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Land Tenure and the Management of Land and Trees in Asia and Africa[1)]

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This paper summarizes and extends the results of seven-country projects conducted in Ghana, Uganda, Malawi, Sumatra (Indonesia), Vietnam, Nepal, and Japan on the land tenure institutions and the management of forest, agroforest, and cropland. It is found that traditional or customary land tenure institutions possess no built-in mechanisms to prevent deforestation. They have evolved, however, from communal ownership to individualized ownership so as to provide proper incentives to induce commercial tree planting and the management of tree fields (or agroforestry). It is also found that common property system is efficient for the management of forests producing minor products such as firewood, whereas more individualized system is more efficient for the management of timber forests.

Keywords: customary land tenure, deforestation, shifting cultivation, individualization, agroforestry, common property, management efficiency.

1. Introduction

Massive deforestation has been taking place in the Third World, resulting in deterioration of ecological environments and greater scarcity of forest resources, such as firewood, fodder, and timber. Cleared land is often used in low-input shifting cultivation, a system that cannot meet the needs of growing populations. While this scenario depicts a substantial proportion of rural settings in the Third World, some positive natural resource trends can also be observed. Reforestation has followed deforestation in selected forests in the hill region of Nepal and Northern Vietnam. We also observed the significant and often growing use of agroforestry, such as the growing of commercial trees, often inter-cropped with annual crops when trees are young (e.g., cocoa in Ghana, coffee in Uganda, and rubber and cinnamon in Sumatra) and the maintenance of low-input, cereal-based agroforestry systems (e.g., nitrogen-fixing and multi-purpose *Faidherbia albida*/maize in Malawi). In this study we attempted to identify, systematically and quantitatively, the factors affecting the evolu-

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tion of land tenure institutions and their effects on the use of land for forestry, agroforestry, and annual cropping and their management efficiency at the community and household levels.

We intended to draw generalizable conclusions by making a comparative study between Asia and Africa, where cultural, natural, and policy environments are vastly different. We confirmed that the use and allocation of forests, agroforest, and cropland are governed by land tenure institutions, ranging at a broad level from communal ownership of land to state ownership, common property, and private ownership.[2] Further, there are consistent findings as to the conditions under which each of these institutions performs well and poorly in terms of promoting efficiency of natural resource management.

This paper attempts to summarize the major findings of seven country studies, including Ghana, Uganda, Malawi, Indonesia, Vietnam, Nepal, and Japan, so as to draw policy implications. Discussions in this paper will be organized around the following major issues addressed in this study. First, what are the more common types of property rights institutions, how, if at all, are they evolving, and to which factors are they most responsive? Second, how do land tenure institutions affect the pace of deforestation? Third, under what conditions is common property system a viable and efficient institutional arrangement? Fourth, how do land tenure institutions affect the incidence of planting commercial trees and their management efficiency? Fifth, how do land tenure institutions affect the efficiency of annual crop farming? And finally, what effects do the different tenure systems have on equity and reduction of poverty? In what follows, we will discuss the emerging conclusions on each topic from our case studies. Final section is devoted to the discussion of policy implications of this study.

2. Evolution of Property Rights Systems

In all the study sites operating under the communal tenure system, population pressure has led to the privatization of land rights on land converted and utilized for agriculture or agroforestry. Strong individual land rights are granted to cultivated land converted from forests and woodlands, even though such rights are weakened when the land is put into long fallow. Rights have been further individualized through long-term investment, most notably in tree planting, which was clearly demonstrated in the case studies of Ghana and Indonesia (Otsuka, Aidoo, and Quisumbing [11]; Otsuka, Suyanto, and Tomich [13]). There has also been evidence from Ghana and Indonesia that during this process land markets have strengthened and that they further contribute to the process of individualization of land rights. All of these trends have caused traditional land acquisition methods to erode. This has been particularly true in the matrilineal inheritance systems of Malawi, Ghana, and Indonesia, where matrilineal customs have given way in part to patrilineal or egalitarian systems, to gifts, or to outright sales of land. More private-type farming systems, such as formal leasehold or freehold tenure, are increasing in some places (e.g., Malawi), but generally remain a minute proportion of total farming area (Place and Otsuka [17]).

There has been much less institutional innovation within the communal tenure system with regard to forest and woodland management (in Ghana, Malawi, Uganda, and Indonesia). Our studies found that these resources continue to be managed as virtual open-access resources, with a few exceptions of very small areas managed as common property (e.g., the Village Forest Areas in Malawi). The reasons for this are diverse, ranging from heavy pressure for conversion by villagers, to low valuation of woodland resources, and to greed on the part of some traditional authorities. On a more encouraging note, many state forests, which used to be largely open-access in Nepal, have devolved to community management and are now thriving under common property

[2] It may be useful to define the concept of the two basic land tenure institutions. (1) Communal land consists of virgin forest land, which is supposed to be controlled by village chief, and cleared land (i.e., cropped land of food cultivation, fallow land, and commercial tree fields) whose exclusive use rights are granted to individual members. (2) Common property is property, which is jointly owned and used by community members. Like private goods, resources managed under common property regime are subtractable (e.g., firewood). It is costly to protect such resources to varying extent.

management (Tachibana, Pokharel et al. [24]). The reasons for these successes are detailed later in this paper.

3. Land Tenure and Deforestation

1) Communal ownership

In our observation, uncultivated forest area under the communal tenure system is open access, at least for members of the community. We repeatedly encountered the cases in Ghana, Uganda, Malawi, and Sumatra that although the village chief is a custodian of the communal forests, he easily allows villagers to clear the forest for cultivation. We also found the case in which village members report the clearance of communal forest to the chief *after* clearance was completed, in order to "register" their ownership, in some villages in Ghana. It appears that the major responsibilities of the village chief are to approve the clearance of forest and woodland and to record the land ownership so as to avoid the possible land disputes in the future. The direct reason why woodlands or forests were conserved by traditional authorities is that there has been an increasing demand for conversion from an increasing number of villagers. This demand arose partly because of poor markets for forest and food products, which meant firstly that little income could be earned from forest products and secondly that they could not easily be traded for food.

