a reforestation programme by cutting down all of the coffee trees and planting calliandra (*Calliandra calothyrsus*). Due to the resulting conflict, and related revenge burning by the villagers, the area has become unproductive grassland (*Imperata cylindrica*) and very prone to annual fires.

The burn scar analysis shows that different patterns of burning can be identified and related to land use issues. For example, it appears that small burn scars are directly associated with stable agricultural areas (e.g. Zone 1), whereas larger burn scars are associated with forest clearing. On this site, very large burn scars were associated with areas known to be subject to conflicts over land use and between land users (e.g. Zone 3). These results show that there is potential to use burn scar mapping to classify fire use or fire problems.

Lessons learned from the participatory approach

The fire study has demonstrated that participatory methods are good tools in characterisation of tenure conflicts and fire problems. Because tenure conflicts and fire problems are very sensitive issues for individual farmers, discussions as a group could reduce anxiety that individuals could be 'blamed' for giving out sensitive information. A participatory approach helped to answer many questions about the tenure conflicts and fire problems: not just 'where' (the location) and 'what' (the nature of the problem), but also 'who' (the perpetrators) and 'why' (the underlying causes).

The most challenging work, however, is what to do about a tenure problem once we have identified that one exists. An approach called 'Natural Resources Policy Dialogue and Negotiations' (see Lecture Note 12) may help to solve tenure problems. However, this will only be effective once **all** stakeholders are convinced that:

- there is a real problem,
- denial of the problem does not suit (or no longer suits) their needs, and
- in the current situation, all parties involved in the conflict actually lose...

Through a negotiation process, agreements or social contracts may arise between the state/government and the local community (managers) for better management of natural resources (see Lecture Note 12). The starting point, however, is that the actual situation on the ground is recognised, the voices of all stakeholders are heard and their views on possible solutions are given serious consideration. How can we ensure that the farmers' voices are heard? Some examples are given in Section 5 below.

6. Farmers' views and priorities articulated

A logical step after the elucidation of farmers' views and priorities in a research context, is to create a platform where farmers can express these views to the local government. 'Outsiders' such as researchers or NGO's can play a role in facilitating the dialogue, giving credibility to the local perspectives and providing a broader context for the views, as a first step towards negotiations and agreements on the use of natural resources.

6.1 Local stakeholder meetings and policy seminars

The ASB programme in Indonesia organised events where such facilitation could take place, in both the Jambi and Lampung benchmark areas (see Boxes 6, 7 and 8). These meetings were seen as a final step in the 'characterisation and diagnosis' process, and as the initial step in a new phase where the research findings will actually have an impact on:

1) the development of land use practices by farmers and
2) the way government agencies try to influence this process via policies.

In Lecture Note 12 we will come back to the policy aspects.

Box 6. Jambi seminar

In a two-day meeting (30 April - 1st May 1999), with about 100 stakeholders, ASB-Indonesia discussed:

- what the main factors have been in the change in land use in the Bungo Tebo district of Jambi over the past 25 years,
- what this means for the people living in the area, and
- how they think that land use will develop over the current and next generation.

The meeting was hosted by the local government planning office (BaPeDa) and involved villagers (male and female) from the two 'benchmark areas' that were the focus of ASB research in Jambi.

During the meeting, results of the characterisation and diagnosis exercises (see also Lecture Note 2) were presented and discussed (e.g. Figure 8 and maps derived from remote-sensing research which showed the changes in land use in the benchmark areas). Presentations were also made by the local government agencies about their views for the future. In sessions with smaller discussion groups (either grouped by village or by ‘stakeholder’, including a separate group for women), visions for future landscape and land use development were explored.

In the Indonesian context it is important for farmers to emphasise that their ‘agroforests’ are ‘gardens’ (‘kebun’) and not ‘forests’ (‘hutan’) – this does not refer to a view of the vegetation as such, but is based on the experience that all ‘forest’ land is claimed by the state (see also Lecture Note 2).

