WHERE'S THE FORESTRY IN COMMUNITY FORESTRY?

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Abstract

The modern form of community forestry, developed over the past two decades, has focused mainly on what might be called forest organization in the context of forest management. With this focus of forestry on the social and cultural institutions of resource use and management, the technical aspects of forestry, especially the scientific element, have been marginalized. Implicitly, it was assumed that existing silvicultural systems would suffice to meet community demands on forest resources. The participatory planning and "learning-from-locals" techniques applied to the development of new systems of forest management were less often applied to the modification of actual field operations and the development of silvicultural systems. In some cases, management practices reverted to those of traditional systems, while in other instances officials promoted the integration of trees into farming systems, which many saw as an alternative to conventional silviculture. In effect the forestry profession has failed to bring its greatest strength - the understanding of the scientific principles of forest ecology and the protocols of forestry research - to bear on the development of more productive silvicultural systems for natural forests under community management. The first step to a better understanding of the productive potential of community forests should be to explore and exploit the existing wealth of knowledge and experience in forest-based communities. This paper examines some of the historical reasons why the technical aspects of forest management and indigenous technical knowledge have been marginalized in community forestry. The paper essentially calls on foresters to look back to their roots and with the aid of local communities strengthen their understanding of the forest ecology and develop silvicultural and forest management systems more appropriate for natural forests under community management.

Introduction

Community forestry, as a concept and a practice, has developed largely over the past two decades. Concentrating mainly on understanding and developing the institutional aspects of community forest management, it has focused primarily on returning the responsibility for decision making back to the communities living in or near designated forest areas (cf. Fortman 1988; Vergara and Fernandez 1989; Gilmour 1990; Poffenberger 1990; Burwell, Helin and Joyce 1994; Roy and Chatterjee 1994; Dove 1995; Pardo 1995; Bird 1996; Victor, Lang and Bornemeier 1998). With this focus on the socio-political or managerial component, there has been a tendency to ignore the technical or biological elements of forest management, especially with respect to the natural forest[1]. Thus, aspects such as silviculture, forest protection from natural threats (such as pests and pathogens), stand improvement and various aspects of utilization have received relatively little attention as compared with the social aspects.

In posing the question "Where is the forestry in community forestry?" this paper focuses on the technical aspects of forestry, especially "silviculture", which is defined essentially as the manipulation of forest vegetation for a predetermined set of objectives to enhance the productivity of one or more forest products. Silviculture systems are developed through consideration of ecological relationships and refined through repeated experimentation, monitoring, and readjustment. For the most part, community forestry has made little progress in developing new technologies to enable the natural forest to better meet villagers' many needs for different forest products and services. Villagers themselves are now asking for assistance in developing more productive forest plots, but foresters have had difficulty in supplying the technical information they need. in short, forestry, as a science, is failing to deliver. As a result, community forestry is falling short of its potential. Better forest management alternatives are direly needed to arrest deforestation and alleviate the threat to natural forest areas increasingly at risk of being stripped of their commercially valuable resources, or of being converted to alternative land uses (Donovan 1998).

The Historical Context of Community Forestry Development in Asia

The roots of many of the present problems in community forestry in Asia lie in the history of forestry

development. Most of the silvicultural systems in use in Asia today were developed in the earlier part of this century, if not before, and focus on the production of exportable timber (Broun 1912; Troup 1928; Champion 1931; van Goor 1982; Dawkins and Philips 1998). During the colonial period, timber was an important strategic commodity as wooden ships formed the backbone of both military and commercial power. Although wood began to decline as a strategic commodity with the advent of steel vessels at the beginning of this century, demands on forest resources barely faltered as timber was increasingly utilized for other purposes, such as building construction, railway ties, and marine pilings.

Initially teak (*Tectona grandis*) was the species of choice in the Asian colonies. As the demand for wood grew, however, timber exploitation expanded to include other species of the more durable tropical hardwoods, especially those of the dipterocarp family. Silvicultural research concentrated on enhancing the growth of commercially desirable timber species - teak in plantation and the others in the natural forest. Early silvicultural prescriptions included the cutting of creepers and climbers, fire protection, weeding, and girdling of trees impeding the growth of the preferred species (Dawkins 1997). Recognizing the limited applicability of European experience to the tropical forest in Asia, colonial foresters stressed the need for developing systems attuned to local, tropical conditions based on a sound understanding of tropical forest ecology (Troup 1928; Wyatt-Smith 1964). Over time, silvicultural prescriptions were refined in accord with the knowledge gained from experimental trials, field operations and research on the biological and ecological relationships.

