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Keijiro Otsuka
Ridish Pokharel

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National Graduate Institute for Policy Studies
7-22-1 Roppongi, Minato-ku,
Tokyo, Japan 106-8677

In search of appropriate institutions for forest management

Keijiro Otsuka^{a,*}, Ridish Pokharel^b

^a *National Graduate Research Institute for Policy Studies, Tokyo 106-8677, Japan*

^b *Institute of Forestry, Tribhuvan University, Pokhara, Nepal*

ABSTRACT

There is a variety of forest management institutions ranging from state management to community and private management. This article attempts to identify the conditions under which one institution outperforms the others in the efficiency of forest management based on a review of the literature, empirical evidence on the dominant forest management institutions, and theoretical arguments. In conclusion, we argue that the community management system performs best for non-timber forests, whereas a mixed management system, in which forest protection is carried out communally and tree management is carried out individually, is likely to work best for timber forests.

Keywords: State management, Community management, Private management, Mixed management, Protection cost, Management incentives

* Corresponding author. Tel.: +81 3 6439 6228.

E-mail address: otsuka@grips.ac.jp (K. Otsuka).

I. Introduction

Why is there a variety of forest management institutions, ranging from *stare* management with state ownership of forests, voluntary or informal community management without formal use rights, state-community co-management with community use rights (e.g. Nepal) or without such rights (e.g. India), private management with private ownership rights, and community ownership of forestland combined with private ownership of trees (e.g. dammar trees in community-owned forests in Southern Sumatra)? Considering that community and private management systems are relatively common among different management systems, the important practical question is under what conditions community forest management outperforms private management and vice versa.¹ A related question is whether there is an institution which can be more efficient, equitable, and sustainable than community and private management institutions.

Despite the central role of institutions in determining the management efficiency of forests, the forestry literature as well as common-property literature seldom raises the questions posed above.² Ostrom (1990), Baland and Platteau (1996), and Hayami and

¹It must be pointed out that government agencies are involved in the management of community forestry in practice (e.g. Murty, 1994; Chakraborty, 2001; Paudel et al., 2012).

²To our knowledge, the major exceptions include Grafton (2000) and Sakurai et al. (2004).

Godo (2005), among others, argue that community management is an efficient management institution in many cases because of the community's strong ability to prevent excessive extraction of community-owned resources.³ Indeed, Edmonds (2002) points out that transferring the use rights of forests from the state to local communities in the hill region of Nepal is associated with a significant reduction in forest resource extraction. On the other hand, the influence of the argument by Hardin (1968) on the tragedy of the commons is still pervasive in economists' consideration of common property resource management. For example, Pindyck and Rubinfeld (2009, p. 673) argue in the seventh edition of their microeconomics textbook that "common property resources are those to which anyone has free access. As a result, they are likely to be over-utilized." Perloff (2012, pp. 622-24) in the sixth edition of his microeconomics textbook seems to agree with this view and further asserts that private management with clear ownership rights is the more desirable system because "converting common-access property to private property removes the incentive to overuse it."⁴ Thus, which institution, community or private, is more appropriate has not been resolved in the literature.⁵

³As is argued by Agrawal and Gibson (1999), detailed institutional rules rather than the mere practice of community-based management may be of critical importance.

⁴I do not agree with the presumptions of these authors that common property is open or free access and that private property can be protected without cost.

⁵A literature review by Lund et al. (2009, p. 71) points out regarding community forest

As Otsuka and Place (2001) argue, another shortcoming of the existing literature on forest management is its almost exclusive focus on forest protection or the prevention of excessive forest resource extraction without considering how to promote investments in forests for reforestation. This point is practically important in view of the widespread deforestation and degradation of forest conditions in developing countries. At present, the rehabilitation of forests is as important as or possibly more important than the protection of forests.

Based on a review of the literature on forest management and empirical evidence on the dominant forest management institutions as well as theoretical arguments, this article attempts to identify the conditions under which one institution outperforms the others in the efficiency of forest management. In conclusion, we argue that community management performs best for non-timber forests,⁶ whereas mixed management, in which forest protection is carried out communally and tree management is carried out individually, is likely to work best for timber forests in developing countries.

The organization of this article is as follows: we provide the theoretical framework to consider the optimum forest management institution in Section II. Based on the

management that it is not clear “where, how, and under what conditions popular participation in forest management is feasible, or perhaps the superior approach to forest conservation.”