Most participants expected rubber-based production systems (Figure 9) to remain the dominant livelihood provider in the area and efforts to maintain or increase its profitability were seen as high priority by all. Such options are particularly needed for the ‘sisipan’ (interplanting) technique that forms an alternative to the slash-and-burn based rejuvenation of rubber agroforests. Most government representatives expressed surprise that such a system existed at all, and acknowledged that it deserves more serious consideration. So far, views on ‘development’ by government officials had focussed on giving out concessions to oil palm companies, even though much of the land involved is already being used for rubber agroforestry by smallholders.

Much of the discussion focussed on the various forms in which outside investors and local people interact in oil palm projects. The current situation was seen by most of the village representatives as unfair and against their interests, while oil palm as a crop can indeed be a profitable option for smallholders. Another hot item in the discussions was the management of the remaining state forest land that is classified as ‘production forest’. The unequal sharing of benefits of the legal and especially illegal logging was a sore point colouring any views of persistence of forest in the landscape.

In a wider sense their was a broad feeling that past government interventions, which had a 'slash-and-burn' character, should and will be replaced by a 'sisipan' way of introducing new elements and ideas, which will have to compete with the existing elements in the landscape, to ensure a dynamic landscape with opportunities for all. The meeting laid a foundation for 'adaptive co-management' as new paradigm for land use by multiple stakeholders. Giving the villagers a chance to articulate their views and priorities, facilitated by the researchers’ presentation of results that are independent of current government views, was an important step. In the Indonesian setting, such a step could only be taken in the climate of ‘reformasi’ after 1998. Follow-up to such a meeting, however, again depends on the political changes in the country and the degree to which they allow for local perspectives to play a role.

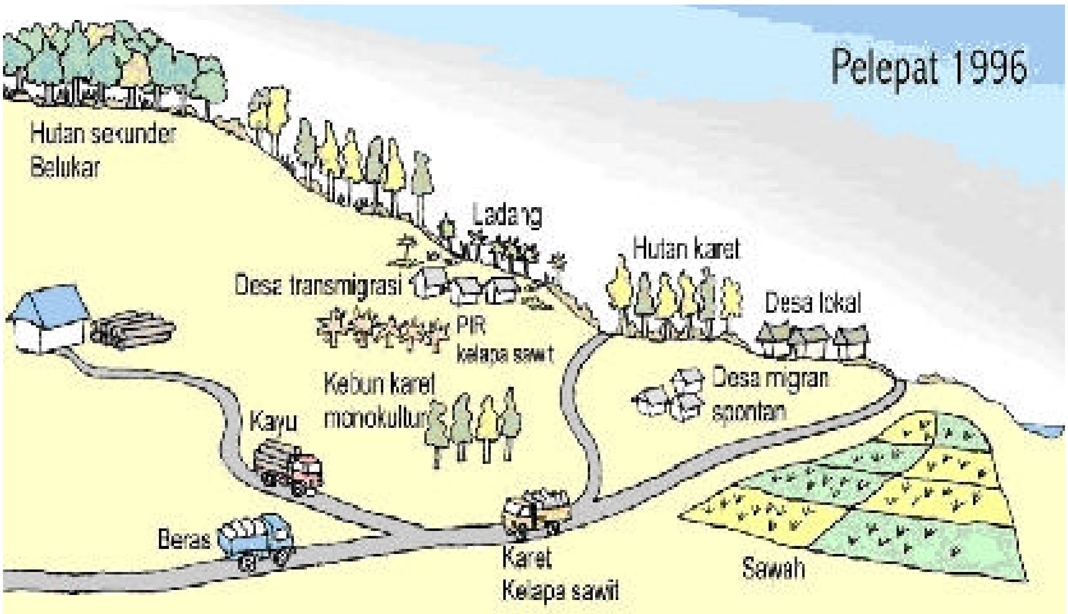


Figure 8. Simple diagrams as used in the Jambi stakeholder meeting can help to build a common perception of what has actually happened in the landscape over the past decades. This diagram describes changes in one of the ASB benchmark areas where oil palm ('kelapa sawit') plantations and transmigration sites ('desa transmigrasi') interact with the local villages ('desa lokal') with their rubber agroforests ('hutan karet'). Bringing representatives from the two types of villages together leads to very different perceptions on the desirability of these changes. ['Hutan sekunder'/'belukar'=secondary forest; 'ladang'=upland rice field; 'desa migran spontan':village of spontaneous migrants; 'sawah'=irrigated rice field; 'kayu'=wood; 'beras'=rice.]

