

THE ORGANISATION OF SMALL-SCALE TREE NURSERIES

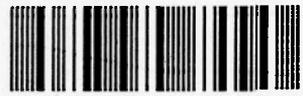
Edwin Shanks
Jane Carter

Rural
Development
Forestry
Study Guide 1



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Overseas Development Institute

THE ORGANISATION OF SMALL-SCALE TREE NURSERIES

Studies from Asia, Africa and
Latin America

Edwin Shanks and Jane Carter

with contributions from:

Kaltoum Ahmed, Tom Arens, Phil Bradley, Fowsia El Dai, Jagdish
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Study Guide 1
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Acronyms

AFD	Agriculture and Forest Department (Vietnam)
APAN	Asia-Pacific Agroforestry Network (FAO Asia)
BBP	Boudha-Bahunipati Welfare Project – Nepal
BTAM	British Tropical Agriculture Mission (Bolivia)
CIAT	Centro de Investigación Agrícola Tropical – Bolivia
DTT	Technology Transfer Department (CIAT – Bolivia)
FAO	Food and Agriculture Organisation of the United Nations
FBD	Forestry and Beekeeping Division (Tanzania)
FCP	Forestry Cooperation Programme (Vietnam)
FLFP	Farm-Level Forestry Project (Vietnam)
FNC	Forests' National Corporation (Sudan)
FPS	Forest Protection Station (Vietnam)
IIZ	Institut für Internationale Zusammenarbeit (Vienna, Austria)
IUs	Intermediate Users (Bolivia)
KEFRI	Kenya Forest Research Institute
KWAP	Kenya Woodfuel Agroforestry Programme
KWDP	Kenya Woodfuel Development Programme
NAF	Nepal Agroforestry Foundation
NGO	Non-Government Organisation
NTFPs	Non-Timber Forest Products
ODA	Overseas Development Administration (UK)
ODI	Overseas Development Institute (UK)
PRA	Participatory Rural Appraisal
RDFN	Rural Development Forestry Network (ODI, UK)
RRA	Rapid Rural Appraisal
SIDA	Swedish International Development Agency
SPU	Seed Production Unit (KWAP Kenya)
ToT	Training of Trainers
VAC	system – locally used for Homegardens. VAC is an acronym formed from three Vietnamese words for garden or orchard, fishpond, and pigsty or poultry shed.
VAP	Village Afforestation Project (Tanzania)
VMG	Village Management Group (Vietnam)
VPSU	Vinh Phu Service Union (Vietnam)

Foreword

'Forestry is not about trees, it is about people. And it is about trees only insofar as trees can serve the needs of people.' (Westoby, 1987)

As long ago as the 1978 World Forestry congress the notion of the importance of 'Forests for People' has been a part of the formal discourse of foresters, even if many did little more than pay lip-service to the idea. While few have been prepared to go as far as Jack Westoby, who clearly elucidated a vision of people's forestry, the interrelationship of local people and trees has been a theme of steadily increasing importance ever since. This has signalled an important move away from forestry solely for the supply of raw material to industry and towards forestry as a provider of an essential resource necessary for the sustenance of local livelihoods.

An overt focus on the relationships between local livelihoods and trees led to new policies and practices pursued through social forestry programmes funded by both national governments and international agencies. 'Social Forestry' was the earliest name used for such programmes – initially in India and Southeast Asia, and later in Africa – which addressed the needs of local people for fuelwood, poles, fodder and timber. Solutions to perceived shortages of forest products were sought through tree-planting initiatives, both on-farm and off-farm, in many parts of the world.

In 1985, the Social Forestry Network (as it was then known) was founded at the Overseas Development Institute, with grants from the Ford Foundation and the Aga Khan Foundation. Its task was to capture some of the diversity of activities evolving in these new forms of forestry, to interact with foresters and others working in the development of social forestry practices, and to disseminate findings about successful and unsuccessful approaches. A complementary research programme was gradually built around the Network, to investigate on behalf of networkers, problems and issues emerging as a result of their experiences, and to generate new ideas.

Over the years the forestry research programme has been working in many ways to encourage a more livelihood-oriented forestry in the tropics. This has since been reflected in the change of name in 1992, from Social Forestry Network to Rural Development Forestry Network.

The Network has provided the focus for exchange of ideas between 1800 members based predominantly in countries of the

African, Asian and Latin American continents, linking senior field staff with academics and trainers, government officials and the staff of NGOs and donor agencies. The Network has published thematically oriented mailings of papers and shorter pieces by networkers and ODI staff, focusing on topics varying from agroforestry and the organisation of forestry extension, to the management of the forest boundary, forest policy issues and the role of non-timber forest products.

Over the last decade there have been significant shifts in practice away from a sole focus on the creation of new forests and planting of trees on farms towards local management of existing natural forests. Much of this important experience was gained in the drier regions of the world where the fuelwood crisis was perceived to be most acute, and in montane areas where ecological degradation was considered to be threatening to the livelihoods of those living in the plains far distant from the uplands. As experience broadened, local people's involvement (usually in cooperation with a state forestry department) in the management of forests became more common. The principles of participation and the lessons learned from this decade of experience are now being used to inform practice in tropical moist forest areas.

Much of what has been learned in this period has come through the experimentation of field practitioners rather than through formal research. The task of the Network has been to try to capture this flow of experience and make it more broadly available through a variety of means of dissemination. In order to consolidate the significant knowledge gained in this period, it is important to promote the systematic incorporation of this experience into the forestry and environment curricula of colleges, universities and other training programmes. In this respect, curriculum change in the South must be matched by curriculum change in the North, since it is institutions in northern countries which still provide many of the training models, and at which many overseas students receive training at some point in their career.

The purpose of this Study Guide Series is to publish compilations of case studies on pertinent topics in rural development forestry. Apart from this nursery guide, other topics to be covered in forthcoming guides include: a review of communication, management and planning processes in rural development forestry, drawing on case studies from Africa and Southeast Asia; the development of participatory forest management practices in South Asia; and new approaches to survey and inventory methods in tropical forest management. The guides adopt a method of analysis and style of presentation for use in a variety of training contexts: in formal training at the undergraduate and postgraduate (masters) degree course levels; in short courses; and at workshops. The primary target for these publications are policy-makers, mid-level professionals and programme coordinators operating at the interface between policy and practice.

The Organisation of Small-Scale Tree Nurseries, the first study guide in the series, starts with the beginning of forests – seedlings and nurseries. Many of the forestry development interventions of the last decade have focused heavily on the creation of new biomass reserves through tree planting, and most extension systems have grown up around seedling distribution programmes. A significant change over recent years in this respect has been a shift towards decentralised nursery systems. Such systems are not an easy management option. The input of staff time on seedling production is not reduced, and more elaborate management skills are needed to ensure the necessary provision of technical advice and physical inputs, as well as adequate monitoring and evaluation. The benefits of decentralisation, however, include more effective seedling distribution and greater participation by local people in the production process.

This Study Guide examines six projects, located in Bolivia, Kenya, Nepal, Sudan, Tanzania and Vietnam, and how the move towards localised seedling production in small-scale tree nurseries has been or is being achieved by them. Looking beyond their different experiences, it also draws from the example of other projects to form wider conclusions about the cost effectiveness of decentralisation; the need for flexibility in planning a more diversified production system; the evolution of new or different management structures and organisations; and the nature of programme sustainability in this context.

Above all, it is hoped that all the study guides in the series will help to consolidate the major advances in forestry practice gained over the last two decades, and provide a key resource for those who are forestry practitioners in this dynamic, diverse and complex world.

EDWIN SHANKS has a first degree in Geography from the School of Oriental and African Studies, University of London and a MSc in Environmental Forestry from the University of Wales, where he is also conducting doctoral research on the subject of Forestry Extension. He was a lecturer in Agroforestry Extension and Education at the University of Wales from 1988–1990. From 1991–1993 he conducted research and advisory work for ODI's Rural Development Forestry Network and Forestry Research Programme. He also assisted in the running of the Rural Development Forestry Network. He is currently seconded to the Vietnam/Sweden Forestry Cooperation Programme in Vietnam, as forestry extension adviser, for two years.

Edwin Shanks's research interests have ranged from community forestry and agroforestry in Tanzania and Zambia, and forest management with local people in East Africa and the Sudan, to forestry land-use planning in Vietnam. His chief research focus for the last six years, however, has been forestry extension. He compiled a critical survey of currently available forestry extension materials for the ODI Rural Development Forestry Network. More recently he has undertaken a major research project on 'Forestry Extension and

Institutional Change', funded through a grant from the Forestry Research Programme component of the ODA's Renewable Natural Resources Strategy, based on case studies from three continents. It focuses on the reorientation of field staff to extension duties, reallocation of funds, new styles of target setting and policy formulation, and the successful scaling up of extension activities. The study guide series of which *The Organisation of Small-Scale Tree Nurseries* is the first volume, springs from this latter research.

JANE CARTER's first degree in Agricultural and Forest Sciences is from the University of Oxford, as is her doctorate. Her thesis draws on 16 months of fieldwork in a Nepali village investigating local people's knowledge and use of trees. It sets out various possible strategies for private tree cultivation and management in Nepal's middle hills.

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1 Introduction: Why Small-Scale Nurseries?

This study guide entitled *The Organisation of Small-Scale Tree Nurseries* has grown out of the need to reassess and consolidate some of the experience which has been gained through rural development forestry programmes over the last twenty years. In the 1970s and early 1980s certain aspects of deforestation in the tropics and subtropics preoccupied planners more than others. It was, in particular, concern over the 'rural energy crisis' and 'desertification' which led them to recognise the great extent to which smallholder farmers, in almost every rural area, depend upon forests and tree products for their livelihoods. This, combined with the bleak predictions that were being made in the 1970s regarding rates of deforestation (some of which, fortunately, have since proved to be exaggerated), prompted many government forest departments and development agencies to start new farmer-based reforestation projects. In the majority of cases these had the objective of solving a perceived imbalance between the area of available forest and the demand existing within rural communities for fuel and timber.

The result was that the interventions made in farming systems by 'social' and 'community' forestry projects were, for at least a decade, heavily biased towards the creation of new biomass reserves through tree planting. Most forestry extension systems grew up around tree nurseries and seedling distribution programmes, and extension communication was geared to encourage farmers and other land users to accept these seedlings and the land management practices their establishment involved.

Since then the scope of rural development forestry has widened. Smallholder farmers are rarely prepared to grow trees solely for fuel, and often only where this is one product of trees grown for other

purposes as well. Nursery production and tree planting by farmers are also only part of the solution to forest depletion. In many areas there is more to be gained through adoption of other strategies such as promoting the natural regeneration of trees in farm and forest ecosystems, strengthening management to secure the flow of products from existing forests onto community land and securing people's participation in the management of forests on state land (for instance in forest reserves). In situations such as these heavy investment in nursery production is not always necessary. Furthermore, these other options often make more economic sense from the viewpoint of rural people because the opportunity cost of establishing new trees may be much higher.

Faced with a need to supply seedlings to farmers, foresters initially opted for production in a few large, strategically located nurseries. There are sound technical reasons for this and also economies of scale in raising many seedlings in one place. However, as foresters strived to meet farmers' needs in the best possible way they have gone through an extended period of learning and adjustment. In many places it has been found advantageous to shift towards decentralised, small-scale nurseries whether managed by individuals or groups of farmers, by villages or by members of farmer organisations or schools.

Defining 'Small-Scale'

Nurseries range in size from those that supply millions of seedlings every planting season, to those that produce fewer than ten seedlings raised by a farmer in a clay pot or tin can in her/his backyard. In choosing to consider small-scale nurseries, we are not only defining them by size (they would rarely exceed an annual production of 20,000 seedlings, and often produce far fewer). The important criteria are their function and the approach adopted to nursery organisation and management.

We take decentralised production to imply a situation in which rural people are raising seedlings primarily for their own needs and the local market (only in exceptional cases does it mean farmers raising seedlings for a forestry agency). Poor and rich farmers, and women and men, may want different things out of nursery production, so decentralisation very often goes hand in hand with diversification, and a breaking down of the boundary between traditional forestry and horticulture. The most commonly cited reasons in favour of decentralised small-scale nurseries are:

- More efficient and easier transportation of seedlings to numerous planting sites in remote areas.
- Better provision for the range of species and numbers of seedlings required by different farmers.
- The promotion of wider distribution of the economic benefits to be had from raising seedlings.

- An important ingredient leading to the sustainability of forestry development by transferring the means of production to the end users.

This trend towards decentralisation has been one of the most significant developments in forestry in recent years. Yet it appears, because the focus of rural development forestry continues to change so rapidly (such that research priority is now put on participatory approaches to natural forest management), that insufficient attention has been given to drawing lessons from the early nursery-centred projects. The most recent comparative studies on nurseries were undertaken as part of a review of agroforestry initiatives in dryland Africa by Kerkhof (1990) and as a collection of papers published by the ODI Social Forestry Network (9a–9e, Winter 1989).¹ Since then the topic has received scant attention, and we believe it is time to take another look at experience from around the world and document it in a more directly useful fashion for trainers and students.

This study guide is written primarily for those people who are, or will be, responsible for coordinating forestry extension and development activities in the field. Small-scale nurseries rarely start up in a vacuum, they evolve from existing systems. By focusing on the questions faced by mid-level project management, we aim to show how the shift from one type of nursery system to another can be guided, and what problems are likely to occur.

Centralised or Decentralised Production?

To juxtapose 'centralised' and 'decentralised' systems is to a certain extent an artificial dichotomy, as it is rarely a case of choosing exclusively between small-scale or large-scale nurseries. The most important decisions to be made often relate to how different types and sizes of nursery fit together in the overall system of seed procurement, plant propagation and distribution. Yet, to make such decisions it is important to be clear about the merits and problems of each type of system, many of which centre on economic arguments.

The economic factors which relate to the efficiency of raising tree seedlings in a few central locations are widely understood. Personnel costs of both hired labour and supervisory staff can be kept to a minimum and it is more convenient to arrange supplies of equipment and materials to a few sites whilst, in addition, nursery protection may be easier. Seedling production can thus be guaranteed by streamlining operations to produce the planned number of seedlings at a given time. Central nurseries are also an impressive sight, which can be shown to government officials, external visitors and others in positions of authority, as evidence of funds well spent.

¹. This 1989 collection included studies from Nepal (Robinson and Thompson), Tanzania (Guggenberger *et al*), Ecuador (Desmond) and three from India (Fatimson; Jagawat; Verma).

A central nursery in Kilosa District, Tanzania

Photograph: Edwin Shanks
If properly run, and assuming transportation costs to the planting sites are kept low, centralised nurseries can provide large numbers of quality seedlings at an economical rate.



Efficiency criteria such as these are most easily applied to situations in which the entire production cycle from raising seedlings to harvesting tree products is under the managerial and practical control of a relatively autonomous agency. In this case the impact upon rural people may be measured in terms of employment opportunities afforded by various operations. However, in rural development forestry *per se*, more complex relationships exist between the functions and services provided by a land use agency and the economic activities of rural people. In this situation it is necessary to consider additional but less easily calculated distributional impacts of forestry development. These relate to the wider goals of multiple forest use, environmental conservation and poverty alleviation.

The integration of 'equity' and 'efficiency' concerns in the economic appraisal of forestry development projects is a recent area of investigation (Harou, 1987). As far as we are aware, there is no case in which they have been applied in conjunction with evaluation of the alternative scales of nursery production. In our analysis of the processes involved in decentralisation we do not intend to fill this gap in a quantitative sense, although there is need for such a study. Instead, through qualitative analysis, we propose to trace emerging relationships between actors at different points in various systems in order to understand the economic and social 'realities' which govern how the process can or should be managed.

The arguments commonly put forward in favour of small-scale nursery production are as follows:

Distribution of Benefits

There is little involvement of local people in the running of large central nurseries beyond the hire of paid labour in their immediate

vicinity. In a decentralised programme, on the other hand, cash earnings (through incentives or through the sale of seedlings) are more widely distributed. By raising seedlings directly for their own needs rural people are less dependent on external support.

Distribution of Planting Material

Central nurseries, by definition, have a wide outreach area and it is necessary to transport seedlings at what is usually the worst time of year for vehicular transport – during the rains. Even if all goes well, the cost of transportation can be high. If vehicles break down, roads become impassable, or farmers cannot reach the collection site, the whole planting programme may be jeopardised that year. Furthermore, transportation conducted without proper care can result in high mortalities. Jolting and exposure damage both roots and stems of the seedlings, and even if damage is not immediately apparent, poor survival rates may be experienced after planting. One of the major factors in favour of decentralised production is that it reduces the direct costs and risks associated with seedling distribution.

Guaranteed Production

Although guaranteed production from central agency-controlled nurseries is an ideal, in practice it may actually be less likely than under a decentralised system. This will depend to a large extent upon the funding source and its reliability. In many countries the forest service has its operations severely hampered when funds are not released on time or in sufficient quantity. Small-scale nurseries are often in a better position to respond to vagaries of funding, and to 'make do' with locally available resources for a time.

Quality of Production

Although foresters often argue that it is easier to produce quality planting material in large, well equipped nurseries, it is perfectly feasible for farmers to produce healthy seedlings from small, simple nurseries. Indeed, some projects have found that in comparison with centralised nurseries, seedlings in small-scale nurseries are tended with greater care, and problems are often more quickly spotted due to the interest and personal involvement of the farmers responsible. If not properly managed, large nurseries may also stand to lose many seedlings rapidly if there is an outbreak of a pest or a disease problem. Locating production in different places reduces the risk of high mortalities for the programme as a whole.

Capital Investment

Central nurseries require a larger amount of land and other inputs. Rich members of the community might be able to establish such nurseries, or profit from renting out land to an organisation for this purpose, but poor farmers can only hope to be employed (in limited numbers) as labourers. Small nurseries require relatively low inputs

Headloading seedlings

Photograph: Ron Gilling, Panos Pictures



and can be established on small plots of land around a homestead. They are therefore an enterprise in which economically disadvantaged people can participate.

Managing the Shift to New Types of Nursery Systems

This study guide concentrates on the organisation of small-scale nursery production, rather than on technical matters, because it is here that major differences from conventional forestry practice lie. Whereas guidance on nursery techniques is widely available in the literature, and generally well covered in the curricula of training courses at various levels, this is not so for the organisational aspects (Shanks, 1992). Furthermore, from the technical point of view there are standard procedures in tree propagation which can be applied with minor adjustments to different levels of production. Creating a management system which is conducive to sustainable small-scale production is more problematic.

We believe it to be worthwhile to review project experience from the viewpoint of nursery organisation as it brings into focus a number of issues which are of wider relevance to the process of institutional change within the forestry sector, and to development studies in general. In particular, different approaches taken to tree seedling production and distribution are amongst the clearest examples of the stresses and strains which can arise between 'supply' and 'demand' driven extension strategies. And related to this, the topic provides us with clearly definable criteria (related to the match between supply and demand) by which to assess how effectively decentralisation takes place in different institutional environments.

As already indicated, many early programmes were propelled by the observed need, on the part of planners, to solve the deforestation crisis: tree seedlings were produced to achieve this end. Yet, as the examples of longer running programmes presented here show clearly, at some point in their evolution it has been necessary to re-evaluate their objectives in response to the actual, rather than preconceived, demand existing within rural communities for new trees.

The managerial difficulties associated with supporting small-scale nursery production are not, therefore, simply those of identifying capable nursery managers, rerouting incentives and material supplies to them, and reallocating field staff from practical to advisory duties. A more important issue is the need for a responsive system of data collection and flexible planning to accurately assess and act upon farmer demand. The problem is that this appears to run counter to the strict forward planning required to ensure timely and productive nursery management from one year to the next.

Of crucial importance then, is the extent to which small-scale nursery managers are given the freedom to plan for themselves and thereby determine both the scale and rate at which the programme progresses and its direction. Decentralisation of decision-making powers is of as much importance as decentralisation of the actual

production. In this respect, the topic provides insight into the processes of group formation, and the role of linkage persons and groups at the farmer/agency interface in forestry extension. If a nursery programme is given over to the clients in this way, mid-level agency staff are confronted with the following types of management questions, on which this study guide concentrates:

- Under what conditions is it possible and appropriate to decentralise a nursery system, and are there situations where it is clearly not feasible or appropriate?
- How can a system be fostered in which local people 'draw on' external support when and if they require it – be it in the form of material supplies, training or simply advice and encouragement?
- How can agency targets be attuned to a set of locally determined aims?
- How can technical and organisational choice and flexibility be promoted according to the needs and capabilities of different nursery managers?
- And how can sustainability be ensured in the shift from subsidised production to commercial or home production?

1.1 The Case Studies

The six case studies which constitute the main body of this study guide have been selected to illustrate contrasting aspects of our general theme: for instance, they are at various points in the project cycle and they differ in terms of their scale of operations and the length of time over which they have been working. They provide examples of programmes supported by government forest departments, non-government organisations, donor assisted projects or a combination of these.

The case studies are presented in alphabetical order according to country. As far as possible, standard section headings have been used to make comparison between them easier. Each begins with an introduction to the project, the agencies involved, and a brief description of the economy and farming systems of the area. The objectives of the project are then identified, followed by a detailed outline of the seedling production strategy. The final section, on project evolution, examines the way in which these objectives and strategies have changed over time in response to new circumstances. The reasons for these changes are analysed.

An 'organisational profile' is presented at the end of each study. In this, an attempt has been made to show the way in which the extension agency fits into the wider institutional context (to this end, the particular bodies and/or personnel responsible for implementing

the programme are *italicised* and funding bodies are in square brackets). The basic format for these profiles has been adapted from a general schema provided by Uphoff (1992). It shows that the spread of organisations/ actors involved is wider and more complex in some situations than in others, although it does not reveal the specific relationships between them.

In Chapter 8 more significant trends and lessons regarding small-scale production are highlighted, and a summary is made of the relative advantages and disadvantages of centralised versus decentralised strategies.

In the margins of each chapter, discussion points are provided which are intended to stimulate thought about the case study material, or they can be used to focus group discussions. A series of more formal questions, which might be used for group discussion or as essay titles, are given in Annex A. There are four types of questions relating to the technical, organisational, managerial and distributional aspects of small-scale nursery production respectively.

2 The CIAT Agroforestry Nurseries Programme in Bolivia

Anna Lawrence and Jane Carter

This study examines a nursery programme supported by a research organisation, the Centro de Investigación Agrícola Tropical (CIAT) in the Amazon lowlands of eastern Bolivia. CIAT is based in Santa Cruz, and should not be confused with the international research institute CIAT in Colombia. CIAT's decentralised nursery project only began in 1991 and this is therefore an account of the project design, and of early progress. The idea of small-scale nurseries arose from agroforestry research initiated four years earlier. The research had begun on-station, but by 1990 some on-farm trials had also commenced. This case study describes an interesting model for the dissemination of technological innovations to farmers, working through a variety of intermediate users (IUs) including local non-government organisations (NGOs). It is also an example of a project that tried from the outset to be flexible in its approach to different groups in the community, and to encourage nursery managers to make seedling production self-supporting.



2.1 Economy and Farming Systems

Agriculture in the Department of Santa Cruz is highly diverse. Much of the area, which covers over 370,000km² of land, is still under forest, but has been increasingly settled over the last 30 years. The altitude ranges from 250 to 400m above sea level. A modern farming sector has grown up around Santa Cruz city, and cattle production is important on the less fertile areas of land not far from the urban zone. Beyond this, mechanised agriculture is also practised on the mainly flat land of the plain. Production is focused upon cash crops, including sugarcane, maize and soya, and the terrain is broken by isolated

Box 2.1

CIAT Linkage Mechanisms

Public sector extension services in eastern Bolivia have long been characterised by chronic weakness. Under a new strategy devised in 1989, CIAT established a co-ordination unit – the Technology Transfer Department (DTT) – whose role is not to work directly with farmers, but with various Intermediate Users (IUs) of technologies who have their own extensionists. It was recognised that CIAT researchers had informal contacts with NGOs, producers, government and commercial organisations and that these contacts were already serving as a conduit for the transfer of CIAT technologies. It was decided, therefore, to organise these linkages with more formality and efficiency. NGOs are one of the most important type of IUs.

The DTT has subject-matter specialists and zonal specialists whose work is supported by a communications section. The subject-matter specialists are in regular contact with their corresponding CIAT researcher and collaborate on some research work. They package research information for delivery to IUs and are mandated to transmit feedback on farmer needs to the researcher. The zonal specialists are designated a geographical area and are responsible for coordinating with IUs in diagnostic activities. They ensure that the extensionists receive the technical information they need from CIAT and the support of the appropriate subject-matter specialists.

Goals for this model of operating have been defined but the specific mechanisms and means to realise these goals are continually adapted and developed in the course of activities which link the different institutions involved.

Source: Bebbington and Thiele, 1993

groups of trees – including patches of remnant forest, windbreaks and (around homesteads) a few fruit trees. To the north and north-east lies the ‘northern colonisation zone’, where over 20,000 colonising families from highland Bolivia (a very different agroecological zone) are practising intensified swidden agriculture. They have been living in the area for up to 30 years, and in some areas are beginning to mechanise production on their farms. The forest cover in the northern colonisation zone varies according to topography and general accessibility. The climate is subhumid to humid, the main period of rains being December to May. Average rainfall varies from about 1,000mm/yr in the south and east to 2,000mm/yr in the north and in the west.

2.2 Project Objectives

CIAT is a well established research organisation, operational since 1976. Whilst in theory it is funded jointly by central government and local institutions, in practice it is mainly financed by the Santa Cruz Regional Development Corporation (CORDECRUZ) and is thus to a large extent financially independent of central government. CIAT receives support from a number of overseas agencies, including the British Government, which supports a technical cooperation project known as the British Tropical Agricultural Mission (BTAM). BTAM is involved in various research activities – one being agroforestry, with an associated nursery project.

Intermediate Users

CIAT’s overall objective is to develop and disseminate appropriate agricultural technologies within the Department of Santa Cruz. Given its relatively low-level funding, its ability to reach farmers directly is limited: it has therefore chosen to operate through a wide range of ‘intermediate users’ (IUs), as described in Box 2.1. In the case of the nursery project, these include farmer cooperatives, non-government development organisations (International and Bolivian), and a local, Methodist funded school (see Table 2.1). The strategy for technology development is largely determined by individual IUs, and it has therefore been argued that it is highly participatory, and reflects real farmer needs (Thiele *et al*, 1988; Farrington, 1990).

The specific objectives of the nursery project have been to respond to a demand for tree seedlings from farmers, perceived and expressed by the IUs. The project aims to work with IUs to help farmers establish small local nurseries to raise tree seedlings according to their needs, thus producing better quality and cheaper seedlings. In addition, nursery skills are disseminated, thus reducing future dependence on centralised production at research stations. This study examines the extent to which the CIAT technology transfer model has begun to fulfil its objectives in generating real farmer participation in the decision making process.

Table 2.1 Project Participants and Nursery Characteristics

Farmer Group	Type of Intermediate Users	Number of Nurseries	Type of Seedlings	Scale of production*
Mennonites	Original contact: Mennonite development organisation	2	Fast-growing exotics for windbreaks	6,000–22,000
Village cooperatives	Agricultural cooperatives	6	Agroforestry species, native timber species, fruit trees	6,000–15,000
Agricultural School contacts	School	1	Agroforestry species	10,000
Small-scale farmers in Yapacaní	Dairy Cooperative	6	Native timber species, forage species	100–5,500

* Minimum and maximum number of seedlings raised in nurseries of this type.

2.3 Seedling Production Strategy

Until 1991, CIAT had been producing seedlings at central nurseries located at three agricultural research stations. At the same time, a demand for seedlings had arisen amongst farmers living some distance from the nurseries. Through contact with CIAT extension staff, they had become interested in conducting on-farm agroforestry trials (see Box 2.2). Transport difficulties rendered their demand for seedlings difficult to fulfil and in general the farmers themselves had no experience of nursery production. It was therefore decided to assist the IUs to set up small, communal level nurseries and train them in the necessary technical and managerial skills. Further discussions with the farmers also revealed a strong interest in the production of other species, mainly fruit trees, not hitherto offered by CIAT.

Box 2.2

CIAT Supported Agroforestry Trials

Participatory on-farm trials of agroforestry systems started at the end of 1990. They include forage alleys, windbreaks and living fenceposts. They are based upon research which CIAT began in 1986. By the end of 1991 a total of twenty-nine trials had been established in various communities occupied by settler farmers with different Intermediate Users, including seven NGOs.

The design of the trials is simple, with one new technology being tested against the farmer's practice. For example, with forage alleys, rows of leguminous shrubs are established with pasture in one half of the plot, and the other half is sown only with pasture. The collaboration of the IUs extensionists is important because of their knowledge of the area and the community where the trial will be established. However, the quality of support received from the extensionists has varied considerably. In some places planning, organisation, sowing and other tasks were carried out by the IU. In others, the extensionist only visited the trial in the company of the subject-matter specialist. These trials are a useful instrument for getting feedback from NGO field staff and farmers. It is believed that they help people at different points in the system to understand the reasons for each others behaviour, thus providing a strong base for a subsequent transfer of activities.

Source: Vélez and Thiele (1991) in
Bebbington and Thiele (1993)

Diversity According to Socio-Economic Groups

The farmers interested in the nursery project belong to four groups, as summarised in Table 2.1. The project has been tailored to their differing needs, both in terms of the technology used and the way in which the work is organised.

Village Cooperatives in San Julián and Berlín Communities

A number of recent immigrants to the area, small farmers who migrated from the Andes within the last 10–20 years, had already organised themselves into cooperatives or syndicates. They farm by intensified swidden methods, and are beginning to mechanise using cooperatively owned machinery. They wished to establish communal nurseries producing small numbers of agroforestry species for on-farm trials, fast growing native timber species, and fruit trees (especially citrus) for sale. Six communal nurseries were established. The nurseries are managed either by the cooperative as a whole, or by a cooperative member chosen, and acting on behalf of, the group. They are supported to varying degrees by the labour of cooperative or syndicate members. The species raised include citrus varieties, *Tamarindus indica*, mango and some *Schizolobium amazonicum*, *Gliricidia sepium*, *Swietenia macrophylla* and *Erythrina poeppigiana* and *E. fusca*.

The Agricultural School at Puerto Fernandez

The agricultural school lies in a zone that was settled earlier than that described above, and where agricultural production is already quite heavily mechanised. Here the project has assisted in the establishment of a school nursery. This aims to produce seedlings of agroforestry species to be used for education and demonstration purposes (of alley cropping and windbreaks) on school land, and for subsidised sale to families of the pupils. There is a lack of extension activity in this region and innovations in agroforestry was an interest expressed by the school, not by the farmers. The species raised include *Schizolobium amazonicum*, *Swietenia macrophylla*, *Erythrina poeppigiana* and *E. fusca*, *Calliandra calothyrsus*, *Gliricidia sepium* and *Tamarindus indica*.

Small-Scale Farmers in Yapacaní

These farmers were also relatively early migrants to the area, but their farms are not mechanised, due to the uneven topography and poor soils. Contact had been made directly with individual farmers during earlier visits by regional researchers, as an extensionist was not then available. Several small-scale validation trials of agroforestry systems had already been established with interested individuals. Six farmers approached the project for assistance in setting up small private nurseries, producing seedlings required for planting on their own land. These include fast growing native timber species such as *Schizolobium amazonicum*, and leguminous species such as *Leucaena leucocephala*,

Gliricidia sepium and *Flemingia macrophylla* for forage trials. They were not interested in raising citrus plants, as these were locally available in other nurseries.

The Mennonite Colonies

Mennonites are a religious sect of European origin who have settled in colonies to the south and east of Santa Cruz. They practise highly mechanised cash crop agriculture on farms averaging 18 hectares in size. Their main demand has been for seedlings to establish windbreaks, in order to comply with recently introduced legislation to control soil erosion. There is a tendency amongst Mennonites to work in family enterprises rather than communal groups. For this reason, two farmers were assisted in setting up their own nurseries to produce large numbers of fast growing exotic and native species for their own use, and for sale to their neighbours. Initial contact with the farmers was made through the Mennonite development organisation Centro Menno, but no extension staff were available to act as the IU. The seedlings raised include *Schizolobium amazonicum*, *Tipuana tipu* and species of *Eucalyptus*, *Casuarina*, and *Grevillea*.