While it is difficult to prove rigorously that primary forest has been operating under open access over an extended period of time, there is no question that forest area has easily been cleared with population growth under the communal ownership. As is shown in Table 1, the proportion of agricultural land increased substantially for the last few decades at the expense of forest and woodland in Uganda and Malawi, according to the analysis of aerial photographs at the community level (Place and Otsuka [15], [17]). At present there remain only small area of forest and woodland in these countries. Furthermore, we found that the age of household head is the critical variable explaining the area of acquired forest land in Ghana and Sumatra (Otsuka, Aidoo, and Quisumbing [11]; Suyanto and Otsuka [20]). The positive relationship reflects the fact that cultivable primary forests have largely disappeared in recent years due to the clearance of primary forests on first-come-first-served basis. Evidence also suggests that remaining forests are largely concentrated in areas quite remote from roads and urban centers.

Table 1. Changes in land use in Uganda, Malawi, and Vietnam (%)

Land use	Uganda[a]		Malawi[b]		Vietnam[c]		
	1960	1995	1971	1995	1978	1987	1994
Agriculture	57	70	52	68	48	69	76
Forest and woodland	32	20	34	19	52	31	24
Others	11	10	14	14	—	—	—

a) Average of 64 parishes in east-central region. b) Average of 57 enumeration areas throughout the country. c) Average of formerly forest areas with slope greater than 24 degrees in 56 communes in two northern provinces.

Table 2. Major causes of deforestation reflected in reduced forest area[a]

	Uganda	Malawi	Ghana	Sumatra	Vietnam
Population pressure	++	++	0	++[e]	++[f]
Land tenure institution	+[b]	+[c]	+[d]	0	++[g]
Distance to road or town	++	0	++	n.a.	+
Age of household head	n.a.	n.a.	++	+	n.a.

a) ++ sign indicates highly significant and positive effect, + indicates significant and positive effect, and 0 denotes the absence of significant effect. b) Positive effect of communal ownership compared with private and state ownership. c) Positive effect of patrilineal inheritance compared with matrilineal inheritance. d) Positive effect of migrants, who are generally subject to patrilineal inheritance. e) Effects of reduction in inherited land area. f) Effects of population growth and rice production per capita during the pre-reform period (1978-87). g) Judged from the structural difference between strict state ownership to more privatized ownership systems.

As is indicated in Table 2, the major factor accounting for the decrease in forest and woodland is identified to be population pressure, measured by population density and population growth in these Uganda and Malawi (Place and Otsuka [15], [17]). Similarly, from a household study in Sumatra (Suyanto and Otsuka [20]), it is found that reduction in inherited land, due primarily to increased number of family members relative to family owned land, resulted in larger clearance of forest land. Although we failed to identify statistically significant effect of population growth on deforestation using cross-section data, it is obvious that large areas of virgin forests have been cleared by influx of immigrants, who purchased land from the chiefs in indigenous villages (Hill [6]).

In both Malawi and Uganda, we found that population pressure is not related to tree cover density in agricultural and non-agricultural land. This provides support to the argument that deforestation is related principally to the demand for agricultural land and not to energy demands, in which case one would have expected to find a thinning of tree cover in areas with high population pressure. In the case of Uganda, because tree cover densities are relatively close between agricultural and non-agricultural land, the conversion effect of population pressure had no major impact on overall tree cover. However, we wish to stress that the composition of tree species had changed considerably and undoubtedly some of the functions provided by the forest trees have not been replaced by planted trees. In Malawi, however, conversion from woodland into agriculture entails a significant loss in aggregate tree cover because relatively few trees are found on agricultural land.

In Uganda where patrilineal inheritance system prevails, it is statistically found that the speed of expansion of agricultural land was faster under the communal ownership than private ownership, suggesting that the protection of woodland has been less strictly enforced under the communal ownership (see Table 2). An important factor affecting deforestation is the conventional rule of the communal land tenure, which honors the ownership rights of cleared forestland. In other words, work effort of clearing forest is rewarded by strong individual land rights. It is also clearly reported from the case studies of Ghana and Sumatra (Otsuka, Aidoo, and Quisumbing [11]; Otsuka, Suyanto, and Tomich [13]) that those who have cleared village forest land are granted strong individual rights. This accrual of strong individual land rights will explain, at least partly, why the conversion of woodland has been faster under the communal ownership than the private ownership in Uganda.

To conclude, there is no built-in mechanism under the communal ownership to protect forest area and forest resources. Thus, forest has been converted to agricultural land to feed the growing number of household members. Halting this trend will not be simple. In the policy implications to be discussed below, we suggest that a multi-faceted strategy of institutional change, technology promotion, and market development is required.

2) Other ownership systems

Strictly speaking, woodland in Malawi, called *miombo* woodland, may be considered as common property in which community members collect firewood, poles, and other non-timber products, and graze cattle. According to our informal interviews with village chiefs, collection of only dead and dry branches is allowed and cutting of live trees and branches is prohibited, whereas no sale of firewood at the market is allowed under the existing management rules. If only dead and dry branches are collected from communal woodland, its sustainable management is assured, so long as grazing is regulated so as to avoid the damages on young seedlings and wildings. Actually, however, woodlands have rapidly degraded and disappeared due to tree cutting for home use, sale in urban centers, and for drying tobacco in the South and Central Regions of Malawi. One exception is the Village Forest Area, a formally identified area actively managed as common property; but to date they are few in number and very small in size, and management rules appear overly protection oriented.