Apart from timber, a variety of new products discovered in the tropics were examined for their commercial potential. The medical profession led the exploration for new species seeking plants with useful medicinal properties, such as quinine (Grove 1995; Dawkins 1997). Local trade items, such as cloves, sandalwood, nutmeg, aloeswood, copal and tea, became important commercial products and the source of much competition between the different European trading companies. Botanical collection and research focused on those species yielding crops with high export potential rather than plants important in domestic commerce or highly valued by local people. Many of today's plantation crops, such as tea, coffee, rubber, cacao, and oil palm, are former tropical forest species. Research into these products soon separated from forestry.

After World War II, most colonies were able to secure their independence. Foreign development assistance arrived soon thereafter. In the forestry sector, technical and financial aid focused on essentially two aspects: the establishment of a forest based industry as part of an industrial development strategy and the organization of forest management to serve the raw material needs of the new industry. Where previous over exploitation had left hillsides bare, reforestation became the priority, especially with fast growing trees, often exotics. Accordingly, silvicultural research expanded to include these new species, especially to solve the problems of adapting these introduced species to new environments.

Community forestry developed in part as a response to the top-down approach of forest management at this time. Moreover, increasing population pressure and a growing reliance on wood fuel as world oil prices rose in the 1970s put greater demands on fast shrinking forest resources. Specific factors stimulating rural peoples' resistance to the direction of the forestry sector included:

- Government nationalization of forest lands and forest resources;
- Assignment of harvesting rights to outsiders;
- Introduction of alien species inimical to traditionally used local species; and
- Lack of attention paid by governments to critical local needs, such as fuelwood, fodder, medicinal plants, and water supplies.

Some argue that despite two decades of work promoting social forestry, forest administration is still largely top-down in its application (Mohapatra and Mohapatra 1997). The wishes of local people may be considered in developing management plans but implementation, because of technological limitations, may constrain or bias output toward government objectives.

Transferring Silvicultural Knowledge from the Old to the New System

As community forestry developed, most forest departments could offer technical assistance only in the areas with which they were familiar, essentially prescriptions for plantations of exotic species or natural forest management for a limited number of industrial timber species. Basically, the technology brought to community forestry was suited more to the needs of industry. Instead of reevaluating production objectives and reorienting silviculture research, foresters often just scaled down operations, relocated or concentrated on packaging and delivering forestry concepts through farmer education and extension programs (Singh et at. 1993; Skutsch

1994; Poffenberger and McKean 1996). The silvicultural prescriptions offered rarely addressed communities needs for the myriad of goods and services that rural people had come to expect from their forest areas. Instead the focus shifted to on-farm trees (West 1983; Foley and Barnard 1984, Rao et al. 1985; Gilmour 1995; Wiersum 1997). With regard to natural forest management then, the tendency in community forestry has been to abandon "scientific" forestry and to revert to traditional systems, most of which are protection oriented (Arnold and Campbell 1986; Fisher 1991). These systems rely mainly on limiting access to forest resources to prevent over exploitation and to preserve the natural regenerative capabilities of the forest. Levels of outputs, as well as inputs, often remain relatively low reflecting the failure to develop opportunities for enhanced non-destructive exploitation with improved silvicultural techniques. Agroforestry, which involves the joint cultivation of field crops and one or more tree species, has been promoted as an alternative to conventional silviculture (cf. Foley and Barnard 1984; Stevens, Bhuniibhamon and Wood 1990; Raintree and Taylor 1992; Arnold and Dewees 1995). Many of these multi-crop, multi-layer production systems reflect modifications to traditional agricultural systems, especially the incorporation of trees into swidden systems, both fields and fallows (inter alia, Jacob and Alles 1987; Foresta and Michon 1993; Momberg 1993; Peluso 1995). Such mixed systems are widely popular and have been useful for stabilizing swidden cultivation. Slightly different, taungya, which involves the planting of agricultural crops between the tree seedlings in teak plantations, is a silviculture system developed in Burma (Myanmar). It permits inter-cropping for a few years during the establishment phase of the plantation as an incentive for local labor to protect the young teak. Arguably such mixed systems may be much more in tune with the needs and desires of the local people, however, from an ecological perspective field conditions in many agroforestry systems more closely approach agriculture or horticulture than silviculture. Although silviculture has been recently associated almost exclusively with timber production, including in plantations, historically its distinction has been its association with vegetation manipulation in complex "wildwood" ecosystems.

