STRENGTHENING FARMERS ACCESS TO FORESTS FOR SUSTAINABLE USE OF NON TIMBER FOREST PRODUCTS: LESSONS BASED ON COMMUNITY MANAGED MATSUTAKE MUSHROOM AND BAMBOO SHOOT COLLECTION IN YUNNAN PROVINCE, SOUTHWEST CHINA

He Jun & Horst Weyerhaeuser

World Agroforestry Center
ICRAF—China
h.jun@cgiar.org

ABSTRACT

In the past decade, there has been increasing recognition that the collection of NTFP (Non Timber Forest Products) plays a significant role in reducing poverty and maintaining forests as part of the global trend of sustainable development. Simultaneously, the development of a market economy also provides opportunities for forest-depended communities to commercialize NTFP collection.

Without good management, commercial NTFP collection may lead to resource depletion and socio-economic differentiation. This goes to the fundamental problems of the "tragedy of open-access". Through the lessons learned from the management, harvesting and trading of Matsutake mushrooms and bamboo shoots in Yunnan, Southwest China, this paper attempts to explore how NTFP conservation could be enhanced through local collective action of NTFP management. It is argued that local collective action can play a crucial role to change the negative impact of "open access" by utilizing the strength and power of communities. The changes are to lead to a sustainable and commonly managed resource, withstanding and coping with the pressure of the new market economy, by strengthening farmers' access to forest and resulting in a better resource management of the environment and forests.

Keywords: Access to Resource, Commons, NTFP, Collectives and Collective Action, Southwest China

1 INTRODUCTION

Non-timber Forest Products refer to "all renewable products in the forest or on any land with similar functions (He, 2000). Compared to timber production and logging, sustainable extraction of Non-Timber Forest Products (NTFP) generally does not damage and impact on the overall functions and structure of natural and regenerated forest (He, 2002). NTFP thus often become the most economic valuable products extracted by local people and could potentially become the basis of a development strategy that reconciles the economic, cultural, and ecological values of the ecosystem (Nepstad and Schwartzman, 1992). In the past decade, there has been increasing recognition that the collection of NTFP plays a significant role in reducing poverty and maintaining forests as part of the global trend of sustainable development. Simultaneously, the development of a market economy also provides opportunities for forest-depended dwellers to commercialize NTFP collection.

However, the impact of increasing commercialization and conservation of resources are not clear and similarly, how the local communities will respond in the longer term; how

existing forest and land management policies might impact and newly developed ones being adopted on the sustainable use of NTFP? In particular, given the rapid growth of the NTFP market, the problem of overuse and unsustainable harvesting practice becomes more challenging (e.g. Fox, 1995; Wollengerg and Ingles, 1998; Rijsoot and He, 2001, He and He, 2003). Without good management, commercial NTFP collection can be observed in many areas to lead to resource depletion and socio-economic differentiation and gap-widening in formerly more homogeneous societies. This often relates to and is attached to the fundamental problems of the "tragedy of open-access". Using case studies and research based on Matsutake mushroom and bamboo shoot collection, this paper attempts to explore how NTFP collection and forest conservation could be enhanced by utilizing local collective action for NTFP management and harvesting. It is argued that local collective action can play a crucial role to change from "open access" to a system where NTFP become common property and be better managed under present increasing pressure of the new market economy, and also be able to strengthen farmers' rights and access to forests. It is expected to lead to more sustainability, equity and justice, better wealth distribution and overall better management of the use of resources and forests.

2. NTFP DEVELOPMENT IN YUNNAN

Yunnan province is of great importance in Southwest China for its upland agriculture and its relatively well preserved, rare, and valuable forest resources. However, from 1949 until 1957, timber extraction to meet the demands for the development of industry and construction of the national infrastructure were the most important focuses of the government, leaving little room for long-term forest management and leading to overuse and unsustainable extraction (Su, 2001). As major forest region of China, the province plays a significant role as timber supplier. Meanwhile, the NTFP use and its market significance had been generally ignored during that time and only played a role at the local markets and often as a fall-back strategy for communities in times of hardship.

Recently, along with implementation of Natural Forest Protection Program (widely referred to as the "logging ban") and access to new markets, the role of NTFP for community development also has been recognized as an additional source of income. Limited research has been conducted on single species of NTFP as they are mostly being lumped into a broad category under 'additional family income'. Nevertheless, the significance of NTFP in improving local livelihoods and possible reduction and pressure through heavy timber logging had been widely acknowledged. In Yunnan, as one of the major areas for the implementation of the Natural Forest Protection Program and other environmental conservation programs (e.g. the establishment of National Parks or Nature Reserves), commercialized NFTP extraction become more and more important for rural community development. Especially, were they provide one of the few sources of cash income, i.e. for forest-depended communities in the proximity of conservation areas (He, 2002). Consequently, sustainable use and sometimes even the expansion of NTFPs extraction as an alternative forest management strategy is advocated by many scholars and more forward thinking foresters, as well as policy-makers at the State Forest Administration.

In economic terms, even so lacking long-term official statistics and village level data, NTFP contribute to the economy, and often play a significant role in cash income generation. Edible mushroom, for instance, have been exported at the level of more that 23,000 m.t. to Japan, Europe and the US in the past 3 years, and generated more than 193 million USD only for Yunnan Province (see table I). Besides mushrooms, other products

likes resin, bamboo shoots, herbal medicine, etc. are also important NTFP extracted from forest and sold either locally, at the national or international markets.

Table 1. Exported Edible Mushroom in Yunnan

Year	Quantities (tons)	USD (million)
2002	6678	43.17
2003	9563	65.76
2004	7744	84.37
Total	23985	193.3

Source: Kunming Custom Statistics.

The forest sector at provincial and national level is now much more aware of the potential of NYFP and realizes that with proper environmental conservation and protection the value of trade could increase, and also that the subsistence value of NTFP is very important to local people living in mountainous forests, since they are often the only products that can provide the daily life needs and cash income (Rijsoort and He 2001). Moreover, at the national and regional level, as Rijsoort and He (2001) highlighted, NTFPs also play a significant role in the international trade and as an export commodity. In other words, development of NTFP not only can improve local people or forest depending communities standard of live, but also increase employment opportunity in rural and semi-urban areas, through domestication, local processing and improved cottage industry. In some cases, people recognized that some NTFP are even more valuable than timber production and extraction, i.e. Matsutake mushroom collection. Initiatives with a focus on the development of sustainable NTFP management and harvesting carried out under associated poverty alleviation and community development programs have now been widely implemented in rural areas with positive impact for livelihoods and environment.

However, with economic success, incentives for over-use of NTFP exist (He, 2002). Over-extraction often takes place where NTFP are not well-managed or local institutional arrangement are weak or good community leadership is lacking. Over-extraction of NTFP may also destroy the structure and function of forest and ultimately may lead to the depletion of the forest recourse (see also Rijsoot & He, 2001) Given the lack of thorough understanding of their requirements and often symbiotic relationships and dependence on their micro-climate sometimes leads to extinction of a species and certainly requires more in-depth research before management strategies can be implemented. In those cases, instead of providing an alternative way to sustainable forest management, collection of NTFP may have a heavy negative impact on the biodiversity and the sustainable forestry management leading to over-harvesting and sometimes extinction.

3. FOREST TENURE AND NTFP MANAGEMENT

Among many reasons for over-harvesting in scientific exchange and analysis of NTFP, people believe forest tenure is the critical aspect to address. Strengthening of forest tenure and user rights is seen as the key to improve long-term sustainable management and harvesting schemes. From a formal legal standpoint, the forest tenure system has been radically transformed from collectivization to de-collectivization over the past four decades in China. This transformation was officially recognized with the “Opening and Reforming Policy” in 1978. Initially, the de-collectivization policy was implemented only in

agricultural lands via the establishment of "Household Responsibility System", which allocated collective lands to individual households. The success of this system in stimulating agricultural production led to the application of the model of agricultural land reform in forestry management by the so-called "Three Fix" policy and the "Two Mountain System" (*lianshang sandiang*) in 1981.

The "Three Fix" policy attempted to clarify the tenure and status of forest lands by (1) delineating the boundaries between state forest, collective forests, and nature reserves; (2) allocating and securing freehold forest to farmers, and; (3) clarifying the responsibilities, rights and benefits associated with forestry for both households and villages (Zuo, 1995). Thus, after the reform, the forestry sector in China depended on the distinction between state forests (*guoyoulin*), collective forests (*jintilin*) and, increasingly, household forests. State forests can be subordinate to central, provincial, prefecture and county level government, whereas collective forests are managed by townships, administrative villages or natural villages. Villages have both use and ownership rights over collective forests whereas the various levels of government own the state forests. However, logging in collectively owned forest is still subject to state quotas and control, and income is taxed, often without clear and transparent assessments.

The tenure system is more complicated for the household forests. Governance of these forests is based on the "Two Mountain System" consisting of "Freehold Forest Land" and "Responsibility Forest Land". The former refers to what are generally poorly forested or un-forested (barren or waste-lands) lands relatively close to a village. The purpose of allocating this land was to allow farmers to plant trees to meet subsistence needs – thus it could be put to any purpose other than clearing (Zuo, 1997). On the other hand, "Responsibility Forest Land" is collective forest that is supposed to be leased to individual households in the form of contracting villages and individuals. This allocation aimed to provide incentives for forest protection and reforestation.

Nevertheless, the "Two Mountain System" policy was not uniformly implemented in Yunnan province. While some villages demarcated forests and implemented household responsibility lands, most villages did not redistribute collective forest to household level. Instead, they maintained a single tract of collective forest for the use of all residents. In other cases, the situation was more complicated and under constant change with the distribution moving back and forth between de-collectivization and re-collectivization. In other areas, some parts of collective forest were leased out to individual households, and the remaining area stayed under the control of a collective of remaining households. With no clear guidelines and long-term experience of farmers to changing policy and taxation environments, sustainable NTFP management could hardly develop under insecure ownership. Henceforth, often it resulted in over-harvesting and short term opportunistic extraction and marketing. The critical issue to address in this environment is not who owns the forest or its products but who can have legal and documented access and rights to harvest and therefore control over the products. With the realization of the potential and value of NTFP and the transition from timber production to NTFP (especially under the present restricted logging rights), it created further pressure on the resource and increased the urgency to clarify resource property rights (He, 2006). Without a clear legal framework and property relations (no de jure rights), NTFP remain in many areas as an "open access" resources, and this inevitably leads to resource competition, and eventually resource degradation and social problems.

4. COLLECTIVE ACTION FOR NTFP MANAGEMENT IN YUNNAN

The collective action refers to "action taken by a group (either directly or on its behalf through an organization) in pursuit of members' perceived shared interests" (Marshall, 1998, as cited from Knox McCulloch et.al. 1998). Collective action in natural resource management include rules on using (or refraining from using) a resource, as well as implementing a process of monitoring, sanctioning, and dispute resolution (Ostrom, 1990). On the other hand, property rights can be defined as "the capacity to call upon the collective to stand behind one's claim to a benefit stream (Meinze-Dick and Knox, 1999). Thus property rights involve a relationship between the right holder, others and an institution to back up the claim (ibid.). Property rights and collective action are interrelated, especially in natural resource management.

In natural resource management, the structure of property rights and collective action shape the efficiency, equity and environmental sustainability. They set up a range of institutional arrangement from a centralized management regime to more devolved institution. A number of success stories such as Community-based Natural Resource Management (CBNRM), co-management, joint forest management, local self-governance and self-organization are now considered good practice to enhance local participation in controlling natural resource. This section examines the case of Matsutake mushroom and bamboo shoot for its local collective action for natural resource management.

THE CASE OF THE MATSUTAKE MUSHROOM COLLECTION

In the Tibetan Area of Northwest Yunnan, especially in the county Shangri-la (formerly Zhongdian), Matsutake Mushroom (*Tricholoma matstutake*) started to play a significant role in income generation and improved local development after the implementation of the partial logging ban and increased demand from traders to export Matsutake, especially to Japan. At present, tax levied from Matsutake trading account for 30% of county revenues, and cash income increased from 50% to 80% at household level due to intensified mushroom collection (He, 2004). This created not only higher pressure on the resource itself, but unclear property rights on Matsutake Mushroom harvesting combined with mass commercialization and processing inevitably imposed a heavy impact on the sustainability of the resource utilization practices. As a result, production of Matsutake declined from 530 metric tons in 1995 to 272 m.t. in 2000 (He, 2003). Rapid resource degradation called for a great attention from both government and local communities. On the one side, the government launched a number of regulations and strategies (e.g. privatization) to govern the collection and market. However, due to poor enforcement and extensive transaction cost they don't necessarily result in better management and sustainable use. On the other side, local communities also initiated different adaptive local actions in a collective way for self-governing the sustainability of Matsutake collection with positive outcomes. The local collective action became a good starting point for resource management.

The majority of Matsutake collection activities occur mostly in the collective forests, since they are closer to the villages. Under the policy of the "Two Mountain System", except for a small number of communities, most villagers have a strong understanding of their access rights to collective forest and apply this now to Matsutake management (whereas the term 'management' mainly relates to the management and protection of the oak/pine forests) and harvesting . Also, they have created several strict rules on how to harvest and market Matsutake and enforce their property rights through both, the formal legal system as well as informal practices.

In Jidia village, for instance, the regulations set up in terms of harvesting timing and hence access to the forest, and zoning are summarized as follows: 1) all extractors are restricted to harvest in village owned collective forests rather than indiscriminately, and outsiders are denied access to the resource. 2) If "outsiders" would like to access, an access fee is charged. But, outsiders are classified as villagers who originate from the village, and might have, out of various reasons (often due to marriage) out-migrated. Rules prohibit access to 'real' outsiders with no family connection to the village forests. 3) The standard of the access fees paid by "outsiders" are RMB 400/year for male and RMB 500/year for female collectors. The reason for this difference between the sexes is because male members are required to participate in forest patrols. 4) The harvesting size or length of the mushroom must be more than 6cm if it is to be collected. 5) For harvesting, access is restricted to every three days for collection, or to more explicit, the common practice and experience calls for 3 days for collection and 3 days for management and protection. 6) The activities of picking the mushroom can be only conducted by traditional oak-stick rather than other tools, and only a small hole can be dug for extraction. 7) After picking the mushroom, the hole should be covered again by soil, leaves and other organic matter to enrich the soil and to allow for mushroom regeneration.

To enforce those regulations, several associated practices are conducted. During the 3 days with no collection of Matsutake, all male should take on the responsibility of patrolling so as to see if anybody breaks the harvesting rules. The rules are explicit and state that there need to be at least 5 males from different households to be assigned and responsible for this task. This task is allocated in a rotation scheme and furthermore, between collection days, all villagers are required to come together three times each day at 9:00 AM, 1:00 PM and 4:00 PM. This is a basic, but well functioning system to make sure whether all villagers are following the regulation. In the 3 days of gathering time, villagers are also required to come together at every morning at 6:00 AM to guarantee equal access rights and time-share to the resource for all members. Besides, people are grouped in 3-4 person teams so that they can mutually monitor each others harvest activities. There are also "village council teams" responsible to both monitor the villagers harvest practice and deal with cases when rules have been broken. After the mushroom season, this village council team continuously takes on the responsibility of sustainable forest management to maintain the forest resource and environment. At the end of the year, a village meeting will be called in to discuss possible improvements, amendments and general discussions on the enforcement of those regulations.

To summarize, the local collective action was instrumental to develop and shape institutional arrangements and practical guide lines to regulate and manage peoples access to a valuable resource, both spatially and in access time, but also setting up arrangements on how local adaptive rules and regulation schemes can be developed and enforced, amended and monitored and can actually be a future guideline for policy makers. It changes and improves the "open access" into a commons scheme with a sound institutional setting and arrangement, which then leads to better sustainable practice of resource utilization and provides conflict resolution in cases where there are disputes.

A CASE RELATED TO THE MANAGEMENT AND HARVESTING OF BAMBOO SHOOT

Bamboo shoots were commercialized after the market reform, however, without much notice by government officials. This case is based on an empirical study of the Nuozhadu Nature Reserve in Yunnan. As in many similar cases in China, the establishment of nature reserve has caused conflicts between the government and local forest depending

communities as it limits access to a traditional income source. In 1999, the local government together with the Sino-Dutch project supported the establishment of joint management committees to support conflict resolution and sustainable use of resources in nine nature reserves of Yunnan. By doing this, joint resource management is not limited to bamboo shoots, it rather tries to address the whole ecosystem on which communities depended and its sustainable resource utilization.

With the establishment of nature reserves, the tradition of bamboo shoots collection and its former management was broken down and bamboo shoots *de facto* became an open access commodity after the market reform. This situation has led to severe bamboo forest degradation. The establishment of the joint management committee is seen as a starting point to focus on sustainable bamboo shoot harvesting and management as well as to address other NTFP harvesting within the nature reserves. It is also seen as a way to establish local organizations and institutionalization of conventional joint management schemes and practice. In order to achieve this, project management and communities set up joint management committees consisting of 7-10 people in different villages. These committees are joint by 1-2 government officials and 6-9 elected villagers. Male and female are to be equally represented and each is assigned with his/her own responsibilities. This management required a monitoring system that aims to check not only on the villagers forest use, but also to help develop and institutionalize functioning village based organizations to achieve commonly derived goals in a given community.

With the support of these organizations, and based upon multi-stakeholders discussion, improved bamboo shoot managerial arrangement was also meant to reduce bamboo forest degradation as follows: 1) Develop spatially fixed tenure systems to restore traditional zoning activities for allocating bamboo forest to communities including freehold forests, collective and state forest. With this, particularly inter-communities boundaries are to be clarified and secured. 2) Allocate proper harvesting times and access by limiting harvest to July to August; extraction of bamboo shoots in any other months is prohibited. 3) Development of harvesting schemes by prohibiting clear cutting, and more specifically, at least one shoot must be left within a bamboo cluster.

Through those formalized and regulated institutions, bamboo forest could recover and increase production of bamboo shoots. Monitoring and organizational support by the committee helped to reduce past damages on the bamboo forest resource. Related positive results are to be found in the reduction of conflicts among communities by restoring and improving a formerly functioning system and this especially is very welcomed by all villagers and communities and receives additional support which again has a positive impact on the overall adaptation of the management scheme. Concerning the second rule, bamboo shoots in Yunnan mainly grow from July to August and naturally a stricter limitation to harvesting time helps to concentrate everyone's focus on bamboo for a limited time and secures the regeneration period. Also merchants only come to the village during that time. Consequently this regulation can be easily implemented and enforced. For the third regulation, villagers are apt to leave the bamboo shoots which grow deeper in the forest, because it is too difficult and time consuming to go deep into dense bamboo forest far away form villages for gathering.

In short, those institutional and management changes can be well implemented in bamboo shoot extracting. Besides, there are also forest guards and members from the committee, who are obligated to monitor harvest practice, and to enforce regulations. Moreover, any rule breaker will be fined. The fines will be used for the committees' operation costs, which contribute to the sustainability of the institution.

In Chinese, those regulations are called "*xianghui mingyue*" (local regulations or village code). "*xianghui*" refer to township regulations; "*minyue*" represent a vernacular mutual agreement. The implications are that those institutions combine official and vernacular regulations, which demonstrate the long history of joint management in China. "*Xianghui minyue*" is the main institutional arrangement of joint management committees in the Nuozhadu Nature Reserve. The committees also formulate other NTFP management "*xiangui minyue*" to guide any NTFP collection.

In turn, the establishment of committees ensures the durability of management schemes and its impact is not limited to NTFP management, rather the committees have a wider positive impact on all village affairs.

In summarizing, local institutions of bamboo shoots were formulated in response to market intervention. An institutional arrangement supported and facilitated the development, in this case the Sino-Dutch development project. Local adaptive strategies as collective actions associated with external support played a key role to sustain resource use and to promote local economic development. Under those circumstances, participatory management institution are formalized and institutionalized based upon multi-stakeholders discussion, with local villagers and government officials participating in decision-making. Joint management institutions can play a crucial role in promoting efficient and sustainable resource use; eventually contributing to the improvement of local livelihoods. A ositive side effect is the improvement of relations between communites and government officials.

5. CONCLUDING REMARK

The challenge of protecting diminishing forest resources combined with the provision of income for communities by letting them access and harvest NTFP can be overcome by promoting sound and regulated economic development and harvesting schemes. With adaptive practice involving all stakeholders, maintaining and even increasing production while simultaneously maintaining or improving ecological conditions is possible (Neumann and Hirsch, 2000). The discussion of sound forest management, therefore, encompasses a wide range of social, economic, political and ecological questions. Clearly, State's regulations and tenure on forest caused unclear property rights of NTFP resource utilization. As a result, tenure system of NTFP is *de facto* open access. Owing to unclear tenure system of NTFP, over-harvesting is common practice, which often not only depletes the NTFP resource, but also leads to forest degradation. Free market interventions associated with poor policy applications often threatens the local environmental sustainability and has a negative impact on communities by widening income gaps.

Local collective action can perform either as a self-governance or joint management practice and can adjust resource overuse. It enables not only more sustainable use of resource, but also inclusive management of resources with its related protection. The local collective action overcomes the weakness of *de jure* forest tenure system, by setting up the local adaptive and situated institution. It decentralizes usufruct rights to a resource to local communities and henceforth creates incentives for economic development and efficient resource extraction. In addition, the institution initiates an improved tenure system to prevent overuse of resource. Rules, regulations and institutions need to be locally derived (and are often based on traditions), adaptive, accountable, and amendable as well as dynamic and open to adjustment.

Thus, strengthening local access to and control over forest is a critical approach within a collective action for achieving rural sustainable development and livelihood improvement. Inclusive and participatory management can meet the needs of a large variety of rural

communities and user groups and help to improve social, cultural and economic conditions. In particular, developing and institutionalizing several types of NTFP management regimes and including spatial and temporal dimensions, can be seen as a more effective way to manage NTFP. Also, local institutions and clearly defined access arrangement can reduce negative impact of globalization and commercialization. Therefore, with the recognition of local tradition and participatory approach, joint management and local institutions are critical for governments to include when developing and implementing resource management strategies and policies regulating access and property rights.

ACKNOWLEDGEMENT

The authors thank the Sino-Germany Foundation in funding the participation of this workshop. Ford Foundation, ICRAF, GTZ and Misereor for their support for field work and paper writing.

REFERENCE

Agrawal, Arun and Elinor Ostrom (1999) "Collective Action, Property Rights, and Devolution of Forest and Protected Area Management". Paper presented at the Policy Workshop on "Collective Action, Property Rights, and Devolution of Natural Resource Management". in Philippines. June. 21-25, 1999.

Fox, Jefferson (ed. 1995) Society and Non-timber Forest Products in Tropical Asia; East-west Center Occasional Papers Environment Series No.19, August 1995; East-West Center.

He, Pikun, (2000) "Development and Utilization of the Non-timber Forest Products in China"; Paper presented in International Symposium II on Montane Main Land Southeast Asia (MMSEA) "Governance in the Natural and Cultural Landscape"; Chiang Mai, Thailand July 1-5, 2000.

He, Pikun and He Jun (2003) Tropical Social Forestry. Kunming: Yunnan Technology Press.(in Chinese)

He, Jun (2002) Local Institutional Responses to Commodity Chain of Non-timber Forest Products: A Case Study in Nuozhadu Nature Reserve, Yunnan Province, P.R. China, unpublished Master Thesis in Sustainable Development, Chiang Mai University, Thailand.2002

He, Jun. (2003) "Cross-scale Institutional Linkages of Commercial Matsutake Mushroom Management and Marketing: a Preliminary Study of an NTFP in Zhongdian County, Yunnan, China", in Xu Jianchu and Stephen Mikesell edited Landscapes of Diversity. Kunming: Yunnan Science and Technology Press. pp. 193-197.

He, Jun (2004) Globalized Forest-Products: Commodification of Matsutake Mushroom in Tibetan Village Yunnan Province, Southwest China. paper presented in 10th biennial conference of the International Association of The Study of Common Property in Oaxaca, Mexico from 7- 15 August.

He, Jun (2006) Political Economy of Recreation of Commons: Matsutake Mushroom Management in Tibetan Region of Yunnan, China. in Lebel, Louis, Xu Jianchu and Antonio Contreras eds. Institutional Dynamics and Stasis: How Crises alter the way common pool resources are perceived, used and governed. Chiang Mai: Regional Centre for Social Science and Sustainable Development (RCSD).

Knox McCulloch, Anna, Ruth Meinzen-Dick and Perter Hazell (1998) "Property Rights, Collective Action and Technologies for Natural Resource management: A conceptual

Framework". Working Paper of CGIAR System-wide program on Property Rights and Collective Action.

Meinze-Dick, Ruth and Anna Knox McCulloch (1999) "Collective Action, Property Rights, and Devolution of Natural Resource management: A Conceptual Framework". Paper present in Policy Workshop on "Collective Action, Property Rights, and Devolution of Natural Resource Management". in Philippines. June. 21-25, 1999.