Forests and woodlands are owned by the state in Vietnam and Nepal. The proportion of bareland or denuded forest land, which is used for shifting cultivation, increased by 21 percentage points from 1978 to 1987 in Northern Vietnam due importantly to food shortages (Table 1). In our observation, forest area has

been essentially open access with no regulation by the state. After long-term leases (50 years) were granted to individual farmers on a voluntary basis in the early 1990s, not only has the pace of deforestation declined but also farmers' initiatives—rather than government-sponsored projects—have focused on planting timber and fruit trees, and regenerating forests by protection. This has resulted in clear recovery of forest conditions in recent years (Tachibana, Nguyen, and Otsuka [23]).

It is also important to observe that management of forests by user groups or under the common property regime did not spontaneously develop in Vietnam, even though Vietnamese communities have a long tradition of communal irrigation and other collective activities. As we will argue, community management of forest is effective when predominant forest products are minor products, such as firewood, grasses, and fodder. In our mountainous sites in Vietnam, these minor forest products are amply available, even though massive deforestation has taken place.

In Nepal, forests were nationalized in 1957 and deforestation followed. Whether deforestation would have been prevented significantly if forests were not nationalized is a difficult question to answer. Yet it is true that deforestation was followed by reforestation with the recent establishment of forest user groups, particularly formal groups that received formal use rights of forests from the state (Tachibana, Pokharel et al. [24]; Sakurai et al. [19]). However, we found that those active and effective informal user groups, which were established in earlier years, tend to have been transformed into formal user groups as of now. In fact, few formal user groups changed their management rules when official use rights were granted. Therefore, the significant effect of formal user group management is likely to reflect the self-selection effect rather than incentive-enhancing effect of establishing land use rights for forest user groups.

Unique to the case of the hill region of Nepal is the absence of expansion of agricultural land. In fact, deforestation took primarily the form of removing tree covers from forests. As will be explained later, this would be due to the critical importance of minor forest products such as grasses and leaf fodder for the livelihood of subsistence farmers. This is clearly perceived by farming population, which prevented the encroachment on the forestland.

To sum up, our case studies demonstrate that forests are not well protected under the state ownership system. In fact, primary forests have largely disappeared in areas owned by the state. *It must be also pointed out that common property regime is not always viable to preserve forest and woodland, judging from the experience of Malawi.*

4. Management of Common Property Forests

Whether the management of forests and other natural resources under the common property regime is an efficient institutional arrangement has been widely debated in the literature. Yet, empirical evidence is deplorably weak. The issue is practically important, as tree planting projects supported by international organizations and aid agencies include social forestry or community forestry projects, which have the principles of equal participation of all community members and equal sharing of benefits. The same principles are usually adopted by voluntarily established community forest management institutions in the hill forests of Nepal and community forests in prewar Japan (McKean [9]). In order to assess the management efficiency of common property forests, this study conducted an analysis of common property forests in the hill and inner Tarai regions of Nepal and mountainous parts of Japan, aside from the case of Malawi mentioned earlier.

Formal user group management of forests in Nepal has been successful in reducing the amount of extraction of dead and dry branches for firewood, preventing the cutting of green branches and felling of trees, and preventing cattle grazing (Upadhyaya and Otsuka [27]). On the other hand, informal user group management, which generally stipulates fewer rules and enforces them less strictly, has had no appreciable impacts on forest conditions, even compared with the cases of no user group management or open access. This is due to the fact that informal user groups were newly formed with the main intention of fulfilling the government requirement to acquire the status of formal user group with official use rights.

There is a tendency that management rules

have been strengthened as scarcity of forest and tree resources have increased over time (Tachibana, Pokharel et al. [24]). It is certainly costly to organize collective action, set up management rules, and enforce them. Thus, forest user groups tend to be formed spontaneously when the scarcity of forest resources reaches the threshold level to warrant the initiation of user group management. It seems that once management rules are formulated, they tend to be obeyed by the user group members in the hill region of Nepal.

There are at least two fundamental factors, which explain the success of common property forest management in the hill region of Nepal. First, subsistence farming and livelihood critically depend on the availability of forest and tree resources, such as firewood, grasses, and leaf fodder (Thapa, Koirala, and Otsuka [25]). The transportation network is poorly developed and access to markets and alternative sources of energy and soil nutrients which can be substituted for firewood and compost is very poor in most communities in the hill region. Furthermore, the large and continuous application of compost is essential to sustain upland farming in terraced fields on steep slopes. Thus, the degradation of community forests immediately and significantly jeopardizes the livelihood of the farming population. This implies that there are potentially strong incentives for farmers to protect and manage forest resources.

In contrast, *miombo* woodlands in Malawi are located in relatively flat areas and the access to markets is much more favorable. This seems to explain partly why the management of *miombo* woodland has been much less successful. In fact, the management of common property forest has never been successful in flat areas of contemporary Nepal as well as prewar Japan. In addition, hilly and mountainous topography tends to favor the development of common property resources in that it gives rise to natural externalities (e.g., movements of soil and water).

Second, it is important to recognize that the types of forest resources successfully protected by communities are minor forest products, products that are of relatively low value, whose value responds very little to improved management, and whose cost of protection would be extremely high if they were owned individually. It will be less costly to protect those resources communally by hiring a selected number of guards or adopting rotational system of patrolling among community members than by hiring guards individually. In other words, we argue that the advantage of community management rests on the economies of scale in protection activities. This hypothesis is consistent with the finding of the case study of timber plantation in the inner Tarai region of Nepal that the cost of protection per unit of area is by far larger under private than community ownership of land (Sakurai et al. [19]).

The cost of protection of forest resources by private owners is much larger, however, if the minor forest products prevail, because, unlike timber, it is easy to cut small trees and branches and haul them from forests without being identified by village people. There is, therefore, no question that it is less costly to protect timber than such minor forest products as firewood and grasses. It is also important to realize that timber production, to be successful, requires such silvicultural activities like weeding, pruning, thinning, and singling. Like the case of collective farming in socialist economies, each farmer has little incentive to carry out these activities so long as benefits are shared more or less equally among community members.

