Management of Non-Timber Forest Products: Recent Innovations in Resource Assessment and Sustainable Harvesting

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Abstract

Increasing subsistence as well as commercial expectations from non-timber forest products necessitates more careful assessment of resource base and sustainable harvesting scheme. Forest User Groups as well as supporting organizations are facing challenges to ensure sustainable harvesting of these products, and in several instances, they are developing specific methods to cope with this. This paper reviews ANSAB and some other organizations' experiences with commercial medicinal herbs and fiber-yielding shrubs. These cases demonstrate the need for a diversity of resource assessment approaches to respond to specific plant form and product types, as well as a holistic consideration of social and ecological factors to address often ignored dimensions of sustainable harvesting. Finally, the paper identifies challenges and draws key lessons in developing sustainable harvesting system and practices that could be applicable in the context of participatory forest management.

Key words: sustainable harvesting, resource assessment, non-timber forest products, Nepal

I. INTRODUCTION

Nepal has very rich floral and faunal diversity due to its topographical, climatic and edaphic variation. The forests (29.0%), shrubland (10.6%) and grassland of Nepal form the major ecosystems (DFRS, 1999). Stainton (1972) classified 35 vegetation types, and Dobremez (1972) has further elaborated into 75 types. Most of the area containing high value NTFP lies in the hills and mountains. From these areas, about 100 NTFP are extracted for trade, and 800 more find subsistence uses as foods, spices, herbal medicines, incenses, oils, fibers and construction materials (Edwards, 1996).

Non-Timber Forest Products (NTFP) are being increasingly recognized for their crucial roles in rural livelihoods, biodiversity conservation and export earnings. In order to cater to increasing levels of subsistence as well as commercial needs of a broad range of people involved in the NTFP sector, more intensive management and extraction of NTFP has become mandatory. This necessitates more careful assessment of NTFP resource base as well as devising sustainable harvesting systems. Stakeholders have started to respond to this concern at various levels, and several initiatives to ensure sustainable management of NTFP have been started within the framework of community forestry. As the community forestry practices were focused more on mid-hills than the Terai or the High Mountains, where most of the NTFP are endemic, the question of NTFP resource assessment did not get adequate attention until very recently. Most of the operational plans (OP) for managing community forests (CF) contain management provisions for timber, fuelwood and fodder only. NTFP are generally excluded in the OP with few exceptional cases which received support from some NGO or projects interested in NTFP. FUG are not authorized for use and management of NTFP if they are not included in OP. Recently, however, with increasing awareness of the value of NTFP, the need to better assess the status of NTFP resources was realized.

Till 1990, management of community forests was guided by a single document signed by FUG and DFO, and this did not explicitly recognize the need for forest resource assessment, not to mention NTFP. As

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the problem of resource information and planning was encountered in the filed, provisions to assess forests and prepare a separate operational plan were then included in Forest Rules 1995. This marked the beginning of more systematic consideration for resource management and institutional arrangement through the provision for FUG Constitution (for management of group) and Operational Plan (for management of forests) as the two separate documents. The Directives issued by Ministry of Forest and Soil Conservation in 2000 has made it mandatory to assess the growing stock of all types of forest resources, and limit harvesting of forest products within the mean annual increment.

The paper presents some evolving methods and techniques of NTFP assessment and harvesting in community forestry in Nepal. Examples of two important groups of NTFP - medicinal and aromatic herbs (MAPs) and bark-yielding shrubs like *Edgeworthia gardeneri* (fiber used for currency-making) and *Daphne* species (fiber used in Nepali paper making) - are discussed. Upon reviewing these specific cases and experiences, an analysis is done to identify lessons and challenges relating to efficient assessment and sustainable harvesting of NTFP in Nepal.