Early European foresters working in tropical forests recognized the limited transfer-ability of European silviculture systems to tropical conditions and worked to develop silvicultural systems more suited to local environmental conditions, at least with regard to timber production (Troup 1928; Wyatt-Smith 1964). However, little analogous effort has gone into developing appropriate silvicultural systems when forest management shifted from an industrial to a community orientation. Participatory planning techniques commonly applied in the organization of community forests have been used much less for the investigation and development of innovative silvicultural systems. Little effort has been made, especially within forestry, to systematically document existing indigenous practices of vegetation manipulation in the natural forest. Most research has focused on trees in farmers' fields or swidden fallow regrowth. Investigations included not only what was planted, where and why, but what factors motivated farmers to plant or protect trees (Gilmour 1990, Arnold and Dewees 1995, Wiersum 1997). More recently interest has turned to non-timber forest products (NTFPs), associated "commercial for aging" and extractive economies with the objective of improving the income from these sources as motivating factor for forest protection (Nepstad and Schwartzman 1992; Wollenberg and lngles 1998). Despite repeated statements that much of what is regarded as primary or virgin forest is, in fact, the product of human manipulation over perhaps hundreds if not thousands of years, forestry has shown relatively little initiative in investigating this process or its implications.

Progress Outside Forestry

While foresters have been struggling with introducing social sensitivity into their profession, social scientists have shown increasing interest in investigating how humans relate to their natural environment. Anthropologists, human ecologists and ethnobotanists have been busy collecting local names and information of the traditional use of many forest species (inter alia, Balee 1994; Martin 1995; Ellen and Fukui 1996; Shigeta 1996). In some cases, they are in a race against time as such information is often pre- served only in the memory of the older members of the community. Younger people often either forget such knowledge, generally as a result of not using it, or fail to learn it altogether.

Over the past decade, a mounting body of evidence indicates that local people have been manipulating the natural forest for many years, often applying silvicultural practices they have developed themselves[2]. Increasingly it is recognized that farmers' knowledge is sophisticated, systematic and comparable with its scientific counterpart (Warner 1991; Berlin 1992; Warren, Slikerveer and Brokensha 1992; Richards 1996; Fukui 1996; Donovan and Puri, forthcoming). For the most part, existing research has emphasized recording nomenclature, use and classification as opposed to operations - in other words the product instead of the process (e.g., Posey 1985; Momberg 1993; Umans 1993; Batee 1994; Roy et al. 1995; Ellen and Fukui 1996; Ellen 1998). Cultivation practices, especially for natural forest species, are seldom evaluated in a systematic way for their impact, either on the specific vegetation treated or the environment as a whole. Table 1 presents examples of some of indigenous silvicultural techniques practiced by forest- based communities.

Table 1: Examples of silvicultural knowledge in traditional systems

Type of knowledge	Area	Reference
Seeding patterns	Uganda	Obua & Muhanguzi 1998
Seed selection	Kalimantan	Puri 1998
Seed collection and preservation	Andaman Islands	Bandyopadhyay & Saha 1998
Seed treatment	Uganda	Obua & Muhanguzi 1998
Seedling selection and replanting	Uganda Kalimantan Sichuan, PRC	Obua & Muhanguzi 1998 Peluso 1995 Cao and Veer 1998
Seedling storage	Sumatra	RAFI 1995
Propagation by rooted cuttings	Lao, PDR Indonesia	Fahrney et al. 1998 RAFI 1995
Propagation by root suckers	Ethiopia Indonesia	RAFI 1995 RAFI 1995
Top grafting w/ young bud	Indonesia, Thailand	RAFI 1995
Species compatibility	- Guinea Lao PDR	Innis 1997 Blench 1997 Fahrney et al. 1997
Animal interaction	Uganda	Obua & Muhanguzi 1998
Shade tolerance	Sichuan, PRC	Cao & Veer 998
Advantages of thinning	Northern Lao PDR	Savathvong et al. 1997
Advantages of weeding	Kalimantan	Peluso 1995
Advantages of pruning	Uganda Lao PDR	Obua & Muhanguzi 1998 Savathvong et al. 1997
Advantages of coppicing	Guinea	Blench 1997
Advantages of culling (refining)	Kalimantan	Puri 1998
Genetic selection by phenotype	Northern Lao PDR Kalimantan	Fahrney et al. 1997 Puri 1998

The potential application of ethnobotanical knowledge is fueling a heated debate in the developing field of applied anthropology (RAFI 1995; Myer 1998; Sillitoe 1998). The question of intellectual property rights of indigenous knowledge is generating particular concern. Following the tenets of the "appropriate technology" movement, such anthropological research has not only sparked, but supports, a growing interest in indigenous knowledge (O'Keefe and Howes 1978).