Nepstad, Daniel C. and Stephan Schwartzman (eds. 1992) Non-Timber Products From Tropical Forests Evaluation of a Conservation and Development Strategy; Bronx, N.Y.: New York Botanical Garden, 1992.

Ostrom, Elinor. (1990) Governing the Commons: The evolution of institutions foor collective action. Cambridge University Press.

Rijsoot, Jeanette Van and He Pikun (eds. 2001) The International Seminar On Non-timber Forest Product: China Yunnan, Laos, Vietnam, Yunnan University Press.

Su, Yufang (2001) Building Collective Tenure for Sustainable forest management in a Multi-ethnic Community: A Case Study in Taohua Administrative Village of

Lijiang, Yunnan, P.R. China; Unpublished, Master Thesis in Sustainable Development, Chiang Mai University, Thailand.

Wollengerg, Eva & Andrew Ingles (eds. 1998) Incomes From The Forest: Methods For the Development and Conservation of forest Products for Local Communities; Bogor: Center for International Forestry Research; World Conservation Union.

Zuo, Ting (1995) "Forestry Liangshan Daohu Policy and Its Impacts on Land Resource Management in 1980s, Yunnan, China"; Benjavan Rerkasem (ed.) Montane Agriculture in Mainland southeast Asia. Proceedings of a Conference at Chiang Mai University.

INTERRELATIONSHIP BETWEEN THE ONTOGENETIC TYPE OF PINE TREES AND THE RESIN PRODUCTION POTENTIAL

HUBERTUS POHRIS and HOLM UIBRIG

Technische Universität Dresden, Institute of International Forestry and Forest Products
Pienner Str. 8, D-01737 Tharandt

1 PROBLEM IDENTIFICATION

Resins of trees are substances extensively used in various industries. China produces about half of the world's resin consumption of altogether over 1 million tons per year. The resin preferably comes from natural pine forests in the Southern belt of the country. Like other renewable resources the pine forests are limited in size and their dynamic characteristics determine the resin production capacity. The resin is synthesised and stored in endogenous, interconnected horizontal and vertical canals of both xylem and phloem of the pine trees. Anatomical knowledge about the resin canal system, the resin biosynthesis and the resin flow are essential to understand the biological fundamentals of resin production and to develop effective resin tapping technologies, too. There is some evidence that resin composition and yield is a function of time, environment, and genetic constitution of the trees. The resin tapping operation affects the tree growth and development behaviour (COPPEN, HONE 1995).

Despite the increasing number of studies concerning the secretory structures in conifers, less is known about differences in the structures, their development, the response to wounding and the variations between species of a certain genus (LANGENHEIM 2003). We have become acquainted with the problem of how pines exude and store resin. However, in order to raise the resin yield capacity of a forest stand on a sustainable basis it is desirable to exhaust all the technological and silvicultural options at hand. To this end, potential crop tree selection and systematic elimination of the serious competitors of each potential crop tree appear to be a necessary investments in stands that grow up nearly uniformly (SMITH ET AL. 1997). Derived from that the critical research question is, whether resin production depends on different ontogenetic types of pine trees.

In this paper results of an investigation on the resin secretory structure and resin flow after wounding of the tropical pine species of *Pinus massoniana* Lamb. and *Pinus merkusii* Jungh. et de Vriese will be referred to. Furthermore, recent research concerning morphologically distinguishable growth types in pine stands of *Pinus sylvestris* L. in central Europe shall be exploited to suggest potential treatment options for tropical pine stands geared to resin tapping. This shall serve as a basis to advance forest stand management research for resin production in pine forests, which have not yet undergone objective-oriented silvicultural interventions.

2 CHARACTERISTICS OF RESIN FLOW AND RESIN REFORMATION AT TWO TROPICAL PINE SPECIES

Comparative studies of 30 to 40-year old trees from Pinus massoniana and Pinus merkusii in Quang Ninh province, Vietnam, have been conducted with regard to their suitability for resin tapping (STEPHAN 1976). The so-called fish-bone technique with the V-shape and a tapping angle of 40° was employed for wounding. The resin flow duration was calculated based on the assumption that the amount of resin outflow (R) per unit of time (t) expressed in per cent of the total amount of resin outflow (T = 100 %) will be proportional to the

difference between the total amount of resin outflow (T) and the amount of resin outflow per defined unit of time (t) as follows:

$$dR : dt = k \times (T - R). \quad (1)$$

After integration and considering that for t = 0 and R = 0 the integration constant results in C = T, the equation changes to

$$R = T \bullet (1 - e^{-kt}). \quad (2)$$

In this non-linear equation (2) the parameter k indicates the effectiveness of the epithelial cells of resin canals (extension due to water absorption) for the resin flow duration. In case of *Pinus massoniana* the mean value $k_{ma} = 0.1645$ was calculated, and for *Pinus merkusii* $k_{me} = 0.0421$, respectively. This reflects clear differences between both of the pine species examined (Table 1).

Table 1. Observations on the physiological behaviour of Pinus massoniana Lamb. and Pinus merkusii Jungh. et de Vries

Attribute	***Pinus massoniana***	***Pinus merkusii***
Resin flow duration	1 day	3 – 4 days
Resin reformation speed	8 – 9 days	4 – 5 days
Stimulation with yeast extract solution	30 % resin yield surplus	no resin yield surplus
Resin crystallisation	during 1 day	during several days

(adapted from STEPHAN 1976)

While the resin flow of *Pinus massoniana* came to end up after one day, it kept flowing for three to four days at *Pinus merkusii*. Measurements of resin reformation speed to compensate the losses indicated considerable differences as well. According to the observations *Pinus merkusii* needs about four to five days to refill the resin canals, whereas *Pinus massoniana* seems to use eight to nine days respectively. It becomes obvious that important differences between both of the pine species concerning the process of resin biosynthesis and the effectiveness of the epithelial cells of the resin canals must be taken into account for tapping operations.

RAPID RESIN FLOW

The amount of resin pouring out from the canal per unit of time depends on the pressure of the epithelial cells, the viscosity of the exudation and the diameter of the resin canal system.

Pressure of the epithelial cells: After wounding the tree, resin will start to pour out immediately. The epithelial cells begin to suck in water from the surrounding sapwood through osmosis and enlarge their volume. This is to initiate the process of pressing out resin from the canal system. During this event the secretory system has already started to provide the resin canals with new resin until they are completely filled and a balanced pressure situation is achieved. However, the crystallisation of resin interrupts the resin flow from the tapped tree.

Viscosity: The content of turpentine is important for the viscosity of the resin. The higher the turpentine concentration is, the better the resin flow will be. High air

temperatures are closely correlated to internal tree temperatures, which reduce the viscosity of resin (Stephan, 1973; Kaminski, 1986). Although higher temperatures improve the resin flow, this correlation is less pronounced in case of accelerated transpiration of the needle biomass. Under this situation the epithelial cells suffer from reduced water supply and cannot generate sufficient pressure for the resin flow. In contrast, increased resin exudation results from high temperature combined with high atmospheric humidity.

Diameter of the resin canal system: Both horizontal and vertical resin canals occur in the xylem, with the vertical canals connected by the horizontal ones. The horizontal resin canals of Pinus sylvestris reach, e. g., a diameter of 0.03 mm to 0.05 mm, and the vertical ones 0.08 mm on average with a length of 0.5 to 1.00 m (Stephan 1967). In examining the diameter of resin canals at representatives of high-productive pine trees Verma (1968) found out that their diameter was almost 50 % larger then those of low-productive pine trees. Indeed, the density of resin canals per unit of area has not been proved being crucial in any investigation.

RAPID REFORMATION SPEED

Resin-synthesizing epithelial cells of pine species are concentrated nearby the resin canals, although their number seems to be much higher around the vertical canals as compared to the horizontal canals (MCREYNOLDS ET AL. 1989). Terpenoid resin formation needs at first mono- and sesquiterpenes being generally volatile. GLEIZES ET AL. (1980, 1983) showed the involvement of plastids in monoterpene biosynthesis, and reported evidence that sesquiterpenes of pines are formed in the endoplasmic reticulum. The locations of nonvolatile terpenes formation in conifers are not well explored up to now. Molecular genetic will improve the understanding of resin biosynthesis in future (BERENBAUM 2002; LANGENHEIM 2003). After resin biosynthesis the metabolic compound is being transported into the lumen of the canals where it is being stored. However, resin components are derived from photosynthetically produced carbohydrates broken down to separate simpler compounds for new substance formation. Therefore, an active primary carbon metabolism and a sound internal resin biosynthesis affects resin tapping operations in a crucial manner.

Stimulation: Chemical application to stimulate and maintain resin flow after tapping operation is extensively used. For a long period of time application of sulphuric acids has been given preference over other compounds in order to open up a large number of the horizontal resin canals and counteract the rapid blocking of the resin canals after wounding the tree. This application results in a prolonged resin flow solely (Coppen and Hone 1995). More recent research was focussed on substances modifying the function of the epithelial cells, the resin canals or the resin biosynthesis for higher yield production. In this sense, yeast extract solutions (Saccharomyces cerevisiae) has been tested and applied successfully to Pinus sylvestris in Germany with a yield increase of between 30 to 60 % (Figure 1).

In the course of further development the plant growth regulator "Ethephon" as 2-chloroethylphosphonic acid ($C_2H_6ClO_3P$) has been added to the yeast extract solutions at a ratio of one to six showing a further increase in resin yield (Stephan 1986). It is believed that the phytohormone ethylene is directly responsible for the resin biosynthesis (Wolter 1977). Most probably Ethephon is acting as an effective promoter of endogenous ethylene production in living plant cells. Though clear evidence exists for enhanced yields of latex in rubber tapping through this ethylene-releasing compound, the long-term benefits of its application in tapping pine trees must still be demonstrated (Coppen and Hone 1995).

Figure 1. Demonstrated reisin tapping technique

3 ONTOGENETIC TYPE OF PINE TREES AND RESIN YIELD

It is well-known that the individuals of any population differ from each other in their genotype (genetic constitution), and in many cases, also in their phenotype (behavioural, physiological and morphological characteristics). Greater fitness of genotypes means a better adaptation to their physical and biotic environment resulting in higher survival and reproduction rates within the population (KIMMINS 1997). Concerning the different ontogenetic types of Scotch pine (Pinus sylvestris) in Germany profound investigations have been conducted in the northeastern lowlands (ERTELD 1955, 1958; ERTELD, KRÄUTER 1957; KRÄUTER 1957, 1964, 1968). At least three ontogenetic types had been identified within the pine populations (Figure 2 and Table 2).

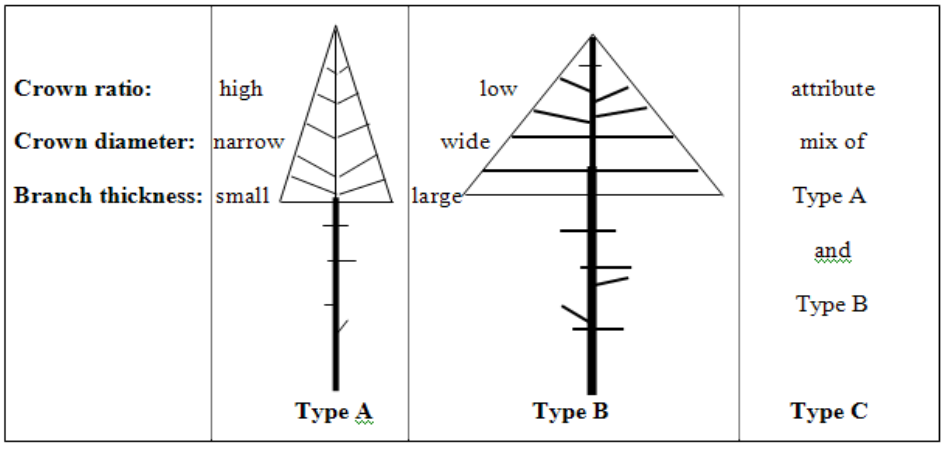


Figure 2. Essential attributes to distinguish ontogenetic types of Pinus sylvestris L. in the northeastern lowlands of Germany (after ERTELD, KRÄUTER 1957).

The attributes identified for the assessment (Table 2) must be recognised as mean values of trees with almost identical diameters in a homogenous stand.

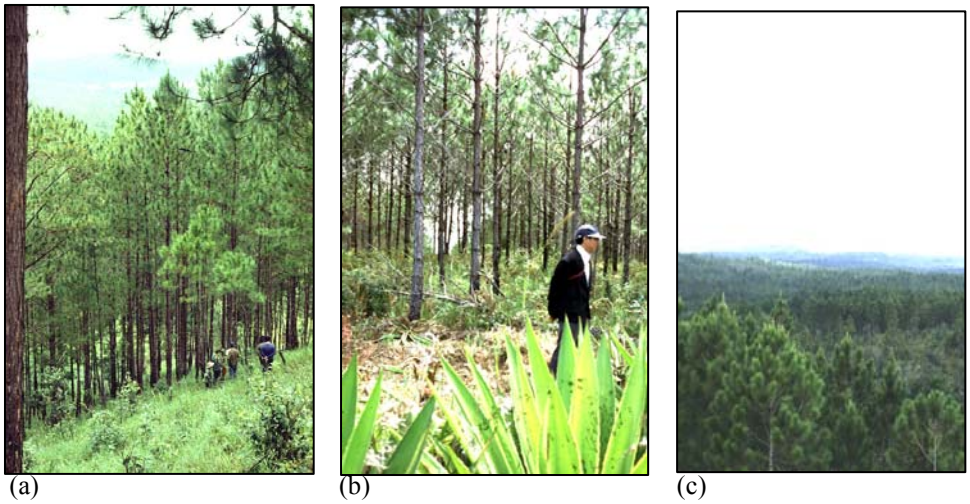
Table 2. Ontogenetic types of Pinus sylvestris L. in the northeastern lowlands of Germany.

Attribute	Ontogenetic type		
	A	B	C
Juvenile growth	slow	Fast	Trees with not
Mature growth	continuous	falling off	clearly identifiable growth prediction
Current height increment	culmination relatively late and low, but high growth values in maturity phase	culmination relatively early and high, but low growth values in maturity phase	concerning the culmination of current height
Crown shape	narrow, good ratio of crown length to crown diameter, fully shaped	wide, poor ratio of crown length to crown diameter, limited shaped	increment and growth values
Juvenile shoot length	short	long	Attributes of both
Branch thickness	small	large	Type A and
Branch angle	wide on trunk, narrow in crown	narrow on trunk, wide in crown	Type B

(after ERTELD, KRÄUTER 1957)

POHFAHL, LOCKOW, KRÄUTER (1979) have carefully tested the existence of the proposed ontogenetic types A and B applying the morphological attributes proposed by ERTELD AND KRÄUTER (1957) on the basis of the multidimensional variance analysis. This examination has revealed that the ontogenetic types differ from each other significantly in terms of both the morphological characteristics and the growth behaviour. Thus, it has been suggested to use the characteristics *crown length to crown diameter* (crown ratio), *branch thickness* and *crown diameter* (branch length) for a reliable diagnosis of the ontogenetic type (Figure 3).

KOHLSTOCK (1982) investigated the proportion of these ontogenetic types in selected permanent research plots. During the 1990s research has specifically been directed to the exploration of the distinct growth behaviour of the different ontogenetic types, and the relationships between molecular genetic markers and characteristics of pine trees in the northeastern lowlands of Germany. A concise reflection on findings relevant for further research on pine resin production is compiled in Table 3.



(a) (b) (c)

Figure 3. (a) naturally regenerated Pinus khasya stand composed mainly of Type A and C trees; (b) planted Pinus khasya stand thinned in favour of Type A trees, Lam Dong, Vietnam; (c) Naturally regenerated Pinus caribaea with varying crown shape in Pinar del Rio, Cuba (Photos: H. Uibrig(a,b); H. Pohris (c))

According to the "Guidelines of Silviculture, 2004" for Scotch pine (*Pinus sylvestris* L.) of the forest administration of Brandenburg federal state the promotion of vigorous, high-graded single trees is the main objective for timber production. As many as 150 potential crop trees should be selected in the well-established pine stand during the phase of between 7 to 12 m top height. They normally fit the Type A and partly the Type C. Experience has shown that a minimum harvestable diameter at breast height of 45 cm to 50 cm is advisable for final felling under different site conditions. However, looking at the results of around 50 years of research work regarding the ontogenetic types of Scotch pine in Germany, the Type B generally leads to noteworthy characteristics as well:

1. The genetically determined outstanding vitality of Type B trees during their juvenile and immature phase favours a fast crown formation with early and high culmination of the current annual increment on productive sites.
2. After stand tending operations that give preferential treatment to Type B trees by liberation, the diameter increment will be encouraged additionally. This allows to achieve the target diameter for resin tapping much sooner than that of the Type A. Furthermore, a site stabilising undergrowth will naturally develop even if the crown closure is only slightly interrupted.
3. Vigorous Scotch pines also produce a biologically active root system with almost 90 % of the total root biomass (ENDTMANN ET AL. 1991).

Taking into account the yield of single trees after resin tapping it has clearly been shown that those trees have yielded most, which had demonstrated an outstanding growth behaviour during the small pole stage. An early selection and preferential treatment of such relatively fast-growing trees may lead to a higher number of "Potential Resin Crop Trees (PRTs)" in a pine stand. As a consequence, it is recommended to use the diameter growth behaviour of pine trees during the small pole stage as an indicator (STEPHAN 1973, 1986).

Table 3. Findings from research on ontogenetic types of *Pinus sylvestris* L. in the northeastern lowlands of Germany (1992 – 2000) relevant for resin production

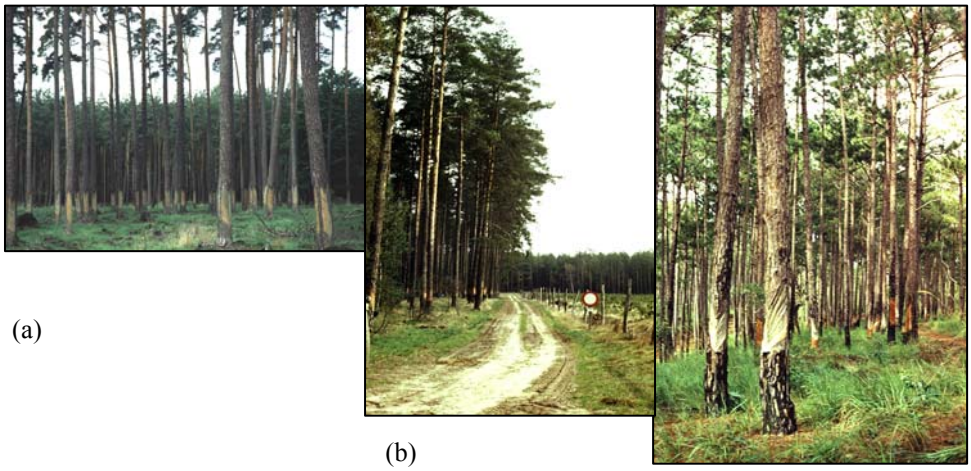
Serial No.	**Growth behaviour**
1	Trees of the Type A and Type B demonstrate a different level of the diameter growth curve under equal site, age and stand treatment conditions.
2	Trees of the Type B develop trunks with larger diameters as trees of the Type A in even-aged pure stands.
3	Trees of the Type A do not surpass the diameter of the trees of the Type B during the development of even-aged pure stands.
4	The superiority in diameter growth of the trees of the Type B results from the larger crown and, consequently, the growing space.
5	Trees of the Type B still indicate a lower growing space economy (annual diameter increment related to crown surface area [mm · m-2]).
6	Trees of the Type A produce higher-graded stem quality after Potential Crop Tree selection and liberation.
7	Data sets from permanent sample plots (PSPs) allow to describe and mathematically predict the growth behaviour (diameter growth curves) of trees from the Type A and trees from the Type B as well.
	Genetic constitution
1	Trees of the Type A and Type B differ with regard to their morphology, as well as in terms of their genetic constitution.
2	Trees of the Type A have shown a higher genetic variation and most likely dispose of alleles serving for a major potential of adaptation to changing environmental conditions (needle analysis).
3	Trees of the Type B have predominantly alleles serving for control of the growth rate (needle analysis).

(adapted from LOCKOW 1992, 1993, 1998, 2000; LOCKOW, POFAHL 1994; HERTEL, KOHLSTOCK 1994; HERTEL, KOHLSTOCK, LOCKOW 1998; KOHLSTOCK, HERTEL, SCHNECK 1993)

4 OUTLOOK

Three fundamental questions arise instantly from the reflections made (Fig. 4):

1. Is it possible to harvest higher resin yield per unit of time from deliberately selected and actively promoted pine trees of the Type B or Type C on productive sites?
2. Do the described ontogenetic types identified for Scotch pine also occur in populations of tropical or subtropical pine species?
3. Which silvicultural treatment allows to obtain highly productive trees for resin tapping within a comparatively short period of time?



(a) (b) (c)

Figure 4. Resin tapping requires an objective oriented management of the pine stands based on scientific knowledge (a, b) *Pinus sylvestris* in Mecklenburg, Germany; (c) *Pinus khasya* in Lam Dong, Vietnam (Photos: H. Uibrig)

Although it can be assumed that the silvicultural guidelines for Scotch pine in Germany do not focus exclusively on the improvement of resin production there is some evidence for the validity of the hypothesis linked with the first question from former resin research plots.

Periodicity and pattern in growth of individual trees of tropical pine populations are well known, but investigations about existing ontogenetic types have not been pointed out expressly (EVANS, TURNBULL 2004). In a 10-year-old stand of *Pinus caribaea* var. caribaea Morelet (II. site class) in the Pinar del Rio province (Cuba), GONZÁLES (1986) found out the Type A and Type B with a mean crown ratio of 1.96 and 1.26, a mean branch thickness of 1.38 cm and 2.11 cm, a crown diameter of 2.10 m and 3.40 m as well as an average diameter at breast height (DBH) of 10.7 cm and 13.8 cm for the first time. STEPHAN AND BETANCOURT (1981) had observed a moderate trend to higher resin yield per unit of measurement [gram per cut and face-metre] with increasing DBH (20 – 30 cm) of *Pinus caribaea var. caribaea* in this region, but without a special classification into ontogenetic types. An objective assessment referring to the second question has to combine both of the observations.

Recently, ROBERDS ET AL. (2003) have published some research results about the genetic and phenotypic variability for constitutive oleoresin flow in Loblolly Pine (*Pinus taeda* L.) in Florida (USA). The 10-year-old trees had a mean height of 12.10 m and mean DBH of 17.7 cm. Genetic components of variance made up a significant portion of the phenotypic variance observed in both the resin flow and growth trials. The estimates of individual tree heritabilities were $h^2 = 0.44$ for spring resin flow and $h^2 = 0.59$ for summer resin flow. For the growth variables they analysed $h^2 = 0.48$ for height, $h^2 = 0.49$ for DBH and $h^2 = 0.53$ for volume. They suggest a directional selection from the pine population to improve resin flow, which concerns the third question mentioned above.

There is a set of silvicultural treatment measures available to improve of the stand growth behaviour of pines (POHRIS 2004). Clonal plantation establishment with tropical pines appears to be difficult due to considerable rooting problems with cuttings from older trees and the time-consuming procedure to prepare plants by grafting. Generative propagation by seeds from high-productive trees may serve as the first step to increase resin

yield from pine stands. A subsequent selection and liberation of Potential Resin Crop Trees (PRTs) can contribute to their fast growth and early reaching of the threshold diameter for resin tapping, which should be more than 20 cm. A study concerning the constraints towards sustainable resin production in pine forests (*Pinus massoniana*) of Guangxi province in China by WANG LIFENG (1998) has shed light on the pressure on pine stands of diameters at breast height below 20 cm in practice. Extensive research works have been conducted on various silvicultural, technological, and economic issues; on management planning and implementation of operational plans in natural and planted pine forests combining timber and resin production following participatory approaches in a number of tropical countries (POHRIS, STEPHAN, UHLIG, UIBRIG 1992). They provide valuable reference for future research.

REFERENCES

Beerenbaum, M.R. 2002. Postgenic chemical ecology: from genetic code to ecological interactions. Journal of Chemical Ecology 28, 873-896.

Berg, H.A.; Bilke, G.; Heduschka, L.; Hendtke, H.; Lockow, K.-W.; Ness, T.; Schmidt, S.; Stähr, F.; Thielemann, T. 2004. Kiefern – Naturverjüngung, Pflege und Nutzung. Ministerium für Landwirtschaft, Umweltschutz und Raumordnung des Landes Brandenburg, Abteilung Forst, Landesforstverwaltung Brandenburg, Waldbau-Richtlinie 2004, 1-14.

Coppen, J.J.W.; Hone, G.A. 1995. Gum naval stores: turpentine and rosin from pine resin. Natural Resources Institute. FAO, Rome.

Endtmann, K.J.; Mai, D.H.; Lange, E. 1991. Die Kiefer (Pinus sylvestris) Artmerkmale, Taxonomie, Entwicklung der Art, Natürliche Verbreitung. Berichte aus Forschung und Entwicklung, Forschungsanstalt für Forst- und Holzwirtschaft Eberswalde, 24, 4-38.