These considerations led us to examine the case of community forest management in postwar Japan, where forests have been converted from those with miscellaneous broad leave trees to timber forests. We found that timber trees have been more actively planted and managed on individually managed portions of community forests than those managed collectively (Kijima, Sakurai, and Otsuka [8]). The emerging conclusion is that the individualized management system is more efficient than the community management system in the case of timber forests in Japan.

This conclusion, however, does not necessarily hold in the Third World where, unlike postwar Japan, there are competing uses of land areas such that grazing of livestock and excessive collection of firewood are major threats to the sustainable management of forests. In fact, one of the reasons for the higher cost of protecting timber plantation under the private ownership in the inner Tarai is the cost of

building fences and employing private watchers. For example, cattle and goats eat young seedlings and step on them. In order to protect a timber forest, collective management with regulated use of forest resources and mutual supervision will be more cost-effective. In order to carry out management activities, however, the individualized system is more efficient. In our view, the best management system therefore is the combination of the two in which protection is carried out by participation of all community members and management activities are carried out under individualized management incentives. Such cases are found in the inner Tarai region, in which management of trees is carried out by labor hired by a central management committee. In this system, the community members agree to follow regulations on grazing and firewood collection and receive the privilege of purchasing firewood and timber at prices much lower than market prices. The proceeds of forest management are used partly for infrastructure development for the benefits of community members at large and allocated partly to the members of user group committee. This system proved to be superior to the conventional collective management in the case of timber forests (Sakurai et al. [19]). It is also important to point out that the possibility of selling harvested timbers to markets is the prerequisite for the efficient management of timber forests, as it enhances profit incentives.

We conclude that the common property forest management can work when the predominant forest products are minor forest products for which exclusion of use is difficult. When products are valuable and depend on management, such as timber, the private tenure system is best in the absence of pressure on the resource from other users; else the combination of collective management for protection and individualized or centralized management for management of trees is most efficient.

5. Communal Land Tenure and Development of Agroforestry

As we have argued, the major single cause for deforestation in our study sites is the expansion of farm areas to grow food and other crops. Those cultivators belong mainly to the poorest segment of the poor society and large forest areas have already been cleared and occupied by them. Such land is often marginal for agriculture and some may be highly sloping. Unless decent work opportunities are made available, it is practically impossible to relocate them to restore the forest conditions. It will be socially more desirable to promote agroforestry systems to mimic many of the forest functions and to provide income earning opportunities for the rural population. Many of the trees farmers plant trees, such as commercial trees, pole trees, fruits, and nitrogen fixing trees, which provide positive environmental externalities such as carbon sequestration and increased flora biodiversity. Commercial tree farming and farming with useful trees are usually more sustainable and often more efficient farming systems in marginal areas because of the low yields of pure crop enterprises on these lands.

It is widely believed, however, that because of the weak individual land rights or tenure insecurity, trees are not planted and well managed under the communal ownership in which the extended family often has influence over use rights in cultivated land (e.g., Johnson [7]; Besley [1]). If this is indeed the case, it will be difficult to disseminate agroforestry in marginal areas even though agroforestry has comparative advantage over food production under shifting cultivation. If the communal tenure institutions provide sufficient incentives to plant and manage trees, however, the incidence of poverty in marginal areas can be reduced by enhancing the efficiency of land use in such areas. Furthermore, the establishment of agroforesty in sloping land will help reduce soil erosion and contribute to the partial restoration of tree biomass and biodiversity. This is reported to be the case in cocoa fields with big shade trees (Gockowski, Nkamleu, and Wendt [4]) and in the so-called jungle rubber forest mixed with non-rubber trees (Tomich et al. [26]).

In matrilineal communities of Sumatra, cultivated land was traditionally owned by lineage members consisting typically of three generations descended from the same grandmother. Gradually joint ownership by sisters became common. As is shown in Table 3, however, agroforestry plots are more likely to be bequeathed from mother to individual families of daughters and even to those of sons at present (Otsuka, Suyanto, and Tomich [13];

Table 3. Distribution of area under different land tenure institutions and the index of land rights on agroforestry plots in Sumatra

	Lineage ownership	Joint family ownership	Single family ownership	Private ownership	
				Purchase	Forest clearance
Distribution of area (%):					
High region	3	5	42	10	37
Middle region	5	2	62	14	19
Low region	0	3	46	12	39
Index of land rights:[a]					
High region	0.0	0.6	1.6-2.0[b]	3.1	
Middle region	0.8	0.9	1.9-2.9	3.8	
Low region	0.0	1.0	1.9-2.8	3.8	

a) The following four rights are considered: rights to rent out under share tenancy, rent out under leasehold tenancy, pawn, and sell. Numbers refer to the average number of rights without obtaining approval of family and/or lineage members. b) The first number refer to the case of single family ownership of daughters, whereas the second number corresponds to the case of single family ownership of daughters and sons.

Table 4. Distribution of area under different land tenure institutions and the index of land rights on cocoa plots in Western Ghana

	Temporarily allocated family land	Inherited family land	Acquired village forest land	Gift	Others
Distribution of area (%):					
Indigenous villages	22	13	19	33	13
Migrant villages	9	18	22	26	26
Index of land rights:[a]					
Indigenous villages	0.3	1.1[b]	3.0	4.9	—
Migrant villages	0.2	3.3[c]	3.9	5.3	—

a) The following six rights are considered: the rights to plant trees; rent out; pawn; bequeath; give; and sell. Numbers refer to the average number of rights without obtaining approval of family members or village chief. b) The number pertains to the practice among matrilineal Akan people. c) The number pertains to the practice among patrilineal non-Akan people.