Despite repeated calls for a greater use of such knowledge in developing innovative systems of resource management, the forestry profession has been slow to adopt these methods (Shepherd 1992; Moran 1993; 1996; Kartasubrata and Wiersum 1993; McKey et al. 1993; Barrance 1995; Walker, Sinclair and Thapa 1995). Most advances have been in the area of agroforestry, which has benefited from the reforms in farming systems research begun over a decade ago. Development assistance activities, such as the "People and Plants

Program" sponsored by UNESCO, WWF and Kew Gardens (UK), are beginning to teach the skills needed to collect ethnobotanical information (Martin 1995). These programs are now beginning to reach foresters. More emphasis, however, is needed on collecting and assessing, in a systematic manner, existing silvicultural techniques and their application.

Obstacles to the Development of a New Silviculture

The first professionally trained foresters to work in Asia were Europeans. Recognizing the limitations of their background, they looked to local people for guidance in under-standing local ecology. Similarly, early botanists collected local knowledge to provide the basis for the technical information they required regarding tropical vegetation growth, patterns, and uses. Examples abound of the extensive amount of detailed information collected by these methods, including the work of Watt (1908) in India, Burkill (1935) in Malaya, Foxworthy (1916) in north Borneo, Heyne (1927) in Indonesia, Vidal (1962) in Indochina, and Brown (1920) in the Philippines. This work remains some of the most useful material available, especially for NTFPs. A recent series of publications by PROSEA (Westphal et al. 1989), a collaborative project between the scientists of Indonesia, Malaysia, Papua New Guinea, the Philippines, Thailand and the Netherlands, building on these earlier works is an example of similar work being produced today.

Why did this practice of local consultation fall into disuse? Although there are undoubtedly many contributing factors, a few of the more important ones appear to be:

- The pressure from higher authorities for immediate action;
- The very low level of support given to forestry research;
- The preference of many government departments to work by fiat and formulas rather than facilitation; and
- The limited recognition of the existence, validity or utility of local knowledge.

The pressure to address the problem of forest depletion and destruction comes not only from national governments but also from outside sources. For many foreign development assistance agencies halting deforestation is at the top of their agenda. All want to see some progress in reversing current trends, however few development agencies have the patience to support the basic research essential for ecological restoration. Support for applied or "action" research is even a hard-won victory in many instances. Hopefully this will change as rural people increasingly resist the planting of only a few, often foreign, species in their community forests and demand assistance to address their specific needs (Anon. 1998)[3]. Only when these concerns are taken seriously by governments and foreign donors will the development of the appropriate silvicultural systems, scientifically in tune with the local ecology and serving local needs, get the political and financial backing it both deserves and requires.

Foresters' reluctance to embrace indigenous technology stems in large part from a poorly developed sensitivity to local needs, but also undoubtedly from pride in the significant advances made with a few tree species. Throughout history, forests have been perceived as resources to be exploited to fuel national development. As long as the focus of government forest policy is the production of raw materials for industry and export, the pressure to specialize in a limited number of species will persist. In short, the research agenda is not without its political agenda, implied if not specified (Lopex and Gonzalez 1993; Scoones and Thompson 1994). If in political circles the forests were viewed more as a resource to be developed, i.e., capital (the principle) to be managed for recurring (sustained) benefits (interest), rather than merely liquidated for cash, then developing appropriate technology through forestry research would undoubtedly receive more support.

Another long-standing problem in forest administration has been the tendency for forest bureaucracies to prefer administrative methods of command and control. Recognizing the legitimacy of the different forest users and reconciling the associated conflicting interests are relatively new concepts in forestry, introduced largely through community forestry. Neither the forests nor the communities they serve are homogenous, and thus there is no magic formula that will defuse all conflict and correct all conditions. Despite decades of experience supporting this maxim, there remains the tendency within many forest bureaucracies to took for a "magic formula" or "package of technology" for universal distribution to solve all forest-related problems (Donovan et al. 1995). Repeated experience has shown, however, that governments working in tandem with farmers is the only way to develop management systems supported by all users and supportive of forest protection and enhanced productivity.