Erteld, W. 1955. Der Zuwachs der Kiefer als Folge innerer Veranlagung und als Ausdruck erkennbarer Merkmale. Archiv für Forstwesen 4,5/6, 511-522.

Erteld, W. 1958. Wachstumsabläufe und Baummerkmale bei der Kiefer. Forst und Jagd 8,1, 35-40.

Erteld, W.; Kräuter, G. 1957. Untersuchungen über die Erkennbarkeit guter und schlechter Zuwachsträger bei der Kiefer. Archiv für Forstwesen, Berlin 6, 5/6, 361-420.

Evans, J.; Turnbull, J.W. 2004. Plantation forestry in the tropics. The role, silviculture, and use of planted forests for industrial, social, environmental, and agroforestry purposes. Third edition, Oxford University Press, Oxford, 467 pp.

Gleizes, M.; Carde, J.P.; Pauly, G.; Bernard-Dagan, C. 1980. In vivo formation of sesquiterpene hydrocarbons in the endoplasmic reticulum of pine. Plant Sciences Letters 20, 79-90.

Gleizes, M.; Pauly, G.; Carde, J.P.; Marpeau, A.; Bernard-Dagan, C. 1983. Monoterpene hydrocarbon biosynthesis by isolated leucoplasts of Citrofortunella mitis. Planta 159, 373-381.

Gonzáles, I.E. 1986. Beitrag zur Durchforstung von Pinus caribaea var. caribaea in Kuba. Dissertation, Technische Universität Dresden, Sektion Forstwirtschaft Tharandt, 139 S.

Hertel, H.; Kohlstock, N. 1994. Different genetic structures of two morphological types of Scotch Pine (Pinus sylvestris L.). Silvae Genetica 43, 268-271.

Hertel, H.; Kohlstock, N.; Lockow, K.-W. 1998. Genetische Untersuchungen an Kiefern. AFZ/Der Wald 18, 928-930.

Kaminski, E. 1986. Untersuchungen zur Temperatur im Holz geharzter Bäume. Agrarwissenschaftliche Gesellschaft der DDR u. a., 3. Wissenschaftliche Tagung Harzgewinnung vom 6. – 9. Mai 1986 in Fürstenwalde, 23-26.

Kimmins, J.P. 1997. Forest ecology. A foundation for sustainable management. Prentice-Hall, Inc., Second edition, 596 pp.

Kohlstock, N. 1982. Neue Erkenntnisse in der Kiefern-Jungwuchspflege. Beiträge für die Forstwirtschaft 4, 155-159.

Kohlstock, N.; Hertel, H.; Schneck, H. 1993. Zur Genetik von a- und b-Typen bei Kiefer. Beiträge für Forstwirtschaft und Landschaftsökologie 27, 174-177.

Kräuter, G. 1957. Wachstumsuntersuchungen an Einzelstämmen aus Kiefernbeständen. Forst und Jagd 7, 565-571.

Kräuter, G. 1964. Ein Beitrag zur Rationalisierung der Pflegearbeiten in Kiefernjungbestockungen. Soz. Forstwirtschaft 14, 7, 203-205.

Kräuter, G. 1968. Kiefernjungbestandspflege, aber wie? Soz. Forstwirtschaft, Berlin 18, 4, 113-116.

Langenheim, J.H. 2003. Plant resins. Chemistry, evolution, ecology, and ethnobotany. Timber Press Portland, Cambridge, 586 pp.

Lockow, K.-W. 1992. Zum Wachstumsablauf und zur Wuchsdynamik der Kiefer mit einigen Schlussfolgerungen für die Bestandesbehandlung. Der Wald 42, 5, 170-173.

Lockow, K.-W. 1993. Zur Quantifizierung der Wuchsdynamik der Kiefer und Schlussfolgerungen für die Bestandespflege. Forst und Holz 48, 357-360.

Lockow, K.-W. 1998. Der Kiefern-Durchforstungsversuch Chorin 97 – Ziele und Ergebnisse für die Praxis. Beiträge für Forstwirtschaft und Landschaftsökologie 32, 1, 15-23.

Lockow, K.-W. 2000. Durchforstungsweise und Bestandesentwicklungsdynamik bei Kiefer. AFZ/Der Wald 20, 1084-1086.

Lockow, K.-W.; Pofahl, U. 1994. Neue Erkenntnisse über Gesetzmäßigkeiten des Einzelbaumwachstums der Kiefer. Beiträge für Forstwirtschaft und Landschaftsökologie 28, 2, 83-86.

Mcreynolds, R.D.; Kossoth, S.V.; Clements, R.W. 1989. Gum naval stores methodology. In: Zinkel, D.E.; Russell, J. (eds.) Naval Stores: Production-Chemistry-Utilization, 83-122, Pulp Chemicals Association, New York.

Pofahl, U.; Lockow, K.-W.; Kräuter, H. 1979. Zur Lösung von Klassifizierungsproblemen mit Hilfe der mehrdimensionalen Varianzanalyse. Beiträge für die Forstwirtschaft 13, 2, 41-48.

Pohris, H. 2004. Some emerging research issues in high-intensity forest plantation management of tropical and subtropical regions. German-CIFOR Workshop on Rethinking Tropical Plantations. CIFOR, Bogor, December 7-10, 2004, 14 pp.

Pohris, H.; Stephan, G.; Uhlig, S.K.; Uibrig, H. (1992) Tharandter Beiträge zur Bewirtschaftung tropischer Kiefern. Mitteilungen der Bundesforschungsanstalt für Forst- und Holzwirtschaft Hamburg, Nr. 170, 60 – 67.

Smith, D.M.; Larson, B.C.; Kelty, M.J.; Ashton, P.M.S. 1997. The practice of silviculture: Applied forest ecology. Ninth edition, John Wiley & Sons, Inc., New York, 537 pp.

Roberds, J.H.; Strom, B.L.; Hain, F.P. 2003. Genetic and phenotypic variability for constitutive oleoresin flow in Loblolly Pine. In: McKinley, C.R. (ed.) Proceedings of the 27th Southern Forest Tree Improvement Conference, June 24-27, Stillwater, Oklahoma, 102-104.

Stephan, G. 1967. Untersuchungen über die Anzahl der Harzkanäle in Kiefern (Pinus sylvestris). Archiv für Forstwesen 16, 5.

Stephan, G. 1973. Die Gewinnung des Harzes der Kiefer (Pinus sylvestris). 2. Aufl. – Berlin: Hauptabteilung Forstwirtschaft beim Ministerium für Land-, Forst- und Nahrungsgüterwirtschaft der DDR, 203 S.

Stephan, G. 1976. Beobachtungen zum physiologischen Verhalten von Pinus merkusii Jungh. et de Vries und Pinus massoniana Lamb. Beiträge zur tropischen Landwirtschaft und Veterinärmedizin 14, 1, 71-78.

Stephan, G. 1986. Der Stand der Anwendung hochwirksamer Stimulationsmittel in der Harzgewinnung. Agrarwissenschaftliche Gesellschaft der DDR u. a., 3. Wissenschaftliche Tagung Harzgewinnung vom 6. – 9. Mai 1986 in Fürstenwalde, 23-26.

Stephan, G.; Betancourt, Y. 1981. Die Höhe der Harzerträge von Pinus caribaea var. caribaea Morelet und die Möglichkeit der Harzproduktion in Pflanzungsbeständen dieser Baumart. Wissenschaftliche Zeitschrift der Technischen Universität Dresden 30, 4, 247-250.

Verma, V.P.S. 1968. Beobachtungen an einigen ertragsbeeinflussenden Faktoren bei der Kiefernharzung. Archiv für Forstwesen 17, 10.

Wang Lifeng 1998. Historical survey of the system and assessment of constraints towards sustainable gum resin production in pine forests of Guangxi Province, China. Master thesis, Technische Universität Dresden, Institut für Internationale Forst- und Holzwirtschaft Tharandt, 99 pp.

Wolter, K.E. 1977. Ethylene-Potential Alternative to the Bipyridium Herbicides for Lightwood Induction. Proceedings of the Annual Meeting of the Lightwood Research Coordinating Council, January 18 and 19, 1977, Jacksonville, Florida.

NON WOOD FOREST PRODUCTS IN TIMBER PRODUCTION FOREST IN EAST KALIMANTAN, INDONESIA

Carol M. Grossmann

Albert-Ludwigs-Universität Freiburg, Germany

As reflected in relevant research publications as well as reports and proposals of international technical cooperation projects of the late 1990s non-wood forest products (NWFP) were frequently expected to have a high development potential. On the one hand it is hypothesized that the current contribution of NWFP to the income and subsistence of rural people living on the forest edge is underestimated. On the other hand, an intensified management of NWFP is anticipated to increase the income of these people (Tan, Ruiz Pérez & Ibach 1996, Sepp et al. 1996), as well as offer incentives for the conservation and sustainable management of natural forests in the form of managed natural production forests, especially in the tropics (Arnold & Ruiz Pérez 1996; BML 1997, BMZ 1997, CIFOR 1995, Falconer 1990, Falconer & Arnold 1989, FAO 1995, GTZ 1993, Nepstad & Schwarzman 1992, Redford & Padoch 1992, Sepp et al. 1996, Tan et al. 1996). Last not least it is propagated by certain interest groups that subsistence use and market oriented management of NWFP can be integrated into forest management schemes aimed primarily at timber production (Prebble et al. 1999).

At the same time voices are on the rise criticizing these expectations claiming that they are often either based on insufficiently tested hypotheses (Godoy & Bawa 1993) or on unilateral sectoral analyses (Godoy & Bawa 1993, Arnold & Ruiz Pérez 1996, Padoch & de Jong 1989). These sectoral approaches usually do not take into account either the technical aspects of forest management or the socio-economic aspects of the use and management of NWFP by the selected target groups. Based on this conclusion the following aims of the presented research project (Grossmann 2000) were formulated:

- Elaboration of a target group oriented and interdisciplinary research concept: a con¬tribution to the development of a transferable methodology for analyzing the role and development potential of NWFP in any area with natural forests.
- Answers to three fundamental questions relevant to the management of NWFP in a timber concession area in East Kalimantan, Indonesia:
  1. How large does the area of natural forest need to be to supply the local population with the types and amounts of NWFP currently used?
  2. How is the supply of NWFP from natural forests influenced by selective commercial logging?
  3. Do the inspected forest stands provide the potential for local people to intensify market oriented management of NWFP that will, at the same time, enhance forest conservation?

An individual working definition of NWFP was formulated for the study as no published definition was suitable to answer these research questions: “Non Wood Forest Products (NWFP) are tree products other than wood as well as other plants, animals and their products growing in natural forests.”

The concession area of the timber company Limbang Ganeca in central East Kalimantan was selected as the research area. Long Lalang and Ritan Baru, which border on the concession area, were selected as research villages. The selections took place in the context of the activities of the Indonesian-German Development Cooperation Project “Promotion of Sustainable Forest Management Systems in East Kalimantan”, which initiated and financed

the study. The research area is covered with Lowland-Dipterocarp-Forest, including 30% primary and 70% logged-over forest. The research area is typical of East Kalimantan in its high socio-geographic diversity. In contrast to other studies with similar research objectives, research sites were not pre-selected due to their production of particular NWFP or their local economic importance.

An interdisciplinary research concept consisting of two consecutive phases was developed for the study. The focus of the first phase was the analysis of secondary data relevant to the region and the implementation of a pilot study in the research area. The pilot study took place in the two research villages utilizing a 'Participatory and Rapid Rural Appraisal' approach. The most important results of the pilot study were:

1. a list of all NWFP used in the research villages, including local names, properties, uses, harvesting techniques and scientific names,
2. clarification of differences concerning the understanding of terms such as 'forest' and 'NWFP',
3. a collection of locally important socio-economic household criteria and their indicators (primarily economic status and ethnic affiliation of the household members),
4. an impression of suitable social behavior during homestead visits and interviews, and
5. the realization that the interest of the local people concerning NWFP is ranked rather low in comparison to other topics relevant for subsistence as well as for income generation.

In the second phase, the main study, the two aspects most important for the analysis of the significance and the development potential of NWFP (technical and socio-economic aspects) were investigated using appropriate methods from forestry and the social sciences.

The forestry part of the study was composed of a sample inventory of 340 square sample plots (0.04 hectare each) distributed on a systematic grid in two different forest stands of the timber concession forest of the study area. In this inventory, the species and population densities of perennial plants producing NWFP were investigated. A stand of primary forest and a stand of logged-over forest were compared to analyze the influence of commercial logging on the supply of NWFP in timber production forests. In addition the site preferences of the NWFP-producing plant species were analyzed. Corresponding interdependencies were considered in the interpretation of the inventory results to eliminate site-induced differences in population densities on the two investigated forest stands.

Fifty-eight NWFP-producing tree species were identified in the investigated research stands. On average they were represented by 1.3 adult individuals per species per hectare. Groups of different species producing interchangeable NWFP collectively reached an average of 2.0 (maximum 7.8) adult individuals per hectare. Regeneration was assured for almost all NWFP-producing tree species.

Thirty-four NWFP producing rattan species were identified at an average population density of 2.0 (maximum 9.4) adult individuals per hectare. The density of ripe and interchangeably usable canes provided by different species was calculated to be between 6 and 72 canes per hectare. Regeneration was assured for five of six of these groups of interchangeable rattan species.

Population densities between 0.3 and 19.7 adult individuals per hectare were calculated for the 8 NWFP-producing palm species that grow in the form of trees or shrubs. None of these species showed a population structure indicating sufficient natural regeneration in the investigated forest stands.

The two NWFP-producing liana species that included more than 5 detected individuals in the study, reached population densities of 1.2 and 3.2 adult individuals per hectare. Regeneration did not seem sufficient for either species.

Selective logging had a significant impact on the populations of different NWFP-producing perennial plant species. Both negative and positive impacts were observed. No differences in population densities between primary forest and logged-over forest were observed for about half of the investigated species.

For most of the NWFP-producing tree species relevant to local people during the research period, it can be concluded that selective logging at best does not have a negative impact on their occurrence and population density. For those tree species (*Palaquium* and *Payena* spp.) that interchangeably produce Gutta Percha, a latex used for subsistence as well as income generation, a further reduction of originally low population densities due to logging was detected.

For most of the NWFP-producing rattans, tree palms, shrub-like palms, and lianas, changes in the structure of forest stand due to logging do not seem to threaten supply. In fact, the density of the respective NWFP-producing plant species actually tended to increase. Nonetheless, data suggested that some NWFP-producing rattan species (e.g. *Daemonorops critina, Plectocomiopsis geminiflorus*), are primary forest species negatively influenced by logging activities because they are shade tolerant and therefore sensitive to changes in the forest canopy.

Several NWFP-producing wildlife species, or their traces, were encountered in the primary forest stand as well as in the logged-over forest stand. Their occurrence was registered, but no quantitative data were collected.

The socio-economic aspects of the use of NWFP by local people in the two research villages were analyzed using methods from the social sciences.

A sample of 31 households provided quantitative data on the contribution of NWFP to their income and subsistence over the period of one year. In addition, information was collected on the natural properties of the NWFP used (such as the average yield per plant), on the harvesting techniques that were applied (destructive vs. non destructive), and on traditional or governmental rules and regulations concerning the harvest of NWFP (knowledge of and adherence to). The following main methods were applied: structured and semi-structured interviews, product counts, food diaries, and participatory observation.

The average monetary income of the local people was calculated at 2,500,000 Indonesian Rupiah (Rp.) per household per year. During the research period this amount was equivalent to about US$ 900. NWFP contri¬buted 124,000 Rp., or 5%, to this total income.

Over 80% of cash earned with NWFP was obtained on the basis of wildlife and wildlife products. Plants provided the remaining 20% of the income based on NWFP. Thirteen percent was derived at the village-level by sales of articles made of rattan. The remaining 7% was generated by sales of, and trade in, unprocessed vegetal NWFP beyond the village limits.

Individual households demonstrated broad variations of total income and of the respective contribution of NWFP to cash earnings. The share of NWFP based income ranged from 0 to 100%.

Associations between commercial use of NWFP and socio-economic characteristics of different households could be shown in context with economic status of the household. The nominal value, as well as the percentage of NWFP based earnings, decreases with rising total income. While poor households generated an average of 11.4% of their annual income on the basis of NWFP, it was only 1.7% for affluent households. In particular, the sale of

game contributed disproportionately to the income of poor households, as could be demonstrated with a further subdivision of the analysis into NWFP product groups.

The contribution of NWFP to subsistence was resolved into two components. Firstly, the contribution of NWFP to nutrition and secondly, the contribution of NWFP to articles of daily use were demonstrated. Faunal NWFP were identified as the second most important source of protein in all households. Game was served with one quarter of all meals, surpassed only by river fish, served with 40% of all meals but not considered a NWFP in this study. Vegetative NWFP were served only with 5.2% of meals and then only in very small quantities, primarily as very bitter vegetables or spices and condiments. Their contribution to the diet as appetizers is valued higher than their probably low calorie and nutritive content.

All participating households owned articles and utensils made completely or partly of durable NWFP such as cutlass handles and sheaths, wickerwork and palm hats. The most important raw materials were rattan canes, used differently according to their natural properties and final purpose. They were followed by *Licuala* palm leaves and Gutta Percha, used as adhesive. Further household articles traditionally made of rattan were also made from agricultural products, especially cultivated bamboo canes and leaves of *Pandanus* palms, or plastic. Informants reported an increasing process of rattan substitution. None-the-less Rattan Sega (*Calamus caesius*) was considered indispensable.

The replacement value of all articles made of durable NWFP was used as a method to compare the contribution of NWFP to subsistence with the contribution of NWFP to monetary income. The total replacement value was calculated as the sum of the local market-price values for the average number of articles per household. The results demonstrate that the monetary value of these articles per household is about equivalent to one third of the average annual cash income of the households investigated. A comparison of the annual replacement value of articles made of NWFP for subsistence with the monetary income generated on the basis of NWFP in the same time frame derived the following figure: the replacement value of NWFP harvested and processed for personal use amounted to five fold the amount of money earned by market oriented use of NWFP. Therefore the contribution of vegetative NWFP to subsistence is valued much higher than the direct contribution of NWFP to local monetary income.

An area of 100,000 hectare of natural forest (including primary and logged-over forest) was calculated to be required to continuously supply the people of Long Lalang and Ritan Baru with all plant-derived NWFP at their current rate of consumption. This figure corresponds with the total management area of the timber concession company Limbang Ganeca and surpasses the usual area of forest related activities by the village people. In addition, the harvest of NWFP by inhabitants of the other 14 villages on the border of the concession area would have to be restricted to assure the current rates of consumption. To supply the need for most NWFP, but excluding the rare and sought for Rattan Sega and Gutta Percha, a total area of about 4,000 hectare of managed natural forest would probably suffice.

In the NWFP-inventory, 101 NWFP-producing plant species were identified, of which only 42 species (about 40%) were actually used by the informants of the participating households during the research period. Only 10 of these NWFP were marketed, either as raw material or as processed goods. *Agelaea trinervis* (Mekai), *Calamus javensis* (Rattan Pulut putih), *Daemonorops critina* (Rattan Pulut merah) and *Parkia speciosa* (Petai) were sold unprocessed; species that were processed and marketed included *Calamus caesius* (Rattan Sega), *Korthalsia echinometra* and *K. ferox* (Rattan Merah), *Daemonoros atra* and *D. longipes* (Rattan Murah/Seringan) as well as *Payena acuminata* (Gutta Percha). These

NWFP and articles made thereof were products that were needed for subsistence as well, except for two rattan species providing Rattan Pulut, which were sold exclusively at the village-level.

An underused market potential could be anticipated insofar as products provided by at least 25 of the recorded NWFP-producing species during the inventory were traded at the provincial level and/or in other regions of Borneo. The socio-economic component of the study found that 16 of these commercial NWFP were not marketed in the research villages. For the others, with the two exceptions mentioned above, trade beyond the immediate research area did not take place during the research period.

Several reasons were identified for why more than 50% of all theo¬retically usable NWFP were not used at all and why more than 60% of all NWFP with market prices were not sold commercially. For most of these species the reasons were low attractiveness or poor quality of their products. Immediately following were economic reasons, which can be traced back directly or indirectly to the scarce plant population densities in natural forest stands. Attempts to promote the marketing of NWFP in the research area would have to deal with these problems of supply and quality as well as limited means of control over vast areas of managed natural forest.

Because of these handicaps the development of more intensive management of NWFP in these natural forests by local people cannot be expected. Consequently, no significant incentives are bestowed for the con¬ser¬vation of natural forests.

A purely sectoral or solely NWFP-oriented approach to secure and/or increase the use of NWFP as a source of income (in monetary terms or for sub¬sis¬tence) by the local people into the future seems promising only through an increased integration of NWFP in traditional agroforestry cultivation systems, provided that these systems are further developed. A rise of income for the people in the research villages could presumably be achieved more easily by pro¬moting the cultivation and marketing of established agricultural products. Having the official right to harvest timber, the improvement of working con¬ditions in the forestry sector and/or a regular share of the profits from the timber industry, reaping local resources as well as regulated monetary benefits from the nationalized usufruct of *Collocalia*-breeding caves, would be more promising than a unilateral promotion of the management of (vegetative) NWFP.

Based on these conclusions, recommendations were formulated in the context of different development options in the research area. At first, several potential development objectives were described, in which the use and management of NWFP played varying roles. These development options and objectives are partly interwoven and partly mutually exclusive. Conscious decisions for specific development priorities are recommended, though a sectoral promotion of the management of NWFP in natural forests is not a focus in either of these options. None-the-less, the results of the study predict a rising demand for particular local NWFP that possess a certain management potential outside of closed natural forests.

The final if disillusioning conclusion of this study is that NWFP are a weak but not to be neglected argument for the necessity of natural forest conservation, more so for faunal than vegetal NWFP. An intensified market oriented management of NWFP will most probably not contribute to natural forest conservation in the survey area.

REFERENCES:

Arnold, J.E.M. & Ruiz Pérez, M. 1996: Framing the issues relating to non-timber forest products research. In: Current issues in non-timber forest products research. Hrsg. Ruiz Pérez, M. & Arnold, J.E.M., Bogor: CIFOR, S. 1-18.

BML 1997: Tropenwaldbericht der Bundesregierung. 5. Bericht, Bonn, 59 S.

BMZ; GTZ; KfW; DSE 1997: Tropenwalderhaltung und Entwicklungszusammenarbeit. 5 Jahre nach Rio. Erfahrungen, Leistungen Perspektiven. Bonn: BMZ, 105 S.

CIFOR 1995: Contribution of non-wood forest products to socioeconomic development and their potential role in forest management concepts. Application for a Restricted Core Project to BMZ, Jakarta: CIFOR, 34 S.

Falconer, J. 1990: The major significance of 'minor' forest products: The local use and value of forests in the West African humid forest zone. Community Forestry Note 6, Rome, FAO, 232 S.

Falconer, J. & Arnold, J.E.M. 1989: Household food security and forestry: An analysis of socio-economic issues. Community Forestry Note 1, Rome: FAO, 145 S.

FAO 1995: Non-wood forest products for rural income and sustainable forestry. Non-Wood Forest Products 7, 127 S.

Godoy, R.A. & Bawa, K. 1993: The economic value and sustainable harvest of plants and animals from the tropical forest: Assumptions, hypotheses, and methods. Economic Botany 47, S. 215-219

Grossmann, C.M. 2000: Nichtholz-Waldprodukte in Ost-Kalimantan, Indonesien: Analyse der waldwirtschaftlichen und sozio-ökonomischen Aspekte ihrer Bedeutung und ihres Entwicklungspotentials für die Lokalbevölkerung in einem Holzkonzessionsgebiet. (Dissertation, Univ. of Hamburg, Germany). In: Mitteilungen der Bundesforschungsanstalt für Forst- und Holzwirtschaft No. 199, Kommissionsverlag Max Wiedebusch, Hamburg, 300 p.

GTZ 1993: Fachgespräch über forstliche Nichtholzprodukte (NHP). Protokoll (unveröff.), 17 S.

Nepstad, D.C. & Schwartzman, S. (Eds.), 1992: Non-timber forest products from tropical forests. Evaluation of a conservation and development strategy. Advances in Botanical Economy 9, NY: New York Botanical Gardens, 147 S.

Padoch, C. & de Jong, W. 1989: Production and profit in agroforestry: An example from the Peru¬vian Amazon. In: Fragile lands of Latin America: Strategies for sustainable develop¬ment. Browder, J.G. (Hrsg.), Boulder CO: Westview Press, S. 102-112

Prebble, C.; Ella, A.; Subansenee, W. 1999: ITTO: Making the most of NWFP. In: ITTO Tropical Forest Update 1, S. 4-8

Redford, K. & Padoch, C. (Eds.) 1992: Conservation of neotropical forests: working from tradi¬tional resource use. NY: Columbia Univ. Press, 475 S.