Suyanto and Otsuka [20]; Suyanto, Tomich, and Otsuka [21], [22]). Private ownership acquired through land market transactions and forest clearance is also common. An important observation is that individual land rights are stronger under the single-family ownership than the collective ownership. Inheritance by sons increases work incentives to them that generally carry out forest clearance and tree planting. In this way, the inheritance system in Sumatra has been evolving towards the egalitarian system in terms of the gender differentiation. The strengthened land rights under the single-family ownership also promoted land market transactions.

In indigenous villages in Ghana, uterine matrilineal inheritance has been practiced in which land is bequeathed from the deceased man to his nephew. While those who clear forest are granted strong land rights, the cleared land eventually becomes the property of the extended family and may be temporarily allocated to those family members in need of land or bequeathed in accordance with the traditional rule. As is demonstrated in Table 4, individual land rights on these family-owned plots in indigenous villages are very weak. The individual rights of inherited land in migrant villages are much stronger; since patrilineal inheritance has been practiced in these villages, the individualization was facilitated by the fact that only a small number of family members, typically father and his sons, are involved in the inheritance decision. It is important to observe that the share of allocated and inherited land is relatively low now. Instead,

Table 5. Effects of land tenure institutions, farm size, and gender composition of family members on the intensity of tree planting and profit per ha based on household survey data[a]

	Tree planting			Profit per ha		
	Land tenure[b]	Farm size	Gender composition	Land tenure[b]	Farm size	Gender composition
Uganda	0	−	To be analyzed	0	0	To be analyzed
Malawi[c]	+	0	0	0	0	0
Ghana	0[d]	0	0	0	0	0
Sumatra	0	0	+[e]	0	0	0

a) + sign indicates significant and positive effect, 0 denotes the absence of significant effect, and indicates significant and negative effect. Data refer to commercial tree planting except in Malawi. b) + sing indicates that the greater tenure security leads to the greater incidence of tree planting and profit. c) Tree planting refers to timber and fruit trees and profit pertains to tobacco and maize production. d) There are a few significant variables. e) Male and female members have positive and negative effects, respectively.

plots planted with trees are often transferred to spouse and children as inter-vivos gifts with the permission of members of the extended family (Otsuka, Aidoo, and Quisumbing [11]). The transfer to spouse and children represents a reward to their work effort to plant cocoa trees. Although the proportion of women's land accounts for 20 percent or so in indigenous villages as of now, the inheritance system has been evolving in favor of women in Ghana.

As is summarized in Table 5, we did not obtain any strong evidence to support the validity of popular arguments in customary land areas of Uganda, Ghana, and Sumatra: commercial trees, such as coffee, cocoa, rubber, and cinnamon, have been planted under the communal ownership system as widely and actively as under the private ownership system (Place and Otsuka [16]; Otsuka, Aidoo, and Quisumbing [11]). We observe this because land rights have become highly individualized due to investment and continuous cultivation by farmers necessitated by high population pressure. Even where land rights are relatively weak, the effort to plant trees is rewarded by strengthened individual land rights.

Given the positive and significant effect of tree planting on individual land rights, there is no wonder that sufficiently strong incentives to plant commercial trees exist under the communal ownership system. Once trees are planted, the land ownership system is *converted to de facto* private ownership within a community. Thus, the management efficiency of commercial tree fields under the communal system is generally comparable to other ownership systems in our study sites, according to the estimation results of profit functions. In other words, the communal system evolves towards individualized system and it does not impede the development of agroforestry.

It is important to point out that the institutional rule to grant strong individual land rights on tree planted fields has been established in communities where agroforestry is more profitable than other cropping systems. Since most areas of Malawi are characterized by flat topography, traditionally known agroforestry is not profitable compared to maize and tobacco production. In such a production environment, we observed that no institutional rule has emerged that grants strong individual land rights in return for tree planting. As a result, land tenure institutions affect the decision to plant trees in crop fields in Malawi, as is shown in Table 5 (Place and Otsuka [18]).

In sum, communal land tenure institutions in no way deter the development of agroforestry, irrespective of the levels of tenure security in these systems, because of the expected increase in land rights after tree planting. Furthermore, incentives for establishing and managing agroforestry systems are strong in more marginal areas and on fragile hillsides where the benefits of alternative cropping systems are low (e.g., with low external inputs) or highly risky (e.g., with high external inputs).

6. Land Tenure and Cropland Mamagement

Land tenure rules affects expected future benefits accruing to those who invest in land improvement, including tree planting. Therefore, it affects long-term but not the short-term management incentives. In support of this,

land tenure institutions did not have any impacts on production efficiency of paddy fields in Sumatra, which do not require much investment (Suyanto, Tomich, and Otsuka [22]). The same point applies to farming of maize in Malawi, for which we did not observe any difference in management efficiency between patrilineal and matrilineal inheritance systems, despite greater security of tenure under the former (Place and Otsuka [18]).

We observed, however, some differences in management efficiency of annual crop production under different land tenure institutions. First, farmers subject to patrilineal inheritance have introduced more profitable burley tobacco farming more quickly and more widely than those subject to matrilineal inheritance, after abolishment of the policy to prohibit burley tobacco production by smallholders in Malawi (Place and Otsuka [18]). Being the new crop, investment in the acquisition of relevant new farming knowledge was required for tobacco production. Unlike tree planting, however, the adoption of new technology does not confer strong individual land rights and, hence, those who are subject to tenure insecurity under the matrilineal inheritance tend to adopt the new crop less actively.

Secondly, we found that cropland owned by the extended family under the communal ownership is less frequently fallowed than land owned privately in Uganda (Place and Otsuka [18]). Land use rights are fairly well established under the communal ownership so long as land is continuously used for cultivation. Once it is put into fallow, however, individual rights are substantially weakened. Thus, the less frequent fallow under the communal ownership can be explained by the weaker tenure security, which forces farmers to continue to cultivate the land to secure use rights.