Project Initiation and Finance

Having received a request from an IU for assistance in setting up a nursery, preliminary discussions and site visits were held between BTAM/CIAT staff, IU staff and farmers. In this process, a few requests were rejected since interest in the project was considered inadequate or appeared to be driven by ulterior motives. For example, in several cases it appeared that the main reason behind the request had been the expectation that the project would, in the process of nursery establishment, provide a water well.

Where preliminary indications were positive, an informal agreement was drawn up between BTAM/CIAT, the IU and the farmer nominated to manage the nursery (who in all cases proved to be a man despite attempts to involve women). The agreement stated that the nursery manager (with the community which he represented, if relevant) was responsible for all the labour input for the nursery, the purchase of all inputs after the first year, and the establishment of a nursery fund to manage these financial aspects. BTAM/CIAT was responsible for financing the capital and supply costs in the first year (construction materials, equipment, and seed supply) and for all necessary technical assistance – including a training course. The IUs involved in the project agreed to advise on accounting and to act as nursery coordinators after the first year. This ensured some continuity of technical support. It was intended that with the establishment of a rotating fund by the nursery manager, the funds provided by BTAM would continue to be available for future purchases of nursery inputs.

Nursery Design

Three somewhat different nursery models were developed. The most capital intensive was used for the cooperative nurseries, and that at the agricultural school. Here the nurseries were each established on a plot 20m x 50m, sufficient for the production of some 20,000 seedlings and including an area for transplanting citrus rootstock. All water in the area was pumped from below ground, so water supplies were improved through the construction of an elevated tank. A brick tool store and germination bed were also built.



A family with their nursery in Yapacaní

Photograph: Anna Lawrence

In the Mennonite nurseries a smaller area (20m x 24m) was chosen since there was no need to raise citrus rootstock. This area was more than adequate for the production of 50,000 non-citrus seedlings. No tool store was built or water supply provided, as both already existed in the nearby nurserymen's houses, although it was necessary to build brick germination beds. In all these nurseries provision for shade was made by constructing timber frameworks. In most cases the shading material used was plastic mesh, although in two cases the leaves of a local palm *motacú* (*Scheelea princeps*) were used.

The simplest nursery design was used in the family nurseries of Yapacaní, where an area of 10m x 10m was fenced and a few potting beds marked out. Beyond this, no construction work was done, no improvements made to the water supply and shade was provided cheaply by using *motacú* leaves.

Technical Assistance from BTAM/CIAT

As noted, BTAM/CIAT ran a training course shortly after the nursery project commenced. Under the CIAT model, this should have been attended by extensionists working for the IUs, but in fact many of the

course participants were the farmers themselves. The course ran over four and a half days, and covered citrus and coffee production, as well as basic nursery management techniques such as soil mixing, potting, shade construction and sowing techniques.

The course was followed up by visits to the nursery sites by CIAT staff, which varied in number according to need and distance from the city. They were most intensive (initially weekly, but declining once sowing had been completed) in the case of the Mennonite farmers, and a number of cooperative nurseries where there was no agriculture extensionist available to advise farmers. In other cooperative nurseries and the school nursery, visits were made every two weeks at commencement. The frequency of the visits was subsequently reduced, due to the presence of an IU extension officer and an agriculture graduate at the respective locations. Relatively few visits were made to the Yapacaní area, where establishment work was simple, and technical staff felt that less advice was necessary. Here visits were confined to a total of four or five over the production period, several being at the most critical periods of seed sowing and seedling transplanting.

2.4 Project Evolution

At the end of the first year of the project, all of the nurseries had achieved production of reasonable quality seedlings in time for the December–January planting season (although a number of the fruit tree seedlings require more than one year in the nursery and were therefore not ready for planting out). No serious technical production problems had been encountered. However, the proportion of the seedlings raised which were actually distributed and planted varied between nurseries.

The nurseries with the highest distribution and planting rates were those established by the Mennonite farmers, and the small farmers of Yapacaní. In the former group, this can be attributed to the 'captive market' amongst the Mennonites, obliged as they are under recent legislation to establish windbreaks. One of the farmers put considerable effort into publicising his nursery, thus increasing demand for seedlings. In the case of the Yapacaní small farmers, planting rates were high because the farmers raised only the number and species of seedlings that they required for planting on their own land.

The rates of seedling distribution and planting were more erratic amongst the cooperative nurseries, and disappointingly low in the case of the school nursery. Amongst the cooperative nurseries, the demand for seedlings varied markedly according to species. In general, the most popular were fruit trees, which were planted both for sale and home consumption. Another popular tree was the indigenous timber species *Schizolobium amazonicum*, which has been promoted by BTAM/CIAT in on-farm validation trials and has a very fast growth rate (and a potential rotation length of 10 years). A local market for softwood

exists for species of recognised quality.

The least popular seedlings tended to be certain unfamiliar species introduced for agroforestry purposes. Their unpopularity was, however, sometimes not immediately obvious as seedlings that did not sell well, such as *Gliricidia sepium*, were in some cases distributed to cooperative nursery labourers in lieu of wages. In one colony where agroforestry trials demonstrating unknown species have only been recently established, people commented that they were waiting to see how the trees grew before planting any on their own land. It seems that it was over-optimistic to have produced seedlings on such a scale in this area before the results of the trials became obvious. The choice of species raised was probably a reflection of staff enthusiasm rather than a specific farmer demand. In the other colony, however, farmers were more assertive about their specific requirements, and this problem did not arise.

Despite the local situation of the nurseries, heavy rain and transport difficulties hindered distribution. Most of the roads in the areas concerned are narrow, muddy tracks, often impassable to motor vehicles in the rainy season. Some cooperatives responded to this difficulty by hiring carts and charging a small fee to the seedling purchasers for delivery. Others still had seedlings on site at the end of the planting season.

Lessons in Project Initiation

Initial experience with the nursery project led to a direct re-evaluation of the extent to which the CIAT extension model allows for real farmer participation.

Farmer Driven or Researcher Driven?

Clearly a project such as this can only be successful where the initiative comes from the farmers themselves. However, tree growing is not a traditional practice amongst the colonisers. The stimulus in most cases arose from a dialogue between researchers, extensionists and farmers. The idea of agroforestry systems itself was initially external, but most of the farmers involved in the nurseries had some experience of participating in agroforestry trials. The idea that seedlings could be produced by farmers themselves originated in various ways. In some cases, it came directly from the farmers (in Yapacaní, and in the Mennonite colonies where farmers were responding to legislation), in others it was a response to the offer of assistance from BTAM/CIAT (the village cooperatives). In the case of the school, staff were keen to include seedling production on the syllabus, but the local farming community had no experience of agroforestry systems and was not involved in the planning of the nursery. The most successful nurseries were in fact those initiated by farmers.

Species Choice

In most cases the species were defined by the community and the seedlings produced were popular and suited to local needs. There was, however, a definite drive to identify likely IUs and advertise the existence of the nursery project. In two cases (the school nursery, and one cooperative nursery) needs were identified more by outsiders (extensionists and researchers) than by farmers. In the school nursery little or no consultation with farmers took place, although more seedlings were produced than could be used in the school trials. The cooperative nursery was treated as the pilot project, and received excessive staff time and enthusiasm, so that farmers were encouraged to sow more agroforestry seed than they had originally requested. As a result, production in both nurseries poorly matched local demand. A smaller scale approach, concentrating on the traditional demand for fruit trees, would have been more appropriate.

The Relationship between Agroforestry Trials and Nursery Initiation

Both the cases described above had the least experience with agroforestry innovations, trials having only been started within the last year. No on-farm trials in the project area are more than two years old.

The research and extension process used by BTAM/CIAT is likely to continue to be one of research station trials, with on-farm validation trials, followed by on-farm demonstrations (Thiele and Muzilli, 1992). Given this process, it is felt appropriate to encourage and support small farm nurseries at the validation trials stage, although only for the production of seedlings as required for the trial. Later, if interest and demand grow in response to results of the validation trial, nursery production can be expanded. Where this approach was used in the nursery project, several of the small farmers in Yapacaní gave away seedlings to their neighbours so that they could try them out – a slow but reliable way of spreading interest in the new idea.

Improvements in Nursery Design

The investment in nursery infrastructure varied widely. The nurseries with the highest capital input were actually the least successful in terms of seedlings planted. A low cost approach was generally most appropriate, as adopted by the small farmers of Yapacaní and the Mennonites (who themselves contributed significantly to the slightly more capital intensive establishment costs).

In the higher cost nurseries, the brick stores constructed for housing tools and equipment were not always used for the purpose intended. As the stores are superior to the homes of many local people, they have become offices for the cooperatives, and even in one case the temporary home of the schoolteacher. Expensive improvements to nursery water supplies have also not always proved justifiable. Nevertheless, where surface water is not available (as is

Project staff now recognise that nursery development must be carefully related to the stage of agroforestry development. It is unwise to encourage seedling production of unfamiliar agroforestry species on a large scale until their performance has been observed over a longer period.

A number of different nursery models were used in the first year. But it was felt that there is a need for greater flexibility in nursery size and layout, leaving such decisions in the hands of farmers themselves.

common in the Santa Cruz Department), some water supply improvements for nurseries are usually necessary.

Changes in Nursery Management

Nursery management was straightforward in the case of the family nurseries (those of the Mennonites and at Yapacaní), where decisions were made by the head of family (in consultation with other members), and work was delegated by him. Similarly, work was delegated to an interested teacher in the school nursery.

In the communal nurseries the choice of management system was left to each community. In some cases, interest in the nursery was widespread amongst members, in others, interest was confined to one or two farmers more willing to risk something new. The resources of the community and hence its ability to reward work also varied. In only a few cases was labour paid for as it was carried out. Some promised a proportion of the price of each seedling sold, or a flat rate from sales, others offered cheap or free seedlings to community members who had worked in the nursery. In one case funds were found to pay the manager who was carrying out most of the work. This last system, developed after the work had begun, caused some conflict within the community. Although such decisions can only be taken by community members themselves, it is obviously important that they should be clearly defined before work is started.

A method for calculating the cost of seedling production was explained to each nursery manager but it was not used by any of them in setting prices. All prices charged were equal or higher than those of CIAT (which had been effectively subsidising seedlings because the cost of transport was not included). Neighbouring farmers seemed prepared to pay these prices and benefitted by having better quality seedlings not damaged in transport. The seedling producers also had strong incentives to produce more seedlings at good returns. In practice, however, seedlings were planted at a time when cash is scarce in rural communities (before the rice harvest) and managers had to allow credit. Past experience suggests that not all the credit will be recovered, although extension workers were involved in working out repayment schemes. It is possible that in the second year of the project, when nursery managers have to pay for the inputs themselves, prices will be based on a direct calculation of production costs.

Both the Mennonite managers covered their costs and did not need to allow credit; one even made a substantial profit. The Yapacaní farmers did not sell their plants and were not expected to set up a rotating fund. In the other nurseries it was hoped that a rotating fund would be established but with low sales (in the school nursery) or high levels of credit (in the cooperative nurseries), this had not happened by the end of the planting season. This will affect the sustainability of the project if the nurseries prove unable to support themselves financially (although the school may choose to allocate education funds for nursery inputs).

It was intended that all nurseries should be 'self-supporting' after the first year. This was taken to mean self-financing, but in most cases seedlings were taken on credit. This money was therefore not available for financing the second year operations. It is likely that some nurseries will develop a market to become financially sustainable over time. For others, which cater primarily for the seedling requirements of the management group, a different interpretation of 'self-supporting' needs to be made.

Technical Changes

The first year has already indicated that much may be learned from and between farmers as they develop their nurseries. A number of new techniques appear to have potential for wider use in future. These include successful experiments with bare-rooted *Schizolobium amazonicum*, the planting out of seedlings at a much younger stage than recommended by technical staff and direct sowing into polybags of certain species (eg *Tipuana tipu*) which responded poorly to pricking out. In some cases, farmers participated with technical staff in developing appropriate technologies. An example is a portable 'wheelbarrow' water tank with a capacity of 200 litres, which was developed with one of the Mennonite farmers. These will be distributed to all nurseries in future, to reduce the investment required in elevated tanks.

A number of farmers also expressed interest in trying out other fruit species, coconut, cashew, cacao and coffee being mentioned most frequently. This is a request that project staff may have difficulty in fulfilling, as in general they do not have adequate training in the propagation of fruit tree species. Furthermore, there was an institutional constraint in that CIAT is not prepared to make recommendations to farmers about species that it has not researched thoroughly. In some cases, the expertise was available within CIAT and in future the project will aim to collaborate with other researchers to respond better to farmers' requests.

Towards the end of the first year of seedling production, a manual on nursery establishment and management was prepared for extensionists. It was written specifically for the conditions and species used in the project zone, and should increase the self-reliance of the IUs in helping farmers to set up nurseries. A training course was held as the second year began, in which 24 extensionists participated. It was felt to be highly successful. Taking only three days, the course concentrated on the planning of nursery activities and the basic technical skills required. Within the better defined target group, training was more effective than in the first course.

Changes in Project Structure

During the first year of the project, links with IUs were not well established and it was therefore difficult to operate according to the CIAT technology transfer model. Rather than working through IUs, BTAM/CIAT staff were learning for themselves the challenges of small, local nurseries. This inevitably restricted the scope of the project, as researchers spent a substantial amount of time in each nursery. It also probably contributed to the poor identification of needs in a few cases. Extensionists in the IUs should be better placed to perceive farmer needs through regular contact. An important development therefore, is the stricter emphasis placed on the identification of suitable IUs and the devolution of decision making to them. For

In seeking out IUs, the aim is not to impose 'researcher-led' initiatives on farmers through IUs, but to advertise the existence of the project in order to respond to more farmers when they take a decision to start a nursery.

effective dissemination of skills, it is considered essential that the IU has a technically qualified extensionist available to work with farmers in the project.

As the year came to an end, suitable IUs were approached in the zone. Santa Cruz has a particularly wide range of NGOs working with farmers in the field, and contacts have now been made across a wide network. It is now the responsibility of the IU to contact farmers, respond to their needs and manage the funds for nursery establishment. BTAM continues to pay for all costs in the first year of each nursery, whilst BTAM/CIAT staff provide technical training and advice to the extensionists, backed up with occasional field visits. In this way the project is able to respond more flexibly and more sustainably to the increasing interest of farmers in growing trees, which is perhaps the strongest indication of success yet.

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3 The Kenya Woodfuel/ Agroforestry Development Programme

Jane Carter with Phil Bradley

This case study considers a nursery programme which began operating in 1984, under the Kenya Woodfuel Development Programme (KWDP). In 1989, this developed into the Kenya Woodfuel Agroforestry Programme (KWAP), the experiences of which are also documented in this case study. In 1991, the KWAP entered its second phase (up to 1995), the activities of which are not discussed here.

The KWDP was set up at a time when the 'woodfuel crisis' was prominent in the minds of planners, an issue clearly reflected in its objectives and operations. The nursery programme adopted is notable for the way in which a deliberate attempt was made to build upon local knowledge and avoid conflict with existing cultural norms. Aspects highlighted in this respect include the way in which the participation of women was actively encouraged through the choice of tree species, attempts to establish a local, sustainable source of tree seed, and the attention paid to building on existing knowledge and practices when introducing an on-farm nursery programme. This project has been well documented, the current study drawing particularly on Bradley and Huby (1993), Bradley (1991), Huby (1990) and Mung'ala *et al* (1988).



3.1 Economy and Farming Systems

Initial plans were for the KWDP to operate in three districts: Kakamega, Kisii, and Murang'a. All of these districts are classified by the Kenya Government as having high agricultural potential. Broadly, this classification corresponds to land of 1,400–2,000m altitude, with a

tropical climate (modified slightly by altitude) which is highly favourable for plant growth (rainfall 1,200–2,000mm per annum, falling in two distinct rainy seasons, mean annual temperatures 18–20°C). Such land is densely settled, the districts of Kakamega, Kisii and Murang'a are supporting a population of 294, 395 and 261 persons per square kilometre respectively. As a result of this heavy population pressure, these districts were identified as the areas in Kenya most likely to be suffering critical fuelwood shortages.

Agriculturally, the districts are also highly diverse. In the west of Kakamega district, for example, sugar cane is the dominant crop and farms are large (10–15ha), whilst in the south and east tea is an important cash crop, and it is common for farms to be as small as 0.5ha. The north is different again, with farms specialising in commercial maize and sunflowers. Trees are a common feature of the agricultural landscape. In general, pressure on the land is high, and farm sizes are decreasing, mainly as a result of the rapidly increasing population, but also (particularly in Murang'a) because richer people have tended to accumulate land, with a commensurate squeeze upon the poor. Markets and alternative employment prospects vary between and within the districts. Each are inhabited by people of different ethnic groups, the Luyia having their homeland in Kakamega, the Gusii in Kisii and the Kikuyu in Murang'a. These groups have different customs, including varied inheritance laws and differing attitudes towards the role of women.

3.2 Project Objectives

The project grew out of research in the late 1970s and early 1980s on Kenya's future energy provision. The research was conducted by the Beijer Institute of Sweden (recently merged into the Stockholm Environment Institute), at the request of the Kenya Government. Having identified fuelwood as the most important energy source in rural areas, as well as the source of charcoal for urban dwellers, a policy recommendation was endorsed to expand wood production on farms through an agroforestry support programme. The KWDP was formulated as a direct result, with funding being supplied by the governments of Kenya and the Netherlands (funding from both these sources being continued for the KWAP). The densely populated District of Kakamega in Kenya's Western Province was chosen as the area in which project activities should commence in 1984, with an expansion to the District of Kisii in 1985. (Operations in Murang'a were eventually limited to information gathering.) The implementing agency was the Beijer Institute.

The varied physical, economic and social characteristics within the project area, as briefly outlined above, have a profound effect on the potential for a fuelwood oriented tree planting programme. An initial component of the project was to investigate such differences, and, based on the findings, determine appropriate strategies. Thus, in the

early stage of project identification, three surveys were carried out: a District Resource Analysis, an Agroforestry Survey, and a Socio-Cultural Survey.

As initial observations had suggested and the surveys confirmed in every district, most fuelwood collection is carried out by women. Fuelwood collection and use traditionally lie within women's economic domain and men generally display little interest in fuelwood issues. This differentiation is reinforced in some communities by a string of cultural taboos on women planting or owning trees. However, there are socio-economic factors affecting land use, both on-farm and off-farm, and labour migration, largely male, which have implications for fuelwood supply. In particular the expansion of agricultural land has meant the clearing of bushes and trees from common land. On-farm supply, already restricted on small farms, is declining since many of the naturally occurring indigenous trees which women once used for fuel are being replaced by exotic trees planted by men for sale.

Furthermore, through labour migration and control of cash crop production, men are increasingly involved in the external economy. As part of this trend, they have taken to growing trees for cash sale, particularly exotic species introduced during the colonial period such as *Eucalyptus* spp, *Cupressus lusitanica*, and *Grevillea robusta* which are used for timber and/or poles. Another reflection of men's greater involvement in off-farm matters is their more effective use and knowledge of modern law, particularly with regard to land disputes. Investigations also revealed that in some communities trees are of traditional significance in this matter, tree planting being used by men as a means of claiming land ownership. Thus current trends, enhanced in some cases by traditional norms, have effectively debarred women from planting or managing trees. However, as in other issues, findings varied. Male control over tree planting tends to be stronger in Kakamega than Murang'a, for example.

Based on these findings the KWDP adopted a variety of initiatives. A small number of individual farmers were selected and using a 'no-message' extension approach, were provided with seed. Project staff observed over a number of years how farmers experimented with the seedlings. A package of recommendations, which were to be used for more extensive extension, was developed. Later, the initial contact farmers formed groups with neighbouring farmers who were also supplied with seedlings and advice. The extension approach adopted by KWDP, called the 'mirror technique', encouraged families and the community to reflect on the local fuelwood situation and the implications for future supply, and the changes in land use in their own area. This was done initially through the performance of a topical play, advertised by posters and supported by a comic strip, which was handed out afterwards. The play later became a film, which was easier to show to large audiences on a regular basis. A key message which the project sought to impart is that problems of fuelwood shortages not only affect women, but the household as a whole, and require

concerted action by all family members. In subsequent discussions, project staff raised the possibility of planting appropriate trees for fuel.

3.3 Seedling Production Strategy

Several large nurseries were already in existence in Kakamega when KWDP commenced operations, as a result of government policy to encourage on-farm tree planting. Seedling distribution was hampered by transport problems, restricting the effective utilisation of large nurseries to farms in their immediate vicinity. Farmers in remote areas had difficulty in merely reaching the nurseries, quite apart from returning to their farms with a heavy and bulky load of seedlings, along roads or tracks mired down by the rains.

It was therefore initially planned to establish 600 small-scale nurseries throughout Kakamega district, to provide a local source of seedlings. However, the findings of the project's agroforestry survey, as well as practical experience, radically altered the strategy adopted. From a practical viewpoint, although small-scale nurseries would collectively serve a larger number of farms than the centralised nurseries, there would still be many farmers living too far away to make use of them. More importantly, the project found through its early research that many farmers were already raising tree seedlings (mainly the species popular for poles and timber) on-farm in simple nurseries. It was decided that a programme of seed rather than seedling distribution would be both cheaper and easier, both from the point of view of KWDP staff and the farmers concerned. Farmers would then be given technical support in raising the seedlings that they required on site. One of the first issues to be addressed was the species on which the project would focus.

Box 3.1

Desirable Characteristics of Fuelwood Species that would be Acceptable to Women

- Branching, multi-stemmed habit that would not produce poles suitable for sale.
- Wood with a high calorific value that burns with little smoke.
- Rapid growth, permitting fuelwood collection within two or three years after planting.
- Potential for cultivation between crops or in hedges, without adverse effects upon the soil.
- Readily propagated, either by direct sowing or in nursery beds. Prolific seed production for future years.
- Multipurpose – for example, in addition to good fuelwood characteristics, having soil-improving properties, leaves suitable for animal fodder, or ornamental characteristics.

Species Selection Strategy

It has been noted above that a variety of cultural and economic values have tended to restrict tree growing in the project area to men. The KWDP was anxious to avoid these restrictions and encourage the active participation of women. It thus focused on tree species that would be perceived by men as 'non-valuable', or not even trees at all. The characteristics which were thought desirable of such trees are listed in Box 3.1.

Although the deliberate focus on trees that would correspond to women's rather than men's needs was unique to the KWDP at the time, many of the requirements for the 'ideal' on-farm species had not been identified by KWDP personnel alone. During the 1980s, there was a surge of international interest in multipurpose tree species, which focused particularly on small nitrogen-fixing trees. One such species was indigenous to the area and already being intercropped in fields and used by women as fuelwood in parts of Kenya's Western Province, this was *Sesbania sesban*. Other species introduced by the KWDP were exotics previously unknown in the area, which had been identified by international researchers as having high potential. They included *Calliandra calothyrsus*, *Leucaena leucocephala*, *Gliricidia sepium* and *Mimosa scabrella*. The species were tested by the project in a small experimental nursery at its Kakamega field office, before being distributed to a small number of farmers in pilot trials, as described below. More intensive trials were also conducted at project field stations in Kakamega (one) and Kisii (two, in different agroecological zones). In these trials, a variety of species were tested in block and line formations to resemble woodlots and hedges. Different management regimes were then superimposed upon them.

As the KWDP developed, it adopted a logo, **moto mwaka**. This means 'fire all the year round' in Kiswahili. The new fuelwood species became known as **moto mwaka** trees. It was felt strongly by many project staff that the fact that these species were new and different was an important factor motivating farmers to try them.

The strategy of initially introducing seed and seedlings of exotic species to farmers without technical guidelines on how to use them has been a subject of considerable debate within the project. It gave farmers the freedom to choose how to manage the trees and enabled project staff to learn from this experience. At the same time, because the species offered were of a limited range, the approach by-passed equally important questions relating to species selection and demand.

Initial Introduction

The KWDP deliberately commenced activities in each area in which it operated with a small-scale approach, working with only 28 farmers (selected on the basis of location, farm size and gender of the farm manager). Each farmer was provided with a total of 15 to 20 seedlings of three **moto mwaka** species, and 50 seeds of one species. The farmers were told only that the trees were fast-growing fuelwood species. Then they were left to cultivate the material they had received by themselves. It was assumed that since farmers in the area had been raising trees for many years, they did not need to be taught what to do. Rather, the project was interested to learn how and where the farmers planted the seedlings, sowed the seed, and then managed what came up.

Information gained from this early phase, both from on-farm observations and discussions with farmers, was used in subsequent project development. For example, some farmers made their own small nurseries to sow the seed, whilst others tried direct sowing. Farmer perceptions of the trees varied, but demand for the seed of most species indicated considerable interest amongst neighbours. The only species that performed badly was *Gliricidia sepium* and was therefore eliminated from subsequent trials. The needs identified during this pilot phase were for a more substantial demonstration of the potential of the new species, a larger and assured supply of seed and seedlings, and to establish contact with many more farmers.

Seed Supply Strategy

A potential difficulty in supporting numerous on-farm nurseries was ensuring adequate local supplies of seed. Large nurseries usually obtain their seed supplies from either the Kenya Forest Research Institute (KEFRI) or Agroforestry/Energy Centres run by the Ministry of Energy. Such seed is generally unavailable to individual farmers and the supply is somewhat unreliable. Another aspect is species choice. Although the Agroforestry Centres have tried to make available a variety of seed, often the most readily obtainable are the commercially valuable timber species. As noted above, these were not the species on which the project intended to focus. Since the **moto mwaka** species were new exotic trees, their seed needed to be imported at first, but there was a clear need to ensure a local supply. Rather than assisting the establishment of centralised tree seed orchards, the KWDP felt it appropriate to put seed production into the hands of farmers.

As a result of this policy, the concept of Seed Production Units (SPUs) was introduced. Primarily intended as a sustainable supply of seed, they also served to demonstrate the potential of the various new species under local conditions, and provided sites for project research on tree growth and related ecological changes. As originally conceived, each SPU measured 10 x 10m, and contained four blocks of trees, each block being wholly planted with one of the **moto mwaka** species. Some SPUs were surrounded by a live fence of trees which can be vegetatively propagated using large cuttings.

It was intended that SPUs should be located in public places, in keeping with these roles. The first was established on ground alongside the KWDP office and nursery in Kakamega. Subsequent SPUs were planted on small plots of land belonging to local farmers, schools, churches, or government bodies. No target was set for the number of SPUs to be planted. The intention was to anticipate a need for an SPU, plant it, and then be ready to commence other project activities in the locality nine months later, once the trees had been established. In practice, some 160 SPUs were established throughout the project area between 1984 and 1986.

Demand for seed was high, and despite establishing SPUs, the supply of seed from centralised sources continued to be necessary. In recognition of this, the KWDP established five seed orchards in 1986 to produce seed of *Mimosa scabrella*, *Leucaena leucocephala*, *Calliandra calothyrsus*, and *Sesbania bispinosa*.

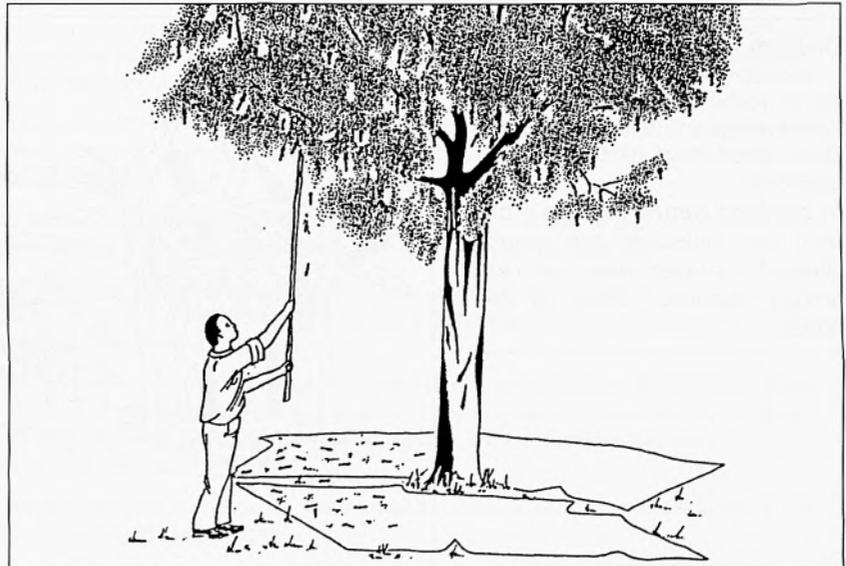
All **moto mwaka** tree seed was initially supplied free-of-charge. Some suspicion about project motives was generated when seed recipients were asked to give their name, age and address to extension workers, so that they could follow-up the performance of the seedlings raised, exchange opinions, and offer advice if appropriate. A number of people wondered whether, if they sowed free tree seed, they would be made liable for payment later on. Staff had to stress that the **moto mwaka** seed, and the seedlings and trees it produced, were entirely owned by the people to whom the seed was given, and that all management decisions would be theirs too (although advice was available on request). It was also made clear that seed supply would not be continuous but represented the beginning of the programme and would be phased out once sufficient locally produced seed became available.

The KWDP has also encouraged people to gather the seed of locally valued indigenous species. For example, in Murang'a, school children were involved in the collection of seed difficult to obtain, such as that of *Grevillea robusta*. Extension workers were given training in how to collect, process and store seed, and teaching materials were also produced on this subject.

Seed Collection

Illustration: Motif Creative Arts Ltd, Nairobi from the booklet *On-Farm Tree Nurseries* by Patrick M Mung'ala, Jan B H Kuyper and Simon Kimwe, KWDP Series on Rural Woodfuel Development

Some fruits or pods can be easily dislodged from the tree by beating the branches with a pole.



Farmers' Nurseries: A Strategy of Starting from Local Knowledge

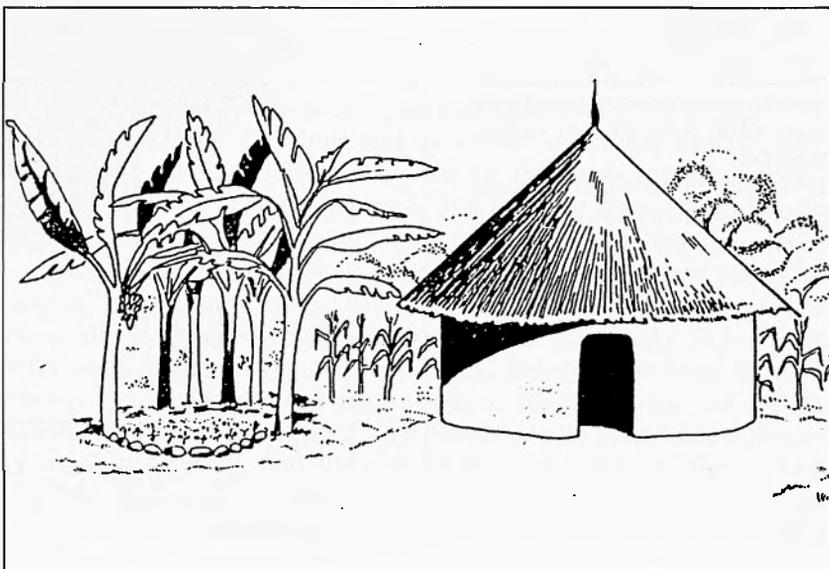
The small central KWDP nursery in Kakamega provided some seedlings for initial distribution to interested farmers. However, it was only intended as a means of stimulating interest in raising more. The agroforestry survey found that a significant number of (male) farmers were already not only planting trees on their farmland, but also raising their own seedlings in on-farm nurseries. These indigenous nurseries, as they will be termed, are of simple construction, requiring minimal maintenance or material input. At their most basic, they may comprise a few seedlings raised in makeshift containers such as old tin cans, broken pots, or washbasins. A more common form of indigenous nursery is a lightly shaded, slightly raised seedbed (sometimes up to several square metres in size), perhaps protected against erosion by stones or branches. An individual nursery of this type may produce anything from ten to several thousand seedlings in a year.