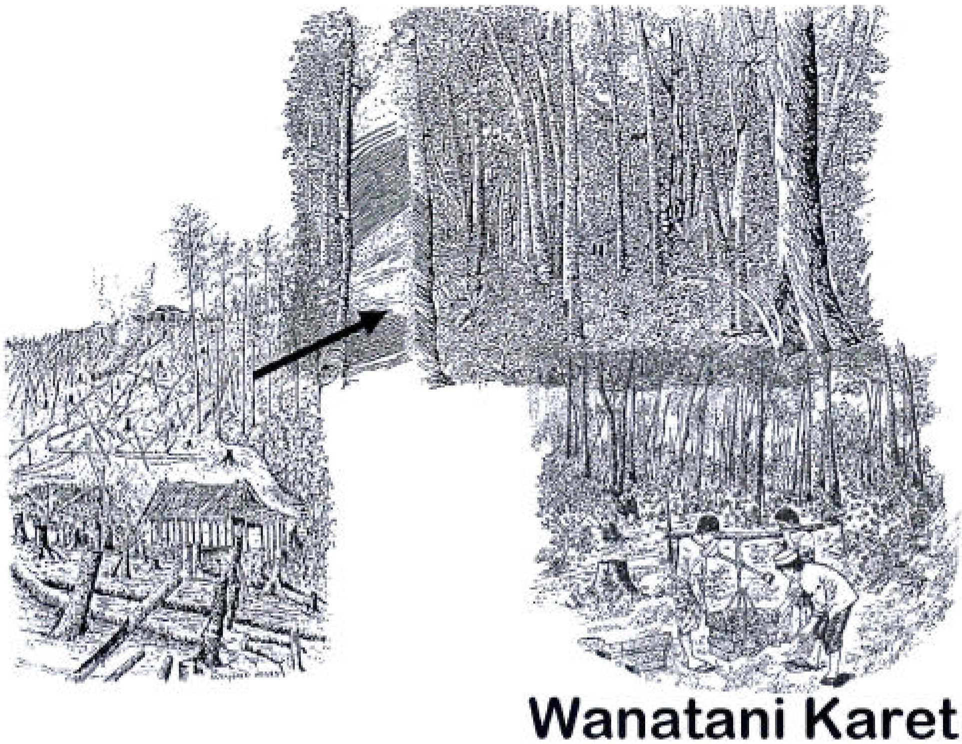


Figure 9. Stages in a rotational rubber agroforestry system, illustrated for the local policy seminar to help in gaining recognition for rubber agroforestry ('Wanatani Karet') as a valid land use system in its own right, and not as a backward or primitive form of 'rubber plantation'.

Box 7. Lampung local policy seminar

In the Lampung benchmark area of ASB, the 'characterisation and diagnosis' stage of the project was concluded with a series of field days and a local policy seminar. During the field days, farmers could cross-visit other villages, see some on-farm experiments, visit a long-term soil ecological research site and discuss the constraints they face and opportunities they have. At the local policy seminar, selected farmer representatives could present their views, alongside researchers and personnel from government agencies, and again discuss constraints and opportunities.

As in the Jambi seminar, a major conclusion was that the government agents have a focus on planning that does not do justice to the diversity of innovations attempted by farmers. Existing policies do not recognise the need for diversity of commodities and activities at farm level as essential in reducing risk, but tend to believe in 'zoning' (this area for oil palm, that for sugarcane plantations, that for rubber). The rationale that was given in the past (efficiency of marketing and processing) does not hold up to closer scrutiny (with improved road access).
The seminar identified a number of areas where government support could stimulate diversification. The existing 'monopolies' on supply of certified planting material for oil palm, for example, was identified as a bottleneck. Another bottleneck to the development of smallholder tree production systems, are the existing rules and taxes on sale of locally-harvested wood. The justification of these rules is the intention to protect remaining forest resources, but one of the impacts is a disincentive to farmers planting trees on their farms. Better information on the actual developments in the timber market is highly desirable for the farmers. These priorities were 'new' for most of the local government officials.