⁶Non-timber forest products are particularly important for the livelihood of the poor (e.g. Beck and Nesmith, 2001; Kumar, 2002).

empirical regularities on the prevailing forest management institutions in various settings, Section III offers theoretical hypotheses. The hypotheses are tested by using evidence provided by case studies in Section IV. Finally Section V discusses a plea for further studies on the identification of optimal forest management institutions.

II. Theoretical framework

While economists commonly recognize that “the tragedy of the commons” is not a necessary consequence of the commons, they tend to focus on the extent of the over-exploitation of common-property resources. In other words, Ostrom (1990) and others argue that the community has the ability to prevent the over-exploitation of forest resources by organizing collective action, and monitoring and enforcing collective agreements. What is missing is the issue of investing in tree resources, managing them, and rehabilitating forests. This is important in view of the widespread deforestation and degradation of forests throughout developing countries, so that the restoration and rehabilitation of forests have become critically important policy issues. Another omission in the literature, which is also potentially important, is the role of the private management of forests; it is best in terms of the provision of incentives to manage forests, and thus we should not easily dismiss this institutional form of forest

management.

From the theoretical point of view, we should consider both the cost of protecting forest resources and management intensity in identifying the optimal forest management institutions.⁷ This point is illustrated in Table 1, which identifies four types of forest characteristics.⁸ We consider that the management intensity is high (or low) when the marginal returns to management effort or investment in improving forest conditions are high (or low).

Usually non-timber trees can re-grow after felling without much care, which means that the marginal returns to management effort are low. On the other hand, to be successful, timber production requires intensive management or such silvicultural operations as planting, weeding, pruning, singling, and thinning, which may be considered as investments as they bear fruit in the future. Thus, non-timber and timber forests are characterized by low and high management intensity, respectively. The cost of protecting forest resources is low in areas where such resources are abundantly available. This is the case in sparsely populated areas in developing countries. It is also low in areas where the demand for minor forest resources, such as firewood, charcoal,

⁷For simplicity, we do not consider the external effects, e.g. the impact of the effective management of community forestry on reducing pressure on government forests located nearby (Köhlin and Parks, 2001).

⁸Needless to say, the efficiency of community forestry depends on the community characteristics (e.g. Gautam, 2007). For simplicity, we abstract away the role of community characteristics in forest management.

and feed grasses, is low. This is likely to be the case in developed countries. The cost of protecting minor forest resources in developing countries is usually high because such minor products extracted in one place cannot be easily distinguished from those in other places. In contrast, the cost of protecting timber is likely to be low because big trees cannot be felled and hauled without being noticed by local people.

Thus, both the cost of protection and management intensity are low in non-timber forests in sparsely populated areas (see the left-upper corner). In the case of non-timber forests in densely populated areas (see the left-lower corner), management intensity is low but the cost of protection is likely to be high. In contrast, management intensity is high in the case of timber forests, as the production of valuable timber requires silvicultural operations. If the demand for minor forest products is low, e.g. in developed countries, timber forest is characterized by high management intensity and low protection cost (the right-upper corner). On the other hand, the demand for minor forest products is generally high in developing countries, particularly in densely populated areas. Even though big timber trees can be easily protected, it is likely to be costly to protect green branches and fodder grasses. Therefore, timber forests in developing countries are typically characterized by high protection cost and high management intensity (see the right-lower corner).

State ownership can hardly be qualified as a desirable institution because the state lacks the resources to protect forests and the motivation to manage trees.⁹ In fact, state forests are usually *de facto* open access (e.g. Metz 1991; Kumar 2002; Tachibana and Adhikari 2009). According to Grafton (2000), the community management system is efficient in the sustainable management of forests and the provision of substantial benefits to forest users, to the extent that collective interests are accounted for in the decision making and the cost of collective action is reasonably low. Although it is not clear what “reasonably low” means, we interpret this to mean that the cost of protection under community management is lower than that under state and private management because community management is effective in enforcing collective agreements as community members know each other and the punishment can include such heavy penalties as ostracism. Moreover, there are scale economies in protecting forest resources: patrolling the entire forest by a few people on the basis of rotation or by hiring a small number of watchers will be cheaper than patrolling small patches of forest by owners individually.