A number of specific farm sites are preferred for indigenous nurseries. Reasonably fertile plots of land are usually selected, since additional soil or manure is rarely added. Site preparation may merely comprise weeding, and a loosening and raising of the soil to form a bed. Plots beneath trees such as bananas are often chosen as they provide natural shade. Patches of ground formerly used for charcoal production are also favoured, as seed tends to germinate more readily amongst the ashy soil, free of competition from weeds (the burning process having sterilised the soil). The sites of old huts are another common location, since the soil tends to have been enriched with matter such as dung and ash from cooking fires.

On-Farm Tree Nurseries

Illustration: Motif Creative Arts Ltd, Nairobi from the booklet *On-Farm Tree Nurseries* by Patrick M Mung'ala, Jan B H Kuyper and Simon Kimwe, KWDP Series on Rural Woodfuel Development

In highland Kenya traditional on-farm tree nurseries are usually situated in shaded areas, perhaps among bananas, close to the house.



Farmers generally obtain the seed that they require from farm or nearby trees. Branches bearing the ripening pods or seed capsules are cut from the tree and placed on the seedbed, so that, as the pods open, their seed falls directly onto the soil. Once germination has occurred, the branches are removed. Since the seed tends to be shed in clusters, the growing seedlings are also densely clustered, and soon in severe competition with each other. However, thinning-out is not a common practice, and mortality must therefore be high. Wastage is probably also considerable at the planting-out stage, when the seedlings are removed from the seedbed simply by pulling them up by the stems. Root pruning is not practised, and root damage must be commonplace. Most seedlings are planted on-farm, but they may also be bundled together, their roots wrapped in banana leaves or similar material to prevent desiccation, and sold locally.

Farmers commonly establish their indigenous nurseries at the onset of the rainy season, to avoid the necessity of watering by hand. Whilst this may be convenient, it has the disadvantage that the seedlings are only of a sufficient size to plant out towards the end of the rains (10–12cm being the minimum height generally used). They are therefore just beginning to establish when the dry season commences. As a result, their mortality in the field is again high.

The KWDP estimated that farmers in the project area had been raising millions of seedlings each year in indigenous nurseries.

Box 3.2

Features that Differentiate the Improved 'moto mwaka' Nurseries from the Indigenous Nurseries

- **Timing** Rather than being established at the beginning of the rains, **moto mwaka** on-farm nurseries are established in time to produce seedlings ready for planting-out at this point. This clearly increases the likely survival of the seedlings in the field, but is not always easy for farmers to adopt, due to the higher labour demands for watering in the preceding dry season. The exact time of nursery establishment of course depends upon the species being raised.
- **Quality Seed and Sowing Procedures** The KWDP's attention to seed supply has already been noted. The project has also worked to disseminate information about the correct seed treatment prior to sowing for different species, and the need to sow seed evenly, to prevent overcrowding.
- **Improved Soil Mixture** Whereas indigenous nurseries usually utilise ordinary soil, the use of topsoil enriched with manure is recommended for **moto mwaka** on-farm nurseries. This produces better, healthier seedlings.
- **Raised Seedbeds** Although the seedbeds of indigenous nurseries are often slightly raised, a raised seedbed supported by stones, pieces of timber, or similar material can effect a big improvement in root development. It also improves drainage and is less susceptible to erosion during heavy rains.
- **Protection and Maintenance** The protection afforded to indigenous nurseries is often minimal. By contrast, **moto mwaka** nurseries are regularly watered (during the dry season) and weeded. They may also be protected from sun and heavy rain by a simple shade supported on poles. Deliberate provision against animal damage may also be made, although the necessity of this depends upon the nursery location.
- **Root Pruning** Root pruning on a regular basis is encouraged in **moto mwaka** nurseries, as this promotes a sturdy root system and ensures less stress to the seedling at planting-out.

None of the simple technical refinements made to the indigenous nurseries represent innovations in themselves. The important point is that they were introduced as a development of existing methods, the practicality of which was ensured and tested by farmers themselves through on-farm trials.

However, as the description of the methods used makes clear, the efficiency of such seedling production is low. The KWDP therefore decided to work with farmers on improving their indigenous nursery practices, by incorporating a number of technical improvements into the original system. The features which distinguish these improved techniques are identified in Box 3.2. A booklet was then produced, describing in pictures the method of construction and care of young seedlings in **moto mwaka** nurseries. Copies of this booklet were distributed free-of-charge.

3.4 Project Evolution

After some uncertainty about the continuation of the KWDP in 1988, a renewed commitment to funding was gained, and the project developed into the Kenya Agroforestry Development Project (KWAP). The information gained through the research and monitoring activities of the KWDP was seen as a base on which to build, and the new project took over with the intention of moving extension activities closer towards the mainline ministries. To this effect, emphasis was laid on training, using the Training of Trainers approach.

Developments in Species Selection

In terms of promoting the cultivation of a number of the **moto mwaka** species, the project has met with considerable success. *Calliandra calothyrsus*, in particular, is now widely planted and thriving throughout the project area. *Mimosa scabrella* has also often performed well. Inevitably, all species tend to perform better in certain site conditions than others, and this has been particularly true of *Leucaena leucocephala*.

Local people's views about **moto mwaka** trees clearly vary. In Kisii, farmers collaborating with the project who were asked to rank the species against all trees known to them gave *Calliandra calothyrsus*, *Grevillea robusta* and *Mimosa scabrella* as the most popular. These species were followed by the already widely planted (exotics) *Eucalyptus saligna*, *Acacia mearnsii* and *Cupressus lusitanica*. However, **moto mwaka** species have not always been accepted by farmers, particularly men, whose interest has been primarily in cash value. The project argues that the new trees provide indirect savings, rather than direct cash (since money that might otherwise be spent on fuelwood would be saved). However, it seems that in some cases another factor influencing the uptake of **moto mwaka** trees has been the project decision to buy back **moto mwaka** seed, thus effectively giving the trees a cash value (see below). One extension worker, for example, recalled how a farmer's attitude to the **moto mwaka** trees changed radically on hearing this news. He is recorded as saying:

... so these trees are useful after all. We can get some money from the trees. I am going to plant more trees so

that I can get money from the seed. They are not 'nothings' after all.

The extent to which local people have used and benefited from the **moto mwaka** is, as yet, difficult to assess. In many areas the planted trees are only now reaching a size and age at which this can be evaluated. There was much early debate amongst KWDP staff as to whether the **moto mwaka** trees should be presented primarily as fuelwood species, or whether their multiple uses should be stressed. The latter view has now gained general acceptance, and farmers are encouraged to use the trees as they like. Within the operational period of the KWAP-I, there appears to have been a major shift in emphasis away from woodfuel only to the planting of trees for a wide variety of purposes. This is reflected in the change of name from a woodfuel development programme, to a woodfuel and agroforestry programme.

Developments in Seedling Supply

In general, SPUs have not fulfilled their intended function, for technical and social reasons. At the technical level, it was found that the plots had been too closely planted for optimal seed production. Seed was produced around the edges, but production was poor inside the plots, where the trees suffered from overcrowding. More importantly, the seed that was produced was often not collected, at least from plots established on school, church, or local government land. People hesitated to take seed as they did not view the SPU as belonging to them, but rather a fenced woodlot belonging 'to the project'. SPUs that had been established on private land (a practice that was discontinued early on) tended to be confiscated by the landowner, who barred seed collection by others. The end result is that whilst SPUs have provided a local demonstration of the **moto mwaka** species, they have not served as effective, sustainable seed banks. This is reflected by their renaming as Species Performance Units.

At the same time, the **moto mwaka** trees have taken on a commercial value. This was not originally intended by the KWDP, but has encouraged their distribution. The project has adopted a policy of buying locally produced seed from farmers, which has not only stimulated production directly, but has also encouraged people to grow **moto mwaka** seedlings for sale to other people. In addition, there is considerable distribution of seed amongst farmers, independent of the project.

Increasingly the projects supplies of seed are being met from within the country, both from farmers and from the seed orchards. Seed is currently sold in seed packages, complete with growing instructions. Carefully and attractively prepared, the packages have been in considerable demand at the end of campaign days convened by the project. Farmer preference appears to be for commercially packaged seed.

Whilst tree seed was initially distributed free-of-charge, it is now project policy to charge a small amount for it. Extension staff consider that a flexible system of judicious seed sale, combined with informal distribution, is the most effective method of seed dissemination. Farmers are also happier that, having bought the tree seed, any seedlings they grow will belong to them. This has helped overcome earlier fears about ownership of tree resources.

The Evolution of Farmer Nurseries

All the innovations to indigenous farmer nurseries suggested by the KWDP involved an additional input of labour. Nevertheless, many farmers have taken up at least some of the suggestions. In particular, many more nurseries are now established during the dry season, using raised seedbeds, but it has proved more difficult to persuade farmers to conduct root pruning.

Project monitoring activities suggest that the majority of farmers who established nurseries have been men. In Kakamega, figures collected after the showing of the project drama indicated that two-thirds of the nursery establishers were men. However, of the women participating in the programme, most (over 80%) established their first nursery after seeing the project drama, indicating that this had a direct influence upon them.

KWAP-I is now seen by KWAP-II staff as a transfer phase from a research and development programme based solely around woodfuel, to an extension programme based on a farming systems approach, in which woodfuel occupies one (often small) part. It is accepted that local people plant trees for a variety of purposes, and that woodfuel is generally still not a priority. The regional cover of the programme under KWAP-II has expanded to include four new districts, with backstopping activities remaining in the original project areas of Kakamega and Kisii districts. Research tools currently used include rapid rural appraisals and topical surveys, conducted in close collaboration with national research institutes. One result of the more holistic approach is that more emphasis is being given to indigenous or naturalised agroforestry species with which farmers are familiar. Seed availability is considered to remain a bottleneck in activities, and there have been calls for this aspect of the project to be redesigned.

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ORGANISATIONAL PROFILE KWDP/KWAP (Kenya)				
LEVELS	SECTORS			
	Government Departments and Extension Services	NGOs and Private Organisations	Membership Organisations and Voluntary Roles	Traditional Authorities
International	[Government of the Netherlands]	<i>Beijer Institute (now Stockholm Environment Institute- Sweden) (until 1988)</i> <i>ETC - Holland</i> <i>ETC - Kenya (since 1989)</i>		
National	[Government of Kenya] Min. of Energy KEFRI			
Province/Region				
District/ Local Government	District Development Committees - Kakamega - Kisii - Murang'a - Migori - TransNzoia - Kitale			
Village/ Community		Private tree seed vendors	Women's groups Other local groups	Village elders
Individual			Farmers in respective districts	

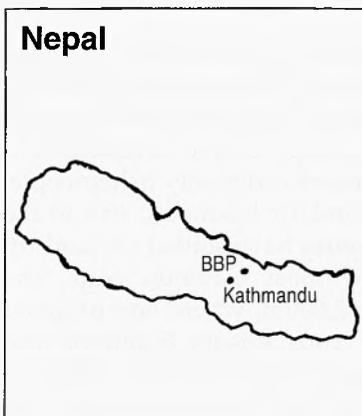
4 The Nepal Agroforestry Foundation Home Nurseries Programme

Tom Arens, Jane Carter and Jagdish Ghimire

Nepal is well known for developments in community forestry, implemented in the middle hills by His Majesty's Government of Nepal with the active support of bilateral and multilateral projects. The activities of NGOs in Nepalese forestry have been less well documented. This case study examines the work of an association set up to foster research and extension in the planting of trees on private land, the Nepal Agroforestry Foundation (NAF). It draws in particular upon the field activities of the Boudha-Bahunipati Welfare Project (BBP), which receives much of its funding from World Neighbors, one of the NGOs with which the NAF works. BBP is a special project of the Family Planning Association of Nepal, a national NGO. Of particular note with regard to the BBP field experience is the way in which the pattern of seedling production has shifted over time between different types and sizes of nursery, in response to changing circumstances. In building upon the work of the BBP in a wider geographical context (throughout the middle hills), much emphasis has been placed by NAF on farmer training and support groups.

4.1 Economy and Farming Systems

Flanking the southern mass of the Himalayas, Nepal is a country of diverse agroecological conditions. Broadly speaking, it may be divided into three parallel bands. To the south lies the (mainly flat) plain or Terai, which borders on India and is largely below 800m in elevation. This rises into the middle hills (roughly between 800m and 2,500m), which grade northwards into the true mountains, bordering China. Over half of Nepal's population still lives in the middle hills, and it is



on this area that the case study focuses. The wide range of altitude encompassed by the middle hills leads to a great range in climate and natural vegetation. Further diversity is caused by topographical and geological variation, superimposed upon which is a heterogeneous human population of different castes and ethnic groups.

Throughout the area, forests and trees play a crucial role in the present form of subsistence agriculture. Manure and/or leaf litter is the main form of fertilizer for the fields and because much of the fodder for livestock, plus the leaf litter, is obtained from the forest, it is essential for sustaining soil fertility. Apart from this, forests provide obvious needs such as timber for housing and wood for agricultural implements, fuel, bamboos for weaving, and a variety of other non-timber forest products.

Since local people recognise the importance of trees in their daily lives, it is common to find trees and bamboos cultivated on private land, especially in areas where access to other forest resources is limited. Where possible, farmers try to cultivate trees and bamboos in non-agricultural patches of land such as along stream sides. In other cases they are prepared to accept some loss of crop yield (due to shade) and cultivate trees in fields, along terrace banks. Those farmers who cultivate most trees and bamboos tend to own a larger than average landholding (at least enough to be self-sufficient in food production). Households owning insufficient land for food sufficiency tend to grow fewer trees. They are also often involved in an external remittance economy, with at least one family member working outside the area the whole or part of the year.

The Boudha-Bahunipati Welfare Project Area

The BBP area is located in Sindhupalchowk District (Central Nepal) at an altitude of some 900 to 2,000m. It has a sub-tropical climate, most of the rainfall of some 2,500mm/yr falling in the four months of the summer monsoon, from June to September. There is a dry season between October and May, and temperatures throughout the year rarely fall below a minimum of 2–3°C, with a mean temperature of 11–25°C.

The BBP area has a population of some 150,000 people, of mixed ethnic grouping, including high caste Hindus (Brahmins and Chhetris), Buddhist hill people (Tamangs and Sherpas), and other ethnic groups (Majhis and Danuwars). These different groups tend to have settled in altitudinal bands. The **Majhis** and **Danuwars** (originally fisherpeople, who now tend to be marginal farmers and/or labourers) live in the valley bottoms. The **Brahmins** and **Chhetris** have settled on land up to 1,500m, where irrigated rice is the most common crop. The **Tamangs** and **Sherpas** farm land above 2,000m, where non-irrigated maize, millet and potatoes are the staple crops. It is the Brahmins who are generally recognised as the wealthiest group, owning the valuable paddy lands and having good access to the expanding local road network and educational facilities, which they have used to their full

advantage. The BBP has focused its activities on the marginalised communities, although it has not operated to the exclusion of any group.

4.2 Project Objectives

BBP Objectives and Background

The BBP began operations in 1973 as a small-scale, local, integrated community development programme with the overall objective of promoting family planning. Early activities concerned community health, drinking water and irrigation. These activities subsequently expanded to include agroforestry, animal husbandry and horticultural components, in the belief that only through effecting an overall improvement in the local standard of living could the original aims of the project be met.

The project started operations in Bahunipati – a fishing village along the Indrawati River – in the late 1970s. Here fodder shortages were identified by villagers as a major problem, particularly between December and April. In times past, villagers had cut fodder from a nearby, communally used forest. Within the last 30 years or so this has yielded insufficient quantities though and villagers have turned increasingly to private fodder resources (as yet in this area there has not been an initiative to manage the forest communally for more sustainable production). The BBP saw fodder development as crucial to promoting livestock health and production and reducing the decline in soil fertility caused by insufficient manure. It therefore promoted agroforestry as a potential solution.

NAF Objectives and Background

NAF is a non-profit association formed in 1991 by a group of community-based NGOs that promote agroforestry in Nepal as one of their activities. Some members of the NAF network have in the past received technical and financial assistance from World Neighbors, but NAF's activities are currently supported by The Ford Foundation. Some financial self-support is also generated from charges for training and fodder seed. NAF was established to replicate the work of the BBP in agroforestry, its purpose: 'To help to build capacity of poor and marginalised communities to fulfil their basic needs from agroforestry development through local NGOs' (Ghimire, 1992).

Whilst the NAF directly supports some on-farm research and trials, it works through its member NGOs to extend the area under agroforestry and improve the income of small and marginal farmers. The objective of the NAF network of NGOs is to reduce environmental degradation of common access forests and private land, through the promotion of agroforestry on private land, using a farmer-centred approach. NAF-supported research comprises trials by farmers in their own fields, with their own investment. Technical assistance is provided by facilitators or resource people, extension and research being fully

integrated. NAF currently works with about 30 NGOs in Nepal, supporting agroforestry demonstrations and training of trainers (ToT). It is also active in information exchange with various government-supported projects and at the national level with government research and policy personnel.

NAF operates on the premise that whilst many agroforestry initiatives (in Nepal and elsewhere) have resulted in some technical success, the impact of such developments could be significantly improved if there was greater emphasis on farmer-to-farmer research, training and extension. Increased farmer participation in determining programme objectives and operational criteria should lead to more appropriate and sustainable agroforestry innovations.

4.3 Seedling Production Strategy

The seedling production strategy adopted by the BBP and subsequently by the NAF incorporates training and extension in a manner that aims to be sustainable. This process may be divided into five stages, as indicated in Box 4.1.

Box 4.1

Stages in the NAF Extension Strategy

- **Motivation** Expose farmers to agroforestry innovations, encourage them to test new ideas, organise an exposure visit for motivated farmers, and stimulate interest using visual and learning materials.
- **Plant Production** Organise one-day homestead nursery training for interested farmers, provide on site training in planting/management techniques and support to sustain farmers' motivation.
- **Support and Follow-up** Farmers are encouraged to form their own groups, meet regularly, and assist one another to produce, plant and protect their fodder trees and grasses.
- **Ensuring Sustainability** Farmers are trained in making observations and collecting relevant data for basic field-level research and training.
- **Training of Trainers** Regular meetings of lead farmers are organised by the local NGO to review their work, and share information.

Motivation

NGO staff or an experienced farmer with training skills (perhaps from another area) begin by opening discussions with members of the community. These discussions focus on farmers' agroforestry practices

Box 4.2**Desirable Characteristics
of (Multipurpose)
Fodder Tree Species for
Use in Nepal**

- Readily propagated (from seeds and cuttings).
- Grow out of reach of grazing animals within six months under dryland conditions.
- Coppice well and can be lopped low to the ground without killing the tree, to prevent shading of crops and increase fodder biomass.
- Provide high quality fodder during the peak dry months (March, April and May).
- Multipurpose, with a proven local capacity for nitrogen fixation.
- Seed can be produced or acquired locally.

Planting out tree seedlings on farm terraces, Nepal

Illustration: NAF extension material



and on reviewing methods of intensifying agroforestry for fodder and fuel. Farmers are exposed to a concept of agroforestry more intensive than that which exists under current, indigenous farming methods. After these initial contacts, further discussion meetings, slide/visual presentations, participatory learning materials, opportunities to attend field days, and visits to nearby demonstrations are made available to interested farmers.

The motivation period generally leads to a few interested farmers identifying one or two species to test, supplementing trees already existing on their farms. The species suggested are generally fodder trees that possess at least some of the characteristics identified in Box 4.2.

Plant Production

Seedlings are produced by the interested farmers themselves in home nurseries, in which the average number of plants raised is 500–1,000. Once farmers have selected the desired species, a one day training course is organised locally for them by the local NGO trainer. Within this one day course, separate training sessions are run on propagation techniques for cuttings and seed. In communities where there has already been some initial success in the programme, resulting in good visible demonstrations, training is often conducted by farmer trainers. Their role is described further on.

Home nurseries are usually located near the home where protection and water are available. Very little water or labour is required so that it is not difficult for farmers to integrate nursery maintenance work with daily tasks. Follow-up by the farmer trainer or staff occurs monthly until planting, just prior to which a training day is arranged in the community for farmers with nurseries, focusing on transplanting, managing and protection.

The species raised are generally limited to those which farmers can grow in a 3–4 month period before the monsoon, since it is difficult for many to protect, manage and water a nursery for a full year. Species requiring longer nursery care, which include many local species, are produced by the farmer trainer as part of her/his responsibility and distributed to members of the group. For simplicity, individual farmers are generally encouraged to raise one species each year rather than mix cuttings and seeds, or species, in the home nursery. However, it is now NAF policy to promote mixed planting. This is done by suggesting to farmers that they share plants with others who are producing different species.

The BBP Experience with *Leucaena leucocephala*

One reason for the current promotion of mixed planting reflects the past experience of the BBP project when problems arose from concentrating too heavily on one species. When the BBP commenced its home nursery programme, the focus was on the production of fodder trees, particularly species that would provide edible foliage

throughout the dry season. The Project identified *Leucaena leucocephala* as a promising new (exotic) species in this regard.

Although previously unknown to farmers in the area, *L. leucocephala* had many desirable features. It could be easily propagated from seed, established readily on terrace banks without shading crops too heavily, responded well to repeated lopping and produced highly palatable and nutritious leaf matter throughout the dry season. First grown in a small central project nursery in 1977, it was introduced into the area through a limited number of interested farmers. A *Leucaena* species suitable for slightly higher elevations, *L. diversifolia*, was also subsequently introduced.

With a demonstration provided by earlier plantings of the species, an education campaign involving pamphlets and posters, and with the ready availability of seed, *Leucaena* rapidly became very popular amongst villagers. Farmers seeking to set up their own home nurseries were often only interested in raising the new tree. At the height of its popularity there were 30–35 nurseries, almost all raising this one species. Figures collected in an evaluation study (New ERA, 1990) indicate that by 1988 there were an average 362.1 fodder trees cultivated per household in Majhigaon (the settlement of project focus), whereas 15 years previously there had been only an estimated 0.4 fodder trees per household. Of the newly cultivated trees, 98% were *Leucaena* (mainly *L. leucocephala*).

L. leucocephala is particularly prone to attack by a psyllid pest, which had devastated populations of the tree in the Philippines and Indonesia, and was first reported in Nepal in July 1989 (Joshi, 1990). BBP staff were aware of the potential problem before attack occurred, and took steps to introduce other species of *Leucaena* that were considered resistant to it. Nevertheless, the bulk of the trees grown by farmers were *L. leucocephala* and the effect of the psyllid upon them was great. By 1990, many farmers (particularly men) were disillusioned with *Leucaena*, and had cut down the trees that they had planted, although only a few completely removed them. Despite this setback, the project's rapport with farmers was sufficiently good for all to learn from the mistake of concentrating too heavily on one species, and to develop in new directions. The project has also worked with a number of farmers in developing management strategies that put psyllid infected trees to some use. Although producing less fodder, they can still be used to provide fuelwood and to support climbing vegetables.

Some of the NGOs working under NAF believe that paying a farmer trainer reduces her/his local credibility. It also may jeopardise project sustainability, as payments to even part-time staff can create difficulties when the NGO moves the focus of its activities to new areas.

The Role of Farmer Trainers

In a community into which agroforestry innovations are being introduced, individual farmers are encouraged to attend group meetings in a nearby community. This may help them appreciate the advantages of working together in a group. Generally two or three farmers living near each other then decide to form their own group, which others may become interested in joining.

The group selects one farmer as a farmer trainer, which is initially

Box 4.3**Sample Criteria
for the Selection of
Farmer Trainers**

- High motivation, and dedication to serve the community.
- Acceptance of the goal to become a successful farmer without continued dependence on an outside stipend.
- Maintenance of a successful demonstration of the new technology and of a home nursery.
- Available time to give an average four to five days a month in teaching and support of other farmers in the group.
- Management of own farm according to a farm plan, drawn up by herself/himself.
- Willingness to produce seedlings or raise parent plants for cuttings to assist other farmers.
- Ability to lead a farmer-to-farmer visit to another community once a year.
- Willingness to attend quarterly farmer trainer review meetings
- Willingness to organise regular and seasonal support meetings of group farmer-members.

a voluntary position. Following the selection of the farmer trainer and demonstrations of successful results on her/his own land, the project may provide an allowance to reimburse the trainer for four to five days a month. This does not occur in the case of all projects, but depends upon circumstances and the policy of the particular NGO. Key factors in this decision include local attitudes, as jealousies can arise amongst others in the group towards the farmer who is being paid and receives recognition for her/his work. A regular salary or *jagir*, even if small, has high status in Nepali society and tends to engender long-term expectations.

If farmer trainers are paid, the suggested daily allowance is generally equivalent to the local daily rate for skilled labour. This is not high enough to distract the farmer from the maintenance of the demonstration plot, nor make her/him fully dependent on the allowance for livelihood. However, project staff believe it is essential to make clear to all concerned that the position of farmer trainer is a temporary one, 3 to 5 years, until their experience has been passed on to other group members. By this time, it is expected that the improvements made by a farmer trainer to her/his own farm will be sufficient to cover the part-time income previously received.

Experience has shown that farmer trainers may become self-supporting in several ways. They may improve their farms to the extent that they increase their income from the improved output, offsetting their temporary allowance. They may also arrange a farmers' organisation at community-level, to run as a cooperative and to meet farmers' extension needs, including costs for trainers and training. Thirdly, they may sell seeds, seedlings and plants to other farmers, thus combining monetary gain with extension.

To retain their position, farmer trainers have to fulfil a set of criteria decided by the farmers group. A typical list of such criteria is given in Box 4.3, based on experiences in a number of projects. It is the farmers group that sets the criteria and selects the farmer trainer. If the farmer trainer fails to meet the criteria, the group proceeds to identify a replacement.

Group Meetings and Ensuring Sustainability

The group holds regular meetings at which the farmer trainer may assist in the development of farm plans for and by each farmer, collect data on seed and material requirements, organise assistance as required by members for field operations, and facilitate the search for solutions to grazing problems. She/he may also organise work on related community needs such as livestock improvement through breeding, fodder improvement, stall feeding, general management and health.

The regular group meetings are seen to speed up the process of information flow and farmer participation in trial results. Activities at farmer group meetings include the following:

- Reporting from each participant about the status of their homestead farm and plans for the future.
- Discussion of new ideas, for example, after a talk from a visitor or after a visit to a field trial.
- Participation in field activities according to season (such as seed treatment, vegetative propagation, assistance to members with field operations, planting, manuring, weeding, harvesting, biomass measurement of species on trial).

Not all farmer members of the group attend each meeting, although participation is encouraged. Other farmers who are interested in joining are also invited to attend. Ideally, new participants mix with older members in the group so they benefit from their experiences. It is suggested that a new group should be formed when membership exceeds five farmers, which seems to be the best sized group. As farmer groups gain experience, they take increasing responsibility for other matters such as credit, seeds, livestock and marketing. Initially, however, groups need to concentrate on the successful demonstration of the agroforestry technology.

Training of Trainers

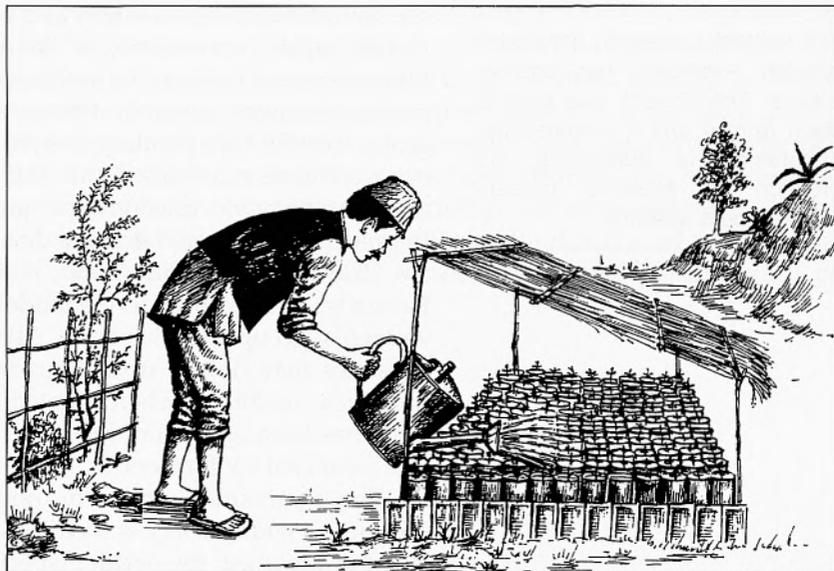
A one or two day review for farmer trainers is usually organised on a quarterly basis by the supporting project, or by NAF directly. All farmer trainers are asked to meet at one site to review their work, including farm plans and ongoing trials. The site chosen provides the opportunity to observe one field example of new or successful technology. Farmer trainers host quarterly meetings in their areas, and other group members in the vicinity are invited to attend. Each participant is expected to report on her/his farm's status and plans for the coming three months. NAF or NGO budgets cover the actual expenses of these meetings, including the travel of farmer trainers.

This approach provides regular support for all participating farmers, old and new, without requiring project staff to expand the area of coverage. Staff remain resource persons and support the process of training. Outside resource persons (and new technologies) are brought in by way of quarterly farmer trainer meetings, ensuring that new ideas reach all farmers taking part in the programme. As farmer trainer skills develop, more experimentation and trials are initiated at farmer-level. This is fundamental to the thinking and aims of the NAF, as it is believed that farmers should be primarily responsible for experimenting with new ideas.

Occasionally, capable farmer trainers may become staff members for training and/or other NGO support roles. This process has the advantage that trainers have practical experience and it promotes programme replication at the community-level.

A home nursery, Nepal

illustration: NAF extension material



4.4 Project Evolution

Recent BBP Nursery Experience

The BBP's recent experience with community nurseries has resulted in a move back to home nurseries. After the problems with *Leucaena leucocephala*, home nursery production in the BBP area was temporarily discontinued. Instead, a number of male farmers formed groups (of 10 to 30 individuals) to raise seedlings together in community nurseries of 4,000–8,000 seedlings. Overall responsibility for the nursery is assigned to one farmer who is selected by the group, sent for training and subsequently paid a part-time salary.

On average, about 80% of all seedlings raised comprise species grown for fodder, whilst 10% are species grown primarily as fuel and timber. The balance is made up of orange, lemon and other horticultural species, depending on the site. Each community nursery produces 15 to 20 different fodder species, all being distributed free of monetary charge (members having contributed their labour to nursery production).

It was planned that nurseries would sell horticultural seedlings at a price enabling them to become self-supporting within a five year period. Although the species raised include some of high value, in most cases local demand for the seedlings produced has been insufficient for financial viability. Once the price charged for a tree seedling rises above several rupees, demand falls quite dramatically and the number of trees purchased is insufficient to meet production costs.

Community nurseries were reduced from six to one for the 1993 planting season. The Project is focusing more upon women's groups

The advantage of community nurseries is that a greater mixture of species can be raised in them than in home nurseries. Farmers are able to share the responsibility and skills demanded by the different propagation technologies and schedules of different species.

The setback caused by the psyllid problem eventually had positive effects. The Project was able to learn from it and it revealed the importance of supporting the creation of adaptive nursery management systems.

for home nursery production and fodder interventions. For example, in the original community of Bahunipati, where the men expressed little interest in testing alternative species to supplement or replace the psyllid damaged *Leucaena*, fifteen women farmers formed their own group. For the 1993 planting season, they produced a variety of species in seven home nurseries. At another BBP site, women decided that the main problem was uncontrolled grazing and formed their own group to prevent the seasonal grazing that was damaging young trees. There are 23 members of this group, with 12 home nurseries. The female farmer trainer has been a role model for the formation of several other women's groups in the area. Although seedling quality in home nurseries may not be up to the standard of the former community nurseries, seedlings when planted out survive better. Furthermore, there has been an overall increase in the number of seedlings grown and protected by farmers.