The concept of different stakeholder perceptions and the need for recognition of all views (Figure 10) needs articulation to challenge the conventional 'the government knows best' paradigm that dominated in Indonesia before the *reformasi* era.

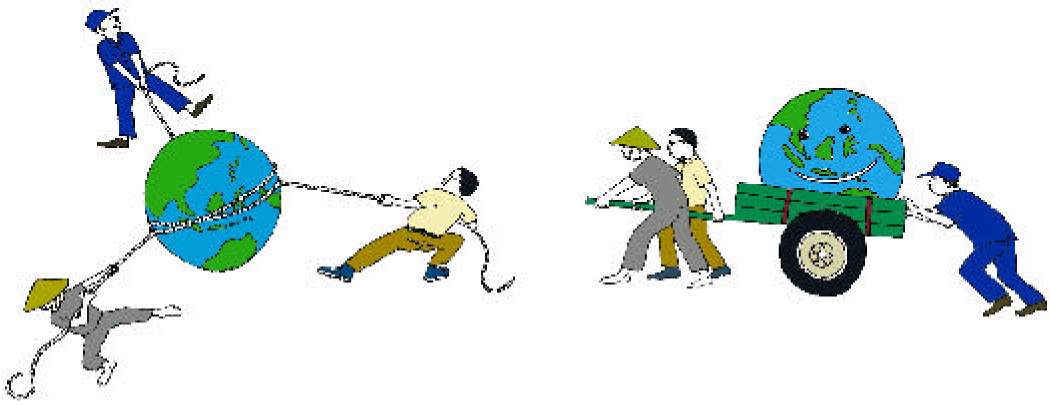


Figure 10. Diagrams used to convey the stages of struggle and competition (left) and of negotiated agreements (right) to the stakeholder meetings; "Where stakeholders such as farmers, government and towns people continue to struggle for control and imposing their view on the world, the outcome may disappoint all; a way forward is only possible, if common goals are found that include saving the essential resource base for future generations."

Box 8: Lantapan Natural Resource Management Planning, Manupali Watershed (an ASB benchmark site), Bukidnon, Philippines

A small planning grant was given to the local government of Lantapan to organise a decision-making and planning process that would incorporate the information and knowledge generated from research. (The grant was part of a global project, SANREM-CRSP: Sustainable Agriculture and Natural Resource Management-Collaborative Research Support Project, which operated in the watershed). ICRAF's contribution to the process stemmed mostly from its research on buffer-zone management and agroforestry.

The planning process became a significant platform for dialogue among community stakeholders, and all participants developed a heightened awareness of:

- local environmental conditions, and
- how their local actions helped in the global effort towards sustainable development ("think globally, act locally").

The stakeholders identified the following issues that directly affected them and the way that they managed their natural resources, and were able to communicate these directly to the decision-makers at the meeting:

- agricultural extension systems at the local level had been neglected and were not effective,
- commodity-focused technological 'packages' had been/were being heavily promoted,
- there were high national production goals for agricultural products, and
- there were very restrictive rules regarding 'forestry', which aimed to protect resources, but, in practice, had the opposite effect. For example, the lack of policy and market support for timber and timber products actually prevented farmers from growing trees and accelerated illegal timber poaching and encroachment into protected areas.

Thus, the local government was made aware of important NRM issues, and took these into account when developing and implementing their local policies and programmes. Among others, new policies included:

- incentives encouraging the adoption of soil and water conservation on sloping lands,
- prohibition of waste disposal in waterways,
- banning of aerial spraying of biocides in large-scale farming,
- declaration of ravines as corridors of biodiversity).