Sepp, C.; Walter, S.; Werner, W. 1996: Grundlagen und Leitfragen zur Thematik Forstlicher Nicht-Holzprodukte (FNHP) im Rahmen der Technischen Zusammenarbeit. GTZ, Abt. 424 (Hrsg.). Wiesbaden: Universum Verlagsanstalt, 47 S.

Tan, L.C.; Ruiz Pérez, M.; Ibach, M. 1996: Non-timber forest product databases. Bogor: CIFOR, 94 S.

ASSESSMENT TOOLS FOR FORESTRY DECISION-MAKERS - EXPERIENCE FROM FOREST DEVOLUTION IN VIETNAM'S CENTRAL HIGHLANDS

THOMAS SIKOR, NGUYEN QUANG TAN, AND TRAN NGOC THANH

Junior Research Group on Postsocialist Land Relations, Humboldt University, Berlin, Luisenstr. 56, 10117 Berlin, Germany, Tel: 49-30-2093-6270, Fax: 49-30-2093-6427
Emails: thomas.sikor@rz.hu-berlin.de; tananh@hn.vnn.vn; mekongdl@dng.vnn.vn

SUMMARY

How can decision-makers in China's forestry administration acquire the information they need for the design and implementation of forest policy? Effective policy implementation requires the development of mechanisms for monitoring, analyzing, and adapting forest policies in a timely and efficient manner. This paper discusses a tool developed in Vietnam for assessing local outcomes of devolution policy. The tool combined attention to the effects of devolution on forest conditions as well as local livelihoods. Results from its application in ten villages suggest that the tool provides an effective and feasible way for forest administrations to generate relevant information about local outcomes of forest devolution. Assessments such as the one analyzed in this paper can make important contributions to learning-oriented approaches to forest policy, i.e., approaches that bring together policy-makers and scientists in mutually beneficial communication processes.

INTRODUCTION

China's forest policy has transferred significant rights on forests to local people (Weyerhäuser *et a*l. 2006). The move towards devolution poses serious challenges to forest departments, as it radically transforms their dealings with local people. Devolution challenges forest departments not only because they have to cede direct control over valuable resources and territory. But forestry officials, in China as in many other parts of the world, are also not used to thinking of local people as responsible resource managers (Edmunds and Wollenberg 2003). In addition, they often lack mechanisms for monitoring and analyzing initial policy outcomes, mechanisms that would allow them to adapt devolution policies to local contexts (Borrini-Feyerabend *et al*. 2000).

Devolution requires significant learning on the side of forest departments. The learning begins with the formulation of devolution experiments, their implementation in the field, and evaluation (Mayers and Bass 1999). Forestry officials need to learn from the outcomes of initial policy experiments in a systematic and collaborative manner. Such a learning-oriented approach involves generating knowledge on critical outcomes of devolution (Fisher 1999, Ribot 2002). Equally important, the approach calls for new ways to give various types of local actors a voice in policy evaluation (Edmunds and Wollenberg 2002). Forest departments need to develop mechanisms that help them work with local people in monitoring, analyzing, and adapting devolution policies in a timely and efficient manner.

In this paper, we present a simple tool developed to support learning-oriented approaches to forest devolution. It is the product of a collaborative assessment of devolution outcomes undertaken with provincial and national decision-makers and a

provincial forest department in Vietnam. The tool is intended to help forest departments derive lessons from initial experiences to inform the design of subsequent rounds of devolution. Its development took explicit consideration of three criteria that are vital for its potential to support learning (Edmunds and Wollenberg 2002): the tool was developed to be effective, in the sense that it generates accurate information about changes in critical devolution outcomes; feasible, in the sense that its resource requirements match with the level of human and financial resources typically available to forest departments; and relevant, in the sense that it generates information upon which forestry decision-makers can act.

The paper is structured as follows. Section 2 introduces the policy and geographical background in which the assessment tool was developed. Section 3 presents the social and analytical processes guiding tool development. Section 4 discusses important lessons learned in the development and application of the tool. Section 5 concludes with more general remarks about assessment tools in devolution programs.

POLICY AND GEOGRAPHICAL BACKGROUND

Just as in parts of China and other Southeast Asian countries, Vietnam's forests used to be under direct state management. Vietnam nationalized forests in 1955 and established a system of state enterprises to manage them in the north and, after reunification in 1975, also in the south. State enterprises and governmental forest departments employed a large number of technical staff to manage the forests in a 'scientific' manner. Forestry engineers trained at Vietnam's forestry colleges and technical schools joined forces with workers recruited among the local population to put scientific management into practice. This was the primary way how people participated in forest management.

In the early 1990s, Vietnam's forest administration embarked on a major reform. The reform aimed to give local people a more active role in forest management. The 1993 Land Law created a legal basis for allocating long-term use rights to forestry land to non-state units, including rural households. A subsequent decree allowed state enterprises to contract out forest protection to local people and made significant funds available to finance the contracts. The reforms expanded the role of local people in forest management. Yet forest departments appeared ill-prepared to accommodate the new role attributed to local people in the legal and policy framework. They granted long-term use rights to local people only for degraded forestry land. Natural forests remained under the direct control of state enterprises.

In 1998, the provincial government of Dak Lak decided to seek new ways to attain sustainable forest management. The decision came after a decade of rapid economic growth fuelled by high in-migration. Dak Lak's dipterocarp and bamboo forests had gotten under increasing pressure from agricultural expansion. The rapid pace of economic change and in-migration had produced deforestation, making forest cover shrink from 70 percent in 1975 to 51 percent in 1999. The rapid pace of economic and demographic changes had also made local livelihoods increasingly insecure. Dak Lak's ethnic minority population, in particular, had felt increasingly threatened by the migrants.

The provincial authorities reacted by endorsing a proposal of the Department for Agriculture and Rural Development (DARD) to devolve forests as a way to stop deforestation and improve livelihood security. 'Forest land allocation' (FLA), as the devolution program was coined, transferred significant authority over natural forests from state enterprises to local villagers (Tran et al. 2003). Allocation granted local people long-

term use rights to natural forests, including the rights to harvest timber and non-timber forest products, convert part of the forests to cropland, exclude others from the allocated forest, and pass forest titles on to their children or exchange them among each other. Forest recipients, in return, had to take over the duties to monitor forest use and report illegal activities to the local authorities. As for governance structures, DARD expected local authorities and village communities to take over most of the tasks previously assumed by the state enterprises. Village communities received the mandate to resolve minor disputes and develop internal management regulations. Local governments were required to fine violators and pass the resolution of larger forest disputes on to district courts.

Dak Lak's initiative met strong reservations on the side of the Ministry of Agriculture and Rural Development. The allocation of natural forests in Dak Lak went far beyond the practice of allocating degraded forestry land to rural households in other parts of Vietnam. Moreover, forest recipients in Dak Lak receive the right to exploit timber, even for sale. The provincial initiative, therefore, provoked initial resistance by the central government. In 2000, however, the Ministry recognized the provincial initiative, according it an experimental status. The provincial authorities, in turn, paused the program, after having allocated 16,000 ha of forestry land to individual households, groups of households and village communities in 15 villages until 2002. The pressure was on DARD to prove the benefits of devolution or abandon its initiative.

DEVELOPMENT OF THE ASSESSMENT TOOL

DARD reacted by requesting the German Agency for Technical Cooperation (GTZ) to support an assessment of the initial experience with forest land allocation. Provincial decision-makers wanted to analyze the outcomes of the first round of allocation before initiating the next one. This section discusses the development of the tool applied for the assessment of local outcomes. It focuses on two critical elements that structured the learning process in Dak Lak: a social and an analytical process. The focus is on the two processes, and not the tool or the results of the assessment, because they are of broader relevance to other forest departments in Vietnam and beyond. The tool and the results, in contrast, are specific to Dak Lak, as they reflect the interests of Dak Lak decision-makers and local conditions (for a summary of the results, see Tran, Nguyen and Sikor 2003b; further in-depth analyses of devolution outcomes are Nguyen 2005, 2006; Tran 2006; and Tran and Sikor 2006).

THE SOCIAL PROCESS

The province and GTZ got the assessment underway by way of a planning workshop in April 2001. They hired two researchers (the two Vietnamese co-authors of this article) to facilitate the assessment, including one DARD official who had played a central role in the allocation program to that point. They formed an advisory team including three senior officials from the Ministry of Agriculture and Rural Development and three experienced researchers with backgrounds in economics, ethnology, and social forestry. They also invited Humboldt University Berlin to contribute scientific advice to the assessment and train the two researchers. GTZ subsequently confined itself to providing financial support. Project oversight rested largely in the hands of DARD.

The development of the assessment tool was carried out in three rounds (see Figure 1). The first round, from July 2001 to January 2003, served to prepare the assessment. The two researchers performed a review of the relevant literature at Humboldt University and

conducted in-depth studies of two villages. They consulted decision-makers in the People's Committee and DARD about their interests in the assessment. The consultations indicated that Dak Lak decision-makers primarily wanted to know about the effects of devolution on forest conditions and the benefits of the forests to local people. These interests informed the development of a prototype tool by the researchers and Humboldt University, including a set of practical aids for the collection and analysis of data.

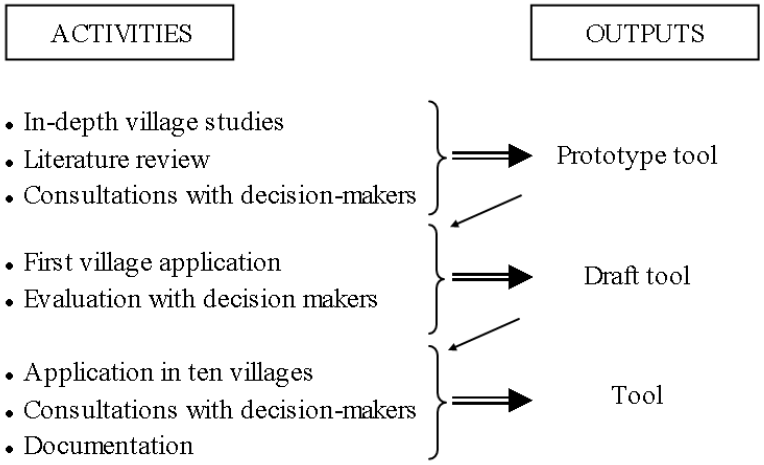


Figure 1. The social process of tool development

The second round, from February to April 2003, tested the prototype tool in the field. A team of three forest officers applied the tool in a village with assistance from the researchers. The two researchers, the advisory team, and Humboldt University evaluated the application and its results through joint fieldwork in the village. The researchers also presented the process and results of the village assessment to provincial leaders, seeking their comments and suggestions for modifications. They made necessary adjustments to the tool and documented the resulting draft tool in a manual.

The third round, from May to July 2003, centered on the application of the tool. Five teams of forest officers conducted assessments in ten villages, using the draft manual under supervision of the researchers (see also Text box 1). They documented their results in village reports and a database. The researchers synthesized the village results in an overview report and incorporated new insights into the manual. They presented the overview report and manual to decision-makers in Dak Lak and Hanoi. They finally had the report and manual printed in Vietnamese and English and distributed them among decision-makers and international development practitioners in Dak Lak, Hanoi, and other provinces (Tran, Nguyen and Sikor 2003a, 2003b).

Text box 1: The assessment tool

In Dak Lak, village assessments included the following activities:

Preparation (2 days): The team leader compiles secondary data about the village and forest, makes the necessary practical arrangements with villagers, the local authorities, and the State Forest Enterprise, and conducts wealth ranking for the selection of the household sample.

Fieldwork (5 days): The team leader and two enumerators collect data through household interviews; key informant interviews with the local forest officer, village leaders, expert villagers, and a person from a neighboring village; forest walks; and, focus groups with forest recipients and non-recipients in the village.

Data input (3 days): The team leader and enumerators put the collected data into a database.

Data analysis and report writing (4 days): The team leader analyzes the collected data and writes a report on the assessment results.

The tool is documented in a set of practical aids, including an operational work plan for a village assessment; data collection forms and instructions for all activities in the field; a database with users guide; instructions for data analysis; and, a template for the village report. The aids are available in Vietnamese from the authors on request.

THE ANALYTICAL PROCESS

The development of the assessment tool involved a social process involving various stakeholders. At the same time, the development followed an analytical process that helped translate the interests of DARD into concrete activities. The rationale helped the assessment team cast the interests of decision-makers into research questions, use analytical frameworks to define the needed variables, define concrete measures and data collection techniques for the variables, and employ analytical techniques in order to use the collected data for answering the research questions.

Research questions and analytical frameworks

Dak Lak decision-makers expected the assessment to produce insights into the effects of devolution on forest conditions and the benefits derived by villagers from the forest. These two primary interests motivated five concrete research questions. The questions, in turn, inspired the development of simple analytical frameworks as a way to identify relevant variables for the assessment.

Question 1: How have forest conditions changed after devolution?

Question 2: How have the benefits derived from forest changed after devolution?

The questions called for direct comparisons of the situation immediately before devolution with the situation at the time of assessment. The comparisons distinguished different kinds of forest resources and types of benefits. They also recognized that the benefits were likely to vary among households.

Question 3: What are potential causes of observed changes in forest conditions and benefits?

Question 3 was about the degree to which the observed changes in forest conditions and benefits probed by the first two questions were due to devolution. It prompted assessments to check the plausibility of a causal relationship between observed changes and devolution. Forest conditions and benefits typically change due to the simultaneous effects of multiple factors, especially in highly dynamic settings such as those prevalent in Dak Lak. Question 3 therefore proposed a simple check on the potential causes underlying observed changes. Its objective was not necessarily to identify to exact cause(s) producing observed changes, but to understand if there were other factors beyond devolution that may have contributed to the observed changes in forest conditions and benefits.

Question 4: What are potential changes in forest conditions in the future?

Question 4 expanded on Question 1 by exploring the possibility of further changes in forest conditions associated with devolution. The recent timing of forest land allocation motivated this question. Changes in forest protection and management were unlikely to have resulted in changed forest conditions at the time of application of the tool. In addition, changes in the local forest institutions in reaction to forest land allocation could be expected to happen gradually and take time.

The analytical framework associated with question 4 linked potential changes in forest conditions in the future to property rights and governance structures. The underlying assumption was that forest conditions improve if forest recipients have secure rights to the forest, if monitoring of forest use and sanctioning of violations exist, and if conflicts are minimized through appropriate mechanisms for conflict resolution. In this way, forest recipients have both the incentive and the means to manage forests in a more sustainable fashion.

Question 5: What are potential changes in benefits in the future?

Question 5 expanded on question 2 by examining changes in anticipated benefits derived from devolved forests. The reasons for this question were the same as those explained above for question 4. Just as in question 4, question 5 linked potential future changes in benefits to property rights. The assumption was that the higher the potential value of the forest itself, the more secure people's rights to the forest, the better their resources, and the more extensive their dependence on the forest, the more likely it is they will benefit from allocated forest in the future.

Measures, data collection techniques, and analytical techniques

The primary interests of decision-makers in the assessment yielded five concrete questions. The concrete questions inspired simple analytical frameworks, which, in turn, defined a series of variables. The variables could be grouped into six sets: (1) forest conditions and benefits from forest; (2) forest users and uses; (3) property rights on forest; (4) governance structures; (5) household attributes; and (6) potential causes of observed changes in forest use.

Measures served to identify concrete data to describe the abstract variables. The measures originated from the researchers' intimate knowledge of local conditions, as they had conducted two village studies to gain the required in-depth understanding of local conditions. The choice of measures was also informed by comparable assessments undertaken elsewhere, in particular the work of CIFOR on criteria and indicators (Prabhu et al. 1996). Each variable had at least one measure. The more important variables were measured by up to three measures.

The assessment incorporated multiple data collection techniques to obtain reliable data required for the measures. They included the collection of existing government statistics about the village and the allocated forest; forest walks to describe forest topographic

conditions, accessibility, and changes in forest resources; focus groups with forest recipients and non-recipients on changes in forest resources, property rights, and governance structures; key informant interviews with village leaders, the local forest officer, and a person from a neighboring village on forest use, property rights and governance structures; and, household interviews on the use of forest, tenure rights, household resources, and main sources of income. The use of multiple techniques was intended to improve data quality through triangulation. Data required for the more important measures were collected from multiple informants and through the use of multiple techniques. For example, changes in forest conditions were described by direct observation, focus groups with villagers, and interviews with a local forest officer.

As a final step, the definition of analytical techniques helped to relate the collected data back to the research questions. The analytical techniques were simple, mostly relying on direct comparisons in tables and charts.

The analytical and social processes served as a basis for developing the assessment tool. The two processes helped the assessment team to translate the interests motivating the assessment into a set of practical aids and generate information on outcomes of forest land allocation. The development of the tool took three rounds of iterations, as discussed above. Each round was informed by new insights gained from the trial application of the tool, joint evaluations, consultations with Dak Lak decision-makers, and the eventual application of the tool in ten villages. In each round, the analytical process helped to structure the discussions involving the various stakeholders. It made sure that the assessment tool generated the information expected by decision-makers. It also helped the researchers to prioritize which data and activities were more important for the assessment and which less.

LESSONS LEARNED

The process described in the previous section generated a tool for the assessment of forest land allocation in Dak Lak. This section identifies important lessons learned in Dak Lak with respect to the development of effective, feasible and relevant tools in support of learning-oriented approaches to forest devolution.

Effectiveness

Application of the tool generated rich information about changes in benefits derived by local people from devolved forests, forest conditions, property rights, and governance structures. The assessment results also indicated villages where devolution was associated with improved forest conditions and increasing benefits and villages where it was not. The information was documented in the form of brief village reports and an overview report. It was also stored in a database for comparative use in future assessments.

The information presented in the village reports and overview report appeared reasonably accurate. We compared the assessment reports from three villages with the findings from our in-depth fieldwork in an adjacent village, finding no apparent contradictions. We believe that the background and training of team leaders and enumerators helped the accuracy. We selected as team leaders only those forest officers who had prior experience with participatory methods in forest management. We instructed them and the enumerators about the application of the tool not only in the office but also in the field. In addition, we closely supervised the first village application to provide practical advice to the assessment team in the field.

Despite the training, enumerators faced problems in inquiring about property rights, and team leaders had difficulty writing about them. The problems originated from five sources. First, property issues are complex, involving multiple actors, resources, and rights (Ribot 2002). Second, some terms used to describe property rights and governance structures in the international literature were not easy to translate into Vietnamese. Third, property relations were largely 'invisible' to villagers, because villagers were not used to thinking and talking about the use of and control over forests in these terms. Fourth, villagers were reluctant to talk about some property issues, as they referred to forest uses deemed illegal and prosecuted by the state. Fifth, the local effects of forest land allocation took time to develop, as they depended on negotiations and changes in material and symbolic practices that unfolded over time. As a result, the assessments team had a hard time describing property rights. We therefore decided to orient the assessment more towards concrete practices in forest management than abstract rights and obligations. This orientation also helped the assessment teams make the distinction between legal institutions and actual property relations.

Just as property rights take time to change, so do the benefits derived by local people and trends in forest conditions. An assessment of local outcomes undertaken a few years after legal devolution cannot be expected to indicate significant changes in benefits and forest conditions. Our experience demonstrated, however, that observed changes might be indicative, even if they are small. Observed instances of changing benefits and forest conditions indicated shifts in underlying trends that take more time to come to the fore. In addition, the general expectation that changes in outcomes would take time to develop helped us motivate the attention to property rights and governance structures. We justified the inclusion of property rights and governance structures by relating them to the primary interests of decision-makers through the construct of 'potential changes in the future'. 'Potential changes in the future' referred to changes in forest conditions and benefits that one may expect if the new regime of property rights, governance structures, and all other influences on forests remained the same. The underlying - and debatable - assumption was that benefits and forest conditions improve if appropriate property rights and governance structures are in place.

We also recognize several limitations to the assessment tool. First, the assumption of direct causal linkages between devolution and changes in benefits and forest conditions is problematic, particularly in dynamic settings such as Dak Lak. The assessment tool includes procedures that help check the plausibility of causal relations between devolution and observed changes. Nevertheless, inclusion of 'control villages', i.e., villages without devolution in similar conditions to those with devolution, would have improved the robustness of the analysis. Second, attention to equity effects proved to be another challenge for the assessment. The tool is 'blind' on intra-household dynamics and pays relatively minor attention to the claims of non-villagers on the devolved forest. Finally, the assessment defined the outcomes of forest land allocation in a rather narrow fashion. A more complete assessment would consider the effects of devolution on non-devolved forests and non-forest income.

Feasibility

DARD did not perceive the human and financial resources required for the village assessments as an obstacle. The department included sufficient staff members who could serve as team leaders and enumerators. They possessed the interviewing and computer skills required for enumerators as well as the organizational, analytical and writing skills demanded from team leaders. The simplicity of the tool and the user-friendly

documentation clearly helped its application. The required number of labor days amounted to five percent of the labor required for the implementation of forest land allocation. As for financial costs, they amounted to between five and ten percent of the costs of allocation, depending on the size of the devolved forest.

We anticipate, however, that the overview assessment poses a significant challenge to the human resource capacity of forest departments. In Dak Lak, the two researchers performed the overview assessment with assistance by Humboldt University. In other cases, forest departments may not have the capacity to conduct the village comparison, which is less standardized than the village assessments. Some parts of the cross-village analysis require analytical skills that are rarely available in forest departments. Similarly, the overall interpretation of village results depends on a familiarity with socio-economic concepts that is scarce in a typical forest department. Without the necessary skills and knowledge, forest officers may easily draw wrong conclusions from the village results. This may mean that forest departments require guidance from external experts until they incorporate such skills and disciplines into their personnel and training.

The need for external guidance is even more true for the development of assessment tools suited to the interests of decision-makers and local conditions. Forest departments are unlikely to have the necessary social and analytical skills to translate the interests of decision-makers into concrete activities in the field. The danger is that, in the absence of these skills, well-intended efforts to learn from initial experiences of devolution may lead to blue-print application of assessment tools developed for other interests and conditions.

Relevance

The assessments generated information relevant to the needs of national and provincial forest departments. Much of the relevance derived from the fact that devolution is in its initial stages not only in Dak Lak but also in Vietnam as a whole. National and provincial decision-makers lacked relevant experience with devolution to guide the design of forest policy and programs. The assessment in Dak Lak provided much needed information about local outcomes of devolution to national and provincial decision-makers in a timely fashion. A report about the outcomes of forest land allocation commissioned by the Ministry in 2004 drew extensively on the results from Dak Lak. In Dak Lak, decision-makers decided on the basis of the assessment results to initiate further pilot projects before scaling the forest land allocation program up to the provincial level. They also recognized the need to strengthen the benefits derived by forest land allocation recipients by way of post-devolution support programs.

Decision-makers at both the national and provincial level consider the assessment tool as suitable for generating reliable information about the local outcomes of forest land allocation. The Ministry intends to include the tool in a 'Forestry Manual' summarizing best practices in Vietnamese forestry. The professional magazine published by the Ministry invited a feature article on the tool. More importantly, Son La province in northern Vietnam has started to adapt the tool to its own needs and conditions. The provincial forest department has applied the tool in one village on an experimental basis and is preparing o use it to evaluate the forest land allocation program implemented in Son La in 2001.

But the learning did not stop here. Evidence suggests that the tool development process contributed to learning among provincial and national decision-makers in other important, less tangible ways. The assessment results have served as an eye-opener for many decision-makers, bringing the drastic difference between the expected results and actual outcomes of forest land allocation to their attention. Decision-makers have increased awareness on the

gap between legal rules and regulations, on the one hand, and de facto property relations and governance structures, on the other (cf. Fisher 1999). They now understand better why policy evaluations require systematic investigation in the field to examine how rules and regulations are mediated locally.

Another important effect is that the tool development has brought together national and provincial forestry officials. In 2000, the Dak Lak authorities and the central government were at loggerheads about devolution. Dak Lak's decision to allocate standing natural forest to villagers met strong reservations in Hanoi. Joint development of the assessment tool provided an important platform for national and provincial decision-makers to meet. Participation in tool development helped the provincial officials gain recognition for their policy innovation and encouraged national officials to assess the provincial initiative. Once they found the tool to be reliable and relevant, both sides recognized the information about local outcomes generated from its application.

CONCLUSIONS

In this paper we have discussed a tool developed in Vietnam that helps forest departments assess the local outcomes of devolution. In its application in Dak Lak, we found the tool to be effective, feasible and relevant. Although refinements are possible and desirable, the tool generated much-needed information about the local outcomes of initial devolution experiments in a timely fashion. In addition, the development of the assessment tool facilitated significant learning among provincial and national decision-makers. National forestry officials overcame their initial reservations against devolution. Provincial officials identified important lessons for subsequent rounds of devolution. At the same time, the Dak Lak forest department could not have developed the tool and performed the overview assessment without external assistance.