Thus, although customary land tenure institutions are not significantly inefficient for the management of tree fields, they are likely to be inefficient in the management of crop fields under shifting cultivation. According to the accumulated empirical evidence from Sub-Sahara Africa, however, land tenure institutions do not seem to affect the productivity of sedentary farming significantly (Place and Hazell [14]). A plausible hypothesis seems to be that like tree planting, investment in land investment, e.g., terracing and destumping, and continuous cultivation strengthen one's land rights where such investments are highly profitable.

7. Property Rights Institutions and Equity

There are several different aspects of equity that are important to consider. The first is the contribution of property rights institutions to equity in land asset distribution across households within a village. We found that generally the communal tenure systems distributed land fairly equitably across households. In land abundant situations, this was accomplished primarily through land clearing and inheritance acquisition methods. Interestingly, the development of land sale and rental markets through the privatization of communal systems has likewise seemed to lead to greater equity than concentration of land. Purchases and renting of land are made mainly by households with poor access to inherited land and by migrants, an issue, which is discussed below, according to the recent Gini decomposition analysis of operational landholdings in Sumatra. However, we encountered large private tenure system in Malawi and Uganda, which due to inappropriate and conflicting State intervention are characterized by large maldistribution of land. Because of the absence of scale economies in most production systems (see Table 5), the maldistribution of land generally leads to inefficiencies in production and inequality in welfare, as was observed in Uganda (Place and Otsuka [16]).

Under effective common property management systems in Nepal and Japan, households typically enjoy equal opportunity to contribute and to benefit from the management of resources. There are normally effective rules over resource use that prevent the wealthier households from benefiting disproportionately. In contrast, forest and woodland resources have been open-access under communal and state tenure systems. Such systems could also lead to equity at the cost of efficiency if the opportunity costs of the wealthy are sufficiently high to discourage them from excessively extracting open-access resources. On the other hand, there are no effective rules to prevent wealthy individuals from excessive harvesting of valuable products, such as timber and pole trees (e.g., the extraction of trees

for drying tobacco in Malawi).

A second type of equity concerns the equity in distribution of assets by gender. One of the trends observed in Ghana, the erosion of traditional uterine matrilineal systems, indicates that women's control over land resources is improving under the transformation of communal tenure systems (Otsuka, Aidoo, and Quisumbing [11]). If demand for women's labor increases in association with the intensification of land use, their land rights seem to increase. In contrast, men's land rights increased in matrilineal communities of Sumatra, when demand for men's labor increases (e.g., Suyanto and Otsuka [20]). Therefore, we do not necessarily agree with Galdwin and McMillan [3] that the introduction of cash crop tends to increase man's control over products in Africa.

A third type of equity to consider is on a more regional scale and that is equity between access to land by different communities. In this context, communal tenure systems have performed quite well and at least in our study sites, migrants from land-scarce communities have been accommodated in the relatively land-abundant areas. In the case of Ghana, this is often through purchase of land and formal sharecropping contracts, which may later be converted into ownership. In Malawi, this is mainly through allocation of land by a chief. In Uganda, the major acquisition mechanism for migrants has been through outright purchase from a local family.

Finally, and most importantly, agroforestry systems, promoted in the private and communal tenure institutions, have a positive indirect effect on equity. This is because agroforestry is more favorable and profitable in marginal areas where there is relatively high levels of poverty, so that systems which encourage their development also make a contribution to reducing the welfare gap between the relatively wealthy and poor rural population.

8. Policy Implications

In this section we highlight the key policy implications from our studies for improving the efficiency of natural resource management while at the same time recognizing the importance of equity. This section is divided into three parts, the first focusing on property rights arrangements for both agricultural and non-agricultural land, the second on the development and dissemination of agricultural and agroforestry technologies, and the last on market development and other issues. We feel that all three areas must be addressed to improve natural resource management efficiency.

1) Property rights institutions and arrangements

Property rights institutions are largely favorable or moving in the right direction to provide proper incentives for efficient natural resource management. It is particularly encouraging that tree planting is facilitated in the different customary systems because with the reduction in forest and woodland, there is an increased need for tree products to be produced on agricultural land. There are a few noteworthy exceptions and areas for improvement, however. First, some traditional tenure arrangements, e.g., family tenure in Uganda and matrilineal land tenure in Malawi appear to provide sub-optimal incentives for some types of agricultural investment, though not for short-term inputs. However, these systems have been found to be evolving towards greater individualization and we believe that indirect policies, such as the promotion of profitable agricultural opportunities and encouragement of more efficient markets, will be effective in hastening this evolution.

Second, we continue to observe that, despite some positive developments, women have inferior rights to resources while at the same time they are expected to be the primary users and managers of the resources. Unfortunately, this study was not designed nor able to clearly address this issue. Though it seems reasonable that improved management will take place when there is a closer match between those who control and those who use resources (e.g., women may plant more trees for fuelwood than men), direct intervention in gender based property rights policy has proved to be extremely difficult.

One final observation concerns the emergence of more formal private tenure systems. We found that in Uganda and Malawi, households are legally entitled to convert their tenure from customary systems to private through the acquisition of a leasehold with the State. To date, very few households in customary lands have opted for this and those that have are generally the more elite. Much the

reason for this is no doubt the fact that the demand for leasehold is rather low. Nonetheless, one should expect that the twin forces of commercialization and individualization of land rights to lead to a more widespread demand for titling over time by smallholder farmers. While many titling programs have failed largely due to prematurity of implementation, they have been found to be popular and sustainable in areas of high market and property rights development such as Central Kenya (Migot-Adholla, Place, and Oluoch-Kosura [10]). We believe that land titling programs will become feasible, once communal land tenure institutions have become sufficiently individualized. Governments should begin now by developing strategies for predicting and meeting demand for more formal property rights by farmers.

