The Contribution of Non-Timber Forest Products to Mid-Hill Farming Systems of the Shivapuri Massif, Nepal

Forrest Brandt[1*]

ABSTRACT: This study investigated the role of Non-Timber Forest Products (NTFPs) in the farming systems of two villages on the Shivapuri massif, Nepal. The objectives were: 1) to record how NTFPs contribute to farming systems, 2) to determine gender of primary collectors, and 3) to investigate the role of NTFPs in household food security. Farm types were determined through structured interviews of a stratified snowball sample of households. Semi-structured open-ended questions were asked of key informants. Local experts assisted in collecting herbarium specimens on transect walks. Participatory Rapid Appraisal activities were implemented to gather community level information. The results reveal that ninety-eight NTFP species were identified from the two studied sites, but play minor roles in the farming systems and household food security. Fodder and firewood as a NTFP resource, however, is vital to the functioning of farming systems and food security and are collected primarily by female member of the household. Knowledge of value-adding processes for NTFP species exists, but investment capital, technical assistance and market access for these income-generating activities to be viable is lacking.
Keywords: Non-Timber Forest Products, community forests, farming systems, food security, Participatory Rapid Appraisal

Introduction

For many rural communities in Nepal Non-Timber Forest Products (NTFPs) constitute a critical component of food security and are important for income generation, especially for women (Garrity et al., 2006). There are an estimated 2000 potentially useful plant species in Nepal spread across all ecological regions (Ghimire, 2008). The study area of Shivapuri Nagarjun National Park (ShNP) begins 12 km outside of the capital Kathmandu; comprises an area of 159 km2; and varies from 1000-2720 m.a.s.l., containing a transition zone between tropical to temperate climate zones. ShNP contains 2122 plant species (Bhuju, 2007), which contribute to its reputation as biodiversity hotspot and provide a multitude of NTFP resources. However, in the study area there is a lack of understanding of the roles and functions NTFPs play in household food security, and knowledge of value adding activities that can generate income.

The aim of this study was to investigate and document the traditional knowledge, utilization practices and benefits of plant biodiversity in selected communities with access to the ShNP ecosystems. Based on a review of literature and preliminary field data the follow hypotheses were formulated: 1) NTFPs do play an important role in the farming systems of the study area, 2) Harvesting of NTFPs is an activity mainly carried out by women, and has an important role in their contribution to household incomes and food security, and 3) Communities lack value adding entrepreneurial activities that could increase their income from NTFPs.

[1] Master Degree candidate, SAIWAM program, Faculty of Agriculture, Chiang Mai University, Chiang Mai, 50200, Thailand.

* Corresponding author: forrestbrandt@yahoo.com

Materials and Methods

The research was conducted over a period of ten days in each site from October to November 2012, with follow-up visits in March 2013. The criteria for each site were as follows: Site 1 is on the southern face of ShNP; it was a peri-urban community with relatively easy access to major markets and the city. Site 2, on the Northern face of ShNP, is a rural community with no direct access to roadways and major markets. Both sites had a small number of households (<50), access to both ShNP and a registered community forest and the presence of a Community Forest User Groups.

A stratified snowball sample of 46 households, 23 in each community, was used to determine resource utilization practices and economic status. The criteria set by McConnell and Dillon (1997) was utilized to determine farm types of the community household sample in order investigate any correlation between farm types and NTFP usage. In Site 1, five non-farm, 16 small subsistence-oriented farms (Farm Type 1), one semi-subsistence partially commercial farm (Farm Type 2), and one small independent commercial family farm (Farm Type 3) farm households were interviewed. In Site 2, 20 Type 1 and three Type 2 farm households were interviewed. **Table 1** shows the differences between the two sites.

Key informants were identified through household surveys and were interviewed with a mix of structured and open-ended questions. Additionally, key informants in both research sites led the researcher on guided land-use transect walks of the community forests, ShNP, as well as household farmlands to show the location and distribution of NTFP resources. NTFP species were collected and the local name and uses were recorded. Referencing the given local name in field-guide identified the scientific name of collected NTFP specimens was identified. Species that were unidentifiable in this method were brought to Tribhuvan University Herbarium and the National Herbarium for identification. Participatory Rapid Appraisal (PRA) tools; seasonal calendars and village resource mapping were employed to gather qualitative information regarding their utilization on the community level.