Another reason for a lack of attention to the development of suitable silvicultural prescriptions lies in the cultural prejudices that still exist in many countries toward various ethnic minorities, many of whom live in or around

forest areas. Within forestry, there is limited recognition of the existence, much less the validity and utility, of indigenous technical knowledge. In many societies it is widely assumed that since the lifestyle and cultivation practices of the hill people do not resemble that of the more sophisticated lowland groups, then there must be no technology in these highland communities[4]. Indeed, if one were to ask indigenous people if they had a "silvicultural system", the answer most likely would be "no", as villagers probably would not recognize what for them are common, everyday activities as a "body of knowledge". Moreover, to the extent that such practices are minimally disruptive to the ecological system (unlike new swidden plots), the untutored observer may be unable to recognize and interpret the various expressions of such indigenous practices.

In sum, one could conclude that the bureaucracy of forest administration is itself often a major impediment to the development of a new silviculture. Although the participatory concepts of community forestry may have been implemented effectively in organizing village user groups and in delineating forest boundaries, many of these basic precepts appear not to have permeated many forestry bureaucracies. It is clear that the essential concepts and values of community forestry have not yet been fully internalized by the very group responsible for implementing these precepts. Thus, the message of community forestry has in essence been compartmentalized and encapsulated in a subsection of an all too often still archaic bureaucracy.

Looking Back for a Better View of the Way Forward

Recognition of a problem is a prerequisite to addressing it. Community forestry is only now recognizing that there is a problem (Fortman 1988; Fisher and Gilmour 1990; Kartasubrata and Wiersum 1993). Although significant progress has been made, foresters are still struggling to redefine their role and responsibilities, especially in the context of improving forest productivity to meet community needs. Recent reviews of community forestry projects point to the poor preparation of the technical component in many instances (van Assen 1996). Thus, many of the present problems appear to stem from ignoring the core of forestry itself.

At this point it may be useful to step back and review the definition and structure of forestry as a science. Box 1 shows how the definition of forestry has evolved over the last few decades. Forestry is no longer focused on timber alone, but recognizes the important role and valuable contribution of all components of the forest ecosystem, despite any difficulty in valuing them. This has come about largely in response to the changing relationship of society to its natural resource base reflecting social, technological and economic development. Increasingly then, in concept if not in practice, forestry has come to recognize and to be reconciled with its basic foundations, that is the science of ecology which encompasses the totality of the biological and physical elements of the forest ecosystem (Ffolliott and Thames 1983).

Box 1: The evolving definition of forestry

Forestry is:

"...science and art of forming and cultivating forests, management of growing timber... [1859] " (O.E.D. 1973)

"…the theory and practice of the constitution and management of forests and the utilization of their products... including their creation... for the continuous production of produce and services." (Champion 1954)

"... the science, the art and practice of managing and using for human benefit the natural resources that occur on and in association with forest land." (Ford-Robertson as quoted in Sharpe, Hendee and Allen 1976)

"...the practice of managing forests and associated natural resources for desired goals with ecology providing a basic foundation.... It is important to note that while growing trees is an essential part of forestry, other vegetation (including grasses and grass-like plants, forbs and shrubs) and other natural resources (soil, water, wildlife, recreation and minerals) must be considered.... A desire to produce wood products should not lead to a disregard for the other values of natural resources." (Ffolliott and Thames 1983)

"...the profession embracing the science, art, and practice of creating, managing, using and conserving forests and associated resources for human benefit and in a sustainable manner to meet desired goals, needs, and values -- including those biological, quantitative, managerial and social sciences that are applied to forest management and conservation..." (Helms 1998)

Table 2 details the component parts of forestry as originally defined in Germany more than a century ago. This breakdown is useful from several perspectives. First, it clearly illustrates the fact that forestry is a management science. Second, it shows the relationship between the various operational elements of forestry and their scientific basis. Third, it provides a glimpse of the educational background that has shaped the orientation of the present generation of foresters. New concepts and terms that recognize the value of community participation (such as community forestry, agroforestry, NTFPs, and integrated conservation and development) have been added to the lexicon in recent years. Indeed, a review of historical literature indicates, however, that many of these "modern" ideas are refinements of earlier concepts.