This argument does not immediately imply that community management is optimal because it is deficient in providing work incentives. In principle, all community

⁹State ownership may be justified, however, if the protection of forests creates positive externalities in areas outside the state forests, such as stable supply of water or the prevention of floods downstream.

members are supposed to participate in protecting forest resources and to share the benefits more or less equally. In terms of incentives to work, community management is low and similar to the commune system in China in which the income from farm production is shared equally by a large number of commune members (Lin 1988). Thus, from the theoretical point of view, which forest management institution, including community and private management, is most efficient is unclear. In order to explore efficient forest management institutions, we undertake a review of the relevant literature in the succeeding two sections.

III. Empirical Regularities and Hypotheses¹⁰

The Japanese experience provides useful lessons to draw insights into appropriate forest management institutions. It was common knowledge in mountainous villages in Japan before World War II that three types of forest institutions coexisted: private timber forests near residential areas; community forests for extracting charcoal, firewood, and feed grasses located not too far away from the village; and state-owned virgin forests located very far from the village. Community forests were covered by

¹⁰Our analysis is confined to East and South Asia, as community management is more widely practiced there than in Southeast Asia (Sunderlin, 2006). Yet, community management is also common in Mexico (e.g. Klooster, 2002) and is emerging in some areas in sub-Saharan Africa (e.g. Jumbe and Angelson, 2006).

deciduous trees and managed effectively, particularly after community ownership rights were granted during the Meiji era (1868 to 1912). All community members participated in burning off dead branches in early spring to kill the seeds of weeds. They were allowed to collect only the assigned amount of minor forest resources and only on “open days” of the forest (McKean 1992). Surprisingly, such management rules are very similar to those currently adopted in the hill region of Nepal.

The location of private, community, and state forests in prewar Japan makes sense in view of our theoretical framework portrayed in Table 1. Since timber production requires intensive management, its location near residential areas is most convenient. Also the cost of protecting valuable timber trees is low in such areas. Since the production of minor forest products does not require so much management effort, its location away from the residential area does not cause much problem except for the prevention of the excessive extraction of forest resources. Virgin forests located very far away from the village are state owned because village people do not have strong interest in such forests.

The management of community forests in Japan experienced drastic changes after World War II. Because of the introduction of kerosene, electricity, and tractors, the demand for minor forest products, such as charcoal, firewood, and feed grasses for draft

animals virtually disappeared. On the other hand, the demand for timber soared due to the construction boom which began with the onset of the miraculous economic growth around 1955. In consequence, non-timber trees were replaced by timber trees.

Community forest users in many locations agreed to subdivide the forest land into smaller parcels either with individual ownership rights or with individual use rights (Kijima et al., 2000).¹¹ This change is consistent with our expectation because the cost of protecting minor forest products declined, so that providing the proper work incentives has become a major issue of forest management.

Similar changes seem to have taken place in China, where degraded forests had been converted from collective management to either private management with individual use rights (e.g. Fujian, Jiangxi, and Yunnan provinces) or smaller group management of several households with group use rights (Holden et al., 2013). Such changes were not imposed from above but voluntarily made by forest users. Since forest land tenure institution reforms have been just implemented, it is too early to assess their impact on forest management. There are, however, indications that they have positive impacts, for example, on tree planting. Most likely farmers planted timber trees or fruit

¹¹The ownership of community forest was registered under the names of all the users, so that in order to confer private ownership rights on small parcels, the consent of all the users was required. Yet, the certificates of ownership rights were sometimes lost, and some descendants of original owners were no longer residents or were missing. In such cases, only the individual use rights were granted to the sub-divided parcels, or the traditional community management system was maintained.

trees, both of which require the careful management of the trees. How the protection of such high-value trees can be carried out, however, is not clear from the available studies.

In northern Vietnam where forests were state-owned, rapid deforestation took place in the 1980s and early 1990s (Tachibana et al., 2001; Sikor, 2001). Similar to China, the collective management of degraded forests has been replaced by individual management since the mid-1990s. Sikor (2001) finds that such a change quickly resulted in the rehabilitation of the degraded forests.