II. RESOURCE ASSESSMENT AND HARVESTING

The fundamental questions that foresters and FUG should be able to answer while planning sustainable management of NTFP at operational level are: what is the existing growing stock and the productivity per unit of time and area? what is the quantity or amount of sustainable yield that can be prescribed for harvesting? what specific sustainable harvesting techniques in terms of seasons, methods and tools are appropriate for each of the products in question? In Nepal, very limited documented knowledge on species as well as ecosystem level is a major constraint to seek appropriate answers to these questions. In view of the limited scientific knowledge, FUGs and foresters are increasingly required to work together to generate more information on the species and often less known ecosystems that produce valuable NTFP, often using indigenous knowledge and beliefs as preliminary basis to design harvesting systems.

NTFP differ from timber products in many respects, and these differences have implications in approaches to, and methodologies for, assessment, management and monitoring of these resources. Unlike timber, NTFP such as flowers, seeds and leaves of plants are regularly produced and shaded, and there is no accumulation of products through the years. This means *yield* (periodic production) may be a more appropriate term than the *increment* for such NTFP. The sustainable harvesting is a complex issue, particularly in view of a paucity of knowledge and data on biological, ecological and economic dimensions of NTFP. Organizations and communities are pooling their scientific and indigenous knowledge in NTFP management. Some have started observing the effects of various harvesting regimes over time to suggest the best possible ways of harvesting.

NTFP include diversity of plant forms and diversity of parts used. This spectrum is further widened when we consider animal products such as honey and others. Plant forms (herbs, shrubs, trees and sometimes climbers) and parts used (whole plant, stem barks, root barks/fibers, roots, stems, flowers, leaves, fruits, seeds, cotton, exudates etc) may be combined in a two dimensional matrix to visualize the range of possible NTFP. A species in one plant form may produce one or more parts used. Any process of NTFP resource assessment and management should specially recognize the nature of plant form and product type used.

Four cases of resource assessment and sustainable harvesting of NTFP (Lokta, Argeli, and MAP) from the central and western Nepal hills are briefly presented. These cases highlight the approach, methods and techniques of NTFP assessment being adopted in Nepal.

Lokta Assessment and Harvesting in Binayak Pimidanda Community Forest, Bajhang

With a purpose of promoting biodiversity conservation through the involvement of local communities in planning, management and commercial use of forest resources, ANSAB has been providing technical assistance to Binayak FUG since 1999. The group was formed in 1995 and a patch of 25 hectares of community forest was handed over primarily for the fulfillment of timber and fuelwood needs. The participatory planning exercise facilitated by ANSAB identified Lokta plant *(Daphne* spp) as one of the

main commercial items along with 40 economic plant species. Lokta is one of the main sources of traditional Nepali handmade paper having attractive local as well as international demands. Lokta is a relatively slow growing shrub attaining a height of around 3-4 meter. The shrub regenerates both by seed and coppice.

Along with a number of enterprise, legal and social issues, a need of getting a sufficiently large size of community forest and devising a sustainable harvesting scheme that would fulfill the enterprise demand was identified. Accordingly ANSAB facilitated the group in revising the operational plan to include adequate area of forests for some gainful economic activities based on commercially potential of NTFP. As a preliminary step of community forestry process, inventory of Lokta as well as overall forest resources was done using stratified sampling procedure. The assessment process followed is summarized in Box 1 below.

Box 1. Assessment of Lokta in Binayak Community Forest, Bajhang

- *Preliminary mapping*

The community prepared a participatory resource map showing forests and its real users. Community members also demarcated the forest boundary on a topographical sheet.

- *Boundary survey and blocking*

Using topographical map sheet, forest boundary was tentatively delineated. The boundary was verified with a compass and tape survey. The community forest area was calculated from the map (912 hectares), and was divided into seven blocks, based on the existing natural boundaries and forest types.