Table 2 highlights the position of silviculture at the heart of forestry. Silviculture is essentially the manipulation of forest components for specific socially determined objectives. The history of scientific silviculture is the development of various methods and a system of intervention based on ecological principles with the aim of improving productivity, both in terms of quantity and quality of products and services produced. Apart from a few species of NTFPs that have been domesticated, and which subsequently have passed into the category of plantation crops, historically more work has been done on timber species than on other tropical forest products (van Goor 1982, Dawkins and Philips 1998).

Table 2: System of forestry knowledge (according to the early German school)

Aspects	Application	Effective Element
Statistics - area, forest conditions, products, by-products, trade, prices **Economics** - commercial aspects and non-market goods and services valuation **History**	**Forestry politics** - the rights and duties of the State; laws and regulations; education and training	**Forest Policy** - the institutional and economic basis "The Condition"
Forest ecology and botany - systematic botany; forest geography; ecology and climate; biology of forest trees, shrubs, herbs & grasses forest soils - biology, chemistry & physics **Timber physics** **Technology** - mechanical, physical and chemical properties of wood, by-products, minor forest products, and waste products	**Silviculture** - natural regeneration - afforestation - cultivation - management systems **Forest protection** **Forest improvement & Rehabilitation** **Utilization**	**Forest Production** - the technical basis "The Crop"
Growth & yield survey **Financial assessment**	**Forest regulation** - establishment of units of management and administration; working plans; determination of annual allowable cut **Forest administration** - establishing routine methods, business practices; tariffs & fees personnel; ization of services and mechanical operations.	**Forest Organization** - the administrative & Financial basis "The Revenue"

As Janzen (1998) noted, while there have been notable advances in agriculture, "We have tens of thousands of years of experience fine-tuning the urban landscape and the agroscape,... we are still in kindergarten in developing the wildland garden..." Indeed, forestry repeatedly finds itself in difficulties because it cannot, or will not, distinguish itself from agriculture and horticulture. Despite the significant advances in forest science over the last few decades, forestry does not yet possess the scope of knowledge, especially in the context of tropical forests and natural forest management, required to meet the demands and expectations of the political bosses or the general public. Recognizing this, the profession should redouble efforts to gain support for the scientific and technological development that will enable the profession to do what is increasingly wanted and expected of it — conserve and develop the *natural* forest.

To develop further, community forestry, as well as the forestry profession as a whole, must acknowledge and access the indigenous knowledge base. The type of information needed to develop new silvicultural prescriptions is illustrated in Box 3. Much of this information, basic data on forest ecology and biology, is essentially natural history, which indigenous knowledge systems generally possess in abundance (Richards 1985; Rusten 1989; Warren, Slikerveer and Brokensha 1992; Thapa, Sinclair and Walker 1995; Harris 1996; Colfer et al. 1997). As stressed repeatedly in the definitions in Box 2, a sound knowledge of forest ecology must provide the basis for silviculture, hence defining the context of forestry itself.

It is clear from even the very limited sample of indigenous forest knowledge illustrated in Table I that many traditional societies living in or near the forest have a sophisticated body of knowledge and practices relating to natural resource exploitation and management. As in the West, much of this information is species specific. Also, much of the indigenous information on the manipulation of forest vegetation is informal, having been subjected to no fixed or regular protocol in its collection or analysis. Indeed, more than one set of cultivation practices may exist in any given community, that is, different farmers may have different methods of cultivation.

Box 2: The developing definition of silviculture

Silviculture is:

"The cultivation of woods or forests; the growing and tending of trees as a department o forestry [1880]." (O.E.D. 1973)

"... the art of applying the knowledge and requirements of different trees, in tending and regenerating existing woods or in rearing fresh woodland crops, an in working them to the best advantage of the forest owner.,, (Broun 1912)

" ...the process by which crops constituting the forest are tended, removed and replaced by new crops, resulting in the production of forests of a distinctive form." (Troup 1928)

"...all the techniques of raising, tending, and regenerating a forest crop, and is directly comparable with the cognate terms horticulture and agriculture for garden and field crops. respectively, though like these terms it is often used with rather a wider significance. It should be noted that silviculture is basically concerned with crops of trees, thus contrasting with arboriculture where the stress is on the care of the individual tree. The study of plant organisms in their environment is covered by the now well established term ecology, so that silviculture may be correctly be described as applied forest ecology.... The primary objects of silviculture are to give the trees retained on any site the best possible conditions of growth, and to ensure the replacement of old or inferior trees lost by death or felling, by new stock". (Champion 1954)