In the mid-hill region of northern Vietnam, it was observed that small round hills, which look like coffee cups placed upside down, coexisted with flat paddy fields.¹² Interestingly such hills are covered by timber trees, trees providing thatching materials, bamboo, and medicinal plants. Such hill forests contrast greatly with collectively-owned state forests, which are located on mountainous terrain and an almost completely denuded. Actually such hill forests are privately owned and managed,¹³ and farmers harvest mature trees and replace them with younger trees. According to the owners of such private forests, they plant and replant trees and undertake weeding so as to

¹²The story reported below is based on interviews by the senior author of this article with farmers in the locality.

¹³Such forests have been managed over generations. Interestingly, the Vietnamese government did not pay attention to such forest land and so did not nationalize its ownership rights.

maximize the income or profit from their forests. Theft by outsiders is a potential problem, but since hills are surrounded by roads and residential houses, the cost of protection is not excessively high. This is somewhat similar to the privately-owned trees grown near the residential areas in the Japanese villages before World War II.

In South Asia such as India and Nepal, there has been a shift from state ownership/management of forests to community management with the devolution of forest use rights from the former to the latter as in the case of community forest management in Nepal and co-management between the state and community as in the joint forest management (JFM) in India (Fisher, 1999). There are many recent studies which are critical of the JFM system because of the low share of sales revenue for users,¹⁴ the ban on felling timber trees, the increasing control of the government, and the lack of communal tenure security (Fisher, 1999; Ballabh et al., 2002; Bhattacharya et al., 2010). These studies commonly admit, however, that JFM contributed to the increased availability of non-timber forest products. The last point is critically important, as it suggests that JFM, or community management, is conducive to the growth of non-timber trees, but not necessarily of timber trees.

Poudel et al. (2013) find in the terai region of Nepal that timber forests have

¹⁴Ballabh et al. (2002) point out that only 25 percent of the proceeds from timber are distributed to forest users.

recovered from serious deforestation and degradation after forest use rights were handed over to the community. According to Paudel et al. (2012), Nepal's forest policy deliberately discourages timber harvesting and trading by putting strict regulatory controls over timber harvesting and allowing such non-competitive organizations as syndicates to control the timber market. Thus, how efficient the community management of timber forests is cannot be ascertained from the study of Poudel et al. (2013) partly because of the absence of other management institutions and partly because of the excessive control of timber harvesting and trading by the government.

Although local communities, known as Community Forest User Groups (CFUGs) are managing forests under mutually agreed and officially approved forest operational plans in Nepal, there are few official or institutional interactions and little communication between CFUGs and forest authorities regarding forest management for timber (Banjade et al., 2011). Such scant communication regarding timber management indicates that the forest authorities may perceive CFUGs as an inefficient body to manage the forest for timber production. Meanwhile, a gradual shift from collective management of timber forest by unpaid community labor to the use of hired wage labor or contract systems between CFUGs and groups of workers has been taking place. Observing the change in harvesting practices in community forestry from collective

labor to hired labor or contractor systems, Pokharel (2000) argues that such changes in community forestry are due to the lower efficiency of community labor in timber harvesting.

To summarize, it seems reasonable to argue that community forest management is successful in the conservation of forests or the prevention of over-exploitation of the non-timber forest resources as is observed in prewar Japan, India and Nepal, whereas privatized or individualized management is preferred for the management of timber forests as in postwar Japan, as well as contemporary China and Vietnam. It is not clear, however, whether and to what extent the protection of non-timber minor forest products are important in China and Vietnam. If there is substantial demand for such products, the cost of protection may also be high. Also it is not clear to what extent the community mechanism is used to protect individually-owned forest resources in these countries.

Based on these discussions, we would like to postulate the following hypotheses regarding the optimum institutions to manage forests:

Hypothesis 1: Non-timber forests can be managed efficiently by communities because they have the capacity to prevent the over-exploitation of non-timber minor forest products.

Hypothesis 2: Timber forests can be managed effectively by a combination of individualized and community management institutions because the major management issues are to undertake silvicultural operations, which require proper work incentives, and to undertake the protection of trees, which may be most effectively carried out by the community.