- *Sampling and measurement*

Using a stratified random sampling method, the group completed a participatory inventory of the forest tree species and NTFP in the forest. Several strata were made based on types of forest. The sampling intensity was around 1% and 136 plots were observed. Twenty major tree species and twenty NTFP species were recorded. Only seven tree species and Lokta were inventoried in greater detail. Stock of Lokta was recorded for predetermined diameter classes (below 3 cm; 3 to 6 cm; 6 to 9 cm) to identify sustainable harvesting levels.

- *Estimation of sustainable harvest levels*

Using the data from the inventory and available secondary sources (on growth rate, stem diameter and bark yield relations etc.), sustainable yield was prescribed for five years. Every year the FUG can obtain approximately 20,000 kg of Lokta bark that produces 7200 kg of hand made paper. Sampling error can be expected but experiences afterwards showed that the estimates provide a fairly accurate basis to judge the potential of Lokta supply, upon which enterprise decisions are made.

- *Incorporation of NTFP provisions in OP*

The information was used to prescribe harvesting system for timber as well as NTFP used in subsistence and/or income generating activities. The plan includes a separate section on the harvesting of NTFP, particularly Lokta. The 5-year operational plan describes the forest management and harvesting activities.

The group applied relatively a quick, participatory yet scientific assessment of resources and expanded community forest area to make a total of 912 ha from an initial area of 25 ha. The sustainable harvesting system mentioned in the OP and implemented by the group supports the optimum raw material need of the enterprise the same group has established.

Argeli Assessment and Harvesting by Bhitteripakha Community Forests, Dolakha

Another example of NTFP assessment and operational plan revision under the technical assistance of ANSAB is from Dolakha district in central Nepal. Here the main commercial NTFP focused for this purpose was Argeli (*Edgeworthia gardeneri*), which is a fast growing shrub with a unique triangular branching pattern. Whiteskin is extracted from steamed stem barks and exported to Japan, where it is converted to a high quality paper that is also used for currency making.

Although the forest was handed over earlier in 1995, the stock assessment and management prescriptions for Argeli were not included in the OP. The FUG showed interests in initiating commercial activities based on this plant, and looking at the market prospects, established a processing enterprise with support from ANSAB. The FUG needed to identify annual sustainable harvest levels for running the enterprise. Accordingly, in early 2000, a detailed assessment was done to estimate the stock and yield of this plant resource in a participatory way.

Argeli habitat was not uniform throughout the forest, and therefore habitat mapping was done to determine the sampling frame. From this, an estimation of number of clumps as well as stems was made, and assuming 30% mortality from one class to another, population was projected for 10 years to estimate sustainable yield.

Box 2. Argeli Assessment in Dolakha

- *Preliminary mapping*

A participatory map of the forest was prepared showing different forest types and conditions, indicating the distribution of Argeli.

- *Habitat mapping and area calculation*

Argali habitat was delineated in the forest map by foresters and villagers. Through a transect walk, three density classes were laid qualitatively in the habitat map.

- *Determining diameter and clump size distribution*

Proportions of stems of different diameter classes were estimated through a sample of 1000 stems in 27 clumps of different sizes. The girth classes used for this purpose were : <2cm, 2-4cm, 4-6cm, 6-8cm and >8cm. These data were used to determine diameter distribution curve. The clump size distribution was also assessed to determine a suitable clump size classification for the sample inventory. Four classes of clump size were determined keeping the method simple as well as fairly accurate: small (<15), medium (15-30), large (30-45) and very large (>45).

- *Sampling and measurement of clumps*

Taking a sampling intensity of 1%, the sampled plots (plot size: 400m2) were allocated proportionately to the three strata delineated on the stocking density map. Only the number of clumps (and not the number of stems) in each size class was recorded.

- *Estimation of total clumps (by size class) and stems (by diameter class)*

The data from the sample inventory were used to estimate total number of clumps by clump-size class for the entire habitat area. Similarly, the diameter distribution curve and the estimated number of clumps were the basis of estimating the total number of stems by diameter class.