"... all management operations that go into the development and maintenance of a socially determined form of forest stand... the applied science [of forest ecology] of reproducing and manipulating the forest." (Sharpe, Hendee and Allen 1976)

"... the science and art of cultivating forest crops..., the theory and practice of controlling the establishment, composition... and growth of forests.... Silviculture is applied forest ecology a means of protecting and enhancing range, wildlife, water and soil resources, as well as timber crops. It is the manipulation of forest vegetation for human purposes." (Wenger 1984)

"...the art and science of controlling the establishment, growth, composition, health, and quality of forests and woodlands to meet the diverse needs and values of landowners and society on a sustainable basis." (Helms 1998)

Using the Familiar Tools of Community Forestry to Develop a New Silviculture

Very little is known of the natural history of most tropical forest species, although as noted by Anderson (1997), "[n]ative peoples are the repositories of generations of keen observation and diligent experimentation that has finely tuned their relationships with nature". Local knowledge is the best starting point for learning more about local ecology and forest cultivation practices (Moran 1993; Walker, Sinclair and Thapa 1995; Anderson 1998; Donovan and Puri, forthcoming). Detailed information about all aspects of a plant's life history, ecological relationships, pollination and seed dispersal (Box 3) is critical for developing silvicultural prescriptions. Description and analysis of indigenous manipulation techniques must be the starting point for any objective assessment of the impacts of indigenous practices on resource productivity and associated vegetation. An experimental, or "scientific", approach with specific questions or hypotheses related to the affect of indigenous cultivation strategic and practices is the logical next step. it is critical that farmers are involved throughout this process (Fisher and Gilmour 1990; Scoones and Thompson 1994). The scientists currently interested in this topic are often anthropologists, geographers or other social scientists. Unfortunately, most of these individuals lack the specific training in the biological and management sciences (i.e., forestry, or perhaps agronomy and horticulture) that would enable them to properly record and analyze the information required for assessing the impact of indigenous forest cultivation practices. In exploring and evaluating the existing knowledge base within forest-based communities, foresters may profitably make use of many of the research methods developed in community forestry. These would include, but should not be limited to, the familiar techniques of participatory rural appraisal (PRA). In this process they should not abandon, however, the analytical techniques common to scientific silviculture. As noted by Andersen (1997) "a better understanding and explanation of forest systems will be achieved only through the development of a better rapprochement between the social, historical and biological sciences than presently exists...".

Community forestry must integrate research techniques from forestry, ecology and anthropology. Foresters need a sound base in the social as well as biological sciences so that they have the skills necessary to work with villagers to devise and test new silvicultural techniques. Foresters must be able to assess local skills and assist farmers in adapting silvicultural practices. The cooperative research techniques of on-farm experiments developed in farming systems research can and should be adapted to investigate forest manipulation by local communities (Richards 1985). The trained forester should be the link between the scientific community and the de facto forest manager - the farmer - recognizing that the flow of information is and always should be two-way. Foresters working in this manner will contribute both to the advancement of forest science and to assisting farmers develop new skills and technology. Thus, the role of the professional forester should be as the midwife and the catalyst to assist local people in developing the knowledge base needed for the refinement of silvicultural prescriptions and enhancement of forest, productivity.

Box 3: Basic informational requirements for silvicultural prescriptions

1. Nomenclature • Genus, family • Derivation of name • Local and trade names **2. General introduction** • Number of genera, species, • Natural range and artificial, extended distribution • Special features • Major and minor uses and history of exploitation; access, tenure • Market prices, royalties, fees **3. Identification** • Dendrologic features • Form, height, girth, crown diameter • Common associations **4. Habitat and Site Data** • Climate preference: rainfall, temperature, humidity • Topography: elevation, landscape preference	**6. Existing silvicultural knowledge** *Natural regeneration* • site conditions preferred • relation to mother tree • inducements *Assisted propagation & planting* • wildling collection • vegetative methods suitable • seed technology: collection, processing, storage, viability, etc. • appropriate nursery techniques • germination factors • shade tolerance • pest & pathogen problems • age and time of planting • site preparation • transplanting techniques • tending: weeding, thinning, pest control *Response to various treatments and refinement techniques; weeding, pruning, thinning, tillage, etc.*