The forest characteristics under which these hypotheses are valid are illustrated in Table 2, which shows the appropriate management institutions of timber and non-timber forests. In the case of non-timber forests where the cost of protection is high, community management is hypothesized to be the most efficient organization (see the left-lower corner), which corresponds to Hypothesis 1. In the case of non-timber forests with abundant supplies of non-timber products, there is no scarcity value of such products and, hence, institutions do not matter (see the left-upper corner). In timber forests where the cost of protection is low, private management is optimal (see the right-upper corner). The cost of protection is likely to be low in developed countries, where the demand for non-timber forest products, such as firewood and charcoal, are low.¹⁵ Finally, in the case of timber forests where the cost of protection is high, e.g. in most developing countries, we advance the hypothesis that some sort of mixed private

¹⁵This justifies the forest management by private companies in Canada and New Zealand.

and community management is optimal, as private management is conducive to the efficient management of trees and community management is effective in the protection of forest resources. Thus, mixed management institutions, in which forest land is owned by the community and trees are owned by individual members or in which small patches of forest land are owned by individuals and forest products are protected jointly by the community, may be efficient.

IV. Empirical Evidence

There is ample evidence that non-timber forests are effectively managed by local communities in India (e.g. Murty, 1994; Kumar, 2002; Baland et al., 2010; Bhattacharya et al., 2010) and in the hill region of Nepal (e.g. Edmonds, 2002; Gautam, Shivakoti and Webb, 2004; Tachibana and Adhikari, 2009),¹⁶ so that excessive extraction of non-timber resources is prevented. Although the evidence is qualitative, non-timber forests were effectively managed by communities in prewar Japan (McKean, 1992). Thus, Hypothesis 1 seems to be supported empirically.

It is interesting to learn that private management of timber trees on formerly cultivated marginal crop fields in the terai region of Nepal is very costly because most

¹⁶Literature reviews on community forest management in Asia by Bowler et al. (2012) and Waylen et al. (2010) support this observation. Also Klooster (2002) argues that community forestry in Mexico contributes to the conservation of forests.

owners must hire permanent watchers who live in the cottages at the edge of timber parcels, even though each parcel is tiny (Sakurai et al., 2004). These authors also point out that private owners allocate large amounts of time to take care of the trees. It seems clear that private management provides strong work incentives, but the cost of protection under this system tends to be high. On the other hand, private management of timber forests was more active in thinning planted trees than community management in postwar Japan (Kijima, Sakurai and Otsuka, 2000).¹⁷ The protection of trees was no longer important in postwar Japan and, hence, private management was likely to be more efficient than community management, as far as timber forests were concerned.

Baland et al. (2010) and Bhattacharya et al. (2010) report that community management of timber forests in India is ineffective in the production of valuable timber trees because of the absence of incentives to carry out silvicultural operations. Sakurai et al. (2004) report that compared with the ordinary community management system, a centralized community management system, in which the community forest user group committee hires workers to take care of trees, while all the community members participate in the protection of timber trees, is efficient. These authors suggest that similar to private forest owners, community forest user committees consisting of 15

¹⁷Community management persisted in some areas in Japan in which ownership rights of forestland were so unclear that the subdivision of forest land was infeasible.

people or so seem to be interested in maximizing the benefit of their members by employing hired workers to take care of trees, rather than relying on community labor.

Since mixed private-community management systems have seldom been practiced in developing countries, we cannot directly test the validity of Hypothesis 2. However, the empirical evidence is consistent with Hypothesis 2 that mixed community and individualized systems are more conducive to the protection and management of timber trees than community management.

V. Concluding Remarks

In view of the increasing threat of climate change, it is becoming critically important not only to protect forests and deter deforestation but also to rehabilitate degraded forests. This study has found that community management or co-management between community and government has contributed to the rehabilitation of forests. This study has also found that the mixed private-community management system, in which the forest is protected by the community and trees are managed individually, is likely to work best in the management of timber forests. Such a system, if efficient and profitable, can contribute to the expansion of timber forests, which would be conducive to the sequestration of greenhouse gases and the improvement of the living standards of

forest users.

Although empirical evidence seems to support the validity of the two hypotheses postulated in this study, it is not totally conclusive. Particularly inconclusive is the validity of Hypothesis 2, as it cannot be directly tested by the actual data. In order to verify its validity, randomized controlled trials are recommended in which comparisons are made between randomly selected control groups (e.g. groups of forests in which ordinary community management is practiced) and treatment groups (i.e. groups of forests in which mixed management is practiced). A review of the literature on community-based project management by Mansuri and Rao (2004), a review of community forest management by Bowler et al. (2012), and an empirical study of community forest management by Baland et al. (2010) all reach the same conclusion for the implementation of randomized controlled trials. We have to recall that the community management of timber tree planting projects, called community or social forestry, has been supported by international organizations, such as the World Bank, Food and Agriculture Organization, and Asian Development Bank, and individual donor organizations, such as the Japan International Cooperation Agency, without carefully analyzing whether this institution is most appropriate for establishing timber forests. Thus, identifying the most efficient timber forest management institution can have

profound implications on the promotion of tree planting projects in developing countries.