6.2 A farmer-led organisation: 'Landcare'

Landcare is a movement of autonomous farmer-led organisations, and can be viewed in two ways: as a development approach and as a community-led movement (Catacutan and Mercado, 2001). In theory, Landcare groups are voluntary, self-managed 'grassroots' units, formed to protect, conserve and restore the local resource base. They are supported by and interact with local governments, and technical service providers/facilitators (Figure 11).

Some distinguishing features of Landcare groups are that:

- they develop their own agenda and tackle the range of sustainability issues considered important to the group,
- they tend to be based on neighbourhoods or small watersheds,
- the impetus for formation comes from the community, although explicit support from outside may be obtained,
- the momentum and ownership of the group's program is with the community.

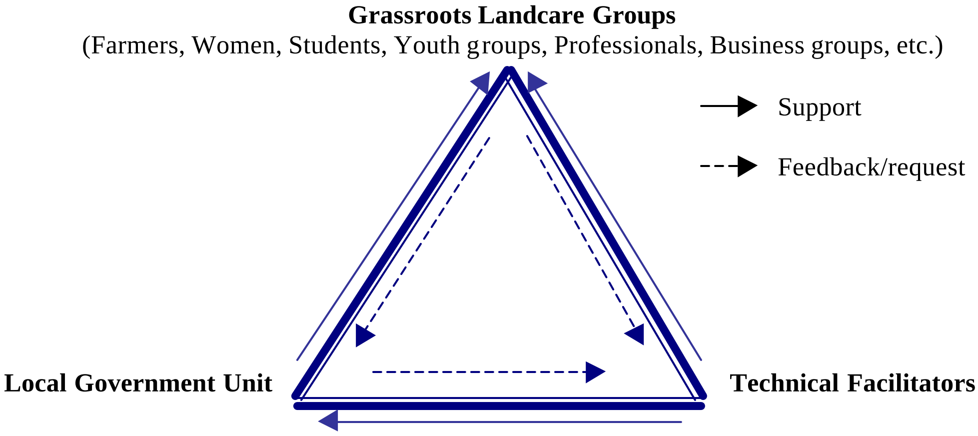


Figure 11. The Landcare triangle: grassroots Landcare groups, local government units (LGU) and technical service providers and facilitators (e.g. research organisations, NGOs) (after Catacutan and Mercado, 2001).

The success of Landcare as an approach is dependent on how the three key actors in Figure 11 interact and work together. In Landcare, the key actors share the costs and benefits of the program:

Farmers provide their valuable time, talents and skills as well as their labour and low-cost materials for group activities and projects;

Local Governments provide leadership, financial, technical and policy support to the programme. For example, in Claveria, in the Philippines, the Local Government has allocated through a local law, an annual budget to support Landcare-related activities and projects;

Technical facilitators and service providers provide the necessary technical support (e.g. on sustainable agriculture and natural resource management), 'Information, Communication and Education' (IEC) programmes and also facilitation for group formation and activities.

The Landcare movement in the Philippines began in Claveria, Mindanao, in 1996 with 25 farmers. Now, about 200 village-based Landcare groups are working in Claveria and other municipalities in northern, central, southern and eastern Mindanao, with a membership of several thousand households. These groups are concerned with practising sustainable and profitable agriculture on sloping lands while conserving natural resources. So far, specific soil conservation practices have been adopted on more than 1500 farms and more than 200 community and household nurseries have been set up that have produced hundreds of thousands of fruit and timber tree seedlings, mostly with local resources.

Landcare and research

Landcare provides important opportunities for improving the way that farmer participatory research is done. Landcare groups can initiate/manage such research (see Box 9 for an example). This enables the groups to diversify their experimentation, ensures a better understanding of the performance and recommendation domains of technical innovations, and offers more effective and less expensive alternatives to technology-transfer approaches.

The 'farmer field school' approach, which was first developed for 'integrated pest management' (IPM) in rice fields, is currently being applied to conservation farming, in conjunction with the establishment of Landcare groups. In theory, this combination could broaden the local research/extension agenda and provide a more sustainable institutional framework for it.