• Soil preference, pH, texture, drainage, soil type, bedrock • Tolerance of shade, drought, flooding, salinity, frost, wind, fire, disease, pests • Forest type, stage & abundance • Distribution & companion species **5. Life cycle characteristics** • Phenology: conducive conditions, periodicity, pollination ecology, seed dispersal • Silvical features: occurrence, abundance, degree of dominance, gregariousness • Natural growth pattern: size, age at maturity, mortality • Yield (all products) per tree/ha	*Suitable silvicultural systems* *Growth and yield data* *Pests and pathogens* *Compatibility in mixed systems* *Coppicing ability* **7. Seed sources** • Domestic • Regional • International **8. Literature** **9. Institutions and scientists prominent in research and development of this species**

Source: Derived from Wadsworth 1997

Conclusion

The emphasis of community forestry over the past two decades has been mainly on restructuring the institutional arrangements of forest management. Although there has been significant work in mapping indigenous territory and more recently recording indigenous use and nomenclature for various resources, little effort has been expended to document local practices of vegetation manipulation in the natural forest. Such an analysis of the existing situation should be the starting point for any development assistance effort. in effect, the forestry profession has failed to bring one of its greatest strengths - the understanding of the scientific principles and research protocols of forest ecology - to bear on one of the most pressing needs of our time: the development of silvicultural systems to enhance the productivity of natural forests under community management. So long as foresters ignore this issue, there will be a perpetual conflict with other sectors, defending the tropical forest from conversion to what is often believed, rightly or wrongly, to be more valuable, alternative uses.

Increasingly, local people are reaffirming not only their interest but also their right to be involved in developing new technologies through research. Indeed, farmers are speaking out to preserve, and where necessary rehabilitate, the native forest rather than establish plantations of exotic species. Foresters are learning with farmers methods by which to revitalize over exploited forests. Such efforts must be more broadly supported and expanded. If foresters fail to help local people develop appropriate silvicultural prescriptions, foresters may lose not only an opportunity to influence future forest conditions and the course of rural development, but also their very *raison d'être*. Moreover, they will fail in their responsibility to forest-based communities as forests fall short in meeting the needs of the local people. Ultimately, this inaction jeopardizes not only the forests, but also the forest communities they are committed to support.

This then is a wake up call to foresters to recognize the true role of farmers as de facto foresters, and to make the farmer a full partner in forest management and development. It is precisely those communities which depend the most on the forest that have both the most to offer and the most to gain from the development of more appropriate silvicultural systems. They also pose a great threat to forest integrity and forest well-being if their needs are ignored. As long recognized in community forestry, strong local cooperation is critical to the conservation of forest resources. Enhanced productivity through better silviculture is one way to secure and sustain local support for forest management.

When we hear the phrase "use it or lose it"[5], we should be reminded not only of tropical timber resources but also of indigenous technical knowledge. Indeed if we don't use the latter the former may be doomed. Community forestry must help rural people to employ systems that will produce the goods and services that they need both now and in the future. Truly, if forestry is to retain its credibility, it must strengthen it's scientific input into community forestry. The first step in this process must be the development of the institutional

flexibility to recognize and utilize local people's knowledge in solving forestry-related problems.

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Notes

[1]Much of the discussion in this paper turns on the definition of "forest". The Society of American Foresters defines a forest as "...an ecosystem characterized by a more or less dense and extensive tree cover, often consisting of stands varying in characteristics such as species composition, structure, age class, and associated processes, and commonly including meadows streams, fish and wildlife". Broadly speaking this could be construed to include fruit orchards and managed swidden fallow regeneration. In this paper, however, the term 'forest' will be used in its original sense (OED), namely, an "...extensive tract of land covered with trees and undergrowth and sometimes pasture ... wild and uncultivated..." though not necessarily uninfluenced by man.

[2]Such information is scattered through a variety of literature; examples include: Padoch and Vayda 1983;

Posey 1985; Godoy and Tan 1988; Gomez-Pompa 1991; Padoch and Peters 1993; dejong 1995; Puri 1997, 1998.

[3]Reportedly scientists from the Smithsonian Institute were kicked out of their long-term ongoing research project in Coast Rica for failing to take into account the wishes of the local villagers (Milius 1998).

[4]We don't seem to have come very far from when Europeans first came to Southeast Asia; they could perceive no structure or order in the traditional forest garden. Thus they often viewed the carefully crafted forest gardens as unutilized tracts or wastelands.

[5]This phrase reflects the sentiments of the argument that banding the international trade in tropical timber would render the forest virtually valueless to the government (in fiscal terms) and thus hasten its conversion to alternative uses, especially agriculture, a more easily taxable venture.