REFERENCES

- Agrawal, A., Gibson, C.C., 1999. Enchantment and disenchantment: the role of community in natural resource conservation. *World Development* 27 (4), 629-649.
- Banjade, M. R., Paudel, N. S., Karki, R., Sunam, R., Paudyal, B. R., 2011. Putting timber in the hot seat: discourse, policy and contestations over Timber in Nepal. Discussion Paper Series 11:2, Forest Action Nepal, Kathmandu, Nepal.
- Baland, J.-M., Badhan, P., Das, S., Mookherjee, D., 2010. Forests to the people: decentralization and forest degradation in the Indian Himalayas. *World Development* 38 (11), 1642-56.
- Baland, J.-M., Platteau, J.-P., 1996. Halting Degradation of Natural Resources: Is There a Role for Rural Communities? Clarendon Press, Oxford.
- Ballabh, V., Balooni, K., Dave, S., 2002. Why local resource management institutions decline: a comparative analysis of *Van (Forest) Panchayats* and forest protection committee in India. *World Development* 30 (12), 2153-2167.
- Beck, T., Nesmith, C., 2001. Building on poor people's capacities: the case of common property resources in India and West Africa. *World Development* 29 (1), 119-133.
- Bhattacharya, P., Pradhan, L., Yadav, G., 2010. Joint forest management in India: experiences of two decades. *Resources, Conservation, and Recycling* 54 (8),

469-480.

Bowler, D.E., Buyung-Ali, L.M., Healey, J.R., Jones, J.P.G., Knight, T.M., Pullin, A.S.,
2012. Does community forest management provide global environmental benefits
and improve local welfare? *Frontiers in Ecology and the Environment* 10 (1),
29-36.

Chakraborty, R.N., 2001. Stability and outcomes of common property institutions in
forestry: evidence from the Terai region of Nepal. *Ecological Economics* 36 (2),
341-353.

Edmonds, E.V., 2002. Government-Initiated community resource management and local
resource extraction in Nepal's forest. *Journal of Development Economics* 68 (1),
89-115.

Fisher, R. J., 1999. Devolution and decentralization of forest management in Asia.
Unasylva 50 (4), 1-5.

Gautam, A.P., 2007. Group size, heterogeneity, and collective action outcomes:
evidence from community forestry in Nepal. *International Journal of Sustainable
Development and World Ecology* 14 (10), 574-583.

Gautam, A. P., Shivakoti, G. P. Webb, E. L., 2004. A review of forest policies,
institutions, and change in the resource condition in Nepal. *International Forestry*

Review 6 (2), 136 -148.

Grafton, R.Q., 2000. Governance of the commons: a role for the state. *Land Economics* 76 (4), 504-517.

Hardin, G., 1968. The tragedy of the commons. *Science* 162 (3859), 1243-1248.

Hayami, Y., Godo, Y., 2005. *Development Economics: From the Poverty to the Wealth of Nations*. Oxford University Press, Oxford.

Holden, S.T., Yi, Y., Jiang, X., Xu, J., 2013. Tenure Security and Investment Effects of Forest Tenure Reform in China. In: Holden, S. T., Otsuka, K., Deininger, K. (eds.), *Land Tenure Reforms in Asia and Africa*. Palgrave Macmillan, Houndmills.

Jumbe, C.B.L., Angelson, A., 2006. Do the poor benefit from devolution policies? evidence from Malawi's co-management program. *Land Economics* 82 (4), 562-581.

Kijima, Y., Sakurai, T., Otsuka, K., 2000. *Iriaichi*: collective vs. individualized management of community forests in post-war Japan. *Economic Development and Cultural Change* 48 (4), 867-886.

Klooster, D. J., 2002. Toward adaptive community forest management: integrating local forest knowledge with scientific forestry. *Economic Geography* 78 (1), 43-70.

Köhlin, G., Parks, P.J., 2001. Spatial variability and disincentives to harvest:

deforestation and firewood collection in South Asia. *Land Economics* 77 (2), 206-218.