Box 9. Landcare Agricultural Research Committee (LARC: Lantapan Bukidnon, Philippines)

The village 'government' of Sungco in Lantapan organised Landcare members (farmers) into an interim Agricultural Research Committee, to implement a research and demonstration project on the suitability of selected timber (*Eucalyptus* sp., *Acacia mangium*) and fruit trees (e.g. durian) in the area, along with maize as a companion crop. The village government allocated funds for the research and requested that an ICRAF researcher provide guidance and direction in the design, implementation and evaluation of the research project.

The project was initiated entirely by the farmers in the village. The fact that this happened and also that the project got off the ground so quickly was probably due to the farmers already being used to working together as a group, as a result of the Landcare programme. Certainly ICRAF had previously found the process of on-farm research to be much slower, and less efficient, where farmers were unused to being part of a pro-active group.

While LARC is still a new experience, it is hoped that participation of these local people in the research agenda that directly affects them will be important in empowering them to effect change and so gain confidence for their own future.

Concerns for the future

The programme appears to be successful so far, and *apparently* seems to be a great way to not only get farmers' views and priorities articulated, but also to empower and enable them to take action themselves. However, it is easy to be carried away with enthusiasm for the 'thousands of farmers empowered' or 'hundreds of thousands of trees planted'. What are the realities on the ground, and the lessons that can be learned, especially with regard to scaling up the approach from the localised settings so far to wider geographical areas? The following are six major concerns that have been identified regarding the sustainability of the Landcare movement**.**

First, given its growing popularity, the movement runs the **risk of being "projectised"**, i.e. attracting the support of projects that do not understand the concept, and that provide funds in a top-down, target-driven mode; this of course would defeat the object of having a farmer-led 'bottom-up' movement.

Second is the issue of **long-term sustainability**. Networking and the stimulation from outside contacts are considered to be crucial for long-term success. This may be achieved through 'Landcare Federations' which could operate at the municipal level, and which would be composed of officers elected from village-level Landcare groups. These have evolved locally in Claveria (Philippines), and the possibilities for provincial and national federations are currently being explored in the Philippines.

Third, group leadership is a time-consuming and exhausting task, particularly when undertaken on a voluntary basis. Landcare is still young in both the Philippines and Australia but **leadership "burn-out"** has already raised concerns.

Fourth, local initiative to achieve 'Landcare' targets can lead to practices that are much **less democratic** than those defined by the Landcare ideology, or even to pure **coercion**. For example, at one stage, a school in Claveria proposed that children could only graduate from primary school if their parents had adopted a soil conservation practice promoted by Landcare…

Fifth, local government may perceive the Landcare formula as a way of achieving its targets that are **not necessarily in the best interest of all farmers**. For example, where conflicts over land tenure and the presence of recent migrant farmers dominate the local agenda, a different type of organisation may be better for channelling local aspirations.

Sixth, the application of Landcare to differing conditions and its expansion to wider geographic scales may corrupt the process, and lead to a **loss of the basic elements of its success** so far. The major challenge in scaling-up Landcare is maintaining its voluntary nature, and therefore any attempts to mainstream Landcare into government programmes should be viewed with great scepticism.

7. When local action is not enough…

As we have seen in this lecture note, for many issues, a bottom-up approach and organisation at a local level can provide solutions. Often, however, local organisations come up against barriers imposed by national policies.

Lecture Note 12 in this series will therefore focus on the often contradictory and conflicting interactions between existing national policies and integrated natural resource management.

III. Reading materials

Text books

Ruddell E, Beingolea J and Beingolea H. 1997. Empowering farmers to conduct experiments. In: Veldhuizen L van, Waters-Bayer A, Ramirez R, Johnson DA and Thompson J (eds). *Farmers' research in practice: lessons from the field*. Intermediate Technology Publications, London. pp. 199-208.