2) Forest and tree plantation

In contrast to the case of agricultural land, there are ample opportunities for changes in property rights institutions to improve the efficiency of forest and woodland management. The most inappropriate land ownership system is state ownership. This is evidenced by strengthened forest management effort in Vietnam when the use rights of state forests have been transferred to individual farmers. Except for the protection of biodiversity, the ownership of forest by the state should be abolished. The communal tenure systems in all the study sites have also largely been unable to prevent massive conversion and degradation of forest and woodland resources. There has been relatively more success with common property arrangements, with many of those in Nepal and Japan proving to be successful. To date governments have invested relatively heavily in agricultural technology development to raise the profitability of agriculture while leaving much of the institutional development to NGOs. Certainly, much more effort is needed in developing or strengthening local institutions to better manage forest resources.

It must be clearly recognized that common-property forest regime is effective where predominant forest resources are minor forest products, whereas timber production is less amenable to community management. Thus, the incentive system under social forestry projects needs to be redesigned. In particular, the system of equal benefit sharing should be replaced by systems that provide appropriate incentives to individual farmers to manage timber trees and other valuable products. The element of community management, however, should be maintained for protection of trees. It is also important to provide profit incentives to grow and manage timber trees by promoting marketing of harvested trees.

3) Development and dissemination of agricultural and agroforestry technologies

A major policy implication is that given the existence of strong incentives to manage agroforestry plots on sloping lands under the communal ownership, it makes sense to develop and disseminate profitable agroforestry systems, through such means as the development of improved species of commercial trees, improving techniques for selecting and propagating useful indigenous tree germplasm, improving the flow of information on these new technologies, and finally providing proper incentives for germplasm delivery systems to develop. In addition, there are wide areas of barren land, which used to be planted to coffee, cocoa, and other tree crops, for which research on sustainable tree management needs to be carried out. The establishment of profitable agroforestry systems will contribute significantly to the reduction of poverty by enhancing the efficiency of farming in marginal areas, as farmers in marginal areas are particularly poor. It will also contribute to the prevention of soil erosion and the creation of tree biomass. Moreover, profitable agroforestry can help to strengthen individual land rights where they are weak. Thus, the development of agroforestry is expected to be conducive to both the efficiency and equity from both the private and social viewpoints.

To prevent excessive degradation of natural resources, however, it is also necessary to reduce the flow of migrants to marginal areas containing the remaining forests and woodlands. Focusing only on technologies for the marginal areas may attract more migrants. Thus, technology development and transfer needs to be strengthened in the more favorable, but highly populated, source areas for migration. Specialized food production may well have a comparative advantage in these areas and this could be facilitated by improved varieties coupled with access to credit and fertilizer inputs, as was realized in Asia during

the Green Revolution (David and Otsuka [2]).

The small areas remaining will continue to face strong pressure from rural populations seeking agricultural land. In such a scenario, agricultural land will be called upon to produce many of the basic forest and woodland products and services formerly sourced from outside the farm. The remaining forests and woodlands should therefore be used very strategically for products and services that are demanded by villagers or society but which cannot be efficiently produced on agricultural land or be substituted for with purchases from the market. For example, it is wasteful for communities or governments to set aside land for the growing of building poles, which are more efficiently grown by farmers. Instead, new forestry technologies may be required to produce public goods such as biodiversity more efficiently.

4) Market development and other policy issues

Market development is critical to generate the degree of intensification required to enable rural people to uplift themselves from poverty without mining their surrounding resources. Increased expenditure for rural road construction is a key component of such development. This point is well understood by policy makers. It must be also clearly understood that while the development of roads may accelerate deforestation by enhancing the profitability of timber harvesting, it will also accelerate the development of agroforestry where primary forests have already been cleared. Further, product market development is found to foster factor market development and will increase the demand for individualization of land rights. In fact, Gordon [5] found that responding to the economic opportunities, small-scale farmers in Ghana expanded cocoa farmland. Thus, we argue that this is a vital strategy in improving natural resource management.

Our findings also strongly show that reducing population growth rates would help to mitigate against deforestation. Most countries are working to reduce population growth rates through improved family planning. However, the effects of these will only be long-term; one can still expect a large number of new families to desire land in the next few decades. As indicated above, in the short-term, governments should work more closely to strengthen local institutions so that they can more effectively respond to increased population, especially where migration is significant. In the longer run, the effect of population growth on forest and woodland resources can be greatly alleviated by increasing employment opportunities in the non-agricultural sector.

According to the results from our study sites, there is much less reason to focus on other policy areas. For example, little deforestation was found to be linked to timber trade and logging, except in state-owned areas. Thus, changes in export regulations and exchange rates would not have made much difference. Similarly, we have not found that demand for fuelwood and other wood products have played a key role in depleting the remaining woodlands, except in such land scarce economies as Nepal. Therefore, energy policy reform is equally not likely to have a sizeable impact on resource degradation in most of our study sites.

5) Summary of policy implications

The problems of deforestation and land management are intertwined with the problems of poverty and food security in rural areas. There is no single-faceted nor uniform approach to policy that can successfully address this complex problem. Thus, solutions will similarly need to be multi-faceted, involving efforts to raise the profitability of agriculturally based rural livelihoods through technology development and market improvement and to strengthen natural resource management institutions. This approach strives to optimize private efficiency and hence growth out of poverty, while at the same providing a better environment for socially more desirable solutions.

References

[1] Besley, T. "Property Rights and Investment Incentives," *Journal of Political Economy,* Vol. 103, 1995, pp. 903-937.

[2] David, C. C. and K. Otsuka. *Modern Rice Technology and Income Distribution in Asia.* Boulder, Col.: Lynne Rienner, 1994.