Assessments such as the one in Dak Lak can make important contributions to learning-oriented approaches to forest devolution (cf. Edmunds and Wollenberg 2002). Given appropriate assistance in participatory action research and socio-economic analysis, forest departments can develop effective, feasible, and relevant tools for assessing the outcomes of devolution. Such assessments not only generate important knowledge about local outcomes but they also give local people a voice in policy evaluation. They can serve as eye-openers for forestry decision-makers who have little experience dealing with local people and limited understanding of socio-economic dynamics in devolved forest management. They can also strengthen the confidence of forestry officials in the potentials of devolved forest management and help them identify ways to improve the design of devolution policies and programs. The low resource requirements of village assessments can even make those a suitable instrument for long-term monitoring.

Two elements appear crucial in the development of assessment tools. First, developing assessment tools is a social process involving a variety of actors (cf. Borrini-Feyerabend *et al*. 2000). The actors jointly develop the tool in iterative rounds of consultations, field application, and evaluation. Joint fieldwork may be especially conducive to overcome stereotypes, firmly-held beliefs and long-standing disagreements. Second, the development of assessment tools involves an analytical process that translates the interests of decision-makers into concrete activities in the field. The analytical process helps the involved actors to make sure that they collect all the data needed to generate the desired information in a timely manner. It also allows them to make best use of available human and financial resources. Focus on these two processes, and not the set of practical aids itself, makes the

experience from Dak Lak relevant to other countries and contexts. It also makes the tool development process adaptable to other goals attributed to devolution, constellations of actors, interests motivating the assessment, and available human and financial resources.

Before we conclude, we want to emphasize the need for complementary tools and in-depth research. Short-term assessments cannot replace more rigorous research. That is why we combined the assessment process with two in-depth village studies. Assessments conducted by forest departments can also not replace monitoring and evaluation undertaken by local user groups (e.g., Springate-Baginski *et a*l. 2003) and people's organizations (e.g., Hartanto, Lorenzo and Frio 2002). Our concern is that forest departments need to improve their capacity because they are key players in devolution and post-devolution forest management. At the same time, they are often ill-prepared to take on the required new roles in forestry. Forest departments need to learn forest devolution.

ACKNOWLEDGMENTS

A more extensive version of this article has been published in the International Forestry Review Vol. 7(4), 2005, pp. 320-331. The Emmy Noether-Programm of Deutsche Forschungsgemeinschaft has funded Sikor's writing time for this paper.

REFERENCES

BORRINI-FEYERABEND, G., FARVAR, M.T., NGUINGUIRI, J.C., NDANGANG V.A. 2000. Co-management of natural resources: Organising, negotiating and learning-by-doing. Kasparek Publishers, Heidelberg. 95 pp.

EDMUNDS, D. and WOLLENBERG, E. 2002. Historical perspectives on forest policy change in Asia: An introduction. Environmental History 6 (2): 190-212.

EDMUNDS, D. and WOLLENBERG, E. (eds.). 2003. Local forest management: The impacts of devolution policies. Earthscan Publications, London. 208 pp.

FISHER, R.C. 1999. Devolution and decentralization of forest management in Asia and the Pacific. Unasylva 50: 3-5.

HARTANTO, H., LORENZO, M.C.B. and FRIO, A.L. 2002. Collective action and learning in developing a local monitoring system. International Forestry Review 4 (3): 184-195.

MAYERS, J. and BASS, S. 1999. Policy that Works for Forests and People. Executive Summary of Series Overview. International Institute for Environment and Development, London. 350 pp.

MEINZEN-DICK, R. and KNOX, A. 2001. Collective action, property rights, and devolution of natural resource management: A conceptual framework. In: Meinzen-Dick, R., Knox, A. and Di Gregorio, M. (eds.). Collective action, property rights and devolution of natural resource management - Exchange of knowledge and implications for policy. Deutsche Stiftung für Internationale Entwicklung, Feldafing. 292 pp.

NGUYEN, Q.T. 2005. What Benefits and for Whom? Effects of Devolution of Forest Management in Dak Lak, Vietnam. Shaker Publishers, Aachen. 350 pp.

NGUYEN, Q.T. 2006. Forest devolution in Vietnam: Differentiation in benefits from forest among local households. Forest Policy and Economics 8: 409-420.

PRABHU, R., COLFER, C.J.P., VEKATESWARLU, P., TAN, L.C., SOEKMADI, R. and WOLLENBERG, E. 1996. Testing criteria and indicators for the sustainable management of forests: Phase 1 Final report. CIFOR, Bogor. 217 pp.

RIBOT, J. 2002. Democratic decentralization of natural resources: Institutionalizing popular participation. World Resources Institute, Washington, D.C. 35 pp.

SPRINGATE-BAGINSKI, O., YADAV, N., DEV, O.P. and SOUSSAN, J. 2003. Institutional development of forest user groups in Nepal: Processes and indicators. Journal of Forest and Livelihood 3 (1): 21-36.

TRAN, H.N., SIKOR, T., DANG, T.L., NGUYEN, V.D. and VU, V.M. 2003. Devolution of Forest Management: Six Years of Experience in Dak Lak. Department of Agriculture and Rural Development Dak Lak, Buon Ma Thuot (available at www.agrar.hu-berlin.de/wisola/ipw/plr). 27 pp.

TRAN, N.T. 2006. From legal acts to village institutions and forest use practices: Effects of devolution in the Central Highlands of Vietnam. Shaker Publishers, Aachen. 325 pp.

TRAN, N.T., NGUYEN, Q.T. and SIKOR, T. 2003a. Local impact assessment after forest land allocation: Manual. Department of Agriculture and Rural Development Dak Lak, Buon Ma Thuot (available at www.agrar.hu-berlin.de/wisola/ipw/plr). 24 pp.

TRAN, N.T., NGUYEN, Q.T. and SIKOR, T. 2003b. The local outcomes of forest land allocation: Evidence from Dak Lak. Department of Agriculture and Rural Development Dak Lak, Buon Ma Thuot (available at www.agrar.hu-berlin.de/wisola/ipw/plr). 34 pp.

TRAN, N.T. and SIKOR, T. 2006. From legal acts to actual powers: Devolution and property rights in the Central Highlands of Vietnam. Forest Policy and Economics 8: 397-408.

WEYERHÄUSER, H., KAHRL, F. and SU, Y. 2006. Ensuring a future for collective forestry in China's southwest: Adding human and social capital to policy reforms. Forest Policy and Economics 8: 375-385.

TRANSFER OF SCIENTIFIC EXPERTISE INTO SUCCESSFUL FOREST POLICY - CONCEPTS FOR THE EVALUATION AND MONITORING OF SUSTAINABLE FORESTRY IN CHINA

Michael Böcher[1], Xiao Jianmin[2], Max Krott[1]

1: Institute of Forest Policy, Georg-August-Universität Göttingen
2: assistant professor, Ph.D Research Institute of Forestry Policy & Information, Chinese Academy of Forestry. Beijing

1 INTRODUCTION

China runs the biggest forestry programs in the world. Improved use of these and the newly planted forests should provide multiple benefits for Chinese people. The success of this ambitious forest policy depends not only on the huge resources invested in it and on a strong political will but also on the expertise required in order to fulfil the task in the correct manner. Due to the complex system of multiple-use forestry it is a huge challenge to pinpoint the instruments which would deliver the desired impacts in an efficient manner. The transfer of scientific expertise into forest policy making is becoming one of the success factors of China's forestry development.

Examples from other parts of the world show that the science/policy interface is a very sensitive relation. (Forest-)scientists often produce unrequired knowledge and stake holders expect scientific answers which cannot be provided to them quickly. An additional common deficit is that stake holders believe in specific traditional or fashionable solutions which are scientifically incorrect. Finally, despite scientific activities, monitoring systems and evaluation reports, national and international stake holders often ignore science in favour of decisions guided by interests.

In the following chapters several factors to ensure a successful transfer of scientific expertise into policy practice will be discussed against the background of the evaluation and monitoring of sustainable forestry in China. The current monitoring and evaluation systems in China will first be described. Subsequently, problems and challenges presented by these systems will be identified. These problems will then be analysed against the background of political scientific theories of knowledge transfer in order to identify weaknesses and potential for improving the Chinese way of monitoring and evaluating. The conclusion will sum up the main results of this paper and will develop further questions for future research.

2 MONITORING AND EVALUATION SYSTEMS IN CHINA

2.1 SCIENTIFIC MONITORING SYSTEMS

Chinese Ecosystem Research Network (CERN)

The most important scientific forest monitoring system is CERN, managed by a selection of the Chinese Academy of Science's (CAS) research institutes and botanic research gardens, There are more than 36 research stations affiliated to CERN over the country, out of which nine are forest ecosystem research stations. These stations are under the auspices of the Ministry of Science and Technology.

The research stations are located in different types of forests, including humid temperate forests, sub-humid warm temperate forests, monsoon sub-tropical forests, high mountain

warm temperate forests and humid tropical forests. All the stations engage in monitoring work, research, experimentation and demonstration.

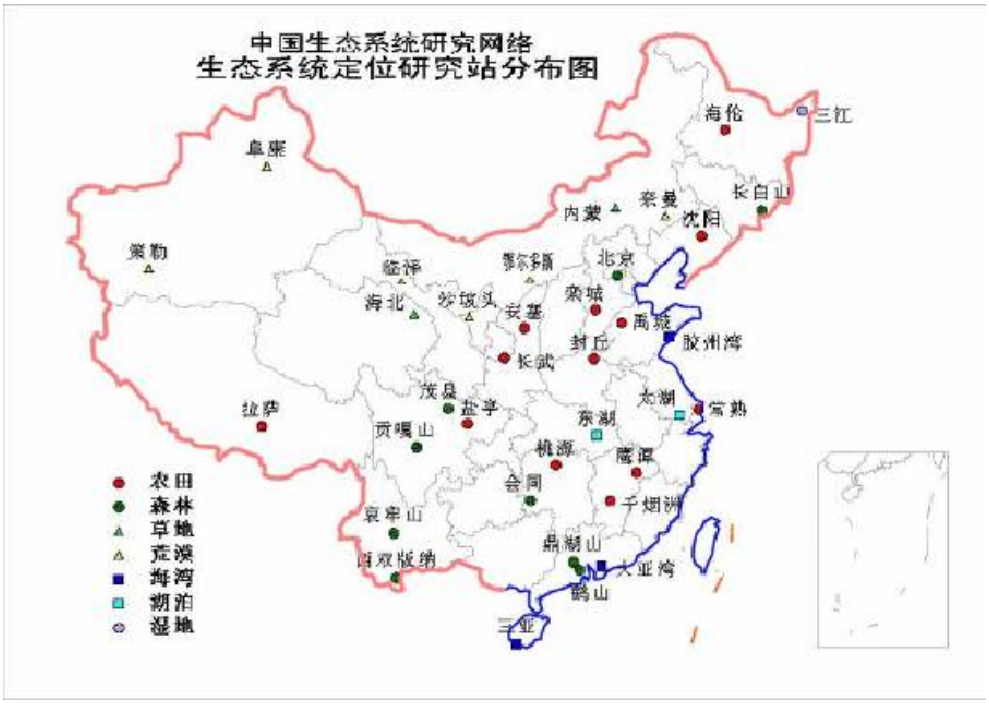


Figure 1. Distribution of CERN stations (the second symbol stands for the forest stations)

- Changbai Mountain Forest Research Station
- Beijing Forest Ecosystem Research Station
- Dinghushan Forest Ecosystem Research Station
- Gonggashan Forest Ecosystem Research Station
- Xishuangbanna Tropical Rainforest Ecosystem Station:
- Ailaoshan Tropical Rainforest Ecosystem Station
- Maoxian Forest Ecosystem Research Station
- Huitong Forest Ecosystem Research Station
- Xiaoliang Tropical Forest Ecosystem Research Station

Chinese Forest Ecosystem Research Network (CFERN)

CFERN is a monitoring system specialized to forest ecosystems. It is financed by the State Forestry Administration and the Ministry of Science and Technology. The committee of CFERN is composed of officials from the State Forestry Administration and forest experts. The chairman of the committee is Jiang Youxu, senior scientist of the Chinese Academy of Forestry (CAF). Some stations are lead directly by CAF, the others are supervised by the forestry colleges and local forestry research institutes. The information from these stations is collected in CAF.

The CFERN was first established at the end of 1950s and the beginning of the 1960s. A total of 6 stations were established during that period. These research stations were based on concepts from Soviet Russia. The other 13 stations were established after the 1960s, and some concepts from the USA and European countries were adopted.

These stations are located in nearly every type of forest in China, including tropical forests, subtropical forests, temperate forests and cold temperate forests.

Figure 2: Distribution of CFERN stations

Table 1: List of forest stations

1. Binglashan Forest station, Laoning	11.Dagangshan Forest Station, Jiangxi
2.Capital Forest Station, Beijing	12.Wuyishan Forest Station, Fujian
3.Xiaolangdi Forest Station, Henan	13.Huitong Forest Station, Hunan
4.Pearl Delta Forest Station, Guangdong	14.Jianfengling Forest Station, Hainan
5.Daxing'anling Forest Station, Mongolia	15.Tianshan Forest Station, Xinjiang
6.Mao'eshan & Liangshui Forest Station, Heilongjiang	16.Qilainshan Forest Station, Gansu
7.Taiyue Forest Station, Shanxi	17.Wolong Forest Station, Sichuan
8.Qinling Forest Station, Shanxi	18.Lingzhi Forest Station, Tibet
9. Baotianman Forest Station, Henan	19.Karst Forest Station, Guizhou
10. Yangtse River Delta Forest Station, Jiangsu	

There are two important research fields. One is the relationship between forest and water resources, the other is forest carbon sequestration and carbon balance.

Main research tasks in the future

- To establish a forest environment monitoring system and forecasting system
- To establish a forest ecological benefit assessment system
- To establish a combination model on forest resources, forest environment, water resources, carbon cycle and social development
- To establish a publicly available database and website

Monitoring indexes system

- Interaction indexes of forest climate
- Physical and chemical indexes of forest soil
- Forest ecosystem health and sustainable development indexes
- Interaction indexes of forest hydrology
- Forest ecosystem community character indexes

2.2 POLICY MONITORING SYSTEMS

Economy Research Centre, State Forestry Administration (SFA)

The Economy Research Centre, a part of the SFA was established in 1994. The institution is responsible for providing an economic forestry consulting service for the SFA's policy makers. Its main tasks include economic forestry consulting, forest policy monitoring and forestry strategy formulation. One of the most important projects of this institution is the so-called "Key public-benefit forest monitoring program at social and economic level" It represents the largest forest policy monitoring program. The program was initiated in 2002. Altogether 200 counties, 188 villages and 1200 farmers were selected to be monitored, and one part-time member of staff is responsible for collecting the information of that county. The data is collected and delivered to the Economy Research Centre annually. A report is published at the end of each year.

Figure 3 Social and economic Monitoring Report of the non-commercial forest programs

Research Institute of Forestry Policy and Information, CAF

The Research Institute of Forestry Policy and Information (RIFPI) was established in 1964. The institute is responsible for providing the SFA, the Chinese Academy of Forestry and other state general departments and administrative agencies with forestry policy consulting, information collection and data analysis services. The institute is also engaged in organizing thematic information studies according to the requirements of the upper administrative organizations and to the need for development dynamics regarding relevant topics. Its main tasks include forestry policy consulting, forestry policy monitoring, world forestry information consulting, forestry strategy making, forest product and market consulting. Key research fields include forestry policy and strategy, forest environmental economy, world forestry, the wood product industry and community forestry.

Centre of Chinese Agriculture Policy, CAS

One of this centre's important research fields is resource and environment policy, which includes

- Cost-benefit analysis of important forest programs
- Forest resource management system reformation and sustainable development
- Land resource protection and sustainable utilization

3 PROBLEMS AND DISADVANTAGES OF THE MONITORING AND EVALUATION SYSTEM CONCERNING FORESTRY POLICY IN CHINA

There are many forest ecosystem research stations and forest policy assessment institutions in China. However it would be wrong to say that forest ecosystem monitoring and policy assessment in China were optimal. There are many problems and disadvantages to these two systems.

1. **Separation of the ecosystem monitoring system from the policy monitoring system**: In China, the forest ecosystem monitoring system and policy monitoring system are distinctly separated from one another. They belong to different sectors. These two systems should be reconciled with each other in order to improve sustainable forest management in China (Xu Jintao, 2002).
2. **Data transparency:** In China, there are several forest monitoring systems which belong to different sectors. Their data is normally not available to other research institutions (Jin Fang, 2005).
3. **Short Monitoring period:** China's forest monitoring system was first established in the 1950s. Due to the fact that it has only been in place for about 50 to 60 years, the data obtained from the stations has not yet been able to provide sufficient information about the forest management cycle on which to base forest policy making (Xiao Jianmin, 2004; Chen Dongli, 2005).
4. **Veracity of information from local governments:** Data obtained from different levels of government is being used in policy monitoring and assessing. In some cases, this data is not reliable; especially when it is required for the analysis of sensitive forest policy issues (Xu Jintao, 2003).
5. **Fairness within policy monitoring and assessing institutions:** In China, policy monitoring and assessment institutions belong to different sectors. These institutions normally delegate the benefits of their sector, and there are some biases in their research results (Ran Yonghong, 2005).

6. **Lack of forestry and pollution research:** Pollution has, especially in recent years, become a very serious problem in China, and with rapid economic development the pollution can only become worse. Forests can to some degree contribute to the reduction of this pollution. This effect is an important factor for forest policy making. This effect has however not been sufficiently taken into consideration within the forest ecosystem and policy monitoring system, (Jin Fang, 2005).
7. **Limitation of international forestry issues:** As the biggest developing country with rapid economic development, China will play a more important role in international forestry issues. At present, China's chances of being able to participate in global forest monitoring and forest policy are poor. There are no specialised institutions currently focussing on this issue (Zhou Shengxian, 2002).

4 POLITICAL FACTORS FOR A SUCCESSFUL TRANSFER OF EXPERTISE

4.1 TRANSFER OF SCIENTIFIC EXPERTISE BETWEEN TECHNOCRACY AND THE "REAL POLITICAL WORLD"

In classic technocratic approaches knowledge flows from science to public policy-making and is applied and mediated from truth to power (Weingart 1999, 2003). In technocratic models policy making is constructed as an act of rational "problem-solving" and expert participation is seen as essential. Within this model, scientists are brought into policy processes to impart their unique knowledge and wisdom to policy-makers (Pregernig 2004). The role of science for policy-making is in such models that of "speaking truth to power" (Price 1981). Scientific advisors influence the policy process due to their superior knowledge, something through which they become powerful. Expertise plays the role of a neutral problem-solving resource for political actors. In principle there is no problem behind the transfer of scientific expertise into successful policy – it is just a question of the policy actors' demand for expertise. The identified problems of the Chinese monitoring and evaluation system for sustainable forestry show that political reality seems to be far away from technocratic dreams. It would be worthwhile to analyse these problems against the background of more recent results within scientific knowledge-transfer research. In contrast to naïve technocratic models, more recent literature has identified some important general problems of knowledge transfer which can be applied to the challenges presented by the Chinese monitoring and evaluation system.

1. Scientific expertise does not always deliver unbiased problem solutions., Experts or institutions can be driven by a variety of other interests such as obtaining funds or serving the interests of their financiers. Experts are not necessarily neutral and apolitical but are often forced to come to an "arrangement" with those groups that financially support them (Fischer 1990; Krott 1989). Decision makers try to use expertise for legitimising their interests and political programmes (Krott 1999) and, thus support those scientists who deliver the scientific results which conform to their expectations and beliefs (Schneider 1989). Political actors often choose the scientific concepts which most represent their political ideas or simply completely ignore scientific assumptions (Murswieck 1994, 105). In the Chinese policy monitoring and assessing system it can be observed that the institutions involved belong to specific sectors whose interests they serve. Their research results are therefore sometimes

biased. In addition to this, the data obtained by these different institutions is not made accessible to other research institutions, so there is no possibility for other experts or institutions to review this data in a critical manner.

2. The technocratic model argues that obtaining the expertise relevant to a specific policy problem does not present any difficulty. However when dealing with complex and novel problems, such as achieving sustainable development, an innovative re-organisation of the transfer of expertise is required even before solutions to such new and intersectoral and interdisciplinary problems can be delivered. Currently, in China, the ecosystem monitoring system is separated from the policy monitoring system and the important connection between sustainable development, forests, and pollution is not well investigated. In addition to this, the shortage of data from the forest monitoring systems and the non-reliability of data provided at different levels of government show that the currently available expertise does not seem to be applicable to sustainable forestry in China.

4.2 CONDITIONS FOR A SUCCESSFUL TRANSFER OF EXPERTISE

There are several conditions to ensure the effective transfer of scientific expertise into policy which should be discussed in order to provide an insight on how to organise the Chinese monitoring and evaluation system. These conditions should reflect the reality of the impossibility of a technocratic application of scientific knowledge. Pregernig (1999) argues that there are two main conditions which lead to the application of scientific expertise in political practice:

1. Research and its results have to be problem-oriented and
2. Expertise has to be perceived and accepted by practitioners and within their "contexts of application" which include power relations and the actors' interests.

The first condition is self-evident and will not be further elaborated in this paper. The second condition refers to the perception of scientific expertise of the political actors and/or other practitioners who are to make use of it:. It also refers to the important point that *political actors have to accept scientific expertise before they make use of it*. Three main factors which positively influence the practitioner's acceptance and/or utilization of expertise are discussed in the literature pertaining to this topic. These factors are: *Salience*, *credibility*, and *legitimacy.*

1. *Salience* refers to the relevance of information for an actor's decision choices or for the choices that affect the given stakeholders (Cash et al 2002: 4). Some topics discussed by scientists may not be very relevant to political practice even though they are elaborated by scientists for an application in practice. Scientific expertise has to suit the interests of powerful policy actors since the selection or application of expertise is more dependent on power relations than simply on scientific rationality. If developed technologies are inappropriate for the special environmental context in which they should be used then the expertise can be deemed to be lacking in salience. If information on specific issues reaches the practitioners too early or too late, or if information is too broad or too narrow in scope, or if it is not at the right scale for decision makers, then the expertise can fail to influence action due to lack of salience (Kingdon 1995). Even if the expertise meets all of these criteria then the amount of influence the expertise has on the political process is still determined by power relations and by the interests of powerful actors.

2. *Credibility* refers to whether an actor perceives information as meeting standards of (scientific) plausibility and technical adequacy. Actors must deem sources of knowledge as trustworthy and/or believable, along with the facts, theories, and causal explanations invoked by these sources (Cash et al 2002: 4). One problem is that political actors are often not able to evaluate the scientific credibility of one source of expertise. The degree of the general credibility of scientific expertise therefore increases with the decrease in the level of scientific uncertainties and a scientific consensus concerning a special issue emerges. Another critical point regarding credibility is that, for professional reasons, actors often regard specific information sources as more credible than others. One source of expertise competes with another source of expertise to gain credibility among political actors. For example, the fact that an actor may have had positive experiences with a specific information source in the past could lead to the policy actor regarding this source as more credible than an information source with which he has not had any experience to date. A policy actor trusting a source of expertise of his own profession more than an outside information source (foresters might trust foresters as experts more than nature conservationists) is a further example of credibility.
3. *Legitimacy* refers to whether an actor and public groups perceive the process in a system as unbiased and meeting standards of political and procedural fairness. (Cash et al 2002: 5). The transfer of scientific expertise into policy may meet such standards by considering appropriate values, interests, concerns, and specific circumstances from multiple perspectives (Cash et al 2002: 5). The legitimacy of expertise increases if the flow of information is organised and communicated in a transparent manner which also incorporates the concerns and perspectives of the different actors involved in the policy process, the actors who have to apply scientific recipes, and the citizens who may be affected by the use of a specific knowledge source.

4.3 ASSESSMENT OF THE CHINESE MONITORING AND EVALUATION SYSTEM

The Chinese monitoring and evaluation system faces specific challenges against the background of these factors of knowledge-transfer:

1. Due to the dynamic change of use and protection of forests in China, keeping up a high standard of salience is becoming very difficult. The integration of new groups affected by forests and forest use into the monitoring process has to be facilitated. The old system of monitoring and use of information is becoming less and less adequate due to newly emerging information requirements. New groups requiring information are private enterprises, citizens who wish to establish their own opinion about the state of nature, national interest groups for environmental protection, international agencies and interest groups who deal with the heritage of our forests worldwide. The sectoral-oriented Chinese monitoring and evaluation system is more and more challenged by the need of intersectoral problem analyses and is not adequate against the background of new questions and information needs.
2. Since some monitoring and evaluations seem to be too biased and the different (especially new) actor groups do not have access to all relevant information or data, there is a lack of trust in the expertise which leads to a decrease of credibility. All in all, the understanding of the strengths and limits of scientific expertise is still small and the partial answers of the scientists are not fully accepted by the stakeholders.

3. The process of producing and using monitoring and evaluation information lacks transparency for the public. The important incorporation of international information processes is still to be worked out and could possibly connect the national monitoring and evaluation system with international discourses and regimes such as forest certification or international conventions.