Scoones I and Thompson J. 1994. Knowledge, power and agriculture - towards a theoretical understanding. In: Scoones I and Thompson J (eds). *Beyond farmer first: rural people's knowledge, agricultural research and extension practice*. Intermediate Technology Publications, London. pp 16-32.

Sinclair FL and Walker DH. 1999. A utilitarian approach to the incorporation of local knowledge in agroforestry research and extension. In: Buck L, Lassoie JP and Fernandes ECM (eds). *Agroforestry in sustainable agricultural systems*, CRC Press LLC. pp 245-275.

Veldhuizen L van, Waters-Bayer A, Ramirez R, Johnson DA and Thompson J (eds). *Farmers' research in practice: lessons from the field*. Intermediate Technology Publications, London.

Mikkelsen B. 1995. Methods for development work and research : a guide for practitioners. Imprint New Delhi ; Thousand Oaks : Sage Publications, 296 pp.

Scientific journal articles

Clarke J. 1991. Participatory technology development in agroforestry: methods from a pilot project in Zimbabwe. *Agroforestry Systems,* 15: 217-228.

den Biggelaar C. 1991. Farming systems development: synthesising indigenous and scientific knowledge systems. *Agriculture and Human Values*, 8 (1/2): 25-36.

Joshi L and Sinclair FL. (in preparation) Reasoning with local ecological knowledge: a case study.

Sinclair FL and Walker D. 1998. Acquiring qualitative knowledge about complex agroecosystems. Part 1: Representation as natural language. *Agricultural Systems*, 56(3): 341-363.

Walker DH, Thapa B and Sinclair FL. 1995. Incorporation of indigenous knowledge and perspectives in agroforestry development. Part One: Review of methods and their application. *Agroforestry Systems*, 30: 235-248.

Manuals / Reports

Chomitz KM and Gray DA. 1994. Road, Land, Markets and Deforestation: A Spatial Model of Land Use in Belize. Mimeo. The World Bank.

Dixon HJ, Doores JW, Joshi L and Sinclair, FL. 1999. Agroforestry Knowledge Toolkit For Windows (WinAKT): Methodological Guidelines, Computer Software and Manual. SAFS, University of Wales, Bangor (UK).

Suyanto S, Dennis R, Kurniawan I, Stolle F, Maus P and Applegate G. 2000. The Underlying Causes and Impacts of Forest Fires in South-East Asia: Site Report. Sekincau, Lampung Province, Indonesia. CIFOR, ICRAF, USAID and US-Forest Services.

Proceedings / Workshop Papers

Angelsen A. 1996. Deforestation: Population or Market Driven? Different Approaches in Modeling of Agricultural Expansion. CIFOR and UNU/WIDER workshop on Theories and Modeling of Tropical Deforestation, Bogor, Indonesia.

Catacutan DC and Mercado AR. 2001. Technical innovations and institution-building for sustainable upland development: Landcare in the Philippines. Paper presented to the START-SARC Regional Science and Policy Conference, Chiang Mai, Thailand, 17-19 February 2001. 21 pp.

Gill GJ. 1994. Rapid and Participatory Rural Appraisal: Introduction. In: Sowerwine, J. *et al*. (eds) From Farmers' Fields to Data Fields and Back. A Synthesis of Participatory Information Systems for Irrigation and Other Resources. Proceedings of an International Workshop. The Institute of Agricultural and Animal Science, Rampur, Nepal, March 21-26, 1993.

Joshi L, van Noordwijk M, Wibawa G, Vincent G, Hardiwinoto S and Sukandi T. 2000. Gap replanting – an emerging trend in rejuvenation of jungle rubber agroforests in Jambi, Indonesia. Paper presented at workshop "Evolution and Sustainability of Intermediate Systems of Forest Management", 28th June to 1st July, Lofoten, Norway.