Kumar, S., 2002. Does 'participation' in common pool resource management help the poor? a social cost-benefit analysis of joint forest management in Jharkland, India. *World Development* 30 (5), 763-782.

Lin, J. Y., 1988. The household responsibility system in China's agricultural reform: a theoretical and empirical study. *Economic Development and Cultural Change* 36 (3), S199-224.

Lund, J.F., Balooni, K., Casse, T., 2009. Change we can believe in? reviewing studies on the conservation impact of popular participation in forest management. *Conservation and Society* 7 (2), 71-82.

McKean, M. A., 1992. Management of Traditional Common Lands (*Iriaichi*) in Japan. In: Bromley, D. W. (ed.), *Making the Commons Work*. ICS Press, San Francisco.

Mansuri, G., Rao, V., 2004. Community-based and -driven development: a critical review. *World Bank Research Observer* 19 (1), 1-39.

Metz, J.J., 1991. A reassessment of the causes and severity of Nepal's environmental crisis. *World Development* 19 (7), 805-820.

Murty, M.N., 1994. Management of common property resources: limits to voluntary

collective action. *Environmental and Resource Economics* 4 (6), 581-594.

Ostrom, Elinor, 1990. *Governing the Commons: The Evolution of Institutions for Collective Action*. Cambridge University Press, Cambridge.

Otsuka, K., Place, F., 2001. *Land Tenure and Natural Resource Management: A Comparative Study of Agrarian Communities in Asia and Africa*. Johns Hopkins University Press, Baltimore.

Paudel, N.S., Luintel, H., Khatri, D.B., Bhandari, K., 2012. *Enabling Forest Users to Exercise their Rights: Rethinking Regulatory Barriers to Communities and Smallholders Earning their Living from Timber*. The Center for People and Forests, Bangkok.

Perloff, J. M., 2012. *Microeconomics*, 6th edition. Pearson Education, Boston.

Pindyck, R.S., Rubinfeld, D.L., 2009. *Microeconomics*, 7th edition. Prentice Hall, Upper Saddle River.

Pokharel, R., 2000. Indigenous forest management practices in some community forests of Nepal. *Banko Jankari* 10 (1), 36-39.

Poudel, N.R., Fuwa, N., Otsuka, K., 2013. The impacts of a community forestry program on forest conditions, management intensity and revenue generation in the dang district of Nepal. Discussion Paper 13-24, National Graduate Institute for

Policy Studies, Tokyo.

Sakurai, T., Rayamajhi, S., Pokharel, R.K., Otsuka, K., 2004. Efficiency of timber production in community and private forestry in Nepal. *Environment and Development Economics* 9 (4), 539-561.

Sikor, T., 2001. The allocation of forestry land in Vietnam: did it cause the expansion of forests in the Northwest? *Forest Policy and Economics* 2 (1), 1-11.

Sunderlin, W. D., 2006. Poverty alleviation through community forestry in Cambodia, Laos, and Vietnam: an assessment of the potential. *Forest Policy and Economics* 8 (4), 386-396.

Tachibana, T., Adhikari, S., 2009. Does community-based management improve natural resource condition? evidence from the forests in Nepal. *Land Economics* 85 (1), 107-131.

Tachibana, T., Nguyen, T.M., Otsuka, K., 2001. Agricultural intensification vs. extensification: a case study of deforestation in the northern hill region of Vietnam. *Journal of Environmental Economics and Management* 41 (1), 44-69.

Waylen, K.A., Fischer, A., McGowan, P.J.K., Thirgood, S.J., Milner-Gulland, E.J., 2010. Effect of local cultural context on the success of community-based conservation interventions. *Conservation Biology* 24 (4), 1119-1129.

Table 1. Characteristics of Timber and Non-timber Forests

		Management Intensity	
		Low	High
Cost of Protection	Low	Non-timber forests in sparsely populated areas	Timber forests with low demand for non-timber products
	High	Non-timber forests in densely populated areas	Timber forests with high demand for non-timber products

Table 2. Hypotheses on the Optimal Management Institutions of Timber and Non-timber Forests

		Management Intensity	
		Low	High
Cost of Protection	Low	Any (non-timber forests)	Private or individual management (timber forests)
	High	Community management (non-timber forests)	Mixed private-community management (timber forests)