- *Projection of population*

Assuming 30% mortality and 8 cm girth as the minimum size for the harvest, Argeli population was projected for ten years using spreadsheet analysis.

- *Estimation of sustainable yield*

Stems greater than 8 cm in girth were estimated using the projected population. The output table gives number of stems that can be harvested and the quantity of whiteskin produced annually. The participatory wisdom determined that the cutting would be controlled by size and not by rotational area.

- *Prescribed harvesting techniques*

Stems less than 1.5 m in length, even if greater than 8 cm in girth, will not be used for processing but may be used for preparing new seedlings through cutting. A sharp cutting device is prescribed so that no bark is dislodged below the cutting portion. The season prescribed for harvesting is December – February.

The green stems of Argeli above 1.2 m in length or greater than 1.8 cm in diameter are steamed to extract whiteskin. Whitskin is a function of green stem weights, so the inventory focused on estimating number of stems of harvestable size (8 cm or larger in girth) that can be sustainably harvested every year.

Several issues relating to sustainable harvesting of this plant are still prevalent. The population distribution is patchy and highly variable. The issues that need further study include cutting impact on regeneration and coppicing ability, rate of growth, optimal percentage of cutting in a clump, differences in population distribution patterns and its causes. These questions will guide future learning of FUG as well as supporting organizations.

NTFP Assessment and Management in Community Forests of Dandapakhar Area, Sindhupalchok

Still another interesting example of NTFP resource assessment and management is from a network of 25 FUG of Sindhupalchok District in Central Nepal. Under the technical assistance of Nepal Agro-Forestry Foundation (NAF) and Nepal Australia Community Resource Management Project (NACRMP), the network mobilized individual FUGs for the revision of operational plans to incorporate NTFP.

More than 25 CFs are already handed over to the FUGs in the area. Various NTFP are found and traded from this area. Major NTFP include- MAPs (such as *Swertia*, , *Gultheria, Berginia*), fiber-yielding shrubs (such as *Edgeworthia, Daphne*), and others (such as *Rubia and Lycopodium*). Before the revision of operational plans, most of these NTFP were over harvested in the community forests. The NTFP harvesting and management provisions were not mentioned in the operational plans. At that time, NTFP were neglected and the information on stock, yield and appropriate harvesting practices was lacking.

To overcome these problems, some FUGs have started to assess the forest resources and incorporate NTFP in their CF operational plans. In addition to this, these FUGs have formed a cooperative to tackle the collection and marketing problems.

A resource assessment exercise done in Bolde FUGs shows that the available annual harvestable amount of different NTFP is about 5000 kg.

NTFP Assessment and Revision of FUG Operational Plans at Dandapakhar, Sindhupalchowk

- Listing the NTFP available in the community forest
- Prioritization of these NTFP on market potential, abundance and policy factors
- Habitat mapping
- Collection of information from collectors and traders
- Sampling and measurement: This was done in forest taking 1% intensity and different plot sizes (25 m^2 for herbs, 100 m^2 for shrubs, climbers and trees) to count the number of plants available per hectare.
- Estimation of relationships through destructive sampling: Relationship between number of plants and quantity of products for each species was developed to quantify the amount through destructive sampling methods.

Incorporating sustainable harvesting provisions: Using the information generated through resource assessment, Bolde FUG and others affiliated with the network have revised their operational plans incorporating provisions for season, amount and methods of NTFP collection.

The revised operational plans contain adequate details of NTFP stocking and management prescriptions. In view of the potential of NTFP cultivation and management in this area, the network (in a form of cooperative) established an action research nursery three years back. The main objective of the nursery is to carry out domestication trials of important wild NTFP species to assess the adaptiveness and productivity in private farming land. After getting good results in the nursery, now they have established experimental plots for two major traded species in the private land to evaluate compatibility with agricultural crops.