Summed up, the organisation of the Chinese monitoring and evaluation system is currently not adequate when taking into consideration the outlined criteria for an optimal scientific knowledge transfer.

4.4 STRATEGIES FOR THE IMPROVEMENT OF THE TRANSFER OF EXPERTISE AND OPEN RESEARCH QUESTIONS

The following potential strategies may improve the transfer of expertise within Chinese monitoring and evaluation systems in order to promote sustainable forestry.

1. A better integration and linkage of ecological and social monitoring can substantially improve the usability of the monitoring systems for the needs of users at national and international level. Only the integration of social and political data leads to a rational selection of the correct ecological tasks which can be carried out against the background of social and political constraints.
2. Scientific expertise on forests would become much more relevant for many groups if they could obtain direct access to data production and data use. Herein lies a huge potential for scientific expertise to produce easy accessible data and to make it accessible to the public.
3. With regard to legitimacy it could be helpful to search for procedures which integrate different sources of knowledge into the monitoring and evaluation system. On the one hand such a strategy could aim at integrating international forest monitoring measures, on the other hand at integrating different kinds of knowledge, especially sources of tacit knowledge, such as older generations' disaster prevention knowledge or the experience-based knowledge of rural inhabitants. This strategy refers to newer approaches of how to produce legitimate systems of expertise-transfer in the political sciences (see Fischer 2002: 24 ff).
4. It could also be of strategic advantage to improve the interface between science and the media as well as between science and political institutions in order to achieve a higher dissemination of expert knowledge and a better integration of the public and political actors' interests into the production process of expertise (transparency).

REFERENCES

Cash, David W.; Clark, William C.; Alcock, Frank; Dickson, Nancy; Eckley, Noelle; Jäger, Jill (2002): Salience, Credibility, Legitimacy and Boundaries: Linking Research, Assessment and Decision Making. KSG Faculty Research Working Paper 02-046. Cambridge, MA: Kennedy School of Government, Harvard University. 25 pp.

Chen Dongli, Yu Xinxiao and Liao Banghong (2005): Analysis on the Function of Conservation Water of the Chinese Forest Ecosystem. World Forestry Research. 18(1):49-54

Fischer, Frank (1990): Technocracy and the Politics of Expertise. Newbury Park et al.: Sage. 387 pp.

Fischer, Frank (2004): Professional Expertise in a Deliberative Democracy: Facilitating Participatory Inquiry. The Good Society (Vol. 13 – No. 1). pp 21-27.

Jin Fang, Lu Shaowei and Yu Xinxiao (2005): Forest ecosystem service and its evaluation in China. Chinese Journal of Applied Ecology 16(8):1531-1536

Kingdon, John (1995): Agendas, Alternatives, and Public Policies. 2nd ed., New York: Harper Collins.

Krott, Max (1989): Policy-Analyse aus der Sicht eines Politikfeldes am Beispiel der Forstwirtschaft. Österreichische Zeitschrift für Politikwissenschaft (Vol. 18). pp. 21-34.

Krott, Max (1999): Musterlösungen als Instrumentarien wissenschaftlicher Politikberatung. Das Beispiel des Naturschutzes. Zeitschrift für Parlamentsfragen (No. 3/99). pp. 673-686.

Murswieck, Axel (1994): Wissenschaftliche Beratung im Regierungsprozess, in: Axel Murswieck (Ed): Regieren unPolitikberatung, Opladen: Leske & Budrich, pp 103-119.

Pregernig, Michael (1999): Die Akzeptanz wissenschaftlicher Erkenntnisse, Frankfurt: Peter Lang.

Pregernig, Michael (2004): Linking Knowledge and Action: The Role of Science in NFP Processes. In: Glück, Peter; Voitleithner, Johannes (eds): NFP Research: Its Retrospect and Outlook. Proceedings of the Seminar of COST Action E19 "National Forest Programmes in a European Context", September, 2003, Vienna. Publication Series of the Institute of Forest Sector Policy and Economics – Vol. 52. Vienna: Institute for Forest Sector Policy and Economics. pp. 195-215.

Price, Don K. (1981): The spectrum from truth to power. In: Kuehn, Thomas J.; Porter, Alan L. (eds): Science, technology, and national policy. Ithaca; London: Cornell University Press. pp. 95-131.

Ran Yonghong, Niu Dingwei and Liu Jinrong (2005): Farmer Participatory in Calculate of Beneficial Result in Study of Returning Some of Their Cultivated Lands to Forest: Take Huacha Valley, Gansu Province for Example. Green Economics. 5: 59-61

Schneider, Wolfgang L. (1989): Kooperation als strategischer Prozeß. Administrative Auftragsforschung im Spannungsfeld zwischen professionellem Interesse und politischer Instrumentalisierung. In: Beck, Ulrich; Bonß, Wolfgang (eds): Weder Sozialtechnologie noch Aufklärung? Analysen zur Verwendung sozialwissenschaftlichen Wissens. Franfurt am Main: Suhrkamp. pp. 302-331.

Weingart, Peter (1999): Scientific expertise and political accountability: paradoxes of science in politics. Science & Public Policy (Vol. 26 - No. 3). pp. 151-161.

Weingart, Peter (2003): Paradox of Scientific Advising. In: Bechmann, Gotthard; Hronszky, Imre (eds): Expertise and Its Interfaces: The Tense Relationship of Science and Politics. Berlin: edition sigma. pp. 53-89.

Xiao Jianmin, Ma Lnyi and Wang Xiaoping (2004): Economic Benefit Dynamics of Carbon Sequestration by F0rest trees in Miyun Watershed Journal of Beijing Forestry University. 26(4):20-24

Xu Jintao, Cao Yiying (2002): Sustainable Development Issues of Land Conversion from Crop to Forest. International Economy Comment.2:56-60

Xu Jintao, Yu Ying and Xie Chen (2003): Effects to Community Forest & Community Economy by Natural Forest Protection Program. Forest Economics.6:28-32

Zhang Lei, Zou Hong (2003): Evaluation on Forestry Policy of Implementing the West Development Strategy. Journal of Northwest Forestry University. 18(1):59-62

Zhou Shengxian, Jiang Zehui and Lei Jiafu (2002): Chinese Forestry Sustainable Development Strategy. Chinese Forestry Press. Beijing, China. pp.374-377

SOIL CONSERVATION POLICIES IN CHINA: CAPACITIES FOR SUSTAINABLE RESOURCE USE

By Nana Künkel

Humboldt University of Berlin
Department of Agricultural Economics and Social Science
Luisenstrasse 56, 10099 Berlin, Germany
e-mail: nana.kuenkel@rz.hu-berlin.de

1 INTRODUCTION

China pursues active environmental policy nationally and at the international level. It has a "relatively well-developed regulatory system with more then 2000 laws issued in the area of environmental protection" (OECD 2005: 13) and plays an active and dynamic role in international environmental conventions (e.g. SEI/UNDP 2002: 64). Still, environmental problems are pressing and it is often pointed to implementation difficulties (OECD 2005, World Bank 2001).

Soil protection has a long tradition in China and several reforestation programs have been implemented since the 1950s (CCICCD 2002). More recently, China has been active in the frameworks of the United Nations Conference to Combat Desertification. The immense losses of human life and property in the 1998 Yangtze flood made policy makers aware of the direct consequences deforestation in the river's upper catchments may have and led to enforced protection measures in the 10th Five-Year-Plan (World Bank 2001). However, soil degradation is a major problem. More than 180 million ha out of a total land area of 926 million ha are affected by water erosion, 150 million ha by wind erosion and more than 70 million ha are affected by chemical deterioration (van Lynden and Oldeman 1997).

Soil conservation is a very distinct and difficult field of environmental policy. Soil conservation has an unfavourable underlying "problem structure" due to low visibility of the problem and complex causes among other things (Jänicke 1999). Therefore worldwide, "only few countries have national soil policies, and only a fraction of those countries effectively implement, monitor and finetune policies" (Hurni and Meyer 2002: 7, for a typology of legal frameworks compare Hannam and Boer 2002). In addition, international activities – a driving force of environmental policy in many other policy fields – are limited.

Against this background this paper presents an analysis of policies and capacities in the field of soil conservation in China. Capacity was defined by the OECD Task Force on Capacity Development: "Capacity in environment relates to the abilities of a society to identify environmental problems and solve them, capacity development in environment relates to the 'process' by which those abilities are developed" (OECD 1994: 9). Further specified by Jänicke (1997) capacities can be described as the strength, competence, and configuration of proponents of environmental protection as well as cognitive-informational, political-institutional, and economic-technological framework conditions. In addition, situative factors (e.g. natural disasters) and the kind of problem (the problem structure) are crucial factors for institutionalization of environmental policies. In the case of developing countries, international influences from development aid or international conventions are rather strong. Therefore, this work extends the framework to incorporate these influences.

The present study is based on a review of primary documents, literature, and web-based information that are available in English (or German, but not Chinese). A wealth of German and English literature on environmental protection in China is available. Detailed documentations and analyses of Chinese environmental legislation were published by Lee (1999) and Heuser and Graf (2001). Overviews on Chinese environmental policy are found in Mao (1996), Cheung (1998), Betke (2000), World Bank (2001), Stockholm Environment Institute and UNDP China (SEI/UNDP 2002), and OECD (2005). More specifically on soil conservation issues compare Küchler and Straub (2002), and documents published as part of the "Capacity Building to Combat Land Degradation Project" led by the Asian Development Bank (ADB 2004). In addition, policy documents by the Chinese Government document soil conservation efforts (especially CCICCD 2002).

The paper starts from a review of soil conservation policies and legislation in an international perspective highlighting the general difficulties in regulating this particular environmental problem. Secondly, the state of policies for soil conservation at the national level is presented and, thirdly, determinants of this development are assessed. Finally, a brief discussion concludes.

2 SOIL PROTECTION – AN INTERNATIONAL PERSPECTIVE

Soil conservation policy and legislation have a long history. The first soil conservation laws were introduced in the first half of the 19th century primarily to control erosion by wind and water (Hannam and Boer 2002: 27). In the 1930ies a system of government programmes to combat soil erosion was introduced in the United States. However, a review of 200 individual national soil legislations suggests that "existing national soil legislations are inadequate" and, generally, "national legislation for soil has received less attention than that for other ecosystem components (e.g. water, vegetation, wetland)" (Hurni and Meyer 2002). This same study (ibid: 28) cites recent reforms in Chinese soil legislation as one of few positive examples. Other than in many policy fields, very different types of legislative regimes for soil conservation evolved. Hannam and Boer (2002) differentiate eight types of soil conservation legislation. This might be a consequence of country-specific requirements, but in parts also reflects how difficult this particular environmental issue is. In addition, most countries approach soil in a fragmented way.

International activities are similarly less developed than for other environmental problems: There is only "soft" law on soil in the international context ("World Soil Charter" and "World Soils Policy"). In three binding international agreements (United Nations Convention to Combat Desertification (UNCCD), United Nations Convention on Biological Diversity (UNCBD), and the United Nations Framework Convention on Climate Change (UNFCCC)), however, soil is addressed, but not the central issue. In sum, concerning external factors limited international coordination and diffusion is observed. An international soil instrument could potentially contribute to raising awareness and improve funding. Another important international activity on soils would be to prepare guidelines for individual nations to improve national soil laws (Hurni and Meyer 2002: 26).

Recently land degradation has become a focal area of the GEF (Global Environmental Facility) that so far was only funding biodiversity conservation. Thus, the international funding activities will increase, and one example is the so-called "Capacity Building to Combat Land Degradation Project" in China, with a considerable budget.

3 SOIL PROTECTION POLICIES

Policy output in the field of soil protection embraces a broad range of activities. Legislation on soils is to be mentioned first. Provisions relevant for soil protection are also found in additional legislation, especially in forest legislation, land use planning and land administration legislation. Apart from legislation, strategies, policies, and plans as well as specific programmes and projects for soil conservation are of crucial importance for soil conservation. Finally, attempts of "greening" other sector and resource use policies, thus, policy-integration, can strengthen soil conservation.

China has an embracing and differentiating environmental legislation and soil specific legislation (Bückmann and Lee 2000: 30). Soil conservation is treated in a specialised law as well as in neighbouring laws and in a general environmental law. Soil legislation suffers from a lack of protection of non-agricultural land and regulating pollution aspects (ibid: 75). In addition, agriculture as a cause of soil conservation is not treated (Küchler and Straub 2002: 75).

A specialised "Soil and Water Conservation Law" was passed in 1991, which replaced the "Soil and Water Conservation Regulations" of 1982 (Bückmann and Lee 2000: 71). As early as 1957 "Soil and Water Conservation Provisional Outlines" were introduced (ibid: 72). Thus China has a fairly long tradition of soil conservation legislation. The law has a strongly preventive character (Küchler and Straub 2002: 75). A second specialised law on soil conservation is the „Law on Combating Desertification" of 2001, which is the first of its kind worldwide (CCICCD 2002: 12). This law was directly related to China's activities as part of the UNCCD. The "Land Administration Law" of 1986, revised in 1998, regulates use of land and states the general objective of protecting land resources and special obligations related to the use of land. This law is especially relevant to soil conservation since it sets the framework for land use in terms of duration of contracts and conditions of use of different types of land. A range of additional laws include provisions on soils. Of special importance for soil conservation are the "Grassland Law" of 1985 and the "Forestry Law" of 1986, revised in 1998 with its objective of protecting forest functions and incentives for reforestation (Heuser and Graf 2001: 28).

Apart from legislation, China's soil conservation programmes especially trough afforestation and water management are impressive and have been acknowledged internationally (Betke 2000: 343). Recent policies and development plans with the aim of controlling land degradation include the "Western Development Strategy" launched in 1999, with one main objective of ensuring sustainable natural resources management, "National Plan for Ecological Environment Construction", "Natural Forest Protection Program", "National Land Conversion Program", "Small Watershed Program of the Ministry of Water Resources", "Desertification Prevention and Control Programs", and the "National Action Program to Combat Desertification".

In Chinese environmental policy, SEI/UNDP (2002: 79) observes three different approaches: (1) a "campaign approach", the earliest government approach starting in the 1960s, (2) an approach based on "legislative and regulatory frameworks" starting with the beginning of the reform period, and (3), most recently, the use of "market-based instruments". Especially in natural resource management, the report (ibid) finds continuation of the first approach: "In the wake of the devastating floods in the summer of 1998, the Chinese government renewed its attention to the conservation of natural resources by issuing new directives to restrict logging and calling for wetland preservation along the middle reaches of the Yangtze River. […] These important administrative measures have been backed up by large investments. Some investments are similar to past methods used in

the 1980s to reforest or re-grass land." However, there are also examples of the use of market-based approaches in natural resource management, especially the "Sloping Land Conversion Program" which provides incentives (a combination of food and cash subsidies over a period of eight years) for farmers to convert steep lands that are presently cultivated or barren, into forest, shrub, or grassland cover (ADB 2004: 6). Also, the new desertification law has some provisions to stimulate community and private sector involvement through the use of fiscal and other incentives (ibid.).

Overall, strong commitment by the Chinese government in soil conservation is observed. Shortcomings are "overlapping roles, conflicts, and inconsistencies" in the legal framework, (ibid: 5). Concerning land tenure reforms the same study reports that "in many areas there is still uncertainty among farmers as to the security of their user rights, particularly with regard to basic farmland suitable for grain production. This discourages them from making long-term land management improvements". Several issues of coherence and coordination in land degradation measures are currently addressed in the above mentioned "Capacity Building to Combat Land Degradation Project" that aims at "improving policies, laws, and regulations for land degradation control" and includes key stakeholders in this field.

4 CAPACITIES FOR SOIL CONSERVATION

4.1 STRUCTURAL CONTEXT FACTORS: ECONOMIC CONTEXT FACTORS

In the last 20 years China experienced rapid economic growth (average economic growth rates between 1990 and 2001 were 10% (World Bank 2003)). The socialist development project was accompanied by the series of environmental problems that other countries experienced in a far longer time span. In the last decades great achievements in poverty reduction were made especially in rural areas (Fan 2000), but still poverty is strongly a problem of rural areas. Especially the western areas and southern mountain areas are the poorest areas. Two thirds of the so called „National Designated Poor Counties" are located in ecologically fragile areas (World Bank 2001: 69) and soil degradation was found to be linked partly to poverty (Künkel 2005).

4.2 POLITICAL-INSTITUTIONAL FACTORS

Institutionalizing environmental issues as a policy field at the national level began in1974 with the Environmental Protection Office (EPO) which was upgraded in the 1980s to an agency with a "bureaucratic rank slightly below a ministry" (World Bank 2001), the National Environmental Protection Agency (NEPA). An important coordinating role was played by the State Environmental Protection Commission (SEPC) (established in 1984), consisting of key persons from ministries, commissions and representatives of large enterprises and media. Today the environmental administration at the national level is lead by the State Environmental Protection Agency (SEPA) (since 1998) uniting the competences of both bodies. The dismantling of the SEPC is regarded as a "step which weakened the possibilities for proper co-ordination of environmental measures within the State Council" (OECD 2005: 10). SEPA was upgraded to a (non-cabinet) ministry and is the agency with overall responsibility for environmental management and protection (World Bank 2001). SEPA has extensive competences concerning policy development, legislative functions, development of environmental standards, coordination of subordinate

departments and the implementation of environmental norms (Betke 2000: 351). However, SEPA is still "far less powerful than some other key ministries or bodies" (OECD 2005: 10). Thus, the institutionalisation of environmental management has already undergone several reforms and adjustments.

Implementation is organised by SEPA for those projects undertaken by the sectoral bodies at the national level, or activities that are of national significance, whereas the Environmental Protection Bureaus (EPBs) at lower levels implement regulations (OECD 2005: 11).

Below the national level, the provincial level has own competences in environmental policy. Apart from implementation, at the provincial level national legislation can be further specified and complemented. Provincial environmental protection bureaus exist in all provinces and are independent agencies (World Bank 2001: 100). The cooperation and division of competences between the levels is characterised by the "horizontal-vertical" issue (World Bank 2001: 99), meaning that "lower-level EPB's report to higher-level EPBs and ultimately SEPA, but receive their budgetary resources from the local government" (ibid). This often leads to conflicting demands, e.g. in the case of polluting industry, on which the local government depends.

Participatory elements have been introduced only recently, e.g. in the Agenda 21 and the in the "Law on the Prevention and Control of Water Pollution" (1996, amended 2000) and are slowly gaining importance. The idea of environmental education was already introduced early with the Environment Act in 1978, and is increasingly practiced.

The role of the courts is not yet very active in adjudicating environmental disputes (World Bank 2001). Thus, enforcement of environmental law is rather weak and is cited as a major weakness of Chinese environmental policy (Jänicke at el 1999). Mao (1996: 242) characterises it as being "without teeth". A recent approach to strengthen implementation was stricter measures in criminal law (Troost 2000).

4.3 ACTORS AND PROPONENTS OF SOIL CONSERVATION

So far, in China relevant actors of environmental protection are almost exclusively on the part of the government (Heuser and Graf 2001: 35).

Within the higher levels of the administration, Mao (1996: 243) observes a high priority for environmental protection since the 1980s. Whereas in early environmental legislation environmental protection was stated to be subordinate to socialist modernisation, in 1981 the state council announced it to be equal in rank with economic development (Heuser and Graf 2001: 24). In the national Agenda 21, introduced by China in 1994 as the first country, the concept of sustainable development is announced as guiding principle of economic development. A "turning point" in the reform of environmental policies was marked by the 1996 Fourth National Conference on Environmental Protection (OECD 2005: 9). It defined, for the fist time, "explicit environmental objectives, duties and plans for the end of the 1990s and the next century" (ibid.). The following ninth, and especially the 10th Five-year-plans were much more sensitive to environmental issues, and the latter contained a specific Five-Year Plan for Environmental Protection (ibid.).

However, economic growth still ranges high as an objective in the administration and among cadres at the national and local level. Cheung (1998: 162) states this "pro-growth bias" as a major obstacle to the implementation of environmental protection. More important, however, are conflicts of interest between the local level and the national level. Priorities for environmental protection at the local level are rather low, especially where

they directly contradict growth interests of the local industries, the "town and village enterprises" (ibid: 163).

The focus in environmental protection was up to the late 1990s clearly on controlling industrial pollution and managing urban environment, whereas rural environmental protection "wasn't a major government priority until the late 1990s" (World Bank 2001: 108). This can be seen for example in the staff resources dedicated to the two fields: of the staff of NEPA in the first half of the 1990s only 10% were allocated to natural resource protection (Mao 1996: 247). Financial and staff resources attributed to soil conservation were low up to the 90ies, thus contributing to neglecting the issue (Küchler/Straub 2002: 74). However, in the late 1990ies a shift of priorities was observed. Already in the ninth Five-Year-Plan, decided in 1995 Lee (1997: 83) observes a strong commitment to soil conservation both concerning soil pollution and soil erosion. He regards soil as having advanced to a generally important subject of protection in this plan. But especially the 1998 Yangtze flood is often cited as a turning point in environmental policies, which was followed by increased conservation efforts of forests and combating land degradation. In addition, as part of UNCCD activities, efforts to combat desertification were intensified and existing measures were revised. But even concerning earlier periods, China's long tradition in soil conservation must not be overlooked when describing priorities in Chinese natural resource management. As in other countries, environmental policy is a rather young policy field, whereas resource policies date earlier.

Concerning soil conservation, the above mentioned general structure of the environmental administration deserves a closer description. As in most countries, responsibilities for land and soil conservation are fragmented. Responsibility for soil conservation is shared between different ministries: the Ministry of Water Resources (MWR) and the State Forestry Administration (SFA), but also SEPA, the Ministry of Land and Resources, and the Ministry of Agriculture (MOA) among other entities. Responsibilities for soil erosion depend especially on "whether it is water-induced (MWR) or wind-induced (SFA)" (ADB 2004: 12). In addition, resource management and resource protection are not under one responsibility, e.g. "the agency responsible for desertification (SFA) is not responsible for the management of grasslands (MOA), despite grassland degradation being the major cause of desertification." A body specialized on soil conservation programs and extension like a "soil conservation service" does not exist in China, as World Bank (2001: 109) notes.

Nongovernmental actors have very little influence on environmental policy (ibid), however, Mao (1997) points to an emerging active role of local actors. OECD (2005: 31) provides a typology of key non-governmental actors and characterises the 1996 "State Council Decision Concerning Certain Environmental Issues" as having "signalled a turning point by strongly encouraging both media and citizens to expose illegal actions that caused environmental damage".

4.4 SITUATIVE CONTEXT FACTORS

As mentioned above, the Yangtze flood of 1998 is often cited as an important incident that raised awareness for natural resource conservation at the national level. It initiated discussions on causes of the flooding and deforestation in the upper reaches of the great rivers became an issue. In reaction to these discussions, the Government announced increased efforts, and changes in land-use policy to stabilize the upper reaches of rivers through afforestation. Much earlier (i.e. 15 years beforehand), a report of a Government Commission on dangers of deforestation in the upper reaches of rivers is cited by Weggel

(1998: 725) to have led, among other factors, to the huge afforestation project "Great Green Wall".

4.5 EXTERNAL FACTORS

International soil conservation activities are not a strong "push-factor" for national soil conservation policies, but in general, Chinese environmental policy is rather open.

In general, the "modern" idea of environmental protection is regarded as an "imported idea" (Mao 1996: 252). Betke (2000: 347) states that the introduction of environmental policies in China was not a reaction to obvious environmental problems, but was initiated, as in most developing countries, by external developments. The starting point is marked by the Chinese participation in the 1972 United Nations Conference on the Human Environment (OECD 2005: 8) in which China took a speaker's position for developing countries. In later international conferences China consolidated its leading role among developing countries, and put developing countries' issues on the agenda, among them desertification and natural resource problems (Lee 1997: 83), but also the need for international cooperation in solving global and developing countries' environmental problems. Several scholars (Mao 1996: 252, Kruse 2001: 30) regard China's active environmental diplomacy as a driving force of domestic environmental policy development. Furthermore, China actively engages in international cooperation and demands support, e.g. with the "China Council for International Cooperation on Environment and Development" established in 1992 (Bechert 1995: 102). Thus, China has evolved to be internationally active and open concerning international cooperation on environmental issues. Among its Asian neighbours, China can be classified as a pioneer (Ludwig 2000: 14).

CONCLUSIONS

China is rather a „pioneer" than a „laggard" when looking at the policy output in soil conservation. A long tradition in soil conservation and a rather high priority for environmental issues in the national administration may explain this development. Input from the international level is actively demanded. Also, soil conservation has been a dynamic field in recent years. Shortcomings to more effective soil conservation lie in compartmentalized and sectorally fragmented approaches, weak capacity at local level and unproper land tenure arrangements and land use rights, as well as undeveloped participatory approaches (ADB 2004).