There remains a role for one central Project nursery, which produces a wide variety of seedlings, numbering some 15,000 per year. Notable amongst the fodder species are indigenous trees such as *Artocarpus lacucha*, *Ficus auriculata* and *F. virens* which require prolonged nursery management (12 months) and are therefore difficult to produce in home nurseries. The nursery has also an important function in training farmers and testing new species.

Recent Directions in the NAF

Project experience has strengthened the belief amongst NAF staff that decentralising plant production – from the community to individuals or groups of farmers – is both possible and appropriate in the middle hills of Nepal. However, not all groups favour home nurseries and they are usually set up under the umbrella of a small group. Some farmers still prefer a joint nursery for practical reasons of labour and water availability. Although this approach may be more successful in some places, it requires a high degree of community cohesion. Possible disadvantages with community nurseries include the distance to the planting sites, and the reduced incentive individuals may have to protect newly planted trees not raised by themselves. Furthermore, a community nursery requires regular labour input which generally must be paid for, making it difficult to sustain it on a long-term basis.

Several NGOs are building upon the traditional form of reciprocal labour sharing used by many ethnic groups in Nepal, known as **parma**. In this system, individuals from several households (not necessarily relatives) pool their labour in tasks which require intensive effort, or do a days work on an exchange basis on each other's land. This includes activities such as field preparation (sharing bullocks for ploughing), planting and harvesting. The **parma** system can be appropriate for agroforestry activities such as the filling of nursery bags, transplanting and watering. The **parma** group may be smaller and less formal than is common for other tasks, and rather than having a paid farmer trainer, she/he takes part in the **parma** exchange.

In conclusion, whilst some of the methodologies used by NAF are still evolving and not completely tested, it is clear that it is feasible for hill farmers to produce their own seedlings of good quality in home nurseries, form farmer groups for self-support and community action, extend innovative practices on a horizontal basis from farmer-to-farmer and sustain and improve these practices through trial and error. A network of NGO members and selected government and international colleagues has been developed and through sales of seed and training services there is the potential for the institutional sustainability of NAF.

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ORGANISATIONAL PROFILE NAF/BBP (Nepal)				
LEVELS	SECTORS			
	Government Departments and Extension Services	NGOs and Private Organisations	Membership Organisations and Voluntary Roles	Traditional Authorities
International		[Ford Foundation] [World Neighbors]	APAN – Asia Pacific Agro- forestry Network	
National	Livestock Dev. Section Ministry of Agric.	Nepal Agroforestry Foundation		
	Forest Research and Survey Centre Dept. of Forests	Family Planning Association of Nepal		
Province/Region				
District/ Local Government	District Dev. Committee Local Development Office DFO – Forest Dept. Dist.Public Health Office	<i>Boudha-Bahunipati Welfare Project (extension staff)</i>		
Village/ Community			<i>Farmer groups (and farmer trainers)</i> 'Parma' labour exchange groups	
Individual			Farmers of different ethnic groups: Brahmins and Chhetris, Tamangs and Sherpas, Majhis and Danuwars	

5 The SOS Sahel/FNC El Ain Natural Forest Management Project, Sudan

Gill Vogt, Fowsia El Dai, Kaltoum Ahmed and Edwin Shanks

This case study examines the experience of a number of village nurseries which have been established in association with a natural forest management project in Kordofan, a semi-arid region of central Sudan. This project, which began in 1989, is supported by an international NGO – SOS Sahel (UK), in collaboration with the Forests' National Corporation (FNC) of Sudan. Village nurseries were not amongst the initial objectives of the project, but were started in response to villager demand. They are seen to complement natural forest management activities by increasing farmers' capacity to handle a range of indigenous species. The study is of particular interest because of the way in which a variety of participatory planning, monitoring and evaluation exercises have been used to build mutual understanding about the direction of the programme and to carry it forward with the aim of achieving a position of sustainability within three or four years. Ensuring seed supplies is seen to be an essential ingredient which may lead to sustainability, as is the development of effective planning procedures within the nursery groups.



5.1 Economy and Farming Systems

The project area encompasses El Ain Forest Reserve (covering 19,000ha) and a surrounding 'buffer zone' in which 23 villages with a combined population of some 7000 people are located. The reserve was gazetted in 1954 with the purpose of supplying woodfuel to El Obeid, the capital of Kordofan, which lies about 26km to the northwest. Later, two seasonal water-courses were dammed within the reserve to

provide water for El Obeid and a 'new extension' of the reserve was mapped to the south at the same time, formal reservation of which is still to be completed.

El Ain lies within the **Sahelian Acacia Wooded Grassland and Deciduous Bushland** vegetation zone as represented by the dominant tree species including **Kitr** (*Acacia mellifera*), **Heglig** (*Balanites aegyptiaca*) and **Tebeldi** (*Adansonia digitata*). The major soils are a non-cracking Luvisol, locally known as **Gardud**. Although fertile, these soils have a low rate of infiltration and their extreme hardness makes them difficult to work. Mean annual rainfall levels of 361mm/yr were recorded for the period between 1951 and 1980. These have now fallen to a rate of between 200 and 250mm/yr.

Most households possess a homegarden close to the village, known as a **jubraka** plot. These are under the control of women and used for the cultivation of early maturing grains and vegetables including okra, peppers and cucurbits. Outside these are crop fields used for growing the main staple crops, chiefly sorghum and millet, which are opened up on a fallow rotation. Livestock rearing (mostly goats, sheep and cattle), though widespread, is of greater importance to some farmers than others. In general, grazing and browsing resources are nearer to the villages in the wet season, but as the dry season progresses animals are taken further afield, including into the forest reserve.

Prior to commencement of the project an informal system of village usufruct rights had been in operation in the Reserve, and it is this system that the project is trying to strengthen. Forest in the buffer zone is subject to common property regulations under the control of the village Sheikhs, who act as trustees of communal land assigned to the village by higher authorities. The combined incomes from cropping and livestock rarely exceed subsistence level and, as money and food resources become scarce towards the end of the dry season, additional income is sought, often through illegal cutting of firewood and charcoal making. The severe drought of the mid-1980s (which resulted especially in the disruption of pastoral economies and hardship amongst farmers in the 'gum arabic belt' to the north of El Ain), combined with the demand for fuel from El Obeid, has led to increasing encroachment of both the reserve and buffer zone by outsiders.

5.2 Project Objectives

Formal management of forest reserves in the dry savanna zone of Sudan has for many years been limited to incidental policing, occasional organised felling by the forest service to supply urban centres with woodfuel, and removal of deadwood by local people under firewood licences. By the 1980s it was apparent that new thinking was necessary if the reserves were to survive and remain a productive resource. Ideas put forward in the review of the forestry sector of 1986 (quoted in Wincelius, 1988) emphasised that protection may only be possible if local land users become actively involved in

management. Appropriate incentives should be provided to encourage land users to collaborate in establishing and enforcing the necessary regulations to achieve this. A new Forests Act of 1989 simplifies the reservation procedure, makes revenue sharing arrangements theoretically possible, and allows new reserves to be registered under the name of individuals, communities and institutions.

The SOS Sahel supported project at El Ain is piloting new approaches to natural forest management which, if they prove successful, may be applied elsewhere in the country. In this respect, Phase One (lasting from 1990 to 1993), has been a period of action-research into technical, social and economic issues, combined with negotiations regarding the future of the reserve. The major objective is to design and implement a long-term management plan for the reserve and buffer zone over a period of 10–20 years (Phase Two). The project team consists of nine people: a national Project Manager, Assistant Manager, Extension Coordinator, four locally recruited extensionists, and an expatriate Team Leader and Extension Adviser.

Progress in Phase One has been slower than anticipated. This was partly due to two years low rainfall and poor harvests (1990 and 1991) which obliged the project to provide food relief for villagers under a food-for-work arrangement. The task of bringing about greater trust and productive working relations between the forest service and local people has also been difficult. This is primarily because it has involved bringing to light and solving a number of latent tenure conflicts in the area. These relations are now much improved, but it is clear that devising and implementing a new management plan for the reserve cannot be rushed. In the first instance, villagers have been most interested in establishing nurseries and planting trees on their own land. Some villages have also begun work on establishing 'village forest reserves', and valuable experience is being gained on the type and level of technical and institutional support required for this.

Small-scale tree nurseries are therefore not amongst the primary objectives of this project. In fact, the only target which was set for the extension component during Phase One was: **'To build mutual trust and confidence between the different parties involved and to establish an organisational infrastructure to enable full participation of local communities in management of the forests'**. In practice, a number of different activities have arisen out of this, including nursery production, the digging of micro-catchments for water harvesting on village land combined with tree planting, and a programme of training for women in the construction of mud stoves. The goals and targets of these various activities are determined largely by villagers themselves. So, for instance, extension staff are under no obligation to establish a set number of nurseries. The stated aim of the village nursery programme has simply been: **'To give people the knowledge and confidence on how to produce trees, so that they can continue to do so in the future without external inputs being necessary'**.

Table 5.1 **Range of Species Raised in Village Nurseries in 1992**

Species	Number of Nurseries	Range of Seedling Numbers	Total Number of Seedlings in all Nurseries
<i>Acacia mellifera</i>	14	100-3,000	10,300
<i>Acacia nilotica</i>	7	25-300	675
<i>Acacia senegal</i>	9	25-1,250	2,775
<i>Acacia seyal</i>	10	25-500	1,275
<i>Acacia tortilis</i>	11	25-500	1,700
<i>Adansonia digitata</i>	4	10-500	565
<i>Ailanthus excelsa</i>	11	25-500	1,140
<i>Albizia amara</i>	3	50-100	200
<i>Azadirachta indica</i>	12	25-200	1,275
<i>Balanites aegyptiaca</i>	12	50-1,000	2,906
<i>Bougainvillea</i> spp	14	20-500	1,160
<i>Cassia fistula</i>	13	10-500	1,630
<i>Cordia sinensis</i>	8	20-400	695
<i>Dalbergia sissoo</i>	12	10-250	1,080
<i>Delonix regia</i>	12	10-300	925
<i>Dodonea viscosa</i>	13	10-200	1,045
<i>Eucalyptus</i> spp	8	25-500	1,515
<i>Grewia tenax</i>	13	50-1,000	2,300
<i>Khaya senegalensis</i>	4	5-100	205
<i>Lawsonia inermis</i>	14	20-1,500	2,790
<i>Prosopis juliflora</i>	14	50-4,000	8,850
<i>Salvadora persica</i>	13	20-300	1,495
<i>Senna siamea</i>	11	10-300	1,005
<i>Tamarindus indica</i>	8	25-200	825
<i>Ziziphus spina-christi</i>	11	25-500	2,025

5.3 Seedling Production Strategy

The nursery programme was initiated in 1991 with training for the two extension staff, both women, who were to be responsible for the programme. Assigning female staff to an activity involving both men and women in the villages did not present a problem in this particular area, though it is realised that in other regions of Sudan this might be the case. Neither extensionist was a trained forester, nor had they previous experience in the establishment of tree nurseries. Therefore, technical as well as extension training was an initial priority. A manual was prepared for use in an intensive five day training course and as a personal reference document for later use.

The Extension System

Contacts with each village began with a visit to arrange a date for a film show and a meeting to which anyone interested in nurseries was invited. The film show successfully drew large audiences of men, women and children. At these meetings it was stressed that the project was willing to work with the village as a whole or with individuals or small groups. Opinions were canvassed and queries on such matters as the type of work involved and quantities of water required were answered.

On subsequent visits extension staff discussed with those people interested in raising seedlings what type of nursery and what species they wanted. Staff suggested that in the first year people should not be too ambitious, they should start small and gain experience, and nurseries could then expand in later years, if required. In the first year 10 villages decided to participate. Most opted for community run nurseries with a capacity of around 500 seedlings. A few decided that substantially greater numbers of seedlings were needed. In one village six home nurseries were set up.

Having first outlined the basic sequence of nursery operations at the preliminary meetings, extension staff took a 'step-by-step' approach to giving advice. This involved practical/method demonstrations of each activity as it occurred in the nursery calendar. Follow-up visits were made to discuss the work and to give additional assistance where required. This method worked well and from it evolved a schedule of frequent advisory visits to each village. Regular visits are seen to be essential during the first year of nursery operations.

Species Choice and Nursery Plans

From the outset, an attempt has been made to provide a wide range of species for farmers to choose from. Due to political upheaval in the country, which has had an adverse effect on government services, external seed supplies are unreliable. Good local seed trees of many species are also becoming more scarce. Nevertheless, the forest office at Wad-el-Bacha (situated in the reserve and within easy reach of the villages) now handles seed of over 30 species (see Table 5.1), most of

Village nursery at Newella, El Ain, Sudan

Photograph: Mary Mayers, SOS Sahel



Box 5.1

Helat Abdu Village Nursery Record 1991 Season

This large nursery was established by both men and women, though it was originally the women who had requested assistance. Despite project qualms that a 5,000 seedling capacity might prove unworkable in the first year, the people insisted that they would manage and five large (1,000 seedling) beds were duly dug and pots filled. The project helped shift sand for the potting mix, as the people had already made major efforts in soil and bed preparation. The nursery is located close to the village handpump. The project provided a barrel which was sunk into the ground to be automatically filled from the overflow channel. Having the pump within the nursery greatly assisted watering operations for the nursery.

Initially, nursery management went smoothly. However, much as project staff had feared, problems arose two months after the start. It seems that committee members were not delegating responsibility to the others and as attendance fell away, they found that they could not cope with the level of daily work. The committee called on the project and after discussing the matter it was suggested that each bed have its own management group, responsible for watering and care. This proved successful and attendance increased once again. In late September, with everyone busy in their fields, root pruning of nursery stock was neglected. The project brought this to the committee's attention and as a result an 'all-out' village effort was arranged to root-prune stock, tidy the beds and clean up the nursery.

This village was the first to put financial value on its seedlings (independently of the project) at 5 Sudanese Shillings for any species. Not only did they sell to other villages from outside the project area directly from the nursery, but they also managed to sell 300 seedlings of assorted species on their first trip to the nearby town of El Banjidid. Furthermore, they have received orders for large quantities of neem, *kitr* (*Acacia mellifera*) and *mesquite* (*Prosopis juliflora*), largely for live-hedging purposes, from fruit garden owners in El Banjidid, as well as the schools at Shabaab-al-Watan and in El Obeid town. However, the committee appears to be a bit over zealous about seedling sales as they began charging seedlings distributed to village people, including those who helped make and run the nursery. This proved to be a disincentive to village planting and is likely to affect participation in future seasons.

Source: Vogt *et al*, 1991

Box 5.2

Warshal Baduga Village Nursery Record 1991 Season

This village has such problems with water supply, having to collect it from some distance away at a neighbouring village, that they were not initially approached for the Nursery Programme. However, this decision clearly offended the people and they called a meeting with the project to find out why they had not been included. The matter was discussed and the villagers maintained that they could and would cope with the nursery watering requirements and told the project, in no uncertain terms, that they needed a tree nursery. As a result a 500 seedling capacity nursery was started.

The villagers were very keen and conscientious about the village nursery, to the extent that excess polybags and seed were used to make small home nurseries which were combined with vegetable seedling production. The main nursery progressed very well until around the time of the first root pruning. Extension staff were in the area doing root pruning demonstrations but had been held up in the other villages, so much so that they arrived in Baduga too late to do more than briefly discuss root pruning methods. This proved to be unsatisfactory and at the next meeting two weeks later the people were disillusioned, as many of the seedlings had suffered badly after root pruning.

Project staff made assurances that the problem lay with their lack of advice, and on the same day the village and project staff cleaned up the bed and salvaged the remaining seedlings and replanted the empty bags. This incident proved to be an important lesson for project staff as far as quality of demonstrations is concerned.

By the end of June, the last village donkey died of starvation and as a result people were collecting water, not only for their own use, but also for the nursery, by headload. In recognition of the villagers' efforts the project delivered a barrel of water on all subsequent visits until the first rains fell in the area and the local waterholes filled.

Source: Vogt *et al*, 1991

which are indigenous to the area. Some village nurseries are raising over 20 species, and this diversity is seen by project staff as helping reduce the risks attached to tree planting in the semi-arid environment.

In the first year, some villages selected species for specific purposes and made plans beforehand for the number of seedlings required for different sites. Others tried a 'bit of everything' in order to gain experience, in which case they agreed on suitable planting sites at the time of planting out. The capacity of the nurseries reflects the differing intentions of the owners. This is shown in the nursery records made by project staff for Helat Abdu and Warshal Baduga villages (see Boxes 5.1 and 5.2). In 1991, these two nurseries ranged in size from 500 seedlings at Warshal Baduga (which wished to raise many more but faced considerable difficulties in water supply), to in excess of 5,000 seedlings at Helat Abdu (which immediately began selling some of their seedlings to other farmers in the area and in nearby markets).

It is interesting to note that the people of Warshal Baduga soon began to use their nursery site for the early establishment of vegetable plants prior to the rains. This diversification of production, combined with an intensification of work effort at the nursery site, took place in several villages. This alerted project staff to the need to look beyond tree species, to constraints that exist with regard to seed availability of vegetable and staple crops, and to the potential of the *jubraka* gardens.

Nursery Management

Nearly all the nurseries are run on a group basis. It appears that this decision was taken for various reasons, including the strong tradition of cooperation in the villages and the need to spread labour. Even so, a variety of organisational patterns have evolved:

- People working in groups, sharing responsibilities, with no committee involved.
- People working in groups, with overall responsibility being assigned to an elected committee.
- Extended family members working together in home nurseries.
- Nurseries divided up into separate beds, each bed managed by a different group of people.

Many groups elected to work through a management committee responsible for coordinating with project staff, making requests for seed and materials, overseeing organisation of the work and calling planning meetings. The groups are fully supported in their efforts to decide on the most appropriate ways of organising the work. This is often in order to overcome a particular problem, especially in

obtaining water for which different rota systems have been devised. Representation of both women and men is good on the forest committees. However, as will be explained in the following sections, uncertainties have arisen in some villages with regard to the way in which committees organise and delegate the work.

Material Inputs

The project supports the use of locally available materials as much as possible. However, a number of tools and materials were supplied free of charge in the first year, and it has become policy that these be provided to each new village joining the programme. They include: bricks for lining the beds (a necessity on the hard compacted soils where many nurseries are situated); polythene bags; watering cans (which are the most expensive input); scissors for root pruning; barrels (which were given to particular nurseries depending on the location of the village water source); netting (for those nurseries having problems with locusts); and the use of the one project wheelbarrow (loaned out for occasional use when large quantities of earth/sand have to be shifted).

The project was initially tempted to put a nominal fee against provision of these inputs. The decision was made against this because people in the area lack transferable property or crop surpluses with which to obtain cash to purchase materials or exchange them. These inputs are regarded as one-off costs, hopefully lasting for a long time, and the nursery groups are responsible for repair and maintenance.

Research on Propagation and Regeneration Techniques

Project staff have carried out research on propagation techniques, the findings of which have quickly found their way to farmers via the extension team. This has included techniques of germinating **Guidem** (*Grewia tenax*), a shrub highly valued in the area for its fruits which provide a nutritious drink as well as being the source of cash income for some families. No information was previously available on the germination of this species, and as a result of this work 13 villages began raising **Guidem** seedlings in 1992.

Innovative research is also being undertaken on the methods of natural regeneration of **Kitr** (*Acacia mellifera*), the predominant species which constitutes well over 90% of trees in the forest reserve. **Kitr** can be easily raised from seed but it is difficult to maintain the vigour of existing populations. It appears that the natural stands of **Kitr** are dying out at an unacceptable rate, probably due to excessive drought stress. Moreover, the species does not respond well to complete coppicing. Trials are therefore under way to investigate the potential for partial pollarding and lopping which does not put excessive stress on the tree.

Tree planting in the dryland savannas of Africa has often resulted in poor survival rates, and has been an inappropriate project

A critical question is whether, in such harsh semi-arid environments, it is better to concentrate on promoting natural regeneration or on planting nursery-raised stock.

intervention. However, research on natural regeneration takes several years to yield demonstrable methods. Given the situation round El Ain, project staff believe that tree planting has been worthwhile because it has enhanced local people's capacity to handle a wide range of species, as well as providing seedlings of the less widespread indigenous species. At the same time, it is recognised that whilst it is comparatively easy to raise and plant seedlings (during the first two years of a project when enthusiasm is high), the more difficult period comes later when the young trees require ongoing care and protection.

5.4 Project Evolution

As already noted, Phase One of the project has involved research, planning and extension activities which should lead to formulation of a new management plan for the forest reserve and the establishment of new community reserves in some villages. The success of this will depend, to a great extent, on creating a conducive institutional environment in which the formal workings of government and the forest service are linked to the more elastic decision making processes which go on at village-level and to local authority structures. To this end, various communication channels and forums have been opened up in which these different groups are encouraged to come together to exchange opinions, resolve conflicts and plan for the future.

In particular, the project has sought to build on horizontal flows of communication within and between villages. The forum in which this is most evident is the **Sheikhs Courses** which are held periodically to discuss the direction of project activities and obtain feedback from the local leadership. Attempts have also been made to develop methods of monitoring and evaluation which focus on both qualitative and quantitative aspects of the work in progress and which actively involve villagers in the process. This section looks at the way in which the nursery programme has been carried forward from the first year by way of a combination of monitoring, evaluation and training activities.

Evaluation of the 1991 Nursery Season

In addition to recording production aspects of the nurseries and seedling survival rates, an evaluation of 1991 activities was made by way of group discussions which focused on how well the work was carried out. The purpose of these discussions was to identify problems which had arisen and to decide how to overcome them in the following season. These discussions were held in two forums:

- Firstly, a **Self-Evaluation** was made amongst project staff. A series of questions, covering important aspects of the extension input into the nurseries, was compiled by the Extension Coordinator to prompt discussion and give structure to the meeting. The meeting

Box 5.3

Questions for the Self-Evaluation by Project Staff of the Nursery Programme in 1991

1. When we were planning the nursery programme, what did we hope to achieve and what goals were we aiming for?
2. Did we achieve these goals?
3. Is the **quality** of the results we achieved better or worse than we initially anticipated it would be?
4. Were there any unexpected results and, if so, what were they?
5. How effective and appropriate were the different types of extension methods (village meetings and practical demonstrations) and materials (posters, film strips, photographs and nursery activity charts)?
6. Could we have achieved more by, for example, better planning or using different extension methods?
7. Who did we work with and did we exclude any groups within the villages without realising it? If so, how can we organise things to avoid this in the future?
8. How good was attendance at meetings and demonstrations throughout the year? What can be done to help maintain people's involvement where it may be decreasing?
9. Did we have all the necessary equipment, materials and nursery inputs available at the right time? If not, what can be done to improve the situation?
10. Did the activities take place in the planned sequence and at the right time?
11. What problems did we encounter when trying to carry out our work? What effect did they have upon the results of the work and how might they be solved?
12. How effective was our follow-up and monitoring of nursery activities in each village? Did we visit the villages too often, not enough, or at just the right frequency?
13. How can we get the people involved in a nursery to participate in the evaluation of the work done?

Source: Vogt *et al*, 1991

Box 5.4

Guideline Questions for the Participatory Evaluation of the Nursery Programme in 1991

1. What have been the benefits (if any) you have gained by being involved with the Nursery Programme (for example, learning new skills, producing own trees, contributing to development of the village, enjoying working with the group/extensionists)?
2. How do you feel about your nursery (for example, proud, happy, unhappy, disappointed; it was too big, too small; the species were good/bad; there was too much work/little work involved)?
3. Will you be continuing with the nursery next year? If so, will your nursery have more or less seedlings than this time?
4. What species did you produce this year? How did each perform (slow but good germination/fast grower)? What species of seedlings do you plan to raise next year? Do you have a good seed source for those species nearby? From your experiences in this year, which species will you be keen to plant and which (if any) will you avoid? Why?
5. Next season, will you be planting certain numbers/species for any special purposes (for example, more Cassia and Neem because they can be sold easily, or more **Kitr** because it is needed for live-fencing)?
6. Do you all feel confident that you know how to produce seedlings in a good way or are there any things you are not sure about?
7. Who is responsible for decision making in the nursery? How are the different jobs, such as watering, organised?
8. How would you describe the support the project staff have provided during the nursery programme? Did you feel encouraged or worried by each project visit? Describe the demonstrations – were they understandable? Did you ever do something and not understand WHY you had to do it? Were the staff able to answer all your questions for you? Would you describe the extensionists visits as too frequent/just right/or not often enough and did you always know when you were going to see them next? Was this a problem?
9. What material inputs have you received as part of the nursery programme? Who is now responsible for them in the village? Have you any comments to make about those inputs or are there any additional inputs you feel are needed?
10. Have you any advice to offer the Project about how to improve the Nursery Programme and/or encourage the participation of other people/villages?
11. If you are participating in the programme again next year, how would you like to see it develop? (eg Are there any skills you would like to develop or things you would like to try?)

Source: Vogt *et al*, 1991

was chaired by the Project Leader, a senior staff member who had no direct input to the Programme and hopefully, therefore, with fewer preconceptions about its progress. The questions used to guide this meeting are listed in Box 5.3.

- The second stage was a **Participatory Villagers' Evaluation** carried out independently by each of the village nursery groups. These meetings were facilitated by the two extension staff not directly involved in the programme, and it was hoped that through this people's views on the project itself could be solicited. The meetings were held in the late afternoon or evening when people were back from their fields. Once again, questions were prepared in advance to help the extensionists guide the discussions, and these are listed in Box 5.4.

Many of the nursery groups were initially bemused by the idea of evaluating 'the project'. It was difficult for some of them since they had no other experience with which to compare the quality of the support given, as the government extension services in all sectors are almost entirely absent in this area. Nevertheless, apart from enjoying talking about their achievements and future plans, the participants were very open and enthusiastic about the evaluation process.

These evaluation procedures yielded greater understanding of a number of important aspects of the programme, and revealed several areas for improvement in the 1992 nursery season.

Quality of the Nursery Work

Quantitatively, the initial goal set by the project of 4 village nurseries was exceeded. Through the **Self-Evaluation**, it was decided that three criteria could be used to measure the quality of the work:

- The number of seedlings actually produced in each village in relation to the targets set by them.
- The level of sustained interest and participation of the nursery team throughout the season, and the number of nurseries that will continue producing seedlings the following season.
- The extent to which people have understood the importance and reasons for different nursery operations.

Many of the nurseries surpassed their own targets for the number of seedlings raised. This was not simply a reflection of people's commitment. Other issues which have a bearing on whether or not targets are achieved include seed quality, the demand for seedlings, the effectiveness of the nursery management system, and the quality and timeliness of the advice given.

The **Participatory Villagers' Evaluation** meetings confirmed the initial impression of project staff that, despite set-backs which might have occurred, the nursery groups all felt positive about the work that they had done throughout the season. All but one nursery group (two women who together produced 1000 seedlings in one village) stated their intention not only to continue nurseries in 1992 but to expand them as well. It appeared that at this stage most were already developing plans for which species to raise for what purposes. This

contrasted with the 1991 season when many groups were 'experimenting' with different species and only developed their planting plans later on. Envious comments from neighbouring villages without a nursery proved an unexpected source of encouragement.

For topics such as nursery operations and seed treatment, the groups were encouraged to describe in detail each step in the nursery cycle and the reasons behind it, so as to establish how well they understood each activity. The responses to this suggested that in all villages people were well aware of and understood the reasons behind the different nursery operations.

Efficiency of the Extension System

The **Participatory Villagers' Evaluation** meetings revealed that while the frequency of visits was generally considered adequate, certain villages were not visited as often as they would have liked. One village proposed twice weekly meetings as more appropriate. From the point of view of project staff, even the schedule they followed entailed a lot of work since more villages were involved than expected, and because different nurseries were at different stages in the production cycle. This, combined with transportation problems, meant that staff were often not able to keep to their timetable especially at peak times. The need for tighter planning of the work schedule (to include the use of a **Village Visit Calendar** by extension staff) was, therefore, one of the main requirements to emerge from the evaluation. Subsequently, as project staff gained confidence and experience themselves, it has been possible to streamline the number of visits required to help set up a new nursery.

Another lesson learned from the first year is that, in addition to being well planned, the extension schedule has to be flexible. The incentives provided for each nursery group also need to vary according to the particular conditions under which they work. Below two examples of this, again referring to the village nursery records given in Boxes 5.1 and 5.2:

Giving advice entails more than simply demonstrating a standard set of nursery techniques in a systematic manner. Of equal importance is that field staff are on hand, and have the mandate, to help solve unforeseen technical or managerial problems if and when they arise.

- In the case of Helat Abdu, project staff 'intervened' when dissatisfaction with the management committee was hindering nursery work, and a new system of managing the nursery beds was devised. One of the chief incentives given to this group was the use of the project trailer to transport sand required for the large nursery.
- In Warshal Baduga, it was necessary to spend more time in the village after project staff failed to provide adequate and timely advice on certain nursery operations. Here, in addition to the basic materials provided, incentives have been directed to easing water shortages.

During the 1991 season a variety of monitoring methods were tested.

At the beginning of the year, **Nursery Activity Charts** were distributed to the nursery groups, on which it was suggested they record the events of the nursery on a regular basis, to be used as a reference for future planning. It was thought they could also be used by project staff to update their own records. In practice, even though some of the villages were able and interested to maintain the charts, they failed to be a useful tool for most. This was partly due to the design of the chart which was too complicated, but also because of the low level of literacy. It was therefore decided, that a simpler chart, using visual symbols rather than words, would be more appropriate. **Seedling Distribution Record Forms** were also distributed to the groups for them to record how many seedlings were raised and to whom they were distributed.

To some extent, the value of written records kept by the nursery groups is questionable, since at least one member of each group keeps a perfectly good memory record of the nursery activities which extension staff can use to compile their own records. Indeed, the more important drawback in the first year was that the project staff's own records were disorganised. A system of **Nursery Notebooks**, to be used in conjunction with the **Village Visit Calendar**, was therefore decided upon for the 1992 season.

Evaluation of the 1992 Nursery Season

A similar participatory evaluation was carried out in 1992, although different methods were used (Shanks, 1992). This time the nursery groups were asked to base their discussions on a method known as '**SWOT Analysis**': that is, of the *Strengths (or benefits)*, *Weaknesses (or problems)*, *Opportunities*, and *Threats* associated with the programme. This year 15 villages had nurseries. Even though rainfall was higher than in 1991 and thus more favourable for tree planting, the season was more difficult for many nurseries in three respects. Many had increased pest problems, from termites, locusts and spider mites. Continuing shortages of water (as a result of low rainfall the previous year) made it difficult for some nurseries to raise enough seedlings and seed germination was slower and poorer than before. In addition, new management problems came to light as some of the nursery groups entered their third year.

In order to explore some of these issues further a **Sustainable Nurseries Course** was hosted prior to the start of nursery work for the 1993 season (Vogt, 1993). At least two representatives (one woman, one man) from each village attended this course which lasted two days. In general, staff wanted to open up the dialogue regarding the sustainability of the nurseries because the form of project support will be changing in the future. The policy of the project is that once the groups have gained experience in nursery practice and management, it would move away from the system of regular advisory visits. In addition, in Phase Two, it might begin working in new villages and increasing attention will be given to the natural forest management

Box 5.5

Tree Seed Sources for Village Nurseries near El Ain Forest Reserve

1. From **seed trees on village land**. Most villages have areas of woodland containing the most common species and most people know how to collect seed. Most people are also well aware of the things to look out for in a good mother tree (shape, health, fruit taste etc). Seed of other species such as **Guidem** (*Grewia tenax*) and **Aradeb** (*Tamarindus indica*) is not widely available so alternative sources must be found.
2. From the **forest office** at Wad-el-Bacha. Good forward planning is required to allow time for the project staff to order seed from elsewhere.
3. From **other villages**. Some villages have seed trees of less common species so it is possible to exchange or purchase seed between villages.
4. From **local markets**. Seed of many fruit trees is periodically available at local markets although it can be expensive.
5. From **newly established seed trees**. This has already happened with **Guidem** and **Mesquite** (*Prosopis juliflora*) which have begun producing seed soon after planting.

components. However, if the groups wish to continue operations they will be able to draw on project support in the form of technical advice and the procurement of seed and certain materials.