Theses

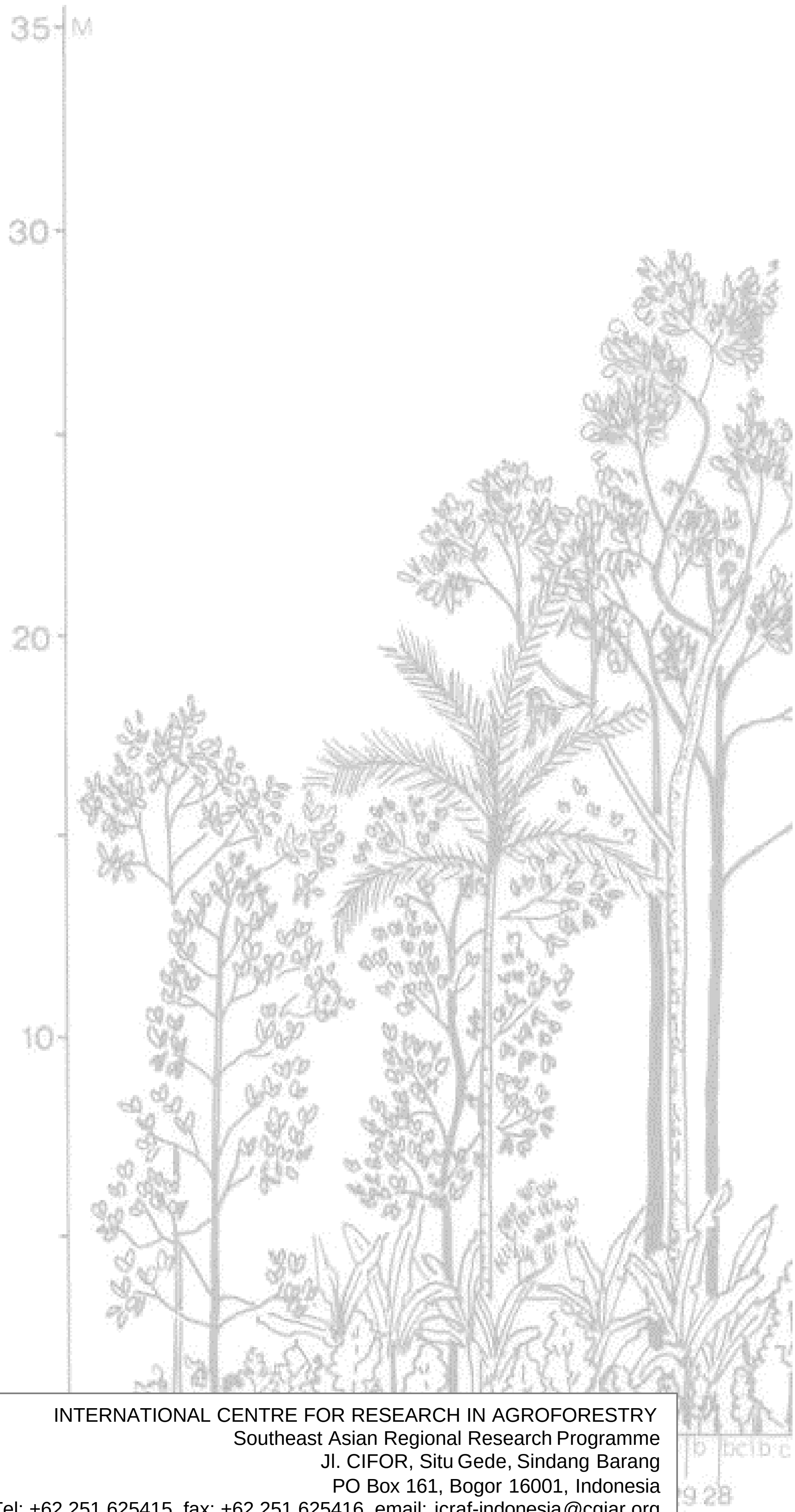
Joshi L. 1997. Incorporating Farmers' Knowledge in the Planning of Interdisciplinary Research and Extension. PhD thesis, University of Wales, Bangor. 271 pp.

Websites

International Institute for Environment and Development, UK. http://www.iied.org/

http://www.bangor.ac.uk/~afs40c/afforum/ which contains the WINAKT software

Contents of this series of lecture notes



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