Table 1 Comparison of Sites 1 and 2

Items	Site 1	Site 2
District	Kathmandu	Nuwakot
Population of VDC (2011 Nepal Census)	15,421	1,582
No. of HH in Study Site	44	44
Elevation of Study Site	1700	1100-1200
Direct road to Kathmandu	Yes	No
Market access	Yes	No
Average reported income over a 12-month period.	US$ 728	US$ 651
% of HH engaged in agriculture	88.6%	100%
Farm types	1,2,3	1, 2
Average land holding size	0.25 ha	0.46 ha
% of HH that grow own grain	78%	96%
% of HH that keep livestock	60%	100%
Months of food from own production	4	7
Yearly average spent on purchased food	US$ 705	US$ 312
Richness of NTFP species	50	68
Main NTFP resource	firewood, fodder	firewood, fodder
HH using Firewood as sole fuel source	52%	100%
Gender of primary NTFP collectors	61% female. 13% male 29% both	43 % female, 17% male 39% both

Results and Discussion

Local Knowledge of Biological Resources

A total of 98 species from 59 families were identified. Fifty species were identified in Site 1 and 65 species were identified in Site 2; with 17 of the same species identified in both communities. Seventy-three species have a single function, while 25 are multifunctional.

There were 36 food species; 27 medicinal species; 12 food/medicinal species; 4 food/craft species; 3 cultural species, 3 food/fodder and 3 veterinary species; 2 craft species, 2 fodder, 2 medicinal/craft species; 1 craft/fodder species, 1 food/firewood species, 1 medicinal/cultural species and 1 medicinal/veterinary species.

Despite an abundance of plant biological resources in the area and knowledge of their uses by a few key knowledge holders, widespread use or commercialization of a diverse range of NTFPs is not common in either site. Farmers choose to invest more time in running agricultural production systems, which is their most important source of food and income. NTFPs do, however, play key

indirect roles in the subsistence and semi-subsistence level farming systems in both sites. Fuel-wood and fodder are both key farm resources gathered from the surrounding ecosystems and constitute a significant time investment from members of households.Previous research by Thapa (1989) and Poudyal (1997) developed the system conceptualization of the mid-hill farming systems of Nepal. The system conceptualization in **Figure 1** builds upon this model by illustrating the interrelationships between areas where NTFPs are gathered (vacant or fallow land, ShNP, and community forests) and the various components of the farming systems. Forests, both protected and community managed, provide invaluable ecosystem services such as water retention and soil stabilization.

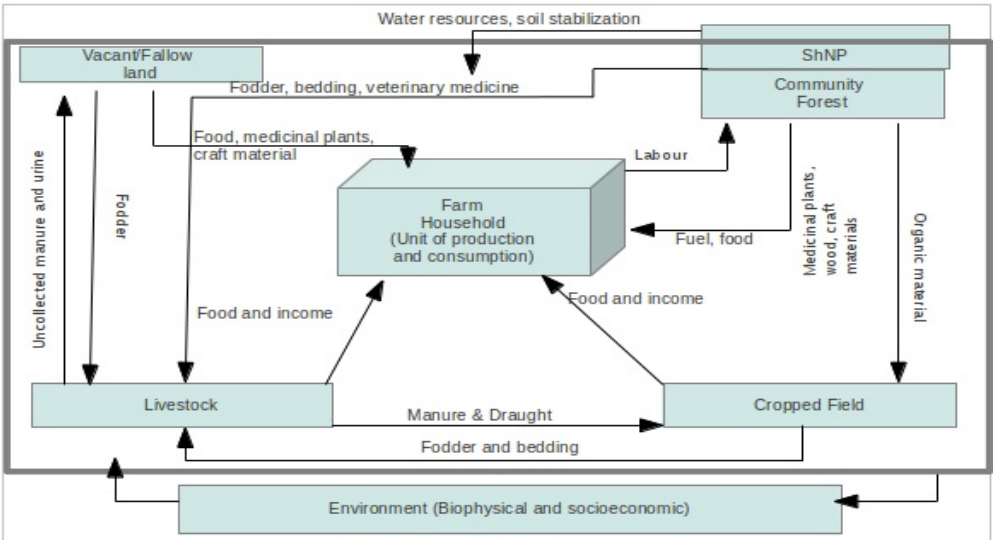

Figure 1 Role of NTFPs in Farming Systems of the Study Sites.