The course concluded, therefore, with a discussion on how this new type of arrangement between the project and existing nursery groups might be introduced. To reach this point of understanding, however, it was felt that it would be appropriate to follow several lines of enquiry. Firstly, on day one, the technical aspects of nursery practice in the area were reconsidered in order to identify physical constraints to continued production. This began with a review of the sequence of nursery operations, after which the participants split into four smaller groups to troubleshoot the particular problems they saw as being of most importance. On day two, the course focused on seed supplies and on nursery management and planning.

Creating a Sustainable Seed Supply Strategy

The background to this topic was succinctly summarised by one of the extension workers at the course in the following words:

People from the villages have told us that in the past the forest in this area was very good and there were many trees growing, each with their own special benefits for the people. Now, we find that not only has the forest disappeared, but also many of the different species have gone completely or have become very difficult to find. This means that we have lost the benefits we used to get from these trees but also, if we want to raise seedlings and replant them for the future, we have difficulties finding a source of seed.

Project staff believe that it is better to encourage the nursery groups to collect seed from local sources as much as possible, rather than relying solely on that supplied by the forest office. The advantages and disadvantages of five different seed sources were first discussed by the whole group (Box 5.5). The participants were then asked to split into smaller groups again and undertake the following two practical activities:

- To construct a monthly seed calendar, detailing the best collection times for 24 of the most highly valued species.
- To construct a series of distribution maps of potentially good seed stands, using a basic locational map of the area.

These activities generated a vigorous debate on species diversity and distribution in and around the forest reserve, and did much to concentrate people's minds on the potential for local collection. Leading on from this, project staff put forward the proposal for setting up a seed centre at the Wad-el-Bacha forest office. This would purchase seed from villagers, redistributing it to other villages, and elsewhere in Kordofan Province.

Improving Management and Planning

Discussion on management and planning at the **Sustainable Nurseries Course** revolved around two issues. Firstly, the impact of village politics on the success of the nurseries. And secondly, the role and attitude of the management committees in the organisation and delegation of work.

With regard to village politics, a number of boundary and land ownership conflicts exist between villages in the project area. This is connected to the nurseries insofar as some people have been raising seedlings to plant on disputed territory (perhaps as a means of securing ownership of this land). It was generally advocated by other course participants that such problems could not be resolved without recourse to higher authorities, but that in the meantime nurseries should produce only enough seedlings to plant on securely held land. Two nurseries are sited on disputed land. At Gahawa Hasabsidu village, for instance, damage has occurred to the nursery because of encroachment by livestock belonging to pastoralists who have settled in the vicinity. This example is of interest because it clearly shows that protection is not simply a technical matter, but also requires effective social control through local agreement.

Two main problems were identified with respect to the management committees: i) that in some villages committee members were keen to make all the decisions but were unwilling to do any of the work; and ii) some committee members did not give enough attention to their duties with the result that nursery work was often interrupted and delayed. A variety of suggestions were made for overcoming these management difficulties:

- The system of village meetings should be strengthened so that the whole group can make important decisions together on a more regular basis.
- Related to this, several groups recognised that management difficulties would be eased if they made better plans at the beginning of the season.
- A more careful selection of committee members was advocated as well as a policy for re-election if certain people failed to fulfil their duties in the eyes of the group. Similarly, the committee may be given the responsibility to sanction or exclude members of the group who are not taking their share of the work.

Project staff recognise that the village meetings held at the beginning of the programme had been decisive events in bringing people together to start a nursery. However, during the **Self-Evaluation** in 1991, doubts were expressed by the extensionists about how representative later meetings were in terms of who attended, who spoke and who made the decisions. Group meetings are most crucial at the beginning of each season so that everyone clearly understands

Everyone on the course agreed that one of the most keenly felt effects of a poor committee was that of declining participation in the nursery over time. Committees are only worth having, if they make the work of the group both easier and more effective. Only genuinely active people should therefore be selected.

Sustainability is often defined in terms of how long a particular activity continues after project/external support is withdrawn. Whilst in some situations this is a valuable indicator, it does not give the full picture. There is another angle of interpretation, which takes into consideration the changing needs of the people involved and group dynamics within the community.

where the nursery will be located, what species are needed and in what numbers, where supplies will come from, and who is responsible for different activities. To this end, the course participants drew up a list of the questions that need to be considered in annual planning, as listed in Box 5.6. The need for further training of extension staff in handling group meetings emerged as another priority for the future.

Box 5.6

Annual Planning of the Village Nurseries

Points drawn up by participants on the Sustainable Nurseries Course

1. Will the nursery continue into the next season or not?
2. Will it continue in the same way as before or will it be necessary to make changes in its size, location, or in the management committee?
3. What benefits are the nursery group looking for – seedlings, income or both?
4. What species are needed and for what purposes? Are these species suitable for the area?
5. How many of each species is to be produced, how big must the nursery be, and will there be the need for new nursery beds?
6. Where will the seed come from and who will collect it?
7. How many bags are needed from the forest office?
8. If seedlings are to be sold, who can they be sold to? What species do these people want? How many should be raised? What price should be put on them? Is it necessary to advertise the fact that they are available, and if so, how?
9. Who will be working in the nursery groups, and who is on the committee?
10. How can the work be organised so that it is shared out equally between all members? How will the benefits of the work be shared out at the end of the season?
11. Is all the equipment ready and in good condition?
12. Which species are slow growers and therefore need to be sown first? Which can be planted at a later date?
13. How can distribution and planting be organised to fit with crop cultivation?

A Note on Sustainability

The overall aim of this programme has been to assist and train interested groups or individuals in how to raise tree seedlings so that in future they will be able to do so unaided. Emphasis has been put not only on demonstrating correct technical practices, but also on supporting village-level planning and management. This combined objective has caused project staff to reconsider the meaning given to success and failure and sustainability.

The study has shown that setbacks have been experienced by many of the village nurseries in the first two years as a result of practical things (such as root pruning) not being done properly or at

the right time. However, such problems have not arisen because the people do not know how to manage a nursery. They might more realistically be regarded as a reflection of constraints in the group decision making process, and of alternative activities taking precedence over the nursery. The important thing to realise is that these problems should not be considered as failures if they constitute an important part of the learning process, and contribute to greater awareness and adaptation in the future. This belief is substantiated by the emphasis placed by participants themselves on improving their management skills.

One result of the flexible approach adopted by this project is that staff cannot guarantee, from one year to the next, which nurseries will stop production and which will continue. The only thing they can feel confident about is that the villagers clearly understand the 'why, when and how' of nursery practice and now have sufficient problem solving experience to tackle difficulties as they arise. Nevertheless, through the various evaluation exercises, project staff have gained a much clearer understanding of the factors which may influence whether or not the nurseries will continue. These include the perceived need for new trees, the strength and cohesion of the management system, the impact of village politics which may encourage or prohibit nursery production, and the opportunities which may exist to expand nursery production in new directions.

The 1993 season has proved to be very interesting because the project has been able to test its theory of '**two years intensive support and then withdrawal**' and contact with existing nurseries has been limited. Many of the nurseries went ahead and nursery group planning and management, seed collection and prearranged seedling sales went smoothly in most cases. It appears that the **Sustainable Nurseries** course did help stimulate people's understanding of how to carry the nurseries forward.

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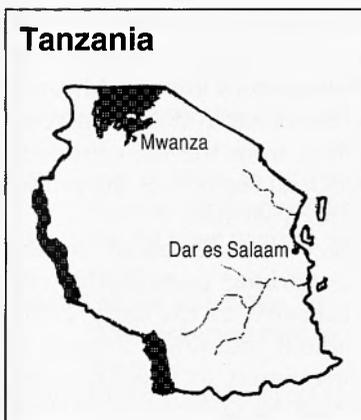
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ORGANISATIONAL PROFILE SOS Sahel/FNC (Sudan)				
LEVELS	SECTORS			
	Government Departments and Extension Services	NGOs and Private Organisations	Membership Organisations and Voluntary Roles	Traditional Authorities
International		[SOS Sahel - UK]		
National	Forests National Corporation (FNC)			
Province/Region	FNC- El Obeid office			
District/Local Government				Traditional Leadership (Omdas and Nazirs)
Village/Community	<i>Project (management and extension staff)</i> Sheikhs (and village committees)		<i>Village nursery management committees</i>	Village Sheikhs
Individual			Nursery Group Members and Home Nursery Producers	

6 The CARITAS Village Afforestation Project, Mwanza Region, Tanzania

Patrick Ndulu, Christian Guggenberger, Gill Shepherd and Jane Carter

This case study looks at an NGO sponsored forestry extension project which has been working in the Mwanza Region of northwestern Tanzania, over the course of ten years. During this time it has developed from a small tree-planting initiative in six villages to a project which is directly active in 34 villages and through its workshops and study tours, has influence far beyond its immediate remit. The incremental and flexible approach taken to nursery development appears to have been fundamental to its success. Through responding to expressed needs and placing emphasis on training, it has supported the establishment of a wide range of nurseries, many of which should be self-sustaining when external project funding eventually ceases. The great care taken to establish good links with government services, church and village leaders has also been critical. In this respect, one of the most frequent criticisms made of NGOs – that they fail to collaborate sufficiently with other organisations – has been defused. The study also shows how diversification has taken place in response to particular market opportunities which exist for nursery producers in different parts of the project area.



6.1 Economy and Farming Systems

Mwanza Region, which lies to the south of Lake Victoria, is divided into six administrative districts. It was in one of these, Mwanza, that the Village Afforestation Project (VAP) commenced, although it has

now expanded into a further three. Topographically, the area is characterised by low hills with granite outcrops, and wide open valleys. The climate is seasonally humid, with two rainy seasons per year (the short rains lasting from October to November, the long rains from February to May).

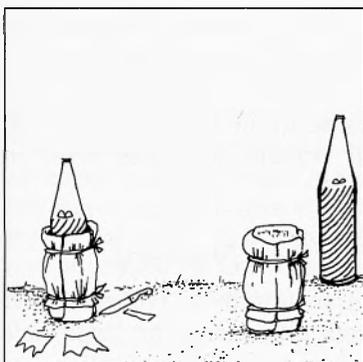
Important food crops are rice and sweet potatoes, grown on seasonally wet valley floors, and maize, millet and cassava, grown on the valley slopes. Cotton is also cultivated as a cash crop. Cattle are an integral part of the agricultural system, and have always been the most valued store of wealth to the local Wasukuma people. They and the Wakerewe comprise the bulk of the region's steadily growing population. According to the 1991 figures, the region's population totalled about 2.05 million, with a growth rate in rural areas of 2.1%, and 2.7% in the municipal district of Mwanza itself.

Traditionally, settlements were scattered, and land-holdings tended to be divided in transects across a slope – the ideal being a holding that ran virtually from hill top to valley centre. The land at the summit of each hill was usually tree covered, with those who lived around it possessing usufruct rights. This pattern changed in the 1970s, as a result of a major land reform programme initiated by the socialist government. In line with the national policy of *ujamaa* (roughly translated as 'familyhood' or the sharing of traditional life), land was reallocated into large holdings, each farmed collectively by a nuclear village. Thus the settlement pattern became one of clustered villages, each generally located near the bottom of a valley slope, close to a permanent water source. Two unforeseen consequences of this programme had a profound effect upon tree management in the area. Firstly, fuelwood gathering became far more concentrated in whatever wooded areas existed close to the villages. Secondly, it led to a loss of control over tree resources in areas distant from the village, such as the hill tops. These became subject to exploitation by entrepreneurs from nearby Mwanza town, seeking wood for charcoal production.

6.2 Project Objectives

The project commenced in 1983, with funding from the Austrian Institut für Internationale Zusammenarbeit (IIZ), and administrative support from the Catholic Church's Development Office of Mwanza Diocese. In 1986, the project was transferred to CARITAS Mwanza (the Archdiocesan Development Office). Funding from the IIZ continued until 1989, when CAFOD took over the financial support of the project which had changed considerably over its six year life.

The original objective of the project was to assist in the establishment of woodlots for fuelwood, working particularly with women. In common with international concerns in the early 1980s, both the IIZ and the Tanzanian government identified a crisis in fuelwood availability, and associated deforestation, as a key problem to be addressed. It was also felt important that the project should focus on women, as they were those most involved in fuelwood collection



Preparation of a polypot

Illustrations: IIZ, Vienna, Austria
from the booklet *Uanzishaji wa bustani (kitaru) ya miti*

Top: Use a bottle as a mould, wrap banana leaves around it and tie them together with string.

Middle: Fold the leaves over, tie again, trim, then remove the bottle.

Bottom: Fill the polypot with soil and use.

and use. A pilot study commissioned before the project's commencement recommended that it should target Destitutes' Camps, schools, parishes and villagers. An annual target of 50ha of plantation and 10,000 seedlings was considered feasible. It was assumed that most planting would take place on a cooperative basis, reflecting the politics of *ujamaa* which were then still in operation.

The forester recruited to the project commenced his work in 1983 by contacting local party and government officials and village councils, in anticipation of forming village forest committees. However, it quickly became apparent that communal woodlots were not feasible, as in reality neither local interest nor sufficient amounts of land were available. Instead, the project commenced operations in six villages, using these to investigate the potential for integrating tree growing with existing agricultural practices, working through interest groups.

In 1985 a survey of local opinions about tree planting and management and the fuelwood crisis was conducted. This resulted in the project adapting its strategy to the expressed needs of local people. The survey showed that villagers did not want to plant trees for fuelwood. They argued that much of the local loss of tree cover was due to towns-people felling trees to make charcoal. Thornbush growing in the area was sufficient to supply whatever fuel they themselves required. However, villagers were interested in raising trees for fruit and for poles, whilst elders, in particular, expressed interest in cultivating indigenous species valued for timber. These preferences were largely consistent with the species already being raised in project-supported nurseries, although subsequent production was even more closely dove-tailed to local demand.

The survey also revealed that for the project to gain widespread local acceptance, farmers needed help with the security of ownership and rights of usufruct of trees raised and planted by them. Assurances to this effect were possible with the changing political circumstances, and changing views on how forestry projects should be conducted. Since 1985 people have been encouraged to plant trees on whatever land is available, thus making private tree planting possible. Moreover, as from 1987, the official strategy of the national Community Forestry Section (of the Division of Forestry and Beekeeping) supported the decentralisation of tree nurseries and the move towards demand oriented seedling production, amongst other measures.

6.3 Seedling Production Strategy

In the 1983/84 planting season, a central tree nursery with a production capacity of 60,000 seedlings a year was established at a Destitutes' camp at Bakumi. Production was concentrated on indigenous species suitable for timber and pole production (such as *Melia azedarach*), and on fruit trees – the project forester having already noted that *Eucalyptus* spp and *Pinus* spp (as first recommended by the government service) performed poorly in the locality. In the first year, all seedlings were distributed free-of-charge. This strategy was

changed from the second year onwards, as it was found that villagers were willing to pay for seedlings.

In the second year, seedlings were again raised in the central nursery, but at the time of planting, petrol and thus motorised transport, was not available. The project was able to improvise by building a donkey cart, by means of which 45,000 seedlings were distributed to all six villages. The petrol problem emphasised the drawbacks of conducting a rural tree planting programme from a centralised distribution point. For the 1985/86 planting season, the decision was made to begin decentralising seedling production by helping interested farmers to set up their own small nurseries, at the same time as maintaining a central nursery. This was a sensitive move at the time, but care was taken to keep the authorities informed and at least tacitly in agreement. Although farmers were initially sceptical about setting up their own nurseries, fourteen volunteered. Their success in the first year motivated others, so in the following planting season (1986/87) a total of 39 small private nurseries were in operation.

The Evolving Role of the Centralised Nursery

In 1986 the central project nursery was transferred to Nyegezi, closer to Mwanza town. At this site, seedlings are raised for large-scale purchasers such as government and non-government institutions, as well as for urban people interested in buying seedlings for hedging and ornamental purposes. Thus, for example, in the 1986/87 planting season the nursery was patronised by a mission and hospital, an agricultural research institute, an agricultural extension project and over 250 individuals. In this first year, the Nyegezi nursery produced 10,000 seedlings of 21 species used for fruit and/or timber, hedging, and ornamental purposes. In subsequent years production levels increased slightly, to a modest 15,000 seedlings per annum.

The main functions of the central nursery have been training, research, and seed distribution. Seed collection is organised from the nursery, the seed then being processed, bulked and sold on site. Particular emphasis is given to a number of indigenous hardwood species, seed of which is now difficult to obtain. In addition, the nursery serves as a source of seedlings which farmers have difficulty in raising, such as teak (*Tectona grandis*). Research on the germination of newly introduced or difficult species is regularly carried out. Thus, a germination technique which could be readily used by farmers was identified for *Melia azedarach*.

Pilot Farmers, Interest Groups and Project Structure

Until the project attracted the interest of a few pilot farmers, it was very difficult for it to move forward. But once this was achieved, it became possible to arrange for groups of other farmers to visit those who had taken action. Some of these pilot farmers were familiar with

Building on informal contacts with a few interested farmers was essential at the outset. Nevertheless, it became necessary to tackle the problem of project multiplication and continuity more directly and identify a suitable extension structure through which to work.

The success of the project may be attributed, to a large extent, to the fact that it has been able to gain the active support of governmental, traditional and religious local leadership structures.

leadership roles because they had been catechists or, as in one case, a Village Chairman (as described in Box 6.1). An informal diffusion effect, of other villagers copying innovative individuals without the project having contacted them directly, was also noticeable.

The project was transferred to CARITAS Mwanza at the beginning of 1987, and at the same time expanded to cover the whole Archdiocese of Mwanza. In the following year, a hybrid management structure evolved. In order for villagers to have dependable links to the source of forestry extension, which in this case was based at, and funded through, the Catholic Church's development arm, the forestry project was explicitly attached to the centre-to-periphery structures of diocese and parish. This system had the reliability of the durable and the formal, yet took up only the time of those people most involved.

At village level, however, planning and execution of activities was carried out independently. The project set up a series of meetings of neighbours from particular quarters of villages, which were intended to help recruit more pilot farmers. From these informal meetings 'village interest groups' came into being – fairly small groups of farmers, formed independently of religious affiliation, interested in learning more about seedling production and tree planting. These villagers could communicate upwards through diocesan structures when they needed to, but be as independent as they chose in the village. Once a group was working successfully and had found its own identity, official recognition was sought, often by asking the Village Chairman or some other local dignitary to be patron of the group. The groups felt more comfortable with such legitimisation, while the elders approached liked to head successful groups.

Box 6.1

The Activities of Two Pilot Farmers

Example 1: Silveri R. Ng'wasonge

Silveri is a farmer who is also an unpaid catechist, he has both the personality and the authority to be a natural local leader. He is not wealthy and has limited land, but he has ringed his compound/home field with 600 *Melia azedarach* trees and can now supply his household's entire firewood needs from their side-branches, as well as having a magnificent pole-crop in the making. He is now thoroughly versed in the budding of oranges, and has taught other villagers and sold them orange-tree seedlings. All his neighbours along a several-mile direct track have now planted at least 50 orange trees each as a result of his efforts, and he himself made 28,000 Tanzanian shillings from selling oranges in 1988.

Example 2: Daniel L. Usagara

The project was keen to encourage the planting of private woodlots in some cases, and the foresters were delighted when a farmer in Usagara said he was interested in a plantation of Eucalypts. He had made enough money out of irrigated vegetables to own a plough and a cart for taking water wherever he needed it. The land he proposed for trees was spare and the low labour input trees require, was an attraction to him.

The farmer took 2,000 seedlings in 1987, but then hesitated and delayed planting them. The Tanzanian project forester threatened him with visits from groups of farmers to show them how he had wasted his seedlings, and in the end, with some project help, the trees got planted. Local reaction was initially mixed: some neighbours told him he was spoiling his field by putting trees in it. But he says he regards the trees as a pension, and he has also planted closely so that in the short run thinnings are yielding firewood and tomato stakes as well. He has added to them in each subsequent year, and other local farmers are beginning to copy him.

Source: Shepherd, 1989

Box 6.2

The Activities of Three Neighbourhood Interest Groups

1: Busweru Interest Group

In Busweru a group of about 20 was formed. Some members participated in the tending of a nursery of about 4,000 seedlings in the compound of the Village Chairman, while others raised their own nurseries at home and came to meetings simply for advice and information. They enabled another hundred people to plant trees by giving and selling them seedlings.

2: Ng'ombe Interest Group

In Ng'ombe, during 1988, a group nursery raised well over 3,000 seedlings, choosing to produce in the following proportions:

- 39% decorative trees including *Delonix regia*, *Bougainvillea* and *Jacaranda*
- 31% timber trees such as *Melia azedarach* and *Eucalyptus* spp
- 25% fruits – oranges, tangerines, papaya, *Annona squamosa* and *A. reticulata*
- 3% local medicine trees including *Azadirachta indica*
- 2% agroforestry trees, mainly *Leucaena leucocephala*.

Source: Shepherd, 1989

3: VIMITI Luchebele Interest Group

Luchebele village is in Nyegezi Parish where VAP and other CARITAS programmes are very active. VIMITI is a youth group of 4 girls and 5 boys, most of them still unmarried, who became interested in tree planting and nursery activities in 1988/89. In that season there was just the group nursery. The group has since received training sessions in nursery practice, and several short study tours have contributed to high motivation amongst the group. One member had the village animators training. In 1990, 6 of the members had private tree nurseries, in addition to the group nursery.

Source: CARITAS, 1991a

The Role of the Farmer Nurseries

Interest groups would consist of about 15–20 people, mostly men, some of whom ran group nurseries and many of whom ran individual nurseries. The compounds of village individuals (sometimes those of pilot farmers with whom the project had already worked) were used as regular places for interest group meetings such as weekly teaching sessions and follow-up surgeries. From the project's point of view, group nurseries were preferable, though most villagers chose the individual route. Three examples of the way in which these interest groups have worked are given in Box 6.2.

The farmer nurseries have become the main source of planting material in the rural areas and have effectively eliminated problems of transportation from nursery to planting site. In addition, they have served as an extension resource in themselves, with local people gaining ideas and enthusiasm for tree planting from observing their neighbours' efforts. Farmer nurseries may be run by a group or an individual and vary in size, from group nurseries of 2,000–3,000 seedlings down to one small nursery of little more than 10 seedlings. Most participating farmers have nurseries producing under 100 seedlings per year. In the case of some of the larger nurseries, establishment costs have been borne (at least partially) through project loans, which were to be repaid from the sale of seedlings.

Workshops

With regard to farmer training, a formal training course of three workshops was devised for newly formed interest groups. This comprised one workshop on the topic of forest loss and tree product availability, followed by a workshop in which a specific plan of action was discussed. The third workshop provided practical training. Topics included the selection, collection and treatment of tree seed; the procurement and mixing of soil; and general principles of nursery establishment. Some training still takes place at Nyegezi, but much is now conducted on site, at farmer nurseries. In support of this, three leaflets have been produced giving practical information (mainly in the form of clearly drawn pictures) on nursery establishment and maintenance, tree planting, and hedge making.

The emphasis of training throughout has been on self-sufficiency and hence sustainability. Farmers are taught how to select and obtain seed, in the process of which good examples of valued indigenous tree species are often located, for future seed collection. Demonstrations are provided of seedbed construction and the mixing of soil for them and for potting purposes. Techniques for building nursery shades and protection are also taught. Plastic polypots are available in the district, but since this may not always be the case, farmers have been shown how to prepare polypots from banana leaves (see page 69). Techniques for grafting fruit trees are also demonstrated. Training courses are followed up with problem-solving sessions, as necessary. Small 'study

tours', comprising visits by farmers to other farmers who have successful nurseries and/or tree plantings, were also initiated as an extension-cum-training tool. These have proved popular, and have been expanded in recent years.

6.4 Project Evolution

When CAFOD took over the funding of the project in 1989, it was for an initial three year period. In 1992, a further three year phase leading up to 1995 was agreed. The period 1989–92 has seen an expansion and consolidation of activities in some 35 villages, located across four districts. A second forester has been seconded from the Forest Department to work with the VAP.

The Nursery Programme

Since its small-scale commencement in 1983/84, the project has greatly expanded and is now supporting the production of tree seedlings on a significant scale. During the 1989/90 season, a total of over 71,000 seedlings were produced in VAP funded nurseries. In 1991/92 this figure was over 109,000 seedlings, as shown in Table 6.1. The table also shows that the greatest rise in production has taken place in the individual nurseries (although the actual number of nurseries has decreased).

Table 6.1 Seedling Production from the CARITAS Village Afforestation Programme 1989–1992

Type of Nursery	Number of Nurseries		Number of Seedlings	
	1989/90	1991/92	1989/90	1991/92
Individual Farmer Nurseries	105	97	26,668	59,750
Interest Group Nurseries	15	11	22,483	10,795
Institute Nurseries	5	6	7,551	7,100
Central Nursery – Nyegezi	1	1	15,000	32,175
TOTAL	126	115	71,762	109,820

Group nurseries have generally been less popular than individual nurseries. This may be a response to a general reluctance to work in any form of cooperative scheme. As far as the VAP is concerned, working with groups is preferable, as it is a more ready means of contacting a wider circle of people at one time. However, the project also accepts the need for flexibility, and therefore supports the establishment of nurseries as interest arises. The project finds it easier to arrange financial loans for nursery establishment to groups rather than individuals. A revolving fund was intended, so that money repaid from one nursery may be made available to another, individual or group. This has had mixed success, and the decision was made that from 1991/92 onwards, nursery materials rather than cash should be lent.

Although the project began with a specific focus on women, it soon became clear that the needs of men and women could not be addressed separately. It had to be accepted that interest in tree cultivation was sometimes greater amongst men. Nevertheless, an interest in working with women has been retained and in the current phase it is hoped to increase their involvement in forestry through an improved stove programme and specially planned workshops.

As can be seen in Table 6.1, the production capacity of the central nursery has been expanded. Although, in essence it remains a demonstration site, the intention has been for it to become financially self-sufficient through the sale of seedlings before the current funding period ends in 1995. Staff are in the process of establishing a two hectare orchard of orange trees near the project office at Nyegezi. The purpose of this is twofold: the expectation of income generation from the sale of fruit and the use of the orchard for demonstration and training purposes.

Farmers and the Market

A number of the individual and group nurseries are producing substantial quantities of seedlings for sale, records indicating nearly 80% of the 1991/92 seedling production being sold. By contrast, production in the smaller farm nurseries of under 100 seedlings each (59 in 1991/92) is almost entirely for the owners' use. Nurseries nearest to Mwanza town have far more attractive market opportunities for tree products than remote areas.

Fruit trees have provided the best option. Prices in Mwanza are high and rising, and for any farmer who has the means to transport fruit there, it is not worth selling locally. Citrus fruits are especially popular because they are durable and not easily bruised. In the villages, fruit is a luxury apart from home-produced and consumed pawpaw and mango. Citrus fruit seedlings have a certain market, but those who buy them cannot tackle very large numbers and the market in any one village is rapidly saturated since most villagers do not expect to sell enormous quantities of fruit. Poles have a potentially high value and even seeds can be sold near Mwanza, as can a variety

of seedlings including hedging species, fruit trees and ornamentals for urban house compounds.

Homestead and Woodlot Planting

It has been noted that whilst the original objective of the project was to support the establishment of community woodlots, this met with little response. Villagers were far more interested in private planting. The sites initially chosen were mainly small pockets of land around their homesteads and along field boundaries. Places some distance from home were not favoured, due to their vulnerability to theft and browsing cattle. The idea of planting a block of agricultural land with trees was also viewed negatively by farmers, food production being considered more important than tree products. This latter attitude appeared to change as people perceived an increasing market demand in particular for poles but also for timber and fuelwood. A few individuals and institutions have therefore established woodlots. In the 1988/89 season three were planted (totalling 9,600 seedlings) and in the 1991/92 season seven (comprising some 23,600 seedlings) were established. By the end of 1992, the total number of woodlots established with VAP support stood at 31.

Training and Institutional Linkages

Training has expanded into a major project function, in which it now has considerable expertise, since one of the two foresters seconded from the government service has undergone overseas extension training. Much of the project's work is conducted through village 'animators'. Local people who receive basic training in nursery and tree planting techniques pass on this knowledge to others in their village. By 1992, 30 persons had been trained as village animators. Training activities take place in five major areas, details of which are given overleaf in Box 6.3.

The current project foresters are both seconded from the Forestry and Beekeeping Division. Links in this direction have been strengthened through the Training of Trainers (ToT) programme. VAP aims to host at least two workshops for government staff each year. There has also been an exchange of information with the Ministry of Agriculture, which is now running a comparable tree-planting programme in another part of the Region. Study tours of 2-3 days, followed by a day of discussion, are also organised for Regional and District heads of all government departments to familiarise them with the work of the project. In the 1992-95 period, one trip is planned every year for each district. Cooperation with the Department of Education is already strong, with many teachers participating in the training workshops. Written into the 1992-95 phase of the project is a plan to assist 15 primary schools in establishing their own nurseries. A number of the institutional nurseries, established with project support, are already run by secondary schools and colleges.

Of particular importance is that a regular dialogue has been opened up with government departments which may be capable of sustaining the initiative beyond the life of the project.

Box 6.3

Training Activities Provided by the CARITAS Project

- **Residential Workshops**

These are conducted by the VAP foresters, and provide training to village animators, primary school teachers and interested farmers. They are held over 2–5 days. The emphasis is upon practical aspects of nursery establishment, tree planting, and tree harvesting, and lessons are accompanied by practical periods.

- **Field Visits**

Field visits are conducted regularly by the VAP foresters. They serve as a means of information exchange and informal advice and where necessary, short training sessions (of a couple of hours in length) are provided.

- **Study Tours**

Study tours are an important means of information dissemination. They usually last 1–2 days, followed by a 'processing day', in which the lessons to be derived from what has been seen are discussed and built upon. Participants include village animators, interested farmers, and village or ward leaders. People and sites visited include, for example, the central nursery, a farmer with a nursery or woodlot, and groups involved in tree planting.

- **Extension Events**

Various events designed to encourage tree-planting are held by Project staff from time to time. They include role plays, drama, videos and films, chosen as appropriate for the given audience.

- **Training of Trainers (ToT)**

Training is provided to government forestry extension workers in the approach adopted by the VAP. In this way it is hoped that the Project's participatory development strategy will spread to government operations. In the 1992–1995 phase of the VAP two such workshops are planned in each year.

Source: CARITAS, 1992

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ORGANISATIONAL PROFILE CARITAS Mwanza VAP (Tanzania)

LEVELS	SECTORS			
	Government Departments and Extension Services	NGOs and Private Organisations	Membership Organisations and Voluntary Roles	Traditional Authorities
International		[IIZ Austria] (1983-89) [CAFOD] (1989-)		
National				
Province/ Region	Forestry and Beekeeping Division (FBD) Ministries of Agriculture and Education	CARITAS Mwanza (Diocesan Development Office) <i>Project (Management and Extension Staff)</i>	Diocese of Mwanza	
District/ Local Government	Secondary Schools and Colleges FBD			
Village/ Community	Division / Ward Offices Village Councils		Parish <i>Village Animators</i> <i>Neighbourhood Interest Groups</i>	Village Elders
Individual			Group and Individual Nursery Producers	

7 The Vietnam/Sweden Forestry Cooperation Programme

Edwin Shanks

This case study examines the evolution of nursery production strategies under the Forestry Cooperation Programme (FCP), which operates in five provinces of northwestern Vietnam. This programme is the latest in a series of cooperation agreements between the Governments of Vietnam and Sweden in the forestry sector spanning nearly twenty years, with funding from the Swedish International Development Agency (SIDA).