[3] Galdwin, C. and D. McMillan. "Is a Turnaround in Africa Possible without Helping Women to Farm?" *Economic Development and Cultural Change,* Vol. 37, 1989, pp. 345-370.

[4] Gockowski, J., B. Nkamleu, and J. Wendt. "Implications of Resource Use Intensification for the Environment and Sustainable Technology

Systems in the Central African Rainforest," *Paper presented at AAEA International Conference on Agricultural Intensification, Economic Development and the Environment, July 31-August* 1, 1998, Salt Lake City, Utah.

[5] Gordon, S. L. "The Role of Cocoa in Ghanaian Development," in S. R. Pearson and J. Cownie, eds., *Commodity Exports and African Economic Development,* Lexington: D. C. Heath and Company, 1974.

[6] Hill, P. *The Migrant Cocoa-Farmers of Southern Ghana: A Study in Rural Capitalism.* Cambridge: Cambridge University Press, 1963.

[7] Johnson, O. E. G. "Economic Analysis, the Legal Framework and Land Tenure Systems," *Journal of Law and Economics,* Vol. 15, 1972, pp. 259-276.

[8] Kijima, Y., T. Sakurai, and K. Otsuka. *"Iriaichi:* Collective vs. individualized management of community forests in post-war Japan," a paper presented at the workshop on *Land Tenure and the Management of Land and Trees: Community and Household Case Studies from Asia and Africa,* held at the Tokyo Metropolitan University, July 1-3, 1998, also *Economic Development and Cultural Change,* forthcoming.

[9] McKean, M. A. "Management of Traditional Common Lands (*iriaichi*) in Japan," in D. W. Bromley ed., *Making the Commons Work: Theory, Practice, and Policy,* San Francisco: ICS Press, 1992.

[10] Migot-Adholla, S. E., F. Place, and W. Oluoch-Kosura. "Security of Tenure and Land Productivity in Kenya," in J. W. Bruce and S. E. Migot-Adholla, eds., *Searching for Land Tenure Security in Africa,* Dubuque, IA: Kendall/Hunt Publishing Company, 1993.

[11] Otsuka, K., J. B. Aidoo, and A. Quisumbing. "Causes and Consequences of Changing Land Tenure Institutions in Western Ghana," presented at the Tokyo Workshop, 1998.

[12] Otsuka, K. and F. Place. "Land Tenure and the Management of Land and Trees: Issues and Analytical Framework," presented at the Tokyo Workshop, 1998.

[13] Otsuka, K., S. Suyanto, and T. Tomich. "Does Land Tenure Insecurity Discourage Tree Planting? Evolution of Customary Land Tenure and Agroforestry Management in Sumatra," presented at the Tokyo Workshop, 1998.

[14] Place, F. and P. Hazell. "Productivity Effects of Indigenous Land Tenure in Sub-Saharan Africa," *American Journal of Agricultural Economics,* Vol. 75, 1993, pp. 10-19.

[15] Place, F. and K. Otsuka. "Population Pressure, Land tenure, and Tree Resource Management in Uganda," *Land Economics,* forthcoming.

[16] Place, F. and K. Otsuka. "Land Tenure Systems and Agricultural Productivity in Uganda," presented at the Tokyo Workshop, 1998.

[17] Place, F. and K. Otsuka. "Population, Land Tenure, and Natural Resource Management: The Case of Customary Land Tenure Area in Malawi," *Journal of Environmental Economics and Management,* forthcoming.

[18] Place, F. and K. Otsuka. "Tenure, Agricultural Investment, and Productivity in the Customary Tenure Sector of Malawi," presented at the Tokyo Workshop, 1998.

[19] Sakurai, T., S. Rayamajhi, R. Pokharel, and K. Otsuka. "Private, Collective, and Centralized Community Management: A Comparative Study of Timber Forest and Plantation Management in Inner Tarai of Nepal," presented at the Tokyo Workshop, 1998.

[20] Suyanto, S. and K. Otsuka. "From Deforestation to Development of Agroforest in Customary Land Tenure Areas of Sumatra," mimeo, Tokyo Metropolitan University, 1998.

[21] Suyanto, S., T. Tomich, and K. Otsuka. "Land Tenure and Farm Management Efficiency: The Case of Smallholder Rubber Production in Customary Land Areas of Sumatra," mimeo, Tokyo Metropolitan University, 1998.

[22] Suyanto, S., T. Tomich, and K. Otsuka. "Land Tenure and Farm Management Efficiency: The Case of Paddy and Cinnamon Production in Customary Land Areas of Sumatra," presented at the Tokyo Workshop, 1998.

[23] Tachibana, T., T. M. Nguyen, and K. Otsuka. "From Deforestation to Reforestation through Tenure Reforms: The Case of the Northern Hill Region of Vietnam," presented at the Tokyo Workshop, 1998.

[24] Tachibana, T., R. Pokharel, S. Rayamajhi, and K. Otsuka. "Dynamics of Common-property Forest Management in the Hill Region of Nepal," presented at the Tokyo Workshop, 1998.

[25] Thapa, G., G. Koirala, and K. Otsuka. "Population Pressure, Natural Resource Management, and Agricultural Intensification: The Case of Hill Villages in Nepal, 1982 and 1998," presented at the Tokyo Workshop, 1998.

[26] Tomich, T. P., M. van Noordwijk, S. Budidarsono, A. Gillison, T. Kusumanto, D. Murdiyarso, F. Stolle, and A. M. Fagi. "Agricultural Intensification, Deforestation, and the Environment: Assessing Tradeoffs in Sumatra, Indonesia," presented at AAEA International Conference on Agricultural Intensification, Economic Development and the Environment, July 31-August 1, Salt Lake City, Utah, 1998.

[27] Upadhyaya, H. K. and K. Otsuka. "Community Forest Management in the Hill Region of Nepal: Rules and Practices in Firewood Collection," presented at the Tokyo Workshop, 1998.

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