Developing Sustainable Harvesting System for Jatamasi, Humla

ANSAB implemented a Biodiversity Conservation Network funded project that had a goal of conserving threatened Himalayan biodiversity through creating economic incentives to local people by making

sustainable use of medicinal and aromatic plants. Although people in the region had a long experience of collecting plant products for local as well as commercial use, the project did not have any convincing basis that the indigenous harvesting practices were optimal in terms of productivity and conservation impact. In order to address this challenge, the project designed a plan to undertake participatory action research to identify best harvest intervals and collection methods for four commercially harvested medicinal plants, including Jatamansi.

Jatamansi is an erect perennial rhizomatous herb growing 10-60cm long. It is used for subsistence purpose as medicines as well as commercial purpose for medicines and perfumery.

While a five year monitoring plan was prepared to assess the outcomes of various harvest intervals in two main types of habitats, the project team developed a rapid yet scientific methods to seek answers to the question, using indigenous knowledge and experiences of the local people engaged in resource management. For details regarding the methodology, see ANSAB (1999).

Jatamasi harvesting was started in the project sites before 1993. For the purpose of quick assessment, these sites were located with the help of collectors. Patches harvested in 1993/94, 1994/95, 1995/96 were discernible, and two more patches were identified for subsequent harvest treatments. By applying same level of harvesting, the five patches were harvested for five, four, three, two and one year rotation. Yields of fresh Jatamasi roots and rhizomes from these harvests were recorded.

The results were analyzed to assess the effect of harvest intervals across the two habitat types. It was known from the analysis that till four years of rotation, the yield increased significantly. In the fifth year, the yield increased but not significantly. Based on this, a harvest interval of five years was recommended as in the fifth year there is some net increase in yields at some negligible additional collection efforts.

In addition to this rapid assessment, five year monitoring studies recommended optimal harvesting season, harvest interval, percentage of plants not harvested, and the harvesting method for rhizomes, roots and leaves of Jatamasi rhizomes, Kutki *(Picrorhiza scrophulariiflora*) rhizomes and roots, and Sunpati (*Rhododendron* anthopogan) leaves.

The time of year the product is harvested also impacts on its ability to regenerate, but as Box 1 (the case of Jatamansi) highlights, this is much more difficult (though not impossible) for the collectors to change.

Experience with Jatamasi and other high value NTFP in Humla has indicated new dimensions of sustainability and management of medicinal plants. In addition to quantity of harvest, methods, seasons and techniques of harvesting were found equally important.

Box 3: Reconciling Social Factors with Ecological Factors: When is Best to Harvest Jatamansi?

Jatamansi is dormant from late Autumn until early Summer. During the Winter, plants are covered in snow, making harvest impractical. The plants sprout in early Summer, after the Winter snow melts, and grow until Autumn. The social and ecological effects of Autumn (mid-October to mid-December) versus Summer (mid-May to mid-July) harvesting were examined to determine when it is best to harvest Jatamansi. Both seasons are similar in terms of spare time available to the collectors.
From the collectors' point of view, Summer is comfortable weather for harvesting work. Whole roots can be pulled up easily from the moist and less compact soil during Summer. During Autumn, the soil is very hard due to freezing and it is difficult to pull out the roots. The collection of Jatamansi is a hardship on collectors during cold weather. There is also a high risk that collectors may have to return empty handed if snow falls early.

As it is easy to pull or dig up the plants during Summer, collectors have a tendency to harvest a higher percentage of plants at this time. Loosening of soil surface and the trampling damage by the grazing animals after Summer harvests also accelerate soil erosion during the rainy season. Harvesting in Summer is also detrimental to the remaining plants and propagules as most of them decay after the harvest during the rainy season. Finally when Jatamansi is harvested during the beginning of its growing season (Summer), its annual yield is reduced.