Beginning with the construction of a pulp and paper mill in the late 1970s, industrial plantations were established to ensure future supplies of raw material to the mill. Alongside these a social forestry project was started in 1986, involving mass distribution of seedlings through the collective system of cooperatives and state enterprises (see Box 7.1 for a definition of these institutions) to enable farmers to replant degraded hill land. Under social forestry, a limited range of timber species seedlings were produced in nurseries controlled by provincial and district authorities. Since 1991, under the current FCP, provincial Farm-Level Forestry Projects (FLFPs) have begun which are testing new approaches to extension under an institutional context which has moved away from collective systems of production. These projects focus on a diversity of farming activities and a wider range of tree species associated with homegarden and forest land use.

This study is of particular interest because it illustrates the types of problems which may be encountered when decentralising and diversifying a large-scale seedling production system. Major questions relate to the redefinition of the role and functions of government organisations in the shift from 'industrial' to 'social' to 'farm' forestry. This study also shows how the distinction between horticulture and



Box 7.1

Definition of Communes, Cooperatives and Enterprises

Communes Communes are historically well established geopolitical units of rural society in northern Vietnam which pre-date the Marxist-Leninist system of government. They consist of a cluster of two or three villages, conforming to realms of local influence and authority based on strong family ties. In present day Vietnam, the Commune People's Committee represents the lowest tier of the political wing of government, and remains an influential voice both locally and at provincial level. Communes always had important functions in the regulation of land use, many elements of which persist today.

Cooperatives Through the cooperatives the state sought to build on collective relations of production which had long existed in the traditional communes. During the mid-part of this century the cooperatives had considerable power over the allocation and use of paddy and hill land. However, it was not possible to regard them solely as instruments of the state with common interests. They were more realistically a 'formal' sub-system operating within a much broader set of 'non-formal' relations aimed at both private and communal land management. During the 1980s the state progressively redefined the function of the cooperatives, reducing their power over land allocation and encouraging them to become self-supporting service and/or market supply organisations. However, in many places they were unable to achieve this transformation and have since become defunct.

Enterprises Enterprises are organisations under the control of state or provincial government, involved in production, marketing, material supply or a combination of these functions. In the agricultural sector they commonly take the form of estates, with estate workers, producing commodities such as tea and timber.

forestry effectively disappears when focusing on homegarden production. The study draws on the information and analysis contained in a number of internal project documents, consultancy reports and research by the author.

7.1 Economy and Farming Systems

There are considerable variations in land use over the five provinces covered by the current Forestry Cooperation Programme (FCP), ranging from the Red River delta to the mountains bordering China (Table 7.1). This paper focuses on the lowland and midland zones, where the farming systems and agricultural landscape can be broadly divided into three integrated sub-systems: irrigated or flooded paddy land, a settlement zone comprising the homegardens which border the paddy land and forest/hill land. Nearly all farm households have paddy land and a homegarden, and many have access to forest/hill land.

In many communes the hill land was forested within living memory and subject to common property regulations, but in recent decades it has been progressively deforested, often through the activities of state organisations including forest enterprises and the army. It has since been put to different uses whilst remaining, according to law, forest land. These hills are often referred to as 'bare hills', and since the 1970s they have been the focus of an intensive reforestation drive by the state. 'Bare hills' is, however, a misleading

Table 7.1 Land Use in the Forestry Cooperation Programme Area of Northern Vietnam

Area	Population Density	% of Paddy to Hill Land	Paddy and Hill Land Use Characteristics	Current and Potential Benefits from Trees
Edge of Red River Delta	High population density up to 400 persons/km ²	82%–18%	Extensive wet rice cultivation (2 crops per year and high yields). Hills important for staples such as cassava, grazing and for supplies of fodder and fuel. Hill land in many places heavily degraded.	Cash income from poles and material for pulp. Great potential for increased production from homegardens including fruit and fodder.
Middle Hills	Medium population density 90 to 100 persons/km ²	40%–60%	Restricted rice land (often 1 crop only) and average yields. Sufficient hill land to allow farmers to invest and experiment in tree/crop and livestock production for domestic use and marketing.	Cash income from poles and fuel. Potential for increased production from homegardens including fruit and fodder.
Mountains	Medium to low population density 40 or less persons/km ²	2%–98%	Very small areas of rice land with low yields. Hills critical for staples including dryland/hill rice, terraced wet rice and cassava.	Some cash income from honey and medicinal plants. Forest and fallow trees provide fruit, timber and fuel. Potential for marketing a wider range of NTFPs, plus enriched tree fallow system.

description because even though they may be denuded of tree cover, they are of great value as a supply zone for fodder and fuel and for temporary crop cultivation.

It is in the lowlands closest to the delta that the hills are most degraded. This results from the intensity of use under high population pressure – in excess of 400 persons/km² in some places. Associated with this is the continual drain of nutrients from the hills onto paddy land, by way of the conversion of livestock fodder (grasses and fodder crops such as cassava grown on the hills) into manure which is applied to the rice land. Further from the delta the proportion of hill land increases in area relative to paddy land. Lower population densities, in the order of 90 persons/km², mean that more households have access to these hills and there is wider scope for different combinations of tree, crop and livestock production.

The homegardens are an intensive system of domestic agriculture geared to providing household and local market needs in vegetables, fruits and small livestock. They are locally referred to as the 'VAC' system – an acronym formed from three Vietnamese words for garden or orchard, fishpond, and a pigsty or poultry shed. A wide variety of fruit tree species are intercropped in the homegardens with vegetable, medicinal and tuber crops. Around the perimeter, timber trees such as *Melia azedarach* are commonly planted together with bamboo, rattan and other woody species.

It is important to note that the homegardens were the one sector of land never collectivised under the Marxist-Leninist system of government. This resulted in a situation whereby institutional support for the different components of homegarden production is very weak. It is recognised that even modest increases in the productivity of existing plants through improved management, and improvements in the genetic material available to farmers – particularly of fruit tree species – could result in substantial benefits in household income and nutritional status.

7.2 Programme Objectives

In order to understand the way in which the nursery system is presently organised under the FCP, this section looks back at the origin and development of the industrial and social forestry projects. As already indicated, the projects arose out of the construction of a pulp and paper mill in the late 1970s. The mill was sited near to road, rail and river transportation links, some 100km northwest of Hanoi, at an intermediary point between sources of raw material and markets for the paper products. The mill initially used existing standing stocks of raw material including bamboo from the homegardens and hill land, and plantations of *Styrax tonkinensis* and *Mangletia glauca* situated in the mountains far from the delta.

From the mid 1980s, the Vinh Phu Service Union (VPSU), the organisation responsible for procuring material for the mill, began establishing new industrial plantations in collaboration with a number

of forest enterprises to ensure future supplies of raw material. These plantations were situated in the more accessible lowlands closer to the mill. This geographical shift into areas characterised by a lower proportion of hill land to paddy land, higher population densities and more degraded hills, made large-scale planting operations rational from the point of view of cost effective access to the mill. However, it was more problematic with respect to the limited availability of large tracts of spare land for tree planting and the latent demand for land and wood within the rural communes.

Social forestry began life in two communes of the delta area, in 1986, as one of several activities associated with the FAO Forests Trees and People project which was attached to the SIDA supported programme (Gayfer *et al*, 1990). It quickly gained momentum and was soon extended to other districts and communes under guidance of the Vinh Phu Service Union and provincial and district authorities. According to project documentation, social forestry was started for three reasons:

- To supply the mill with raw material.
- To supply local timber markets and help improve the economy of rural households involved in tree growing.
- To reduce the pressure being put on the newly established industrial plantations by local people. Illicit cutting of trees and collection of leaf litter for fuel had become a major problem in many plantations soon after they were established.

The project concentrated from the outset on building capacity for seedling production and distribution, and promotion of a specific planting technology. The package was one of monocropping with timber trees including *Eucalyptus camaldulensis*, *Acacia* spp and at a later date *Eucalyptus urophylla*. This approach stemmed from the close association of social forestry with the industrial plantations, and the considerable pressure put on local authorities and farmers by the state to 're-green' the bare hills. Nursery production was subsidised by the project so that tree seedlings were made available to farmers free-of-charge or at cost price.

7.3 Seedling Production Strategy

The number of seedlings produced annually through the social forestry project grew rapidly from 1 million in 1987, to 8.5 million in 1989, to 21 million in 1992. In the order of 50 million seedlings were raised and distributed during this period in 32 of the 39 districts in the FCP area. By 1992 there were some 330 formal and informal nurseries in operation. Several parties have been involved in the development of the system:

- The VPSU, the organisation overseeing the industrial plantations,

initially had responsibility for procuring and channelling seed and consumables funded by the project to the provincial and district authorities. They also provided technical supervision of nursery activities.

- The provincial Agriculture and Forest Departments (AFDs) were responsible for coordinating with the VPSU on project inputs, allocating government financial contributions, primarily labour costs, and approving the plans for seedling production and planting targets submitted by the Forest Protection Stations (FPSs) at district level.
- At district level, the FPSs were the main implementing agency. They had ultimate responsibility for the project by realising targets, planning and data handling. They also determined the location of the nurseries and who managed them and arranged seedling distribution. The FPSs play an important strategic role at district level. Since they have sufficient human resources and the mandate over forest land, they have been intimately involved in the process of forest/hill land allocation for tree planting purposes.

The majority of nurseries, including the largest nurseries, were established under direct management of the Forest Protection Stations. Even so, a great variety of contract arrangements evolved for nursery management as follows:

- Nurseries managed directly by FPS staff.
- Nurseries under cooperative control but managed by individual households or groups of households under contract with the cooperative.
- Nurseries managed by individual or groups of households under contract with the FPSs.
- Nurseries under the control and management of state enterprises and their employees.
- Nurseries managed by other institutions such as forestry training colleges.

In a way, therefore, the system which exists today is extremely diverse. Different management strategies have arisen out of particular negotiations and agreements made between the FPSs, other institutions and individuals. This reflects a common pattern of adaptation of general guidelines for development laid down by the government to local circumstances and needs.

Decentralisation to smaller scale nurseries in order to achieve wider and more effective distribution also began under social forestry. This was most commonly through the distribution of newly

Workers at a Social Forestry nursery in Vinh Phu, Vietnam

Photograph: Edwin Shanks



germinated seedlings from central nurseries (managed by the FPSs) to satellite nurseries (within the communes).

Land Reform and Social Forestry Targets

Recent economic reforms in the rural areas of Vietnam have been built on changes in the official system of land holding, combined with a breakdown of the collective systems of agricultural production. Under the new Land Law, land is made available to farming families and organisations on the basis of 'allocations', for periods of up to 15 years for agricultural land and between 30–60 years for forest/hill land.

With regard to paddy land, the reform generally reaffirms existing spatial arrangements and tenurial agreements. But for forest/hill land it is involving the actual reallocation of large areas with significant changes in land use. Land which has for many generations served as a supply zone – as a source of fuelwood and fodder and as reserve crop land which could be allocated to households for one or two years in times of hardship – is now being put under the tenure of fewer households for extended periods of time. It is in this context that the social forestry project supplied seedlings to enable farmers to actually establish trees on newly allocated land.

According to policy, the allocation of forest/hill land should be directly to farm households resulting in a formal tenure certificate. The allocation of small parcels of land to a large number of households is, however, a lengthy procedure with high administrative costs. As a result of this, direct entitlement began slowly. An alternative route, which was commonly adopted in the early years of the land reform, was for forest/hill land to be certified under the name of the cooperatives who in turn made contracts with farmers for tree growing. The exact terms of these contracts, which were made in the late 1980s, varied greatly from commune to commune as the following examples show:

- Farmers get 50% of the harvest and the cooperative 50%.
The forest tax is paid by the cooperative.
Planting, tending and protection is done by the farmers.
- Farmers get 25% of the harvest in return for protection.
Planting and tending is done by the cooperative through collective labour.
- Farmers get 70% of the harvest and the cooperative 30%.
The forest tax is paid by the cooperative.
Planting and tending is done by the farmers.
- Farmers get 60kg of rice per protected hectare and 20% of the harvest.
- Farmers get 80% of the harvest in return for tending and protection.
The cooperative supplies the seedlings and does the planting.

In total, 7 million ha of forest/hill land have been earmarked for reallocation nationwide. This represents a forest land reform on a scale unparalleled in any other country in recent decades. A significant proportion of this land is not under tree cover, but the government's intention is to see it forested. This has created a large demand for tree seedlings and in consequence has led to the rapid development of the social forestry nursery system.

To begin with, a majority of the resources provided by the social forestry project reached farmers through this contract system. For instance, a survey conducted in three districts (Thanh Hoa, Ham Yen and Van Chan) in the 1990/91 season found that 74% of the 946,000 seedlings produced were distributed through the cooperatives (Kardell and Boi, 1992).

At this time, the cooperatives were under increasing pressure from the state to operate as self-sustaining economic units. Therefore, it was in their interest to establish contracts with more prosperous farmers who were likely to fulfil their part of a production agreement. Thus, a joint venture with a few well-off farmers was a better way to nurture a cooperative's investment in forestry than taking the risk of dealing with a large number of poorer families. The cooperatives themselves became a major client of social forestry, a situation in which they can be said to have had both a positive and negative influence.

Cooperatives were at an advantage because they could take over large areas of land and implement reforestation activities quickly. They were also able to merge the incentives provided by the social forestry project with the requirements set for land allocation in a single contract agreement with farmers. In some cases these contracts also included terms for seedling production, as illustrated by the example given in Box 7.2.

Box 7.2

A Combined Agreement for Nursery Production and Forest/Hill Land Use Luong Vuong Commune, Tuyên Quang Province

A leading farmer in this commune is a retired school teacher who now has the time, interest and economic resources to invest in forestry. In 1988 when news reached him about the forest land allocation policy he made an application for land to plant trees. In the first year, after receiving the land, he went to the FPS nursery to get 4,000 seedlings, few of which survived due to late planting and poor quality of the stock.

In 1990 he took on the responsibility of managing a tree nursery producing 100,000 seedlings under direct contract with the FPS. The nursery is in his own homegarden. The FPS provides the seed and materials and organises the distribution of seedlings. In return the farmer receives 20 dong per seedling produced, has free seedlings for his own plot, and can use cast-off consumables to produce extra seedlings for cash sale.

Only 10 households in the commune had been allocated forest land in 1991. This farmer has two separate plots which he has planted with timber species. At present he does not know where the market for the timber will be, or whose responsibility it will ultimately be, to develop market linkages. His first priority has been to establish the plot, for which he is under contract and to maintain the trees until they are ready to harvest.

Yet, this farmer has much more ambitious long-term plans for the plots. These included planting other tree species, particularly fruit trees, establishing a living fence of rattan around the plots, as well as bringing in colonies of honey-bees to make use of the *Eucalyptus* nectar. The farmer has already begun to diversify the species on the plots by direct sowing of the candle-nut tree (*Aleurites moluccana*).

Source: Gayfer and Shanks, 1991

Initial development of the social forestry nursery system was, therefore, bound up with complex realignments taking place in the relationship between the state and people in the rural communes, associated with land reform and the transformation demanded of the cooperatives. This gave rise to a number of unanticipated constraints and inequities in the seedling distribution system which may be summarised as follows:

- Nursery production and seedling distribution were tied almost exclusively to the contracts made for forest/hill land use. Social forestry seedlings, though produced on a massive scale, were not freely available to anyone who wanted them, as most were assigned to specific clients included in cooperative/FPS plans, before the nursery season commenced. In many communes it was only a minority of households which received allocations of hill/forest land.
- This resulted in a situation where only a small number of seedlings were available on an unrestricted basis. These seedlings could be produced outside the plan as a result of good nursery work. As they were generally sold at the real market price, this worked to the disadvantage of those farmers not able to take over forest/hill land. At the same time, it should be recognised that farmers have always had access to other sources of tree seedlings if needed. Many rely on natural regeneration of trees in their homegardens, in particular of *Melia azedarach*, for replenishment of their timber reserves.
- The FPSs and cooperatives tended to favour a uniform plantation yielding a marketable product (sawn timber, pulpwood) at the end of a 10–15 year rotation. However, many farm households look for a more flexible approach using a wider range of species. Where households were sub-contracted by cooperatives it was normally the preference of the latter which determined the planting model. In this situation, there was always the danger of inadvertently tying up large areas of land in a form of monoculture that could be sub-optimal in terms of variety, volume and frequency of products which a family requires from a piece of hill land. Moreover, there was little incentive or scope for nursery producers to diversify the species raised in the nurseries.

The decision-making focus of social forestry has been centralised at district level. Decisions about who received seedlings and in what numbers, pricing policies, and in many cases, who was allocated land for tree planting purposes were all sanctioned by the FPSs. One commentator suggested that they may have been the real economic benefactors of the project since all seed and consumables passed through their hands.

Problems Resulting from Large-Scale Production

The rapid growth of the nursery system has meant that government staff have been preoccupied with handling large numbers of seedlings. A number of technical and managerial problems resulted from this:

- Insufficient attention has been paid to seedling quality. Large amounts of seed, for both industrial and social forestry nurseries,

have to be purchased outside Vietnam. However, seed utilisation and seedling quality could be much improved by better nursery practices and especially by reducing environmental stress. For instance, it has been estimated that, on average, only between 30,000 and 33,000 pricked-out seedlings are obtained per kilogram of *Acacia mangium* seed sown in the germination beds. This is significantly lower than seed utilisation rates for the same species elsewhere in South East Asia, such as in Sabah, where an average of 60,000 pricked-out seedlings per kilogram of seed is achieved.

- With so many different sources and destinations for seedlings, discrepancies between supply and demand and delays in the distribution schedule were inevitable.
- Production also outstripped the capacity of the staff involved to follow up effectively on what happens to the seedlings once planted and to provide continuing managerial advice.

Despite these problems, social forestry has provided an effective 'start-up' package, enabling farm households to occupy newly allocated plots of forest/hill land. The planting of trees confirms ownership after which farmers can, if they choose, embark on the long-term task of turning the tree plots into more diverse forest gardens. In many places this is resulting in creative experimentation by innovative farmers as they exploit the opportunities now open to them. However, in order to support this, a more intensive and diverse system of extension support is required.

7.4 Project Evolution

The situation described above illustrated the problems commonly arising in 'target driven' afforestation programmes involving seedling distribution from centrally controlled nurseries. The way in which these problems manifest themselves, however, is unique to the extraordinarily complex political economy of rural Vietnam. The relationship between state organisations and the communes has long been one of contract agreements for the production of goods required by the state (such as rice, tea, timber and tree seedlings), in return for which subsidised inputs are provided together with some form of incentive payments. This type of relationship pre-dates the cooperative era and may well continue in one form or another in the future.

At the same time, the combination of land reform and legitimisation of informal, private sector marketing ventures is resulting in an upsurge of economic activity at the level of family business. The income of many families is rising, although not solely through increases in agricultural production. Of equal importance is that individuals are increasingly taking over service/supply functions formerly assigned to the cooperatives.

In this situation, the government is faced with the critical question

of what type of land use extension organisation is needed in the future and how the system should be developed to respond to the new demands being made by farmers. Attention to such issues has gained momentum following a recent government directive of 1993 (Decree 13), which stipulates that each province should establish a new system of integrated agriculture, irrigation, livestock and forestry extension.

It is within this context, that the FCP began operating in 1991. As well as starting new activities the FCP has inherited activities from the old programme, including the social forestry nursery system, which needs to be placed into a new institutional framework.

This section looks at the way in which the nursery system has been adapting under the Farm-Level Forestry Projects (FLFPs) which have been started in each of the five provinces covered by the FCP, under the management of the provincial Agriculture and Forest Departments. Nursery production still consumes a major proportion of the budgets allocated to these provincial projects, yet interest and time spent on organisational development has focused on other newer aspects of extension.

Differences between Farm-Level Forestry and Social Forestry

The objectives of the FLFPs differ greatly from those of social forestry. Rather than operating over a wide area from the outset, the FLFPs have begun work in a few 'pilot' communes and villages in each province. An extension system is being tested and developed in these places through which deeper and more sustained contact is fostered with individual farm households than was usual in the past. At the same time, the purpose of the projects is to define organisational models and agroforestry models, which will be replicable on a wider scale in the future.

An essential feature of this approach is that, at all stages, it should be directed by farmers and commune/village-level groups as much as by the government agencies involved. As a basis for this, work in each village begins with a Participatory Rural Appraisal (PRA) exercise lasting several days. These exercises involve a depth of analysis of local farming conditions and needs that is completely absent in the social forestry system. They also involve a level and type of dialogue with farmers which is new to most government staff. The PRAs have the following overall objectives:

- Achieving a mutual understanding between villagers and outsiders of the land use situation in the village, the constraints and opportunities faced by rich and poor households alike, and the priorities for extension activity.
- Generating information which can be used in the planning process and as a baseline for future monitoring and evaluation.

Farmers and extension workers transferring a 3-D model of village land, used in land use planning, on to paper. Tree leaves are used to indicate different forest areas on the model. Yen Bai, Vietnam.

Photograph: Bardolf Paul



- Formulation of a preliminary Village Development Plan that can be analysed for technical and practical feasibility and given detail accordingly, prior to implementation.

It is important to note that the PRAs also define needs in relation to other, often more important, aspects of land use. From a technical point of view, the FLFPs began by concentrating on forest/hill allocation and the establishment and maintenance of forest plots and upgrading the quality and management of fruit trees in the homegardens. However, soon after the projects began, a rural credit scheme was incorporated which has radically altered the scope of the projects. Farmers in all areas are using credit almost exclusively for investment in livestock, for example, in fish stock and fish pond renovation, pigs, buffalo, goats and cattle.

Investment in livestock production has the dual advantage of quickly increasing household income, through the sale of meat, as well as increasing the turnover of nutrients and the availability of manure to fertilise paddy land. It also immediately gives rise to a set of secondary needs in relation to animal husbandry and veterinary care and fodder production. Diversification of the extension system and increasing interdisciplinarity are a necessity, not an option, in this situation.

The need for new approaches to community-level management of project resources/inputs is being achieved through the formation of elected Village Management Groups (VMGs). In many places these groups are made up of people who formerly held responsibility in the cooperatives, as well as representation from the political wing of government – the Commune People's Committees. The VMGs are responsible for such activities as nursery organisation, management of credit allocation, compiling the Village Development Plans, coordinating with the district/provincial extension staff, as well as being involved in farmer training.

Adaptation of the Nursery System

Experience has shown that the PRA exercises yield a diverse picture of farmer demands for a variety of tree species for different categories of land. Based on farmer requests, the Village Development Plans then provide the necessary data for nursery production. However, re-organising the nursery system to respond to this situation is proving to be a complex process.

With the introduction of the FLFPs there was a period of intense debate about what should happen to the mass seedling delivery system that had developed under social forestry. At least three different points of view were put forward:

- One option was to channel the requests made in the Village Development Plans through the existing nursery planning and production system. However, some commentators suggested that

the types of nursery needed for farm-level forestry are so different in size, species raised and techniques, that it would be very difficult to convert the existing system in this way.

- An alternative was to phase out social forestry and redirect resources to the establishment of community-based nurseries managed on a group or individual basis. What would remain would be a delivery system geared to providing the necessary inputs for the scale and type of nursery operations defined by the Village Development Plans. This would imply three things. First, the nurseries would have to be much smaller and more diversified. Second, several years would be needed to decentralise the system and find its appropriate form. Third, rather than controlling production, the government organisation would become strictly a supplier of certified quality seed, providing additional technical, administrative and training services where required.
- The third option put forward was to concentrate on commercialising nursery production. Skilful nursery managers in the social forestry system would be identified and asked whether they were interested in starting a nursery on their own. The FLFPs would offer incentives, such as seed and consumables at cost price to be paid back at low interest rates once the seedlings were produced and sold. Nursery managers would be allowed to sell seedlings at the best price they could get.

However, it has proved unrealistic to assume that definite policy decisions can be taken and implemented by the FLFPs in any one direction, and what has been happening in practice falls somewhere between these options.

The political impetus behind the afforestation drive is such that it is impossible to simply curtail the mass delivery system even if this were desirable. At the same time, adjustments are being made to the system to make it more responsive and the organisations involved more accountable. Of note here is the decision by several provinces to remove sole responsibility for management of the social forestry nursery system from the Forest Protection Stations. In these provinces it is being integrated with the newly emerging land use extension organisation at district level. Thus, a general situation exists in the FCP provinces today whereby:

- The mass seedling delivery system is being maintained. It operates outside the FLFP pilot villages and (together with sources of government funding) continues to consume a large proportion of the FLFP budgets allocated to seedling production.
- A parallel system of small-scale nurseries is being fostered in the FLFP 'pilot' villages, where emphasis is being put on bringing

nursery management and the technical skills of tree propagation, under the control of the Village Management Groups and farmers themselves.

However, in many villages the systems have overlapped and the distinction between the two approaches to nursery management is not clear cut. This is illustrated by the example of Thanh Long Village in Tuyên Quang Province, where the introduction of the FLFP followed shortly after the distribution of social forestry seedlings the year before (see Box 7.3). This example shows how farmers, the Village Management Group and district staff are being asked to cope with a difficult process of institutional change, the final outcome of which is still uncertain.

Box 7.3

Transfer from Social Forestry to Farm-Level Forestry in Thanh Long Village, Tuyên Quang Province

In Thanh Long, much of the forest/hill land recently allocated to farmers is ex-plantation land released from a nearby forest enterprise. This land was harvested before reallocation. Several farmers are encouraging natural regeneration of *Mangletia glauca* and *Styrax tonkinensis* trees through minimal tending combined with enrichment planting.

Social Forestry seedlings were first distributed to the village in April 1993 from a Forest Protection Station nursery situated outside the village. These seedlings were predominantly of *Mangletia*. When the seedlings arrived, no technical advice was given on planting techniques with the result that site preparation was done badly. This, combined with a period of low rainfall at the time of planting, meant that many farmers experienced considerable losses, with survival rates as low as 30% being quite common.

Somewhat surprisingly, farmers in the village do not seem to be upset about the failure, but realise the need to learn from the experience. Many believe that *Mangletia* is the wrong species for the land and with the advice of extension staff, have turned their attention to *Acacia mangium* as an alternative.

Following the introduction of the FLFP and the Participatory Rural Appraisal which took place in June 1993, it was decided that a tree nursery should be set up inside the village. This is being done by an individual farmer, Mr Lau, and his son. Mr Lau had planted 5,000 social forestry seedlings on his 3ha plot of forest land but experienced the same low survival rate as the other farmers. He has taken 500,000 dong from the FLFP credit scheme to invest in labour costs for the tree nursery, whilst the project has supplied seed and materials. He is under contract to the Village Management Group to produce in the order of 40,000 seedlings, a majority of which are *Acacia mangium*. Mr Lau expects to get 50 dong per seedling when they are ready for distribution, which means he should get a return of about 300% on the credit investment. This is evidently a major undertaking for the household, involving a heavy labour input. He has had some problems with seedlings dying after germination but does not know why this occurred and would like more technical assistance.

Introduction of the FLFP has included a two-day course in nursery techniques and the management of fruit and forest trees. The heavy emphasis being put on *Acacia mangium* by most farmers and extension staff is questioned by some people. For example, one poorer farmer requested *Styrax* in the belief that it is safer to rely on indigenous species, which he believes grow quicker than other species and are also more hardy. However, this farmer has been told that *Styrax* is unavailable.

Source: M Beckman pers. comm.

This case study concludes by highlighting two aspects of this process of institutional change which require further attention if the nursery system is to achieve a more settled form in the future.

Diversification into Homegarden Species

The village nurseries being developed under the FLFPs are generally

well equipped to produce forest tree seedlings. The situation with respect to fruit trees for the homegardens is in many places more problematic.

As already indicated, because the homegardens were never collectivised, institutional support in the horticultural sector is today very weak in terms of advice, research, training and supplies of propagation material. Even so, informal transactions of homegarden species were maintained within and between villages, with a few individuals in each area acting as repositories and sources of technical knowledge and genetic material. Effective 'extension' in horticulture, such as it exists, is thus mainly private although not necessarily commercialised. Up-to-date practices and input intensive production is found close to urban markets, such as Hanoi, where rich farmers and cooperatives specialising in citrus or other species employ their own advisers.

This situation presents a dilemma for the FLFPs. The demand for fruit tree seedlings being made through the Village Development Plans is high. In order to meet this demand in the short term, the district authorities are making contracts for large quantities of seedlings with the few experienced and well established fruit tree producers. They are then arranging transportation of these seedlings to project villages, often over considerable distances. However, because of the wide range of species involved, and the differing nursery schedules demanded by each species, it is often proving difficult to arrange seedling distribution so that the correct number of seedlings, of the right species, arrive in the villages in time for planting.

The alternative approach, of helping to increase the capacity to propagate fruit tree seedlings within the villages, is constrained by the lack of training skills and the paucity of sources of improved stock. There is no immediate solution to this problem, but the situation highlights the need for the extension system to draw on a wider pool of different sources of expertise and plant material in order to fulfil the objective of providing for homegarden needs.

Reformulating Contracts and Improving Accountability

Since in a majority of communes the cooperatives have ceased to function, farmers receiving seedlings for forest/hill land are now rarely obliged to enter into contract agreements. The one situation where this still takes place is with respect to use of 'watershed' land that has not formally been allocated to individual households. The status of the large number of cooperative/farmer contracts made in the late 1980s is unclear, but it seems likely that in most cases these have been abandoned by tacit agreement.

However, the system of 'contract production' remains strong with respect to nursery production in the social forestry system as well as in some FLFP villages. It is apparent that one of the most critical constraints of effective decentralisation of the nursery system lies in the way in which these contracts are formulated.

Nursery managers are often under contract to the district authorities and are therefore primarily accountable to them. Whilst on the one hand this may provide an element of security for nursery managers, there are also risks attached, mainly in delayed payments for the seedlings. These risks and opportunities are illustrated by the example of one nursery manager as described in Box 7.4. However, this example also shows that the current alignment of these contracts means that there continues to be little accountability towards the end users, the farmers. In many cases district authorities are still at liberty to alter plans and redirect the distribution of seedlings.

The decentralisation of nurseries under the FLFPs is not, therefore, simply a matter of siting smaller nurseries in the project villages and encouraging the development of farmer skills in raising trees. There are two more important conditions. First, the terms of production should be such that nursery managers are made more accountable to

Box 7.4

Tree Nursery of Mr Hoe, Ngoi Village, Tuyên Quang Province

Mr Hoe is a prosperous farmer in one of the villages where the FLFP is working in Tuyên Quang Province. As well as owning a home garden and paddy land, he secured access to 30ha of forest land in the 1980s. On certification of this land, however, he gave 20ha to other families in the village, keeping 10ha for his own use. He has been progressively turning this into a mixed forest garden, planting timber species and encouraging natural regeneration, planting fruit trees (mainly citrus), together with vegetables, pigs, bees and a large fish pond.

In 1990 he started a small nursery to raise seedlings, on site, for his own land because supplies from elsewhere were unreliable. The following year, the district Forest Protection Station started to make use of his skills, to raise seedlings on a contract basis for the state reforestation programme. These seedlings are for distribution in Ngoi and other villages. In line with the provincial government's recent decision to remove seedling production from the Forest Protection Stations, this contract is now with a local Forest Enterprise.

Since 1992, Mr Hoe has been raising forest tree seedlings, also on a contract basis, for the FLFP in Ngoi Village. In 1993, he was further contracted by the district authorities to raise 40,000 coffee seedlings, although farmer demand for these has been minimal and many remain pot-bound in the nursery. For the 1994 season, he now has three nurseries in different locations and is raising in the order of 500,000 seedlings, mainly *Acacia mangium*. The situation of Mr Hoe illustrates the considerable opportunities, as well as risks, attached to raising seedlings on a contract basis for external organisations such as the project and local authorities. The risks may be summarised as follows:

- The absence of advance payments to cover production costs and frequent delays in back payments from the local authorities, mean that he has to personally invest a considerable amount of money in labour costs.
- Lack of seedling uptake for some species means that contract payments may not be fulfilled. For instance, final payment for the coffee seedlings may be withheld because they have not left the nursery and he may lose money on this venture. This reflects a deeper problem of state directives, in this case for coffee production, not matching local interests.
- Handling contracts with different organisations may result in over or under production. For instance, seedling requirements within Ngoi village were not fulfilled in 1993 because the Forest Protection Station demanded, at a late stage, more seedlings for distribution elsewhere.