REFERENCES

1. Asian Development Bank (ADB) (2004/2002): Framework Brief for the PRC-GEF Partnership on Land Degradation in Dryland Ecosystems,
2. Bechert, Stephanie (1995): Die Volksrepublik China in internationalen Umweltregimen. Mitgliedschaft und Mitverantwortung in regional und global arbeitenden Organisationen der Vereinten Nationen, Münster.
3. Betke, Dirk, (2000): Umweltkrise und Umweltpolitik, in: Hermann-Pillath, Carsten, Lackner, Michael (Eds.): Länderbericht China. Politik, Wirtschaft und Gesellschaft im chinesischen Kulturraum, 2. edition, Berlin, pp. 325-357.

4. Bückmann, Walter (Eds.) (1991), Probleme eines Bodenschutzgesetzes im internationalen Vergleich, Technische Universität Berlin, FAGUS Schriften No. 1, Berlin.
5. Bückmann, Walter, Lee, Yeoung Huei (Eds.) (2000): Verhaltenssteuerung zum Bodenschutz – Probleme eines Konzepttransfers zwischen Deutschland und Ostasien, Technische Universität Berlin, FAGUS Schriften No. 10, Berlin.
6. Chen, Chang-Chin (1997): Beijing`s Environmental Diplomacy, in: Issues and Studies, Vol. 33, pp. 68-89.
7. China National Committee for the Implementation of the UN Convention to Combat Desertification (CCICCD) (2002): China National Report to Implement the United Nation`s Convention to Combat Desertification (UNCCD), Beijing, (http://www.unccd.int/cop/reports/asia/national/2002/china-eng.pdf, 24.05.03).
8. Fan, S., Zhang, L. (2000): Growth, Inequality, and Poverty in Rural China: The Role of Public Investments, International Food Policy Research Institute, IFPRI Research Report 125, Washington.
9. Heuser, Robert, Graf, Jan de (Eds.) (2001): Umweltschutzrecht in der VR China. Gesetze und Analysen, Hamburg.
10. Hurni, H., Meyer, K. (Eds.) (2002): A world soils agenda. Discussing International Activities for the Sustainable Use of Soils, Prepared with support of an international group of specialists of the IASUS Working Group of the International Únion of Soil Sciences (IUSS), Centre of Development and Environment, Bern.
11. Jänicke, Martin, Kunig, Philip, Stitzel, Michael (1999): Umweltpolitik. Lern- und Arbeitsbuch, Bonn.
12. Jänicke, Martin, Weidner, Helmut (unter Mitarbeit von Helge Jörgens) (Eds.) (1997): National Environmental Policies: A Comparative Study of Capacity-Building, Berlin.
13. Kruse, Claudia (2001): Umweltbildung und Umweltkommunikation in der VR China, in: ASIEN, VOL. 78, pp. 25-49.
14. Küchler, Johannes, Straub, Wolfgang (2002): Wasser- und Bodenschutz als Baustein einer Strategie zur Überwindung der ländlichen Armut: Erfahrungen aus einem deutsch-chinesischen Projekt in Shandong, in: Zerbe, Stefan, Küchler, Johannes, Hamann, Bettina (Eds.): Ökoligische und sozio-ökonomische Grundlagen und angewandte Aspekte des Natur- und Umweltschutzes in Nord-China und Südkorea, TU Berlin Schriftenreihe der Fakultät Architektur Umwelt Gesellschaft, Berlin, pp. 74-85.
15. Künkel, Nana (2005): Sozioökonomische Ursachen von Bodendegradation in Asien – eine
16. räumliche, statistische Analyse auf der Grundlage von Agrarentwicklungsmustern,
17. Agrarwirtschaft Special Issue No. 181, Ph.D. Dissertation Humboldt-University of Berlin, Frankfurt.
18. Lee, Yeoung Huei (1999): Umweltschutz in China. Umweltpolitik, Umweltplanung, Umweltrecht und Rahmenbedingungen in der Volksrepublik China, FAGUS Schriften der Technischen Universität Berlin, No. 9, Berlin.
19. Liu, Shouying, Carter, Michael, Yao, Yang 1998: Dimension of Property Rigths in Rural China: Dilemmas on the Road to Further Reform, in: World Development, Vol. 26, pp. 1789-1806.
20. Ludwig, Jutta 2000: Die Wasserwirtschaft im Rahmen der Umweltpolitik in der Volksrepublik China, in: ASIEN, Vol. 74, pp. 2-26.
21. Mao, Y. 1997, China, in: Jänicke, Martin Weidner, Helmut (Eds.): National Environmental Policies, Berlin, pp. 237-255.

22. Oldeman, L.R. van Lynden, D. 1997: Assessment of the Status of Human Induced Soil Degradation in South and Southeast Asia, International Soil Reference and Information Centre (ISRIC), Wageningen.
23. Troost, Georg 2000: Recent Trends in Chinese Environmental Law, in: ASIEN Vol. 74, pp. 27-39.
24. SEI/UNDP (2002): Stockholm Environment Institute/United Nations Development Programme (UNDP) China (2002): China Human Development Report 2002. Making Green Development a Choice, New York.
25. Weggel, Oskar 1998: Naturkatastrophen und Archetypen – Variationen zum Thema „Yangzi-Fluten“, in: CHINA aktuell 7/98: pp. 718-730.
26. Weidner, H., (2002): Capacity Building for Ecological Modernization. Lessons From Cross-National Research, AMERICAN BEHAVIORAL SCIENTIST, Vol. 45 No. 9, May 2002 1340-1368
27. Weidner, Helmut, Jänicke, Martin, (Eds.) (2002): Capacity Building in National Environmental Policy. A Comparative Study of 17 Countries. Berlin u.a..
28. World Bank (2001): China. Air Land and Water. Policies for a new millenium, Washington.
29. Zieschank, Roland, Jänicke, Martin, Tietz, Wolfgang (1999): Wesentliche Problembereiche aus der Sicht der Policy-Analyse. In: Bückmann, Walter, Jänicke, Martin, Lee, Yeong Heui, Tietz, Wolfgang, Wolff, Julian, Zieschank, Roland: Steuerungsfunktionen von Recht, Politik, Planung und Information am Beispiel des Bodenschutzes, Technische Universität Berlin, FAGUS-Schriften, Band 8, Berlin, pp. 11-70.

CERTIFICATION ISSUES IN RESPONSIBLE UTILIZATION OF RENEWABLE NATURAL RESOURCES

Marion Karmann

FSC International
Charles de Gaulle Str. 5
53113 Bonn, Germany

INTRODUCTION

The mention of certification evokes passionate responses from many people concerned about the environment and working conditions. Certification is seen by some as the panacea that will bring about much needed reform in natural resources sectors, while others are vehemently opposed to this form of voluntary regulation as an unnecessary barrier to trade. Whatever the opinion, certification has become the hot topic in many natural resource sectors.

The following shall serve as background information for the discussions on the existing certification schemes relevant for NTFP and on the benefits, challenges, and constraints of certification for the people involved, with a special focus on forest management certification.

1. CERTIFICATION

Certification is the process of evaluating and labeling products against accepted standards of good management. To ensure the objectivity of certification, a reputable independent third party conducts the evaluation against defined standards. Once certified, a business may promote their business and products as certified, which is often done by using the distinctive logo of the standard-setting organization.

FSC defines non-timber forest products (NTFP) as: “All forest products except timber, including other materials obtained from trees such as resins and leaves, as well as any other plant and animal products.” (1).

NTFP can play important economic, social and environmental roles: some provide income for the poorest people and are at the same time incentives to maintain natural forests, others like oil palm or coffee are intensively managed at a large scale, with significant contribution to a country’s income. Under specific conditions NTFP extraction can provide a reasonable income for forest dwellers and can take place with causing only minimal damage to the forest structure. Many NTFP are exploited unsustainably (for the source of the NTFP or for other parts of the eco-system, where the NTFP is coming from), but there is a growing market for responsibly-produced NTFP, guaranteed by a certificate. NTFP may then be certified based on standards for fair trade, organic production, and/or forest stewardship. Different organizations have developed standards for certification that may be applicable for NTFP:

- Forest Stewardship Council (FSC): Forest Stewardship is the process of managing forests to protect their ecological values while creating responsible economic and social benefits. Biodiversity, water quality, employment, cultural values and the rights of first nations are among the issues addressed by forest stewardship certification. The FSC is an international network organization promoting well-managed forests through the application of criteria addressing these issues. (2).

- The International Federation of Organic Agriculture Movements (IFOAM) is the equivalent world body for organic agriculture, and has criteria for wild-harvested products as well as specific criteria for some NTFP like maple syrup and honey. (3).
- Fairtrade Labelling Organizations (FLO) International places an emphasis on the social components of production, ensuring the well-being of the producer, and currently certifies a limited number of agro-forestry products.(4).

Through the FSC system, the forest owners, managers, forest product manufacturers, local communities, non-governmental organizations and other interest groups are given equal access, voice and vote to a mechanism that is democratic, inclusive and transparent. FSC provides a system to develop standards with criteria and indicators to certify forest management, and only in some case dedicated standards for the responsible management of one or of a group of NTFP.

The primary goal of certification of forest management including NTFP management is to bring about positive environmental and social change in resource stewardship. Certification criteria can be used by producers and harvesters everywhere as a model for best practices.

2. SCOPE OF NTFP AND CHALLENGES FOR CERTIFICATION OF NTFP

While the certification of forest management (and also of organic agriculture) is, even though on management unit basis and therefore based on individual cases, already a kind of routine, the development of certification standards for NTFP is still challenging for several reasons.

One reason is that the NTFP cover a *wide range of products* from plants and from animals, products for food, medicine, for construction and more. This includes for example major crops, such as oil palm or coffee, venison (from extensively-managed species such as reindeer or from wild species), honey from wild bees, exudates like rubber and resin, livestock fodder, or materials for construction. Looking only at edible NTFP from trees, these can be roots, barks, leaves, exudates, fruits, sprouts, etc. Certification requires the development of standards, which are appropriate for the products addressed. So far there is no general standard for NTFP that can cover all these products (or their harvesting time, quantities, qualities, e.g.) sufficiently.

Also the *management types* of the resources are quite different: Some are collected from the wild, others semi-managed and are collected extensively, while another group can be quite intensively cultivated. Many are minor products from an economic point of view, while a few can be large scale (oil palm plantations). Certified organic foods often come from agricultural/cultural landscapes. Although many NTFP are essentially available freely, often providing income for the poorest people on subsistence level, their collection is labor-intensive with low-income return.

The ownership of, *tenure rights* and/or the rights to harvest and utilize NTFP differ equally: Some of the certified management units for NTFP may occur on state-owned forests/lands, communal lands or private lands especially for organic certification. This may have some implications on small producers and subsistence users including their need to prove or formalize customary tenure and access rights as well as the potential to lose their subsistence use rights due to increased market demands.

As a positive example, many of the European state-owned, communal or also private forests are operated primarily for timber production, but members of the public have, as part of "everyman's" policies, access rights to the forests (including the right to walk and camp), some countries' public have even the rights to collect fire wood, for hunting and fishing. This can lead for example to commercial collecting of forest products such as berries, even by people migrating in from other countries. However, to carry out the inspections necessary for the certification of operators involved in picking, buying, and processing of the berries, many different levels of stakeholders are involved. (If going towards organic certification, the organized collectors will be provided with information and training about the rules of the relevant certification scheme, they sign an agreement to follow harvesting instructions, which is then the contract with a registered organic buyer.)

Related to other forestry activities, NTFP can also be harvested under FSC group certification schemes: a group manager (an individual or a legal entity) develops the group scheme. Individual forest managers can then join the scheme and their forestry activity can be certified as part of the overall group. The collection of pine nuts (e.g. from Pinus cembra sibirica) in Russia Far East and Mongolia may demonstrate that responsible harvest of the NTFP is possible, when it is following some technical and legal regulations: The harvest is usually done by hitting the tree with big sticks until the cones with the seeds fall from the tree. If the cones are close to their natural ripeness, this can be done without high energy input, and without much damage to the tree's stem and bark. The competition of harvesting requests that legal regulations define the earliest time for the start of the harvest – and this needs control over the resources, and consequences for infringements of regulations. If the collectors of the cones start their business late in the year, they might have to face he situation that other people already collected the cones. The collectors need to act in an organized and monitored way.

There are different types of *knowledge* about NTFP: The lack of ecological knowledge about individual species, including baseline data, sustainable harvesting levels and resiliency levels is probably one of the reasons for the low acceptance of NTFP on major markets. This knowledge is often only relevant to specific ecological niches and is held in part by local harvesters. If the product has a high economic importance (coffee, berries in Scandinavia, hunting in Europe, ...), it is usually subject to intensive research and much is known about sustainable management. If the product is only traditionally used locally and for subsistence, there may exist a long tradition of oral information for sustainable management practices, but for certification the documentation of quantities harvested, mapping of resources, management plans and other information is prerequisite. Apart from this, in many case studies a gendered knowledge about NTFP can be observed (with the general trend, that women are more experts in the field of edible NTFP and for subsistence use, compared to men, who are more often dealing with NTFP when it come to cash crops (5, 6). This needs to be reflected (but is often ignored) when certification standards are in the process of development or when stakeholder consultations are made during certification processes.

To be able to manage a natural renewable resource responsibly, the characteristics of the resource must be known. This can be critical if there is a recent growing international market demand for such forest products that have had a long traditional local importance without any information documentation on their characteristics and management. Certification of forest management and of organic products requires that the manager of the resource has control over the information as described above, the management regulations (legally required or described in his own management plan), the legal framework and impacts on social issues. Basic questions are what and how much is where and when

available. Certification requires that the information is gathered, documented and monitored. The wide array of NTFP does not allow an easy access to general, uniform and standardized information. At the same time the Certification Body needs to be knowledgeable about these issues, to be able to raise the appropriate questions.

The threat to sustainable harvesting comes when a market value is attached to the individual species and harvesting rates increase. There are still and will be in future difficulties in creating market benefits from certified NTFP. Markets for certified products are not well developed and tend to occupy niche markets for high quality products. Often quality control measures in NTFP harvesting and processing need to be developed. Additionally, it has yet to be shown whether certified NTFP are able to command a higher price in the marketplace.

Nevertheless there is a growing demand for sustainably-produced and certified NTFP, especially for those with a demand growing towards international markets. Currently, they are certified by organic and forest certification bodies, and in some cases additionally by Fair Trade schemes. There are already products jointly certified according to IFOAM and to FSC regulations. The underlying principles of the certification schemes have many complementarities with respect to NTFP, but also some differences. Joint inspections offer a range of potential advantages: reduced costs for the certification process, joint promotion from different certification schemes for the same product, easier market access, less competing messages to consumers. The differences are potentially in the area of requirements regarding the use of pesticides and genetically modified organisms, occupational health and environmental issues, and different methods relating to chain of custody inspection – and the lack of experiences with the NTFP. One of the early examples is the certified chewing gum “Jungle Gum” (the “chicle” species Manilkara zapota). The Mexican operation received organic (Wild Things ®) and FairTrade e.V.® certificates as well as the first FSC approved NTFP certification(7).

While FSC is most closely associated with NTFP, it is also the most complex certification program to implement with regard to standard development and stakeholder consultation, as FSC takes into account the requirement of directly and indirectly involved constituencies and their social, economical and ecological interests. In addition, the FSC system is difficult to apply to the vast majority of informal community-based NTFP operations that constitute the bulk of NTFP harvesting worldwide. FSC is beginning to look at new models of community-based certification where a number of harvesters are certified as a group or where a resource manager is certified to oversee multiple harvesting operations (see below).

For small scale NTFP operations, as is the case for most food and medicinal product harvesting, organic agriculture certification provides a reasonable alternative. The range of criteria addressed under organic certification is narrower than under FSC, with an explicit focus on building soil fertility and crop management techniques. However, organic certifiers are beginning to look at landscape level issues as well as social concerns. Given the relatively low cost of certification and strong consumer recognition for organic, this certification may be appropriate for many NTFP harvesting operations.

Fair trade is also an option for NTFP certification although only for southern producers. Fair trade is beneficial for small producers since its primary focus is on ensuring that they receive a fair deal for their products. The costs of certification are borne by the retailer and consumer rather than by the producer. The current scope of products covered under fair trade only includes a few agro-forestry products although it is likely that this product base will grow to include NTFP.

3. FSC AND NTFP CERTIFICATION

In 1996 FSC formed an NTFP Working Group, which produced in 1997 a draft "FSC Principle 11" to address NTFP. However, the FSC accredited Certification Bodies have since then developed a range of species-specific NTFP standards.

Table 1: The following table gives examples of NTFP currently certified according to FSC Forest Management standards and the forest products (see data base on www.fsc.org (2) :

NTFP	**use / description**	**origin**
Examples for NTFP certified under FSC forest management		
Chicle (latex) Manilkara zapota	Ingredient in chewing gum (also certified as organic and fair trade)	México
Venison Cervus elaphus	Food	Scotland, Germany
Christmas greenery	decoration	Europe, N-America
Seeds	for tree nurseries	Europe, N-America
Bamboo, Rattan	Multipurpose	Asia
Acai palm (heart & sprouts) Euterpe edulis	Beverage & food product	Brazil
Oak tree bark Quercus robur	Medicinal tea (also certified as organic)	Denmark
Shiitake mushrooms	Food	México, Japan
30 species of plants	Cosmetics & medicine	Brazil
within FSC forest management certification, but specific standard prepared for accreditation:		
Bamboo „Gadua"		Colombia
NTFP certified within FSC forest management areas, but with specific FSC standard:		
Brazil Nuts Bertholletia excelsa	Food product	Bolivia, Peru
Maple syrup Acer saccharum	Food product, beverage, sweetener	USA

The FSC accredited Certification Body SmartWood published in 2002 generic guidelines for assessing NTFP. The Non-Timber Forest Products Certification Standards Addendum provides guidance for forests managed principally for timber production, but

with the possibility to incorporate commercially harvested NTFP within the forest management area. The NTFP Addendum is a complement to FSC Forest Management standards. The NTFP Addendum is so far focussed on plants only; in future guidelines for production systems incorporating the harvest and management of animals will be included (8).

An example for a specific NTFP FSC standards is the Non-Timber Forest Products Addendum with Special Reference to Maple Syrup (9).

As shown above, many NTFP are managed by local communities and groups of users. The number of these types of NTFP certified, either by FSC alone or jointly with other certification schemes, is still low. One reason for this is that local communities cannot bear the costs for regular forest management or organic certification, or that they cannot follow the regulations for certification, especially those related to the documentation of their management. In 2004 FSC developed the concept of **Small and Low Intensity Managed Forests** (SLIMFs) to reducing certification costs for small producers by publishing its draft standards on FSC SLIMFs Eligibility Criteria (10) and summarized in the FSC SLIMF Streamlined Certification Procedures (11). NTFP collectors (including women and those who harvest on land which is not theirs) are one of the target groups focussed on by the SLIMFs standard. The SLIMFs Streamlined Certification Procedures are applicable to:

- Small forests with areas is less than 100 ha (in reasonable cases up to a maximum of 1000 ha).
- Low intensity forest for NTFP production only: All natural forests being managed exclusively for NTFP (with the exception of NTFP plantations) are considered 'low intensity'.
- Groups of SLIMFs: All group members are either 'small forests' or 'low intensity forests', as defined above, without limit on the number of members in a group of SLIMFs.

The FSC SLIMFs Streamlined Certification Procedures recommend that requirements for monitoring and assessment be modified to include shorter, more concise public summaries, a checklist for forest management evaluations, automatic renewal of five-year certificate if annual audits are satisfactory, and fewer audits and peer reviews than for regular forest certification.

4 OUTLOOK

The demand for certified NTFP is growing, as well as the need for sustainable management of the resources and for stable income for the rural poor. One probable scenario for future cooperation of producers, certification schemes and market is that certification schemes will continue to develop projects that integrate two or more systems of certification at different stages of the certification or accreditation process. This may include projects to promote certified products in general, market studies, mutual support and recognition in monitoring and chain of custody, or development of common policy positions in trade discussions. There is a general trend towards more comprehensive standards and criteria for certification. This will result in increasing overlap between certification systems, and may provide stronger motivation for clients and certification organisations to participate more in the certification of NTFP for the benefit of the ecosystems and the people involved in management.

The author Dr. Marion Karmann is currently working at the FSC International Center in Bonn, Germany. In 1995–2002 she did research in the area of NTFP sustainable harvest in the tropics.

REFERENCES

1. FSC (2004); FSC Principles and Criteria for Forest Stewardship, FSC, Bonn, Germany.
2. The Forest Stewardship Council: What is FSC, work in progress, get involved. www.fsc.org
3. Fairtrade Labelling Organizations International (FLO) (2006): Standards and certification body for the Fairtrade movement. www.fairtrade.net/standards.html
4. IFOAM (2006); The IFOAM NORMS for organic production and processing 2005, IFOAM, Bonn, Germany
5. KARMANN, Marion (2000): Bark harvesting as an example for ethnic and gender oriented work. Paper for the Joint FAO/ECE/ILO Committee Seminar on Harvesting of NTFP, October 2000, Izmir, Turkey. Proceedings.
6. KARMANN, Marion; LORBACH, Ingrid & THALOUK, Salma, 2001: Gendered knowledge about NTFP. European Tropical Forestry Network ETFRN News No. 1.
7. KARMANN, Marion (1999): Zertifizierung von forstlichen Nebennutzungen. / Bericht von der 2. FSC VV in Mexico. Forstliche Mitteilungen 8/99.
8. SmartWood (2002); Non-Timber Forest Products Certification Standards Addendum: Guidance Notes, RainForest Alliance, New York, USA.
9. PIERCE, A.; LAIRD, S. and MALLESON, R. (2002): Non-Timber Forest Products Addendum with Special Reference to Maple Syrup. Annotated Collection of Guidelines, Standards, and Regulations for Trade in Non-Timber Forest Products (NTFP) and Botanicals, Rainforest Alliance, New York, USA.
10. FSC (2004): SLIMFs; SLIMF Eligibility Criteria (draft 2-0); FSC, Bonn, Germany.
11. FSC (2003); SLIMF Streamlined Certification Procedures: summary; FSC, Bonn, Germany.