The quality of Jatamansi harvested in Autumn was found to be better than that harvested in Summer. The Jatamansi harvested in Autumn has low moisture content, is less likely to be damaged by fungi and other factors, and produces heavier high quality essential oils. The Jatamansi harvested in Summer contains high moisture, is likely to be damaged by fungi, and produces poor quality essential oils. Therefore, Autumn is recommended as a more appropriate season of harvesting from the biological point of view.

Appreciating the tradeoffs that must be made between the social and ecological factors, the method of harvesting and other management considerations (e.g. grazing practices, burning, etc.) is important when devising management plans.

Source: Subedi and Koonz 1999

III. CHALLENGES AND LESSONS LEARNED

The four cases discussed above are among a few innovations in the field of NTFP resource assessment in Nepal. There are other similar efforts being undertaken for various plant species and products by other researchers and institutions (Bhattarai and Acharya 1996, Wong et al 2001, Ddhungana and K C 1995, CECI 1997, CECI 2002, NSCFP 2001). A review of some of these innovations also indicate that there are certian generic challenges that need be addressed to advance our understanding this field, and at present, there is already some amount of consensus as regards how they can be addressed. The challenges and lessons are outlined below:

Challenges

While there is a growing recognition of importance of more accurate assessment and sustainable use of non-timber forest products from both governmental and other institutions, a number of challenges must be dealt with:

- Diversity of product and life forms of NTFP species makes assessment complex, and requires special considerations in designing site and product specific methods.
- There is a need to take advantage of knowledge regarding harvesting, assessment and management of NTFP that is fragmented across organizations and people.
- Only limited information is available at species level for most of the commercial NTFP and even more limited knowledge exists at ecosystem level.
- Many of the traditional harvesting techniques are developed in the context of open access regime and need to be reassessed before they are adopted in the changing community forest management scenario.

- A care has to be taken to check the tendency of commercial species being taken as the main basis for forest management leading to more reductionist approach (mono-cropping, species focused management) to forest management rather than ecosystem approach.
- Technical capacity of both facilitating organizations and FUG in designing and implementing assessment and monitoring of all forest resources including NTFP as an integral part of forest management needs to be strengthened and improved.

Lessons Learned

- Unlike timber, NTFP are distributed unevenly depending on the ecological requirements and they are not generally uniform through out the forest. For assessment, harvesting and management, these variations have to be kept in mind.
- Stratification by stand types of major NTFP before designing sample inventory for resource assessment can help to increase the degree of precision with low sampling intensity.
- Indigenous knowledge with local communities prevails in many cases, particularly with respect to biology, phenology, distribution, uses and several other aspects. These can be combined with scientific techniques to design assessment plan, experimental research, and preliminary harvesting systems.
- Use of basic topographical maps for participatory as well as scientific survey is useful.
- Sustainable harvesting has many dimensions: amount, season, and techniques of harvest as well as percent of plants left intact.
- In many cases, social and ecological processes are in conflicts with regard to harvesting. A participatory trade off analysis is needed to reconcile these diverging factors.
- A range of techniques and methods in this have been evolving but a site and product specific approach that takes care of both ecological and social factors still needs to be developed.

IV. CONCLUSION

A wide range of assessment techniques and harvesting practices has to be considered for NTFP to address the enormous variation in terms of plant form, life cycle and product type. Methods of assessment and sustainable harvesting of NTFP have to be site and product specific to address both ecological and social considerations. Understanding ecological regularities of species as well as ecosystems can facilitate speedy inventory of NTFP. Community's interest, capacity and need must be considered in designing management and use plan.

Sustainable NTFP harvesting is a complex issue requiring analysis of multiple dimensions, and matching of social and ecological aspects. Indigenous knowledge is often overwhelming and may provide a basis of scientific inquiry as well as provisional harvesting plan. But the indigenous knowledge may not be enough particularly in a situation where commercial harvesting is a recent phenomenon. Systematic inquiry into sustainability issues can be done through participatory action research over a period of time to resolve the conflicts between social and ecological systems for achieving sustainable and efficient management of high value NTFP in Nepal.

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