At the same time, Mr Hoe is firmly of the opinion that having the nursery situated in the village has made it easier to fulfil local demand. In a recent evaluation of the FLFP in Ngoi, he suggested that further efforts should be made to generate the capacity within the village to raise fruit tree seedlings. At the moment, these are transported from central nurseries, with the result that the specific demands made by farmers are not met.

the Village Management Groups. The second area of concern lies in the way in which the supply of subsidised material inputs can still be used to impose conditions on nursery managers.

This case study has shown how control over material supplies has given mid-level government organisations a considerable amount of power in the past. Not only did it ensure the maintenance of employment, but it also enabled them to determine production contracts. Continuing economic liberalisation in the country today has set a very new agenda for adaptation of the public sector services. In this situation, one of the most pressing, yet sensitive issues facing extension planners is the extent to which government organisations should continue to be heavily involved in the control of material supplies. The alternative policy will be to transfer such responsibility to the informal sector, leaving the extension organisation freer to develop advisory capacities which remain underdeveloped, particularly with respect to homegardens.

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ORGANISATIONAL PROFILE Vietnam/Sweden Forestry Cooperation Programme

LEVELS	SECTORS			
	Government Departments and Extension Services	Quasi-Governmental Organisations	Membership Organisations and Voluntary Roles	Political Authorities
International	[SIDA]			
National	Ministry of Forestry			
Province/Region	Agriculture and Forest Departments <i>Provincial FLFP extension team</i>	Forest Enterprises		
District/Local Government	Forest Protection Stations Agriculture & Forest Sections <i>District FLFP extension teams</i>	Material/Service supply companies		
Village/Community		<i>Cooperatives</i>	<i>Village Management Groups</i>	Commune People's Committee
Individual			Individual Nursery Managers	

8 Discussion: Processes of Decentralisation and Diversification

As noted in the Introduction, we chose to examine the experience of these rural development forestry programmes from the particular viewpoint of nursery organisation for two reasons. The topic merits specific attention because nurseries have been the focus of the high levels of government expenditure and donor funding devoted to boosting tree planting by farmers in recent years. The topic is of wider relevance because it brings into sharp focus the relationship between factors of supply and demand on the one hand, and the processes involved in decentralisation and institution building at the farmer-agency interface on the other.

It has been suggested by Fisher (1990), that rural development forestry is by definition concerned with the decentralisation of productive activities and decision-making powers. In this respect, the major questions which need to be tackled are often those which relate to how, and to what extent, government agencies can handle a programme of decentralisation. In this final chapter, this statement is used as a general hypothesis to test the experience of the different programmes examined in the preceding case studies.

The discussion begins by reviewing the comparative advantages and disadvantages of centralised and decentralised strategies for nursery production and a summary of these particular arguments is given in Figure 8.1. It then goes on to highlight some of the more significant trends and lessons regarding small-scale production, drawing on evidence from the case studies supplemented by examples from elsewhere. Particular attention is given to the need for adaptive planning, nursery diversification, the role of nursery management groups and linkage organisations, and research and training. The

Figure 8.1

Comparative Advantages and Disadvantages of Centralised and Decentralised Nursery Systems

Issues	Centralised Systems		Decentralised Systems	
	Advantages	Disadvantages	Advantages	Disadvantages
Management	<ul style="list-style-type: none"> Ease of forward planning, financial disbursement and monitoring. 	<ul style="list-style-type: none"> Target driven production leads to less responsive nurseries. 		<ul style="list-style-type: none"> A programme driven by farmer demand is less easy to plan for in advance. Planning and monitoring requires additional information gathering exercise during slack season. Disbursement of funds has to be flexible.
Staff employment and farmer participation	<ul style="list-style-type: none"> Personnel costs (per seedling produced) can be kept to a minimum in the input of both manual labour and supervision. 	<ul style="list-style-type: none"> Economic benefits from raising seedlings go to only a few people. Local people's participation usually limited to wage labour. 	<ul style="list-style-type: none"> Benefits of cash earning from raising seedlings may be more widely distributed. Local people involved. 	<ul style="list-style-type: none"> Staff time and costs may be increased as decentralisation takes place. Additional training and supervision of field staff required.
Seedling production	<ul style="list-style-type: none"> Production of seedlings may be more guaranteed and quality may be controlled. Central nurseries can serve as a reserve against failure of small-scale nurseries. 	<ul style="list-style-type: none"> The selection and relative numbers of seedlings raised may not reflect farmer needs and preferences. Plantation production often dictates a limited range of species. 	<ul style="list-style-type: none"> Higher potential for the range of species and number of seedlings raised to correspond with farmers' needs. Potential for diversification of production at the nursery site. 	

8.1 continued	Centralised Systems		Decentralised Systems	
Issues	Advantages	Disadvantages	Advantages	Disadvantages
Transportation and Material Supplies	<ul style="list-style-type: none"> Supply of external materials easy to a few nurseries. 	<ul style="list-style-type: none"> Transportation of seedlings to many remote farm sites often a major problem (in actual cost, timing and seedling damage). 	<ul style="list-style-type: none"> Transportation problems are minimised – as a result there is more choice in production methods, and timing of seedling collection and planting. 	<ul style="list-style-type: none"> Arranging material supplies to many widespread nurseries is time consuming.
Training and Research	<ul style="list-style-type: none"> Training courses and facilities readily housed at central locations. A formal research programme can also be integrated with the running of a large nursery. 		<ul style="list-style-type: none"> Small-scale nurseries can serve as an excellent extension tool, demonstrating methods of raising seedlings to a wider audience. Training at nursery sites brings field staff into closer contact with farmers. Easy testing and application of techniques suited to small-scale production and upgrading of farmer skills. 	
Protection	<ul style="list-style-type: none"> Fencing may be easier and chemical control of pest outbreaks may be more efficient. 	<ul style="list-style-type: none"> Low intensity damage may go unnoticed. Alternatively, large-scale pest outbreaks may spread very rapidly. 	<ul style="list-style-type: none"> Experience shows that seedlings are often tended with greater care in small-scale nurseries through the commitment of the nursery managers. 	<ul style="list-style-type: none"> Small-scale nurseries may be more difficult to protect, and can be severely disrupted in the event of uncontrolled disease or pest problems.

Source: Adapted from Jagawat, 1989

chapter concludes by examining the place of subsidies and incentives, and considers what is implied by the term 'sustainability' in the context of farm forestry development.

8.1 Coordinating Production from Different Types of Nursery

In some places, geographical or environmental factors determine what types of nursery will be possible. In remote mountainous districts with few roads, for instance, transportation may be so difficult and may need to be done entirely by headloading that the nursery system has to be highly decentralised to work at all. Conversely, it is often said that in arid and semi-arid areas a regular, year round water supply may be so problematic that only a few sites will be suitable, implying the need for larger nurseries. Asking households to divert some of their precious water resources to seedling production might be unrealistic. However, as shown in the study from Sudan, when farmers are firmly interested in raising seedlings, ways may be found to overcome such difficulties. In this case, a variety of rota systems have been devised around the transportation and application of water, thus reducing the individual burden.

In most cases, however, seedling production is not based exclusively on large-scale or small-scale nurseries. In industrial programmes there is often a hierarchy between permanent central nurseries, and temporary 'flying' nurseries which are set up for several years near remote plantation sites, or seasonal 'satellite' nurseries to which propagules (such as newly germinated seedlings) are distributed part way through the production cycle (Evans, 1992). Similarly, even in programmes which are committed to decentralisation, it is usually necessary to maintain one or more large nurseries at the hub of the system. These might serve a variety of functions, most notably:

- Training and demonstration facilities and activities.
- The storage and distribution of seed and material supplies, and a back-up supply of seedlings if farmer nurseries fail.
- The production of specialised planting stock, eg species with recalcitrant seed which because of difficulties in storage or propagation require the controlled conditions of a professionally run nursery.

Furthermore, the linkages between different types and sizes of nursery necessarily change over time as new circumstances arise. This might represent a planned evolution, or that changes need to be made in response to unanticipated events. The central nursery at Nyegezi in the study from Mwanza Region in Tanzania is a good example of the former (Guggenberger *et al*, 1989). At different points in time this

Decentralisation entails different things in different places. The shape of the system will depend upon the particular infrastructural and geographical, as well as political, social and economic conditions which need to be worked around in each region. The important factors are how different types and sizes of nursery fit together, how these connections change over time, and whether the planning system can cope with increasing diversification in nursery production. Diversification is as important as decentralisation.

nursery served all the functions identified above. To begin with, farmer training courses were conducted mainly at Nyegezi, but once farmer nurseries began operating it proved advantageous to shift training to these sites. Here a larger number of people could be reached, training was directly related to the work in hand, and operations were more cost effective. The Nyegezi nursery now has different primary functions. The most notable is the establishment of a commercial citrus orchard, which is intended to provide the project with income through the sale of fruits and grafting stock when external funding ceases.

The example of the BBP project in the study from Nepal shows how nursery managers themselves had to shift between different types and sizes of nursery due to unanticipated technical problems. In this case individual farmer nurseries had been producing seedlings mainly of *Leucaena leucocephala*, but with the arrival of the *Leucaena* psyllid in Nepal many of these were abandoned. Although considered in one sense to be a failure, the study shows how the project was able to draw greater success by adapting to the new circumstances. Local seedling production did not cease, but was moved to larger community nurseries involving up to 30 people. A greater range of species can be raised in such nurseries, and the individual incurs less risk. More recently, there has been further diversification as some people have returned to individual nurseries. Central nurseries are also maintained for indigenous fodder tree species which are unsuitable for local production because of the length of time they have to remain in the nursery.

8.2 Transportation and Distribution of Seedlings

The need for more efficient and more economical seedling distribution is cited as a reason for decentralisation in all the case studies. It is obvious that the physical transportation of seedlings to multiple farm sites in remote areas is easier, with less risks attached, if production is based in small-scale nurseries. Two other benefits are less widely recognised, but are nonetheless as important:

- A wider variety of propagation methods may be used in small-scale nurseries located close to the planting site. This includes bare rooted seedlings which cannot be transported long distances without root damage, and more mature seedlings (particularly fruit tree species) which need to be raised in larger containers and are therefore heavier and more expensive to transport.
- By having nurseries close at hand, farmers are in a better position to choose exactly when to collect seedlings. This is a critical consideration if tree planting coincides with crop cultivation.

In the study from Kenya, in particular, such factors shaped the extension strategy that was eventually adopted. The initial plan here was to set up 600 farmer nurseries in one district, Kakamega.

However, it was soon realised that even though collectively these would serve a larger number of farmers than central nurseries, there would still be many people living too far away to make use of them. The decision was therefore made to focus on the distribution of seed to numerous individual households, combined with technical advice on raising small numbers of seedlings, rather than supporting a limited number of intermediate producers.

Transporting seedlings in Nuwara Eliya District, Sri Lanka

Photograph: Jane Carter

Transporting loose seedlings in an open trailer over long distances can cause damage.



Tree seed supply is a critical area for further research and development, which raises a number of fundamental technical and organisational questions. In particular, more work needs to be done to strengthen the links between 'local' farmer-based and 'national' supply systems. In most countries, this appears to be more critical than simply investing in increasing the independent procurement and outreach capacity of the central supply organisations.

8.3 Seed Supply Strategies

Whilst many programmes have been successful in helping to open up appropriate and regular sources of material supplies to farmer nurseries, seed supplies are far more problematic. The studies show that many programmes are choosing to build on local capacity to collect and circulate seed, as much as relying on external supplies. External sources of seed, from government centres or from the one or two major international seed organisations that are expanding operations in many countries, are still often unreachable and prohibitively expensive. Available local sources, and even external sources, of farm forestry tree seed are rarely of the most productive provenances.

The experience of the Seed Production Units in the study from Kenya indicates the technical and organisational problems which may be encountered in attempting to set up a system of new seed orchards in the vicinity of small-scale nurseries. At the same time, it is recognised that farmers in the area are already heavily involved in seed collection. As the project expands to include many more indigenous species in the future, ways must be found to build on this local capacity. A separate survey of farmers' tree seed handling

Box 8.1**Summary of Survey Findings on Farmers' Tree Seed Practices in Kenya**

The survey carried out amongst farmers in four regions showed the considerable depth and variety of technical knowledge they have on seed collection and handling. For some species, farmer practices are at variance with those adopted by professionals, for example, in matters such as collection times (for *Calliandra calothyrsus*) and storage techniques (for *Prunus africana*). In other cases, farmers are applying propagation techniques not recognised by scientists, such as for *Zanthoxylum gillettii* (Syn: *Fagara macrophylla*) and *Maesopsis eminii*, which have potential for wider application.

In terms of seed supply, farmers are already heavily involved in collection from trees on farmland and in the wild. Indeed, it is estimated that up to 70% of the seed circulated by the large number of NGOs operating in the Kenyan forestry sector is purchased from farmers. It is concluded that there is great potential for building stronger links between these local systems and the activities of the national tree seed supply centres. In particular, this would involve:

- Encouraging farmers to adopt more refined methods of selecting seed trees according to genetic qualities. This should be the focus of advice and of training for field staff.
- Creating a stable and regular system of purchase. As noted by the author of this survey, farmers should not be put in the risky situation of being used by the national organisations to ease a chronic shortage of seed and then shut out again when the short-falls have been corrected.

Source: Kamondo, 1993

practices in Kenya, carried out by Kamondo (1993), sheds further light on this matter as described in Box 8.1.

In the study from Sudan, seed supply is considered to be one of the most important factors which may determine whether village nurseries will continue as project support is progressively withdrawn. To this end, it was a focus of discussion at a 'sustainable nurseries course' for nursery managers held at the end of the second year of the programme. The discussion began by constructing a local seed collection calendar, and mapping out where good stands of seed trees exist in and around village land. It then went on to identify the ways in which seed could be exchanged or bought and sold between different nursery groups, to be supplemented by that distributed from the local forest office. Project staff believe that a course of this kind did much to alert the nursery managers to the opportunities and potential difficulties of seed procurement, and in particular to the need for forward planning. As this and several of the other case studies show, nursery managers often need to draw on several different seed sources. It may be important to help locate and work with those individuals in the community who act as repositories of knowledge and genetic material, whilst respecting the right of these people to maintain ownership of this resource for their own benefit.

Alternative Propagation Methods

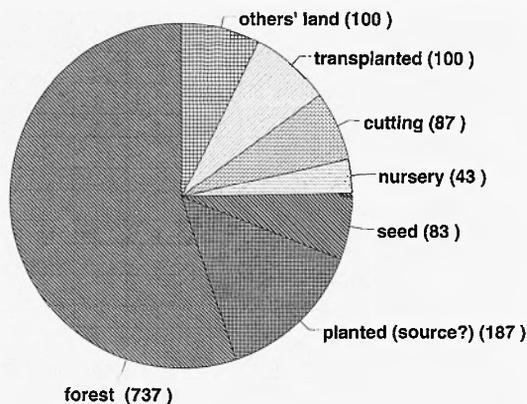
It must also be recognised that farmers do not only raise trees from seed. Indeed, in some cases the majority of trees planted on farm land may originate from other sources, such as naturally regenerated seedlings (wildlings) transplanted from elsewhere on-farm or off-farm or vegetatively propagated from cuttings, strikes or truncheons. This includes many fruit trees, as well as multipurpose species which are grown in living fences and hedgerows. As summarised in Box 8.2, a study in the middle hills of Central Nepal, an area where no specific attempts were made to encourage private tree planting, showed that most trees cultivated by farmers on their land had not been raised from seed. The case study of the CARITAS programme in Tanzania shows how project staff have progressively upgraded their own skills in different propagation methods over time, in order to provide wider technical choice to the nursery managers.

Of special interest is the wide variety of species used by farmers for living fences throughout dryland Africa. For instance, one of the most commonly used and widely distributed is *Commiphora africana*, which can be established by way of large truncheons (over a metre in length) and which therefore forms an effective barrier within a short time. An added advantage is that the most suitable time to establish hedges of many of these species is during the dry season, as planting during the rains may cause rotting of the stems. It is thus a method of tree establishment that does not interfere with the busy period of crop planting when the rains commence.

Box 8.2

Tree Cultivation on Private Land in the Village of Suri, Dolakha District, Nepal

In a study focusing on farmers' own perspectives of their tree cultivation activities, an inventory was conducted of all the trees being grown on the land of 44 households. The owners participated in this process and provided much information about their trees, including their origin. Over 7,000 trees were counted, from young seedlings to mature specimens and of these only 19% (1,337 plants) were reported to have been planted, against 80% (5,677 plants) which had regenerated naturally and been deliberately cultivated (the origin of the remaining 1% was unknown). As shown in the pie chart, of the planted trees, the majority had been transplanted as wildlings from forest or other land not belonging to the household. Some had been propagated vegetatively – a common method for a few species, but one which accounted for only 5% (87) of all planted trees. Similarly, only a few species, notably fruit trees (especially citrus) had been raised from seed. Nursery stock accounted for very few planted trees, partly because no nurseries were located close by, but also because of other factors. These included unavailability of species most valued by farmers and (unnecessary) hesitation to plant seedlings perceived as 'belonging' to the government, over which it might exert claims in the future.



Source: Carter, 1991

Living fence of *Commiphora africana*, Tanzania

Photograph: Edwin Shanks



8.4 Range of Species and Number of Seedlings Supplied

One of the most common complaints about central nurseries has been that they do not cater adequately for the actual needs or preferences of farmers, in terms of the range of species available and the numbers of each supplied. This is perhaps the major factor which has prompted a reappraisal of programme objectives and changes in seedling production strategy.

Such problems are in part a consequence of the practical difficulties of transportation from central nurseries. When trying to reach a large number of people over a wide area there is bound to be a certain shortfall of seedlings in some places, and wastage in others. As noted above, difficulties in the procurement of seed may also prevent nursery managers providing what people need. However, discrepancies between demand and supply cannot be regarded as an inherent problem of central nurseries *per se*. More important constraints lie in the way in which species selection and production targets are set at the beginning of a programme, and thereafter whether or not nursery production is geared to a rolling assessment of farmer demand from year to year.

Evidence from the case studies suggests that species selection at the project definition stage has often been determined as much by external conditions and priorities as through direct consultation with the intended beneficiaries. The factors of importance here are summarised below in Box 8.3.

In some places, such factors have resulted in the needs of some farmers not being met at all. More commonly, the species provided have not entirely matched local preferences, and a period of adjustment has been needed to correct the situation.

This type of situation is illustrated with respect to the first year activities of the CIAT Communal Nurseries Programme in Bolivia. Although in most cases the seedlings produced were popular and suited to local needs as defined by the different communities involved, in two situations it appeared that an over enthusiastic advertisement of the new project obscured farmers' real needs. In the case of the cooperative nursery, that was treated by agency staff as a pilot area for the production and use of new agroforestry tree species, farmers were encouraged to sow more of these than they needed. Their real

Box 8.3

External Factors which have Commonly Determined Species Raised in Rural Development Forestry Programmes

- The species promoted through the early rural development forestry programmes were often confined to those already well known to foresters. There is also circumstantial evidence which suggests that in some places it was even influenced by farmers' own perceptions that a 'forest department' would/could/should only provide exotics.
- The production of fruit tree seedlings, which are often the priority for farmers, has in places been constrained by uncertainty over which government agency (agriculture, horticulture or forestry) should provide the necessary support.
- Particular problems may be encountered when a programme of seedling distribution to farmers is being run in tandem with a plantation programme. The latter often receives priority, with nursery production being primarily geared to plantation species.
- Where a project set out with the intention of meeting a particular facet of rural needs (such as woodfuel), or with the idea of promoting a particular planting model (such as alley cropping or communal woodlots) the range of species supplied has been limited accordingly.
- Considerable emphasis has built up around species which have been the subject of international research and genetic improvement. This is especially the case with the group of multipurpose leguminous species which have underpinned most research on agroforestry (such as *Leucaena* spp, *Gliricidia* spp and *Calliandra* spp).

demand, for fruit trees, went unfulfilled.

It is commonly accepted that if nurseries are run directly by the people who are to plant and grow the seedlings raised, they will be in a better position to determine how many seedlings, of what kind, they need. This observation is substantiated by the experience of those projects under which decentralisation of plant production and/or decision-making powers appear to have progressed furthest – such as the programmes in Sudan and Tanzania. However, it should not be assumed that small-scale producers will necessarily be more effective in their response to other people's requirements. This is particularly the case in situations where they occupy an intermediary position between a land use agency and the people who will eventually plant the trees, and hence, where more complex communication links exist between the sources of supplies, the nurseries and their clients.

8.5 Setting Targets and Programme Planning

The financial and material planning of nurseries for industrial plantations is comparatively simple, since precise targets for the number of seedlings required to cover a given land area can be calculated well in advance, and funds released accordingly. One of the chief disadvantages of a decentralised system is that forward planning becomes much more complex for agency staff. It is also more difficult to arrange supplies to numerous nursery sites. If they are to be established in response to farmer demand, there must be a corresponding flexibility in the disbursement of funds. Thus decentralised production systems require greater managerial skills and a greater input of field staff time. Field staff need to develop a good rapport with local people, which presupposes skills which are not within the usual remit of many technical staff. This in turn often necessitates training.

In many of the early rural development forestry programmes, targets were set and measured simply in terms of the numbers of seedlings produced and distributed to farmers. If monitoring was undertaken, it was usually only of seedling survival rates soon after planting or after a period of one or more years. More sensitive types of analysis, and more intensive dialogue with farmers, are required to understand reasons which may lie behind the success or failure.

The case study from Sudan illustrates ways in which this might be achieved. In particular, it shows the value of participatory approaches to project planning, monitoring and evaluation. These are combined with on-the-job training of field staff. The annual evaluation of the village nursery programme carried out here by the villagers and field staff at the end of the planting season has two functions. First, information is gathered about production aspects, such as survival rates and indicative preferences for the following year. Second, the group discussions focus on how well the work was carried out. A clear distinction is thus made between:

If nursery production is to match local needs more accurately, the gap between demand and actual production has to be closed. In practice, this usually means that a separate information gathering exercise has to be slotted into the annual planning cycle somewhere between seedling distribution and full commencement of nursery activities for the next year.

In constructing a participatory system of monitoring and evaluation, the first step is to define the forums in which people come together to exchange information and their opinions on progress, rather than starting by identifying the information which needs to be collected. The indicators used to assess progress may then be discussed and agreed upon as part of the process of evaluation.

- Data collection, on which to base production targets and the procurement of supplies.
- The use of monitoring as a management tool, to learn about the problems and opportunities people face at different points in the system in a structured way, so that the information gained will be of use in further planning.

The project in Sudan has been able to adopt this flexible approach partly because of its small size (operating in only 23 villages), which means that relatively intensive support can be given by the available staff. In programmes supported by government departments, which often operate over a much wider area, more formal systems of monitoring are required to aggregate and pass on the information collected in villages.

8.6 Overcoming Institutional Constraints on Adaptive Planning

Simply putting a monitoring system in place at field-level, however, does not guarantee a more responsive programme. It may be necessary to enquire more deeply into the technical and operational imperatives set by a project or government ministry to understand the ways in which they facilitate or inhibit adaptation to new circumstances. This point is clearly illustrated by an evaluation carried out of the Karnataka Social Forestry Project, in India, as described in Box 8.4.

Box 8.4

Evaluation of Village-Level Monitoring and Programme Planning under the Karnataka Social Forestry Project, South India

This project included a communal tree planting programme on public land and a farm forestry programme aimed at individual land holdings. The main concern of the donor agencies during the evaluation was on the social effects of the project. However, with hindsight, it was realised that the project was inherently limited by the failure to analyse internal institutional arrangements and the inability of project procedure to change and evolve.

An intensive system of field monitoring had been created, whereby Village Motivators were recording farmers' needs and opinions in notebooks which were then passed on to district officers. However, in many cases the information recorded was not acted upon. One of the main results of this was that farmers' interest in new and different tree species went unheeded. It was concluded from the evaluation that institutional structures need to change so that:

- Mid-level officers are given a clear mandate to act upon information collected in the villages.
- The information collected in the villages constitutes, rather than being put in conflict with, the annual targets set by the department.

Source: Shields *et al*, 1992

The case study from Vietnam explores such problems from two different angles. Despite the fact that there has been a shift towards small-scale nurseries under this programme for a number of years, and there is great local variation in the patterns of nursery organisation, inflexibility is evident. Nursery managers are still tied to externally

determined production targets, and a planting model which favours the use of certain tree species over others. Under this programme in the past, government bodies had access to a considerable amount of material supplies and control over the decision making process. At least part of the difficulty in attempting to re-route project funds to different types of nursery under different management lies in restricting the control exerted by district authorities within the system.

The Vietnam case study poses the question of whether it is possible to adapt an existing large-scale, centralised government nursery programme, or whether it is preferable simply to replace it with an alternative system. At the same time, it shows that even within an institutional environment which tends towards centralised planning processes, there is a place for information gathering exercises ascertaining farmers' needs. The crucial factor is that they are introduced in ways which allow existing systems time to adjust. In the Vietnam example, Participatory Rural Appraisal (PRA) exercises have been incorporated into the planning cycle. In the first instance, these have provided government staff with the opportunity to learn about the diversity of needs associated with homegarden production. A more responsive and diversified nursery system may soon result from this. In the long-term the PRA exercises might be extended to deal with the broader aspects of land use planning.

8.7 Diversification in Programme Evolution

Once a decentralised system gets under way, new economic relationships emerge between nursery producers and the people whom they are supplying. Whereas programmes may begin by promoting just one or two management models, and a limited range of propagation techniques, all the case studies indicate that they increase in complexity over time and as they expand. Some producers may set out to sell seedlings for an extended period, whilst others may be interested solely in production for home consumption in which case they may only raise seedlings for one or two years. Some people may wish to group together to run a nursery, whilst others may have the resources to manage on their own. Diversification may take place along several lines:

Flexibility and opportunity, according to the needs and capabilities of different producers, is a crucial ingredient which may contribute to success.

Diversification According to Socio-Economic Groups

For instance, in the study from Bolivia, the nursery programme supported by CIAT has been tailored to the requirements of four groups which occupy different positions in the rural economy. The production strategies which are being devised in collaboration with these groups vary according to the level of material inputs they can afford, and according to the way in which they wish to organise the work. For instance, whereas the Mennonite colonists are most interested in private nurseries, the syndicates have set their nurseries up through joint enterprise.

Diversification According to Market Opportunities

Alternatively, the study from Tanzania shows how technical and operational flexibility has evolved in response to differing market opportunities for nursery producers within a relatively homogeneous agricultural and social environment. It will be recalled that most nurseries here are run by individuals, producing from fewer than 10 to over 3,000 seedlings per year. Many of the larger nurseries sell seedlings, and they tend to be located near to Mwanza or other towns where a market exists, for fruit trees in particular. The project has provided loans to partially cover establishment costs of some of these commercial nurseries and some group nurseries, the loans being repaid from the sale of seedlings. Production from the smaller nurseries, which tend to be in remote villages, is almost entirely for the owners' use. In this situation project staff have seen the need to promote the use of locally available materials and reduce dependency on external agencies.

Diversification According to Gender Needs

Diversification often results from an increased understanding that men and women need trees for different products and services. Several of the programmes examined here identified a particular need to give women access to the resources and knowledge on how to raise seedlings. Because women are often responsible for vegetable gardens or orchards around the home, which are good sites for a nursery, they are frequently in a better position than men to take on the task of raising seedlings. In some societies it is beneficial for women to group together for different types of work, and a project may therefore work through formal or informal women's organisations.

The study of the Kenya Woodfuel/Agroforestry Programme sheds light on the extent to which it is possible to focus exclusively on women's needs. As already indicated, the promotion of multipurpose leguminous species has been an important component of many agroforestry extension schemes. In the Kenya example, they were promoted primarily as woodfuel species that would be acceptable to women, meeting household subsistence needs rather than yielding marketable produce which would be sold by men. A considerable amount of research and trial-and-error activity has been put into finding an appropriate niche for these species in the farming systems of the area. Decentralisation has progressed satisfactorily, making planting stock readily and widely available. Yet, on reading about the project, we are left questioning to what extent the considerable emphasis put on these species masked the need for development of other species or tree management techniques. Moreover, as the programme evolved, it became clear that the situation could not be addressed adequately by simply selecting species that would be acceptable to women. Men could not be ignored, and if money was to be made out of nursery production and the supply of seed, they were

In forestry, as in all aspects of rural development, gender implies more than focusing exclusively on women's needs. Women's needs cannot be addressed separately from those of men with regard to their position in the market place, and labour division within the household. Only by exploring these relationships in all their complexity will it be possible to decide whether a particular activity will be of interest to them.

likely to become involved in project activities.

Diversification into Horticultural Production

Several of the case studies show that farmers often wish to expand nursery production to include plants other than trees. This is clearly illustrated by the study from Sudan, where farmers soon began raising vegetable seedlings in the nursery before the rains commenced, thus making the most economical use of water in an area where it is extremely scarce. It also makes optimal use of labour, inasmuch as diversification of the species raised is combined with intensification of work effort at the nursery site. This, in turn, prompted project staff to look beyond tree species to the constraints which exist in the area with regard to the availability of propagation material of vegetable and staple crops.

The extent to which a 'forestry project' or a 'forest department' can respond to this move into horticulture may be limited, or problematic. As the study from Vietnam has suggested, developing an extension system which caters for the diversity of activities associated with homegarden production may imply fundamental changes in institutional structures and new linkages between different ministries. Similarly, in the Bolivian programme, CIAT researchers recognise that they do not themselves necessarily have the skills to cater for the interest farmers have in fruit trees, and that it will be necessary to draw on expertise from other organisations.

Box 8.5

Situations in which group nurseries are more appropriate than individual nurseries

- Where there are significant environmental and / or economic risks attached to nursery production.
- Where there is the need to spread the labour involved, either because of an absolute shortage or because of a higher than average labour input needed for certain operations (eg watering).
- Where there are well established forms of reciprocal or pooled labour exchange (such as the **parma** system in the Nepal example).
- Where the range of species required is large, and hence where an individual may not have the time or skills to cope with the various propagation techniques and schedules demanded by different species.

8.8 Group Formation Processes

Underlying these aspects of diversification are the dynamics of how nursery producers interact with the rest of the community as they develop their enterprise. These interactions are important to understand because they have implications for the way in which the external agency links into the farming community. In particular, whether it is necessary to help set up 'committees' or 'management groups' to formalise and strengthen the links between extension staff and farmers. Many programmes have attempted to work through such groups, but experience from them is mixed.

The study from Nepal considers the changing relationships between 'individual' and 'group' nurseries. As already indicated, under parts of this programme there has been a shift from individual to group nurseries, made largely in response to pest problems with a predominant species, and back again as diversification took place. This proved to be an invaluable learning experience because it highlighted the conditions under which farmers were willing to handle different scales of production. On the evidence provided in the studies, the situations in which group nurseries of one form or other are likely to be preferable are summarised in Box 8.5.

The problems experienced by individual nursery producers under the Nepal programme gave rise to a system whereby they came

The most significant lesson to emerge with regard to management committees is that it is rarely possible to determine how they should be formed or how they should operate at the outset of the programme. In most cases, the most appropriate management structures and systems have only evolved after two or three years work.

together to provide mutual support and advice. Farmer/trainers, selected by local people to act as intermediaries between them and field staff, are central to this process. Their nurseries and agroforestry plantings are used as demonstration sites. They are also responsible for hosting regular meetings at which progress is reviewed and the plans of individual farmers are aggregated for the coming months. This approach is seen to broaden the impact of the programme and enhance its sustainability in two ways:

- A means whereby regular support can be provided to a growing number of farmers without placing extra demands on existing agency staff or necessitating more staff.
- A way of building capacity at community level to direct and manage the programme.