Further literature:

1. BROWN, Larianna; ROBINSON, Dawn and KARMANN, Marion (2002); The Forest Stewardship Council and Non-Timber Forest Product Certification: A discussion paper, FSC, Bonn, Germany.
2. COURVILLE, S. (1999); Promoting Biological Diversity Through Sustainable Certification and Fair Trade, Institute for Agriculture and Trade Policy, Minneapolis, USA
3. ETFRN NEWS 32: NTFPs. European Tropical Forest Research Network, Wageningen, The Netherlands, http://www.etfrn.org/etfrn/
4. MALLETT, Patrick (1999): NTFP Certification and Marketing Program, Falls Brook Centre, New Brunswick, Canada, http://www.fallsbrookcentre.ca/forestry/NTFP_Web/analysis_doc.htm)
5. MALLETT, Patrick (undated): NTFP Certification Challenges and Opportunities, Falls Brook Centre, New Brunswick, Canada, http://www.fallsbrookcentre.ca/forestry/NTFP_Web/certification_challenges.htm (accessed September 2006)
6. MALLETT, Patrick & KARMANN, Marion (2001): Certification of Non-Timber Forest Products. An emerging field. European Tropical Forestry Network ETFRN News No. 1

7. SHANLEY, Patricia; PIERCE, Alan and LAIRD, S. (2005); Beyond Timber: Certification of non-timber forest products, Forest Trends, CIFOR and Plants and People International, USA

SYMPOSIUM PROGRAM

Sunday 12 March 2006		
	Arrival	
21:00	Welcome at Hotel “Eden”, the *Symposium Venue*	Organizers

Monday 13 March 2006		
08:30	Registration of participants in the Symposium room	
09:00h	Opening Vice-President of Georg-August-Universität Göttingen Welcome on behalf of the Sino-German Center for Research Promotion, Beijing Welcome on behalf of the Symposium organizers	Reiner Kree Zhao Miaogen Yang Yonping Christoph Kleinn
09:30h	Sustainable use and conservation of Non-Timber Forest Products in Southwest China: Status, challenges and prospects	Yang Yongping
10.00h	Forest management systems and diversified production (NTFP): principles of sustainable management of natural renewable resources	Achim Dohrenbusch
10:30h	*Tea / coffee*	
11:00h	Harvesting of Non-Timber Forest Products in the alpine region of Northwest Yunnan and its impact on biodiversity conservation	Sun Hang
11:30h	Biologically Active Substances from Higher fungi in Yunnan, China	Liu Jikai
12:00h	Management of Matsutake in NW-Yunnan and key issues for its sustainable utilization	Yang Xuefei
12:30h	*Lunch*	
14:00h	Diversity of mushrooms in Hengduan Mountain region, Southwest China	Miss Wan Lan
14:30h	Applied research on bee products for human health protection	Ms. Jie Dong
15:00h	Bamboo development for rural livelihood and its impacts on biodiversity and environment in China	Lou Yiping
15:30h	*Tea / coffee*	

16:00h	Barriers and success factors for implementing mechanisms for the sustainable use of biodiversity	Susanne Stoll-Kleemann
16:30h – 17:30h	Resource data provision as basic component of sustainable management of the forest resource Discussion on issues of information status and requirements.	Christoph Kleinn (presenter and moderator)

Tuesday 14 March 2006		
08:30h	Close-to-Nature Forest Management for biodiversity conservation	Lu Yuanchang
09:00h	Collective action for promoting communities' marketing capacity: Sustainable NTFP management in the context of the Community-Based Natural Resource Management (CBNRM) mechanism	Zheng Baohua
09:30h	Silviculture for wood and NTFP production in tropical rain forests: Contradiction or chance? An example from the South Pacific Islands	Michael Mussong
10:00h	How can we enhance NTFP conservation by strengthening farmer's access to forest: lessons from Matsutake mushroom and bamboo shoots	He Jun
10:30h	*Tea / coffee*	
11:00h	Interrelationship between the ontogenetic type of pine trees and resin production	Hubertus Pohris
11:30h	Chinese Research Environment, Challenges and Opportunities for International Collaboration	Horst Weyerhaeuser
12.00h	NTFP in Timber Production Forests	Carol Grossmann
12:30h	*Lunch*	
14:00h	Assessment tools for forestry decision-makers - Experience from forest devolution in Vietnam's Central Highlands	Thomas Sikor
14:30h	Transfer of scientific expertise into successful forest policy - concepts for evaluation and monitoring for sustainable forestry in China	Michael Böcher, Max Krott, Xiao Jianmin
15:00h	Politics and policies of natural resource conservation in China: Capacity building for sustainable resource use	Nana Kuenkel
15:30h	*Tea / coffee*	
16:00h	Certification issues in sustainable utilization of renewable natural resources	Marion Karmann, FSC

16:30h	Collaboration between the University of Göttingen and Chinese Scientific Institutions Presentation of the Center for Tropical and Subtropical Agriculture and Forestry, Georg-August-Universität Göttingen	Paul Winkler Uwe Muuss
17:15h	Preparation of Wednesday-Workshop	Moderators

Wednesday 15 March 2006		
8:30h	Introduction to workshop, forming working groups, assigning tasks and responsibilities	Moderators: Yang Yongping, Christoph Kleinn, et al.
9:00h *10:30h Tea/coffee*	*Workshop / Working groups:* Summarize the current state of knowledge and identify major gaps of knowledge and topics for future collaborative research: Tentative topics: Potential and success factors of sustainable NTFP harvesting. Instruments for assessment and monitoring for the sustainable harvesting of NTFP in China. Challenges of balancing the role of NTFP within multifunctional forest use. The final definition of working gourp topics will be an outcome of presentations and discussions during the first two symposium days.	
12:30h	*Lunch*	
14:00h	Preparation of working group presentations	participants
15:00h	Working group presentations to plenary. Discussion	Yang Yongping / Christoph Kleinn (moderators)
16:00h	*Tea / coffee*	
16:30h	Discussion: Final definition of program and topics for the Friday morning workshop. Assigning responsibilities.	Yang Yongping / Christoph Kleinn (moderators)
17:00h	Information on field trip and program of 16 and 17 March	Achim Dohrenbusch, Torsten Sprenger

Field Trip **Thursday 16 March 2006**		
8:00h 10:00h	Departure from Hotel Eden: Visit to the Planning Office of the Forest Service of the State of Lower Saxony (in the city of Wolfenbüttel): Topics: Forest management planning in state, community and privately owned forests.	 Dr. Böckmann and Dr. Kleinschmit (Forest Service of the State of Lower Saxony)
13:00h	Lunch (in the town of Goslar)	
14:30h	Brief visit to the *Kaiserpfalz* in Goslar (the emperor´s residence in medieval times). Onward to Clausthal Zellerfeld	Achim Dohren-busch, Torsten Sprenger
16:00h	Visit of the mining museum in Clausthal Zellerfeld (the history of mining is in Germany closely linked to the history of forestry. In fact, it was a mining engineer, Carl von Carlowitz, who first described - in 1757 - the principle of sustainability as a strategy to guarantee sufficient wood production on the long run for the mining industry!).	
About 19:00h	Return to Göttingen	
20:00	NTFP Dinner	

Friday 17 March 2006		
8:00h *10:30 Tea/coffee*	*Workshop:* Tasks and topics include: - Planning of further activities, - Preparation of workshop documentation, - Preparation of workshop reporting.	Yang Yongping Christoph Kleinn
12:00h	Closing session	
12:30h	Lunch	
14:30h	Guided tour in Göttingen city (“History of Göttingen” or “Gauss in Göttingen”).	

Saturday 18 March 2006		
	Return	

PARTICIPANTS FROM CHINA

Mr. **He** Jun	Center for Mountain Ecosystem Studies (CMES), World Agroforestry Center (ICRAF-China) c/o Kunming Institute of Botany 3/F Library and Documentation Building Heilongtan, Kunming Yunnan 650204, PR China	Tel: +86 (0) 871 – 5223014 Fax: +86 (0) 871 – 5216350 Email: hejun@cbik.ac.cn
	Author: Strengthening farmers' access to forest for sustainable use of Non-timber Forest Products: Lessons from Matsutake Mushroom and Bamboo Shoots in Yunnan, Southwest China (page - 118 -) **Co-author**: Management of Matsutake in NW-Yunnan and key issues for its sustainable utilization (page - 48 -)	
Ms. **Jie** Dong	Institute of Apicultural Research, Chinese Academy of Agricultural Sciences Xiangshan Beijing 100093, P.R. China	Tel.: +86 (0) 10-82594044 Fax: +86 (0) 10-82594044 Email:jiedon@126.com jiedong@caas.net.cn
Prof. **Liu** Jikai	Kunming Institute of Botany, CAS Heilongtan, Kunming Yunnan 650204, PR China	Tel: +86 (0) 871 – 5216327 Fax: +86 (0) 871 – 5150227 Email: jkliu@mail.kib.ac.cn
	Author: Secondary metabolites and their biological activities from mushrooms under forest in China (page - 29 -)	
Dr. **Lou** Yiping	International Network for Bamboo and Rattan (INBAR) 8 Fu Tong Dong Da Jie Wang Jing Area, Chaoyang District Beijing 100102 China PR China	Tel: +86 (0) 10-6470 6161 Fax: +86 (0) 10-6470 2166/3166 Email: yplou@inbar.int
	Author: Prospective Strategy on Biodiversity Conservation in Bamboo Forests Ecosystems in Tropical and Subtropical China (page - 66 -)	
Prof. **Lu** Yuanchang	Institute of Forest Resources Information, Chinese Academy of Forestry Dongxiaofu 2, Xiangshan Road 100091 Haidian Beijing, PR of China	Tel.: +86 (0) 10- 62888448 Fax.: +86 (0) 10- 62888315 Email: YLu@caf.ac.cn
	Author: Development of Planning System of Close-to-Nature Forest Management for Multiple Benefits Ecological Forestry in China (page - 82 -)	

<table>
<tr><td rowspan="2">Dr.
Marco Stark</td><td>Center for Mountain Ecosystem Studies
c/o Kunming Institute of Botany
3/F Library and Documentation Building
Heilongtan, Kunming, Yunnan 650204, China</td><td>Tel: +86 - (0)871 – 5223052
Fax: +86 - (0)871 – 5216350

Email: m.stark@mail.kib.ac.cn</td></tr>
<tr><td colspan="2">Author: Certification of Non-Timber Forest Products: potential pathway toward balancing economic and environmental goals in Southwest China (page - 97 -)
Co-author: Research on non-timber forest products: a rewarding subject for joint projects between Chinese and German research institutions (page - 1 -)</td></tr>
<tr><td rowspan="2">Prof.
Sun Hang</td><td>Kunming Institute of Botany, CAS
Heilongtan, Kunming,
Yunnan 650204, PR China</td><td>Tel: +86 (0) 871 – 5215002
Fax: +86 (0) 871 – 5150227
Email: hsun@mail.kib.ac.cn</td></tr>
<tr><td colspan="2"></td></tr>
<tr><td rowspan="2">Ms
Wan Lan</td><td>Kunming Institute of Botany, CAS
Heilongtan, Kunming
Yunnan 650204, PR China</td><td>Tel: +86 (0) 871 – 5223507
Fax: +86 (0) 871 – 5150227
Email: fungi@mail.kib.ac.cn</td></tr>
<tr><td colspan="2">Author: Wild edible fungi of the Hengduan Mountains, southwestern China (page - 58 -)</td></tr>
<tr><td rowspan="2">Dr.
Horst
Weyerhaeuser</td><td>Center for Mountain Ecosystem Studies (CMES), World Agroforestry Center (ICRAF-China)
c/o Kunming Institute of Botany
3/F Library and Documentation Building
Heilongtan, Kunming
Yunnan 650204, PR China</td><td>Tel: +86 (0) 10-62119430

Fax: +86 (0) 10-62119431
Email: horst@loxinfo.co.th</td></tr>
<tr><td colspan="2">Co-author: Research on non-timber forest products: a rewarding subject for joint projects between Chinese and German research institutions (page - 1 -)
Certification of Non-Timber Forest Products: potential pathway toward balancing economic and environmental goals in Southwest China (page - 97 -)
Strengthening farmers’ access to forest for sustainable use of Non-timber Forest Products: Lessons from Matsutake Mushroom and Bamboo Shoots in Yunnan, Southwest China (page - 118 -)</td></tr>
</table>

<table>
<tr><td rowspan="3">Prof.
Yang Yongping</td><td>Centre for Mountain Ecosystem Studies (CMES), Kunming Institute of Botany (KIB)
Chinese Academy of Sciences (CAS)
Department of Ethnobotany
Heilongtan, Kunming
Yunnan 650204, PR China</td><td>Tel: +86 (0) 871 – 5223234

Fax: +86 (0) 871 – 5150227
Email: yangyp@mail.kib.ac.cn</td></tr>
<tr><td colspan="2">**Author**: Research on non-timber forest products: a rewarding subject for joint projects between Chinese and German research institutions (page - 1 -)
Co-author: Management of Matsutake in NW-Yunnan and key issues for its sustainable utilization (page - 48 -)
Certification of Non-Timber Forest Products: potential pathway toward balancing economic and environmental goals in Southwest China (page - 97 -)</td></tr>
<tr><td>Dr.
Yang Xuefei</td><td>Kunming Institute of Botany, CAS
Heilongtan, Kunming
Yunnan 650204, PR China</td><td>Tel: +86 (0) 871 – 5223014
Fax: +86 (0) 871 – 5150227
Email: xuefei@mail.kib.ac.cn</td></tr>
<tr><td colspan="2">**Author**: Management of Matsutake in NW-Yunnan and key issues for its sustainable utilization (page - 48 -)</td></tr>
<tr><td>Prof.
Zhao Miaogen</td><td>Shuangqing Lu 83
Haidian District
Beijing 100085
VR China</td><td>Tel.: +86 (10) 6234 2632
Fax.: +86 (10) 8238 0042 oder
+86 (10) 6234 2637
Email:
zhao@sinogermanscience.org.cn</td></tr>
<tr><td rowspan="2">Prof.
Zheng Baohua</td><td>Center for Community Development Studies (CDS), The Old Campus, Yunnan Academy of Social Sciences
133 Qixiang Road, Kunming
Yunnan 650032, PR China</td><td>Tel.: +86 (0) 871-4184434
-4184058

Fax: +86 (0) 871-4184842
Email: zhengbh64@163.com</td></tr>
<tr><td colspan="2">**Author**: Collective Action for Promoting Communities' Marketing Capacity: Sustainable NTFP Management in the Context of the Community-Based Natural Resource Management (CBNRM) Mechanism (page - 91 -)</td></tr>
</table>

PARTICIPANTS FROM GERMANY

Prof. Dr. Achim **Dohrenbusch**	Georg-August-Universität Göttingen Büsgenweg 5 37077 Göttingen, Germany	Tel.: +49 (0) 551 - 393678 Fax: +49 (0) 551 - 393270 Email: adohren@gwdg.de
	Author: Forest management systems and diversified production - Principles of sustainable management of renewable resources (page - 22 -)	
Dr. Carol **Grossmann**	Institute for Forest Policy, Markets and Marketing Section, University of Freiburg Institut für Forst- und Umweltpolitik Tennenbacherstraße 4 79106 Freiburg i. Br., Germany	Tel.: +49 (0) 761203-3726 Fax: +49 (0) 761-203-3729 Email: carol.grossmann@ifp.uni-freiburg.de
	Author: Non Wood Forest Products in Timber Production Forest in East Kalimantan, Indonesia (page - 139 -)	
Ms Marion **Karmann**	FSC International Charles de Gaulle Str. 5 53113 Bonn, Germany	Tel: 0228 / 367 66 -11 Fax: 0228 / 367 66 -30 Mail: m.karmann@fsc.org Homepage: http://www.fsc.org
	Author: Certification issues in responsible utilization of renewable natural resources (page - 176 -)	
Prof. Dr. Christoph **Kleinn**	Institute of Forest Management Georg-August-Universität Göttingen Büsgenweg 5 37077 Göttingen, Germany	Tel.: +49 (0) 551 39-3473 (direct) -3472 (secretary) Fax: +49 (0) 551 39-9787 Email: ckleinn@gwdg.de
	Author: Forest inventories: resource data provision as basic component of sustainable management of the forest resource, including non-wood forest products (page - 13 -) **Co-author**: Research on non-timber forest products: a rewarding subject for joint projects between Chinese and German research institutions (page - 1 -)	
Prof. Dr. Max **Krott**, Michael **Böcher**, **Xiao** Jianmin	Institute of forest Policy, Forest History and Nature Conservation Büsgenweg 3 37077 Göttingen	E-mail: mkrott@gwdg.de Michael.Boecher@t-online.de Tel.: +49 551 39 3412 Fax.: +49 551 39 3415
	Authors: Transfer of scientific expertise into successful forest policy - concepts for the evaluation and monitoring of sustainable forestry in China (page - 157 -)	

Ms. Nana **Kuenkel**	Fachgebiet Agrarpolitik, Landwirtschaftlich-Gärtnerische Fakultät, Humboldt-Universität zu Berlin Luisenstrasse 56 10099 Berlin, Germany	Tel.: +49 (0) 30 - 20936062 Fax.: +49 (0) 30 - 20936301 Email: nana.kuenkel@rz.hu-berlin.de
	Author: Soil conservation policies in China: Capacities for sustainable resource use (page - 167 -)	
Prof. Dr. Michael **Mussong**	University of Applied Sciences of Eberswalde Alfred-Moeller-Str. 1 16225 Eberswalde, Germany	Tel.: +49 (0) 3334 - 65484 Fax: +49 (0) 3334 - 65428 Email: mmussong@fh-eberswalde.de
	Author: Silviculture for wood and NTFP production in tropical rain forests: contradiction or chance? Examples from the South Pacific Islands (page - 109 -)	
Dr. Uwe **Muuß**	Center for Tropical and Subtropical Agriculture and Forestry (CeTSAF) Georg-August-Universität Göttingen Büsgenweg 1 37077 Göttingen, Germany	Tel.: +49 (0) 551 39 3909 Fax: +49 (0) 551 39 4556 Email: umuuss@gwdg.de
Dr. Hubertus **Phoris**	Institute of International Forestry and Forest Products Technische Universität Dresden, PF 1117 01737 Tharandt, Germany	Tel.: +49 (0) 35203 - 3831832 Fax: +49 (0) 35203 - 3831820 Email: hpohris@frsws10.forst.tu-dresden.de
	Author: Interrelationship between the ontogenetic type of pine trees and the resin production potential (page - 128 -)	
Dr. Thomas **Sikor**	Institute for Agricultural Economics and Social Sciences Humboldt-Universität zu Berlin Luisenstr. 56 10117 Berlin, Germany	Tel.: +49(0) 30 - 20936270 Fax: +49 (0) 30 - 20936427 Email: thomas.sikor@rz.hu-berlin.de
	Author: Assessment tools for forestry decision-makers - Experience from forest devolution in Vietnam's Central Highlands (page - 145 -)	
Mr. Torsten **Sprenger**	Center for Tropical and Subtropical Agriculture and Forestry (CeTSAF) Resource Assessment Working Group Georg-August-Universität Göttingen Büsgenweg 1 37077 Göttingen, Germany	Tel.: +49 0) 551 - 399752 Fax: +49 (0) 551 394556 Email: tspreng@gwdg.de

PD Dr. Susanne **Stoll-Kleemann**	Humboldt-Universität zu Berlin Institute for Agricultural Economics and Social Sciences Luisenstr. 53 10099 Berlin, Germany	Tel.: +49 (0) 30-2093-6515 Fax: +49 (0) 30-2093-6565 Email: susanne.stoll-kleemann@agrar.hu-berlin.de
	Author: Barriers and Success Factors for Implementing Mechanisms for the Sustainable Use of Biodiversity (page - 75 -)	
Mr Paul **Winkler**	University of Göttingen: Area Management for collaborative research centres and International Projects Goßlerstr. 9 37073 Göttingen	 Telefon:+49 551 39-12277 Fax:+49 551 39-12278 E-Mail: pwinkle@gwdg.de

Annex (FAZ, 20.03.2006)

Seite 36 / Montag, 20. März 2006, Nr. 67 Frankfurter Allgemeine Zeitung

Natur und Wissenschaft

Schätze aus Chinas Wäldern

Auch die ländlichen Regionen sollen am Aufschwung teilhaben

Tannenhonig und Heidelbeeren, Bärlauch und Steinpilze – neben dem Holz der Bäume haben Wälder noch manch anderes zu bieten. Hierzulande hat das zwar kaum eine wirtschaftliche Bedeutung. Weltweit sind laut einer Studie der Vereinten Nationen jedoch mehr als eine halbe Milliarde Menschen auf solche Produkte angewiesen. Auch Chinas Wälder liefern viel Nützliches, von Wildgemüse und Heilkräutern bis zu pflanzlichen Farben und Lacken. Manches davon wird auch auf den internationalen Markt gebracht. So willkommen solche Einkommensquellen sind, so groß ist freilich die Gefahr, daß sie, weil allzu eifrig geplündert, rasch versiegen. Wie sich der vielfältige Reichtum des Waldes langfristig erhalten und nutzen läßt, war dieser Tage das Thema eines Symposions in Göttingen. Chinesische Fachleute trafen sich dort mit deutschen Forst- und Agrarwissenschaftlern, um die Grundlagen für eine enge Zusammenarbeit auszuloten.

Chinas Milliardenvolk lebt immer noch vor allem von der Natur. Doch die Ausbeutung der Wälder könnte bald schon deren Ruin bedeuten. In Göttingen haben chinesische und deutsche Forscher nach Lösungen gesucht.

Nachhaltige Forstwirtschaft hat in China noch keine lange Tradition. Vielerorts wurden selbst steile Berghänge großflächig abgeholzt. Die wenigen Wälder, die nahezu unberührt blieben, stehen mittlerweile jedoch unter Schutz. Künftig sollen Plantagen einen Großteil des Holzbedarfs decken. Zugleich soll das ehrgeizige Aufforstungsprogramm die Bodenerosion beenden und den Wasserhaushalt verbessern. Meist sind die Aufforstungsflächen allerdings Monokulturen. Mal wachsen dort chinesische Kiefern, Lärchen oder Pappeln, mal australische Eukalyptusbäume. Etwas mehr Abwechslung, so räumte Lu Yuanchang von der Chinesischen Akademie für Forstwirtschaft in Peking ein, könnte nicht schaden. Schließlich steht eine reiche Palette heimischer Baumarten zur Auswahl. Dabei hat Lu Yuanchang nicht nur die Holzproduktion im Blick. Die chinesische Eßkastanie (Castanopsis hysterix) etwa trägt wie ihr europäisches Pendant auch nahrhafte Früchte.

Gräser der Bambusfamilie können ebenfalls zu einer attraktiven Einnahmequelle werden. Wie Lou Yiping vom Internationalen Netzwerk für Bambus und Rattan in Peking erläuterte, läßt sich aus den oft baumlangen Bambushalmen fast alles herstellen, was üblicherweise aus Holz gefertigt wird: Dachbalken, Fußböden und Möbel ebenso wie Papier oder Zellulosefasern für Kleiderstoffe. Darüber hinaus liefern manche Bambusarten eßbare Sprosse, die nicht nur als Gemüse taugen, sondern sich auch zu Bier oder Softdrinks verarbeiten lassen. Mit Bambus, ob wildwachsend oder angepflanzt, läßt sich fernab der großen Städte Geld verdienen. Ganz im Sinne des neuen Fünfjahresplans, nach dem nun endlich auch die ländlichen Regionen an Chinas wirtschaftlichem Aufschwung teilhaben sollen.

Gezielt gepflanzt, kann Bambus mit seinem weitverzweigten Wurzelwerk die Erosion eindämmen. Daß die Bewirtschaftung solcher Plantagen mancherorts zunehmend industrialisiert wird, sieht Lou Yiping jedoch kritisch. Nicht nur, weil großflächige Monokulturen oft mit aufwendiger Bewässerung und einem großzügigen Gebrauch von Düngemitteln und Pestiziden einhergehen. Wo Maschinen ganze Arbeit leisten, verliert die lokale Bevölkerung Arbeitsplätze und Einkommen.

Mühsame Handarbeit bleibt indessen das Sammeln von Speisepilzen, zumindest dann, wenn es sich um sogenannte Mykorrhizapilze handelt. Da diese in Gemeinschaft mit Baumwurzeln leben, lassen sie sich nicht auf Holz oder Strohballen heranziehen. Zu dieser Kategorie gehören zum Beispiel Steinpilz und Pfifferling, aber auch die begehrten Matsutake-Pilze. In den Bergwäldern im südwestlichen China scheinen Matsutake-Pilze besonders gut zu gedeihen. Chinesen finden zwar nach wie vor wenig Geschmack an ihnen. Doch der Export von Matsutake ist zu einem lukrativen Geschäft geworden. Im Nordwesten der Provinz Yunnan, so berichtete Xuefei Yang vom Botanischen Institut in Kunming, schwärmt jung und alt gerne zum Pilzesammeln in die Berge aus.

Nach dem Washingtoner Artenschutz-Übereinkommen gelten für Matsutake-Pilze zwar Handelsbeschränkungen. Aber die jeweiligen Quoten werden so willkürlich festgelegt, daß sie den schwunghaften Handel nicht bremsen. Im Jahre 2005 exportierte Yunnan 1426 Tonnen Matsutake, hauptsächlich nach Japan. Ob die Pilzbestände bereits Schaden genommen haben, ist schwer abzuschätzen. Denn wie bei solchen Gewächsen üblich, sprießen die Fruchtkörper je nach Witterung in manchen Jahren zahlreich aus dem Waldboden, in anderen spärlich. Xuefei Yang plädierte dafür, die Matsutake-Pilze durch Einschränkungen, die auch im Interesse der Dorfgemeinschaften liegen, rechtzeitig vor Raubbau zu schützen.

Lohnen würde es sich schon, wenn man die jungen Pilze schonte. Nicht bloß, weil ausgewachsene Exemplare mehr Gewicht auf die Waage bringen. Mit solcher Ware lassen sich auch die höchsten Preise pro Kilogramm erzielen. Überreife, geschmacklich minderwertige Pilze wiederum stehenzulassen, damit sie ihre Sporen ausstreuen können, wäre kein allzu großes Opfer. Ein Kilogramm Matsutake-Pilze bester Qualität kostet im internationalen Handel bis zu achtzig Dollar. Damit die Pilzesammler davon einen fairen Anteil erhalten, benötigen sie entsprechende Informationen, was aber dank moderner Telekommunikation auch im ländlichen Yunnan zunehmend einfacher wird.

Weite Teile des Hengduan-Gebirges im Nordwesten sind freilich noch immer schwer zugänglich. Mit rund neuntausend verschiedenartigen Farnen und Blütenpflanzen zählt diese Region zu den „Hotspots" biologischer Vielfalt. Daß die vermutlich nicht minder abwechslungsreiche Pilzflora dort noch längst nicht vollständig erforscht ist, bestätigte Lan Wang vom Botanischen Institut in Kunming. Von den gut achthundert wissenschaftlich beschriebenen Pilzarten mit großen Fruchtkörpern sind manche auch aus Nordamerika oder Europa bekannt; andere sind ausschließlich im Hengduan-Gebirge und dem angrenzenden Himalaja heimisch. In dem reichhaltigen Sortiment eßbarer Pilze hofft Lan Wang noch einige zu finden, die für überregionale Märkte taugen.

Ein Waldgebiet auch unter solchen Aspekten zu betrachten ist Christoph Kleinn von der Universität Göttingen keineswegs fremd. Seit Jahren beschäftigt sich seine Forschungsgruppe mit dem mannigfaltigen Potential von Wäldern in aller Welt. Daß sie den Wald vor lauter Bäumen nicht sehen, läßt sich solchen Forstwissenschaftlern gewiß nicht vorwerfen.

DIEMUT KLÄRNER