These observations are substantiated by the example given in Box 8.6, of the women's backyard nurseries at Shendi in Sudan. Here, also, time was needed to settle on the most appropriate management system. The committees formed by men lacked cohesion because they were allied too closely to the customary forums in which men got together in the villages. The committees formed by women, on the other hand, were found to be more efficient because they were more elaborate and focused on the work in hand. They better represented the interests of the individual producers and because of this, training and the dissemination of skills was more effective.

The study of the El Ain forest management project in Sudan also explores the relationships between village-level management committees and individual farmers. Here again, the committees have a dual role: acting as a conduit for the procurement of nursery supplies, and overseeing planning and reviewing progress. Whilst many of the committees have worked well, in a few villages disputes have arisen over their role, primarily as a result of a high-handed attitude they took to the delegation of work. As noted in this study, one of the most keenly felt effects of a poor committee has been that of declining participation in the nurseries over time by people not in the committee.

The need to help solve difficulties such as these has implications for the way in which agency staff arrange their own work schedules and the way in which they participate in village affairs. In the Sudan example, in addition to the routine visits made to each village, some of the most necessary and effective support is that given on an *ad hoc* basis. At different points in time many of the village nursery groups have gone through a period of crisis, due to dissatisfaction within the group, because of technical or environmental problems, or a failure on the part of project staff to fulfil their own commitments to the group. In such situations extra visits to the village were made and extension staff were encouraged, by their superiors, to become actively involved

Box 8.6

The Men's and the Women's Forestry Committees at the SOS Sahel Village Extension Project at Shendi, Sudan

The villages where the project worked are set along the east and west banks of the Nile. They are located at the boundary between the Nile-side irrigated farmland and the desert, which begins abruptly beyond the limit of irrigation.

Almost everyone in a village, apart from resident government officials such as school teachers, is related, and the village sheikh is often the oldest or most authoritative male relative in the village. All villagers are Muslim, and the sexes live relatively segregated lives. This is true not only in public, but also in the home, where there are strongly defined men's and women's rooms and courtyards.

It was clear from the project's inception in 1985 that people's main interest (identified through a house-to-house survey) was in planting shelterbelts behind the villages, to stop sand dunes moving forward on to housing and valuable farmland. However, women also expressed an interest in tree planting in their courtyards, particularly shade trees and economic trees of various kinds including fruit trees.

Male and female Sudanese project staff were identified (the first woman extensionist was very hard to recruit, until a senior forestry official in the area nominated his niece who had a degree in agriculture) and men's and women's forestry committees were set up in each village.

Differences between the Committees

Men's committees were generally formed by elders, and tended to be composed of senior men in the village. They met when a senior man called them, and did so to plan for and accomplish a specific communal task, such as arranging to give up a Friday to plough and level land for a shelterbelt, or to dig irrigation channels for one, or to fill polybags at the village nursery. These committees were able to deal with village-wide problems, such as what to do with goats straying near the shelterbelts and nibbling seedlings, but they were not themselves composed of a representative cross section of village males.

Women's committees, though they were often launched by the sheikh's wife, were most actively carried forward by younger women who had left school but not yet married, or who were newly married and did not yet have children. The committees' tasks were concerned with enabling individual women to raise seedlings in their courtyards, and plant them out. Thus each committee member acted as a trainee extensionist from the first, and made herself responsible for the activities of a certain number of women in her village. Committee meetings were called at times when the female project extensionists were visiting the village, and committee members could take these extensionists straight to the homes of women experiencing problems. The committee members were from a category of young women who had leisure and some education, and who were thus not among the poorest women in the village. However, they worked with a very wide cross section of village women in their courtyards and homes.

Project Extension and Seedling Production Activities

The village nurseries were established by the communal labour of men, women and children in each village, but it quickly became necessary for the project to pay the salaries of two nursery staff per nursery to tend seedlings. Although male extensionists succeeded in encouraging a few male farmers to grow seedlings for their farms, experience of seedling production and planting was in fact limited to relatively small numbers of men. Among women however, through the female extensionists' work with women's committees, close on 7,000 women in the area have now learned how to produce the trees they want, and the result has been far greater outreach.

Post Project Experience

The village nurseries have proved the least sustainable part of the project activities – the need for paid staff makes them almost impossible to maintain, since it is difficult for them to sell enough seedlings to cover staff costs, particularly once the need for seedlings in a particular village is satisfied. Project attempts have been made to get newer villages who want a shelterbelt to commission the seedlings from a village with an older nursery to maintain. This is still unlikely to raise enough cash for salaries.

In some villages without a nursery, the experiment has been tried of commissioning women who already have experience in raising seedlings to produce the 3,000 or so seedlings required by the local shelterbelt. To date this has not been well enough synchronised, and although women have been keen to produce seedlings to be bought back for shelterbelts, they have tended to produce seedlings insufficiently homogeneous in age, size and hardiness for ready use. However, better planning could easily overcome this problem in the future.

The prospects for continuation, at maintenance level, of project activities are good if a solution can be found to the production of seedlings for shelterbelts. Villages who never had any dealings with the project are keen to learn from villages who already have shelterbelts, and the seedlings are the only constraint. The senior woman extensionist has been taken on to the permanent staff of the region to train small numbers of female extensionists in each village.

Source: Shepherd, pers.comm.

in the nursery work for a period.

This suggests that from the viewpoint of the programme coordinator, the essence of good management in this context lies in creating a situation in which:

- A clearly defined schedule of visits is mapped out with the nursery producers, during which advice can be given and queries answered on a regular, systematic basis.
- Flexibility is developed in the system which allows and encourages field-staff to respond to unanticipated events.

A further ramification is that field staff need to be rewarded for their personal commitment. Their progress and achievements cannot be assessed simply according to the number or productivity of nurseries they help establish. Project coordinators also need to be aware of other channels through which they can gain an understanding of farmers' and extensionists' own perceptions of how well the system of advice and material supply is working so that more sensitive reward systems can be developed.

8.9 Linkage Organisations and Structures

A closely related matter to nursery group formation is that of the role of linkage organisations of various types which can mediate between the interests of government and rural people. These often act as the 'vehicles' of decentralisation. Such bodies may include NGOs, schools, commercial organisations and traditional or religious authorities.

Small-scale nursery programmes are often started, and funded for an initial period, by NGOs. The capacity for NGOs to develop constructive working relations within rural communities is widely recognised. Government-NGO links, on the other hand, are often less well formulated and the ability of NGOs to extend support over a wide area may be limited. It is necessary to consider what types of interagency linkage have proved to be most beneficial. The evidence from these studies suggests that, if effectively organised, intensive agency involvement in farmer nurseries in a particular locality may not need to extend beyond two, three or four seasons. It is rarely the case, therefore, that an NGO (or project) established, permanent and independent contact/outreach system gets taken on at a later date by the government service. The more critical linkages exist in other directions:

- Coordination is essential to avoid unnecessary spatial duplication, or conflict between the objectives of their respective activities. This is especially important in the way in which incentives are devised and applied. There are cases in which heavily subsidised seedling distribution programmes have been introduced into areas in which other organisations have been helping to develop market

responsive systems on an incremental basis.

- Some of the most constructive long-term NGO–Government contacts may be built up around training, and linking local to national seed supply systems.

A school nursery

Illustration: Oscar Casquino
from the booklet *Manual de Viveros y Plantaciones Escolares* by Manuel Valdivia Rodríguez, FAO/ Holanda/ INFOR project, Peru



Schools are also often included in forestry extension programmes. Although a specific example of a schools nursery programme has not been included in this study guide, the potential advantages and drawbacks of their involvement in such activities have been well documented elsewhere. The major benefit of working through schools is, of course, the educational impact of encouraging young people to learn about forests and the environment and developing their farming skills. To an increasing extent, foresters are being called on by educationalists to help prepare teaching materials on these topics, and to assist in setting up small tree planting schemes.

Experience has shown, however, that problems often arise in attempting to take this a stage further, in using schools as a more formal link between local farmers and the agency:

- Whilst schools can usually produce adequate seedlings for school woodlots, orchards and shelter, constraints on nursery management often make it difficult for them to supply quality seedlings on a dependable basis to nearby farmers. In particular, the lack of labour and/or supervision during school holidays can disrupt the work.
- Staff and pupils rarely have the time or skills to manage a system of consultation with farmers to ensure that the seedlings produced

actually meet local demands. This point is demonstrated by the experience of the agricultural school tree nursery in the CIAT programme in Bolivia.

To illustrate these points further, an example is given in Box 8.7 of the experience of three agricultural high school tree nurseries in Ecuador. The assumed benefits of these nurseries were not realised because of a conflict between their educational and productive functions, and because of low levels of motivation and training amongst staff.

Finally, if we take an overall look at the longer running programmes amongst the case studies, we find that they grow to encompass a wide variety of linkage bodies and management groupings at different levels. This is especially well illustrated by the CARITAS programme in Tanzania. This programme has effectively knitted its various planning, training and advisory functions into local government, traditional and religious authority structures. The 'extension system', if viewed in its entirety, is thus a complex amalgam of these institutional interests. The key to the success of the programme has perhaps been in its ability to develop and sustain an outreach system which is reliant on these more durable organisational forms.

Box 8.7

The Experience of Agricultural High School Nurseries in Ecuador

Tree nurseries run by three agricultural high schools formed an important part of a Community Forestry project supported by CARE in Ecuador in the late 1980s. The major goal of these nurseries was seedling production for the rural communities working with the project in the establishment of communal plantations on village land. The nurseries were endowed with considerable financial resources and reached production levels of over 500,000 seedlings in one case, and between 40,000 and 50,000 in another.

At the outset, several assumptions were made about the benefits school nurseries could bring to the project:

- They represented an effective intermediate step between centralised government nurseries and farmer nurseries.
- Their position within the rural communities would facilitate seedling distribution.
- They would be receptive to the new idea of raising trees in local nurseries.
- They already possessed much of the infrastructure needed to establish a nursery.
- They could handle a wide range of species, as well as acting as centres of investigation into propagation techniques.
- They would benefit from institutional coordination with other schools, local government and NGOs.
- They would eventually be able to develop into multipurpose advisory centres within the rural communities.
- They would be able to capitalise on nursery production through the sale of seedlings and trees grown on school land.

In practice, however, these benefits were not fully realised, for two reasons: a lack of clarity over the exact role of the nurseries and a discrepancy between their educational and productive functions, and low levels of motivation and competence amongst the teachers. The levels of seedling production were also too high, with the result that seedlings of poor quality were produced which never left the nursery. It was subsequently decided that the principal focus of the school nurseries should be forestry education and that to achieve this an appropriate incentive and training package should be directed towards the teachers.

Source: Desmond, 1989

8.10 Research and Training

Understanding the capacities of different types of nursery is important when deciding how to instigate research, or when introducing the results of research carried out elsewhere. Formal research is obviously best integrated into the running of a large nursery, the scale being such that statistically valid replications can be made. Such research may include raising seedlings for species and provenance trials, recording germination and mortality rates, and investigating performance under different treatments (for example, seed processing techniques, pre-sowing treatments and soil mixes). Similarly, there are advantages in coordinating training from a central location, where a wide variety of species and propagation techniques can be put on view and facilities such as a seminar room and accommodation for trainees can be provided.

Despite these advantages, it appears from the case studies that in practice some of the most useful research is carried out on an informal basis, in response to problems and opportunities that arise out of regular contacts between land users and agency staff. Even research carried out by professional nursery managers is more often than not 'adaptive' rather than 'basic' in nature. Amongst the examples cited here include the discovery of how to germinate *Grewia tenax*, a shrub yielding fruits of considerable importance to people in central Sudan which was previously only collected from the wild, and developing appropriate methods of raising *Melia azedarach* in Mwanza. In both these cases the research was carried out on a trial-and-error basis as a sideline activity by project staff, but has yielded valuable techniques which have been passed on to small-scale nursery managers.

The case study from Bolivia shows how farmers have experimented themselves (and in cooperation with agency staff) on appropriate nursery techniques which have potential for wider use in the area in the future. This includes the development of a portable 'wheelbarrow' watertank and experiments with direct sowing, bare-rooted stock and the timing of planting out seedlings. The study from Kenya shows how on-farm research was conducted to upgrade indigenous methods of raising seedlings, making improvements in such matters as the timing of seed sowing, soil mixtures and protection and maintenance.

The way in which different elements of formal and informal training for both land users and field staff may be put together is discussed in the study from Tanzania. Training under this programme is of five types:

- **Residential workshops** held at the central nursery which concentrate on upgrading technical skills and introducing new ones.
- **Field visits**, serving as a means of information exchange, practical demonstrations and trouble-shooting sessions.

- **Study tours** for village animators, farmers and local leaders to promote horizontal learning.
- **Special events** such as film shows.
- **Training of trainers** for extension workers in the government sector.

It is in situations such as these that the conventional distinctions between 'research' and 'training' disappear. Whilst there is a place for training in the formal sense, in workshops and seminars for instance, the visits made to small-scale nurseries as part of the regular contacts between agency staff and farmers are perhaps the best training forum for all concerned. If well run, small-scale nurseries can be an excellent extension tool, demonstrating techniques to other people in the vicinity on a scale that is appropriate to them, and testing new ideas. Furthermore, small-scale nurseries have in many places served as an essential training ground for forest department field staff themselves.

8.11 Subsidies, Incentives and Ensuring Sustainability

It is often said that the sustainability of rural development forestry may be greatly enhanced by shifting responsibility for seedling production from a government forest department or other agency to small-scale producers. This rationale is implicit in the strategies adopted by all the programmes examined here, yet there appears to be no consensus on what sustainability actually means in this context. This is a critical question, because it has a bearing on what type of external support may actually be needed by farmers, how it should be provided and how it should be phased out. This final section draws some tentative conclusions on this matter.

In the wider context, decentralisation has been cited as one means of 'sustaining' forestry activity, and therefore the replacement of forest cover, at a time of stringent public sector spending and cut backs in the operational budgets of forest departments. This may be a desirable medium to long-term objective, and the capacity for farm forestry to increasingly fulfil local and national markets is often justified. However, all our case studies show that the short-term costs, especially staff and training costs, are not reduced for the agency involved. It is not, therefore, an immediate means of trimming government spending.

Supporting the production of tree seedlings is also only a means of sustaining the replacement of tree resources. We have already suggested that more may be gained through alternative strategies of increasing the flow of tree and forest products into the rural economy: through techniques of natural regeneration, and through strengthening management of existing forest on state or community land. At the same time, studies from East Africa (Shepherd, 1989; Mortimore, 1992;

It is necessary to challenge the assumptions made about sustainability by asking the question: sustainable for whom? It may imply very different things for the implementing agency, for the forest service, for those people who wish to sell seedlings or to raise them for subsistence needs, and for those people who have longer term ambitions to enter into commercial farm forestry production.

Warner, 1993), Nepal (Gilmour and Nurse, 1991; Carter, 1992) and Nigeria (Cline-Cole *et al.*, 1988) have yielded a much better understanding of the types of circumstances under which farmers are already planting new trees, or might be supported in doing so, either on-farm or off-farm. These include:

- A decline in the availability of tree products off-farm.
- Rapid population growth and increasing land scarcity but increasing security of tenure for those who do hold land.
- Commercialisation of the economy and the development of a rural infrastructure giving greater access to markets.
- An evolving cash market for forest products.

In situations such as these investment in a nursery programme may be justified, especially where propagation material is in short supply. However the extent to which, and the way in which, it is necessary to subsidise seedling production needs to be carefully reconsidered. Experience from these case studies suggests that, in creating an effective subsidy/incentive system, there are at least three factors which need to be taken into account.

- **The need to gear subsidies and incentives to levels of technology and affordability suited to the needs and objectives of different producers**

In the definition of project objectives, sustainability is often loosely conceptualised simply in terms of generating the capacity amongst rural people to produce tree seedlings for their own use and economic gain. However, closer analysis reveals that this implies different things for 'home' producers who wish to raise seedlings for their subsistence needs only, as distinct from those who wish to enter into commercial production of seedlings and/or forest products.

The focus of sustainability for the home producer may be on limiting the extent to which they depend on external or project support. In this case, reducing dependency on financial subsidies may be more desirable than obviating their need (through subsidised inputs) to purchase or exchange seed and material supplies – relationships which may have a positive effect on the local economy. For the commercial producer, an equally important condition is that constraints which may limit their involvement in farm forestry (beyond simply selling seedlings) are recognised and attempts made to remove them.

Furthermore, the case studies show that standardised subsidy/incentive mechanisms, although easier to manage, may inhibit production by some people. The support given to different nurseries needs to vary. This is particularly well illustrated by the example from Sudan. Here, a standard package of tools and materials was supplied free-of-charge in the first year. Further incentives provided to each

Sustainable seedling production rarely means continuous seedling production. What is more important is to consider the sustainability of the entire production cycle from seed collection, to nursery production, the management of trees in the field, harvesting and the marketing of forest products.

nursery group varied according to particular location specific constraints they needed to overcome. For one large nursery this involved using the project trailer to transport sand for the potting mixture. For another, smaller nursery, project transportation was used to supply barrels of water during a period of critical water shortage.

- **The need to reach agreement regarding timespans for the provision of subsidies/incentives and ways in which nurseries can become financially self-supporting**

Several of the programmes have had definite policies towards achieving self-sufficiency of the nurseries, but the extent to which this had been achieved has been limited. In the example from Bolivia, a system of seedling purchase was put in place from the outset. It was intended that nurseries should be self-financing after the first year, through the use of a revolving fund to be established by the nursery managers. The project was responsible for capital and supply costs in the first year only and for ongoing technical assistance. However, few nurseries recovered costs in the first year through the sale of seedlings. In most cases seedlings were distributed on credit, primarily because distribution took place at a time when cash is scarce in rural communities. Most nurseries were therefore not able to set up a revolving fund. It is suggested that sustainability of the project will be affected if nurseries prove unable to support themselves financially, but that a longer timespan is needed to achieve the position of financial independence.

In the study from Nepal, it was planned that nurseries would sell high value horticultural seedlings at a price enabling them to become self-supporting within a five year period. However, in most cases local demand for seedlings has been insufficient for financial viability. Once the price rises above several rupees per seedling, the demand falls quite dramatically and returns do not meet production costs. On the other hand, in the study from Kenya, where the focus was on seed rather than seedling distribution, all seed was initially distributed free-of-charge. Emphasis was put on assisting the establishment of local farmer run Seed Production Units. Tree seed gained a commercial value following the project decision to buy back seed from these farmers. This has stimulated production and local markets independent of project activities.

- **The need to ensure that subsidising seedling production does not prohibit the development of market responsive systems, or destroy those that may already be in existence**

To illustrate this point, an example is given in Box 8.8 of the detrimental impact project activity has had on an existing nurseryman in one area of the Terai, in Nepal.

Box 8.8

Distortions between Private and Subsidised Seedling Production in one area of the Terai, Nepal

In an area of high farm forestry potential, one farmer has established a nursery supplying 100,000 seedlings of a variety of species, including fruit trees and unusual exotics. Prior to the establishment of a community forestry nursery, funded under a World Bank project, half an hours walk away, private demand for seedlings from the farmer's nursery, particularly of *Dalbergia sissoo*, had been high. However, a ready supply of heavily subsidised seedlings close by has distorted the market and made it uneconomic to run the nursery for private buyers alone.

Interestingly, the farmer although bemoaning the distorted private market, was encouraged to continue to raise seedlings as demand from government for seedlings for community plantings remained high and undiscerning in terms of the quality specifications. Such distortions in the market have knock-on effects in terms of the quality of seedlings produced, with this farmer freely admitting that the requirements of the private buyer were much more rigorous than that of the government. Since private interest was much reduced he was not having to take such care in nursery management. This has led to the production of inferior planting stock.

Source: Hobley, 1992

The experience of the large-scale social and farm forestry projects carried out in several states of India in the 1980s is instructive in this respect. As in many other countries, these projects focused on the provision of subsidised planting stock and/or incentives to offset establishment and maintenance costs. But as noted by Arnold (1992), this type of intervention often encouraged cash cropping of trees in situations where it was unlikely to be profitable and where it led to undesirable distortions in land use. Alternative interventions in the wider marketing system of forest products may be a more effective way of stimulating appropriate levels of seedling production and tree planting. Changes in legislation are particularly important, since most states in India still place restrictions on harvesting and the sale of wood products by private producers.

Finally, if we look at sustainability from the viewpoint of farmers themselves, it becomes apparent that it does not necessarily mean 'continued' or 'continuous' seedling production after the programme ceases. This is because there is an inherent redundancy factor built into nursery operations: as the demand for new trees declines, as it shifts in space to new areas, or as the demand declines for certain tree species it possibly arises for others, or for other types of plants. Moreover, from the farmers' point of view raising tree seedlings will only ever be a minor activity, or one amongst several means of generating income.

It is through this that we reach a more refined understanding of what 'sustainable seedling production' implies within the context of the dynamics of a rural economy. For once small-scale producers have the knowledge of how to raise seedlings, they will be in the best position to stop and start production as the need arises. The opportunity cost involved in opening and closing larger agency-controlled nurseries prohibits this type of response to the market, and this is perhaps the greatest advantage small-scale nurseries have over them.

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A Appendix: Discussion Questions

This appendix provides a series of questions which may be used as a basis for group discussion, project work, or as essay titles. These correspond to the technical, organisational, managerial and distributional aspects of small-scale nursery production. Some questions take up important issues and themes raised in the case studies and prompt the reader to make further comparative analysis of the case study material. Others require proposals to be formulated for survey, planning and training activities relating to different aspects of nursery management.

1 Most farmers have the basic skills needed to raise, plant and protect tree seedlings. Very often, people can be found in a rural community who have more extensive knowledge than foresters on propagation techniques of a wide range of tree species. Experience has shown that forestry extension messages dealing with 'how to raise and plant a tree' are often too simplistic and generalised. One reason for this is because an assessment is rarely made of existing farmer practices and how standard nursery procedures can be adapted to them.

Design a survey to find out about existing farmer knowledge and skills related to tree propagation. What methods would you use for this survey? What particular topics and questions would you investigate?

2 In many areas farmers are already involved in the collection and distribution, purchase and sale, of tree seed to a greater extent than people were aware of in the past. It has been suggested that in this situation what is often required is additional skills and knowledge in selecting suitable mother trees (for seed and/or vegetative propagation material) according to various genetic qualities.

Prepare a plan for a one or two day workshop on this topic for farmers and extension field staff. It should involve practical work as well as providing an understanding of the principles behind the selection process. Give details of the criteria you would propose for selection of mother trees for different types of farm forest species such as fruit, fodder and timber trees and living fences. What practical activities should be included?

- 3 In what situation are techniques of natural regeneration likely to be a more effective means of replenishing tree stocks and of greater interest to farmers than nursery production and tree planting?
- 4 Are there environmental, socio-economic and/or political circumstances under which decentralisation of a nursery system is definitely not a feasible option and if so, what are they?
- 5 One of the most complicated aspects of managing a small-scale nursery system lies in successfully transferring from a situation whereby seedling production and supply are subsidised, to a situation in which it is self-sustaining. What are the factors which need be considered in this respect, what problems commonly arise, and how might they be overcome?
- 6 Successful management of a decentralised nursery system necessitates a simple but effective system of data collection and information transfer. Experience has shown that this should ideally combine the following elements:
 - Assessment of farmer demand.
 - Aggregation of individual requests into nursery production plans.
 - Monitoring of nursery inputs and outputs.
 - Monitoring of the quality of nursery production and the match between demand and supply.
 - Financial/material record-keeping.

Construct a planning and monitoring system which incorporates these different elements for a particular situation which is well known to you. Identify the parties involved in the system (farmers, nursery manager, supply organisations, advisory agencies, etc) and draw an organisational chart showing the different linkages between them. Prepare checklists and forms for data and information which needs to be gathered at the different levels. Specify times at which this information needs to be gathered and transferred according to an annual planning schedule.

- 7 An essential component of supporting a small-scale nursery system is the training for extension field staff and nursery managers. Prepare a plan for a practical introductory training course, lasting about a week, on the management of small-scale nurseries. The plan should include details of the topics for each session of the course and the methods of training which are likely to be appropriate and effective (eg group work, practical activities, etc).

- 8 What are the advantages and disadvantages of paying farmers for special contributions they make to the running of an extension programme, such as organising group meetings and allowing their plots to be used for demonstration purposes?

B Appendix: Glossary of Key Terms

Action research Activities or interventions intended to achieve tangible development goals, while at the same time increasing understanding of how (ie by what combination of inputs, decisions and activities) those goals can be achieved (Moris & Copestake, 1993).

Agroforestry The deliberate use of woody perennials (trees, shrubs, palms, bamboo) on the same land management unit as arable crops, pastures and/or animals, either in a mixed spatial arrangement in the same place at the same time, or in a sequence over time.

Alley cropping Growing annual crops in spaces between rows of trees or shrubs, often leguminous ones that tolerate heavy and regular coppicing. The leafy and woody material of the trees and shrubs is used as mulch in the crops and also often as fodder, timber, fuel, etc.

Animators Individuals whose role is to facilitate and catalyse change at village level. They may be government or non-government extension staff, or villagers themselves.

Biomass The quantity or weight of living material (animals, plants, etc) in a unit of area.

Buffer zone The buffer zone concept was elaborated by the Man and Biosphere (MAB) programme in the 1970s. Zonation provided for graded control over 'biosphere reserves' and protected areas. With these reserves MAB provided for core zones for the areas of greatest biological value, and buffer zones for peripheral areas where

protection need not be absolute but land use is constrained by regulations (Hall and Rodgers, 1992). This conservationist view of buffer zones has been broadened by some to include 'an area inside or adjacent to a protected area where a harmonious relationship between the natural environment and people is promoted' (Brown, 1992, quoted in Hall and Rodgers, 1992).

Common property Land collectively owned and managed by a defined group of users, governed by a system of rights and duties. Common property resources can degrade to 'open access' resources.

Community Forestry One of a series of terms often used interchangeably. In general, the use of public (state-owned) or communal lands for tree growing. Community forestry programmes can involve different levels of community involvement and participation (Warren, 1992). See also 'Social Forestry'.

Crop Annual or perennial plants cultivated to yield products desired for human consumption or processing, eg grain, vegetables (edible roots, stems or leaves), flowers, fruit, fibre, fuel.

Farm Forestry On-farm planting and management of trees.

Flying nursery See 'Temporary nursery'.

Gender Gender differentiation and gender identity result from the socialisation process – particular to each society – which assigns certain aptitudes, capabilities and capacities to males and females. In all societies, assumptions about capabilities of males and females result in different opportunities and access to resources and benefits. 'Gender' is used to describe socially determined characteristics and 'sex' to describe biological characteristics (Warren, 1992).

Homegardens Homegardens, also known as compound farms and as homestead and mixed gardens, are usually located close to the household as one of the more intensively cultivated parts of the overall farm. They are characterised by a mixture of annual or perennial species grown in association and commonly exhibit a layered vertical structure of trees, shrubs and ground cover plants which recreate some of the properties of nutrient recycling, soil protection and effective use of space above and below the soil surface found in forests (FAO, 1989).

Home nursery A small nursery contained within the boundaries of the homestead.

Homestead The house and productive garden surrounding the house.

Horizontal learning Exchange of experience and knowledge between individuals operating in a similar social and economic context, eg farmer-to-farmer.

Industrial forestry Ownership and management generally reside in private corporations. Usually plantation forests established to produce raw material for industry.

Intermediate users Organisations with an extension capability which act as a conduit to farmers for technologies derived from a research organisation.

Non-Timber Forest Products (NTFPs) Plant and animal products derived from the forest or forest habitat that are non-timber. These may include foods (fruits, mushrooms, nuts, vegetables, bushmeat), fodder, oils, gums and resins (such as gum arabic, damar, turpentine), medicines and fibres.

Participatory Rural Appraisal (PRA) A semi-structured process of learning by, with and from communities about their own situation and conditions of life. It originated from Rapid Rural Appraisal, the major difference being that control and ownership of the appraisal process is held by local people (IIED/MYRADA, 1991).

Pollard A silvicultural operation which involves cutting the main pole at a variable height of between 1.5 to 2.5m to encourage the growth of straight shoots for poles, fencing hurdles and basket-making. This operation can only be performed on certain species which respond well to this type of lopping eg willow (*Salix* sp) and poplar (*Populus* sp).

Propagules General term for a seedling, cutting or other part of a plant used in propagation.

Rapid Rural Appraisal (RRA) A systematic semi-structured activity carried out in the field by a multidisciplinary team, in order to acquire new information on, and construct new hypotheses about, rural life and production systems. Core techniques include: secondary data review, semi-structured interviews, direct observation, use of diagrammatic models, analytical games, workshop analysis sessions (Warren, 1992). Some key features of these tools include:

- 1) Iterative – goals and processes modified through learning by doing.
- 2) Innovative – techniques adapted to each new problem, rather than applied according to a fixed procedure.
- 3) Interactive – interdisciplinary.
- 4) Informal – avoiding use of predetermined questionnaires.
- 5) In the community – learning is taking place through an exchange of ideas with rural people in the field (McCracken *et al*, 1988:13).

Recalcitrant seed In contrast to ordinary seed it presents special problems of retaining viability. Many rainforest species have recalcitrant seed which are damaged by low temperatures, and tend to lose viability when dried to moisture contents below 35%. This is in contrast to most tree seed which requires drying to a low moisture content to ensure long storage life (Evans, 1992).

Rural Development Forestry The growth and management of trees where primary management decisions are made by users of the trees, either as individuals or groups, and where the primary benefits of trees remain within the household or community (Warren, 1992).

Satellite nursery See 'Temporary nursery'.

Social Forestry The term was first used by the Indian Government during the 1970s, as a land tenure term for forestry on village, not forest reserve land. In 1978, the term was used by Westoby at the World Forestry Congress to mean 'forestry for local needs'. In the 1980s, it became an umbrella term for individual farm forestry, for communal village planting and in some places for forest management by villagers. See also 'Rural Development Forestry', 'Community Forestry' and 'Farm Forestry'.

Sustainability Ability of a system to maintain its productivity when subject to stress or perturbation.

Swidden agriculture A form of agriculture or forest farming in which a primary or secondary forest is cleared, cultivated for a period of time, and then temporarily or permanently abandoned. Rotation period is defined in terms of yields. Fallow periods are traditionally sufficient to allow nutrient re-accumulation. Population pressures are one factor leading to shortening of fallow periods. Three kinds of shifting cultivation are identified (Warren, 1992):

- 1) True shifting cultivation - sites are permanently abandoned.
- 2) Bush-fallowing system - human settlements are permanent but field use is shifted.
- 3) Cash crop cultivation - shifts are controlled by yields.

SWOT Strengths, Weaknesses, Opportunities and Threats analysis. SWOT is a participatory evaluation tool. A simple categorised framework which allows groups to analyse and evaluate project activities. Strengths include those project elements that have worked. Weaknesses include those project elements that have not been successful. Opportunities include ideas about how Weaknesses can be overcome and Strengths built upon. Threats are the constraints that exist and diminish the range of Opportunities (Davis-Case, 1989).

Temporary nursery Also flying or satellite nursery, the temporary nursery is established for a short period (mostly less than 5 years) and located near or within the planting area, to meet a specific but temporary local need (Evans, 1992).

Tenure The nature of property rights under which a resource is held and used. With respect to trees, describes: The right to own or inherit trees, the right to plant trees, the right to use trees and tree products (usufruct), the right to dispose of trees. With respect to land tenure, describes: The nature of ownership over a particular parcel of land (Warren, 1992).

Usufruct The right to use and enjoy the yield of resources (land, vegetation, livestock, etc) which belong to someone else.

Windbreak Single or multiple rows of trees planted on windward field boundaries. Windbreaks help prevent soil desiccation and yield secondary tree products.

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In recent years there has been a significant shift towards decentralised nursery systems in rural tree planting programmes. In *The Organisation of Small-Scale Tree Nurseries*, the authors discuss the benefits and problems associated with this trend through detailed case studies of six projects, located in Bolivia, Kenya, Nepal, the Sudan, Tanzania and Vietnam. Looking beyond the different experiences of these projects, they explore the organisational and managerial aspects of small-scale nurseries, and assess the processes of decentralisation and diversification.

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