Firewood

Firewood plays an important role in food security of the communities: 76% (35) of households use firewood as their sole source of cooking fuel, and 22% (10) of households use cooking gas and firewood. Only one household, the only Type 3 farm, does not use firewood at all. As the average household income is US$ 728 and US$ 651 per year in Site 1 and 2, respectively, at US$ 18 per year, cooking gas is cost prohibitive for many households. Firewood collection only requires a time investment; and even generates income if surplus is sold.

In Site 1, firewood is collected from both the CF and ShNP, although collection from the park is illegal. Through household interviews it was determined that household members spend as much as eight hours a day collecting firewood from ShNP. Female household members are primarily responsible for collection, although elderly males often contribute.

In Site 2, household members primarily collect firewood from their own land. Respondents expressed that there was little need to collect firewood from ShNP or the CF. The households that collected from the CF did so because they run a metal smith enterprise or are immediately adjacent to the CF. The GDCF president explained that the CFUG generates revenue by selling firewood to communities and individual households that are not members of the CFUG.

The frequency of collection depends on seasonality. During planting, harvesting, and rainy seasons, collection of firewood is less frequent as more time is invested in agricultural production. Between cropping seasons respondents reported daily collection to create a stockpile of firewood

While farmers collect any type of dry woody material, a few key species have been identified as favorable sources of firewood. The fast growing *Alnus nepalis* D. Don. (Betulaceae) is naturally occurring in this region of Nepal, but the CFUG in Site 1 has specifically chosen to manage it to the extent that it could be considered an agro-forestry species in their community forest. *Shorea robusta* Roth (Dipterocarpaceae), *Castanopsis tribuloides* (Sm.) A. DC. (Fagaceae), and *Betula utilis* D. Don. (Betulaceae) are desirable species because of perceived rapid growth rates and relative abundance in the surrounding ecosystems.

Fodder and Veterinary Resources

Livestock is kept by 80% of households in the combined study sites. The various land use types in the area provide much of the fodder and feed for livestock. On-farm sources of fodder consist of agricultural byproducts, such as rice straw, legume crop residue and maize, which are grown primarily for livestock feed. Farmers gather grasses and other palatable plants on a daily basis from their own land, vacant land, the community forest, and in the case of Site 1, from ShNP. Key fodder species include *Euphorbia sp.* (Euphorbiaceae), *Artemisia vulgaris* L. (Asteraceae), *Leucaena leucocephala* (Lam.) de Wit. (Fabaceae), *Eulaliopsis binata* (Retz.) C.E. Hubb. (Poaceae).

In Site 1 there is little regularity in the frequency of fodder collection as farmers only keep goats, which are more apt at grazing on limited and sloping land. With an average of three goats per livestock owning household, respondents stated that they gather about 40 kg of fodder every three days from the surrounding areas.

Farmers in Site 2 pose a diverse range of animals. Oxen, buffalo, and cows in addition to goats, are kept. These large ruminants require more fodder and are not as suited for grazing on sloped terrain. Farmers in Site 2 require an average of 40 kg of fodder per day.

Access to professional veterinarians and veterinary pharmaceutical medicine is extremely limited and cost prohibitive; therefore knowledge systems around beneficial herbs has been developed and maintained. *Lobelia pyramidalis* Wall. (Campanulaceae) is used to treat festering infections in livestock. *Curcuma longa* L. (Zingiberceae) is given to livestock for its anti-parasitic properties and *Cautleya spicata* (Sm.) Baker (Zingiberceae) is used as a livestock diuretic and for its cooling properties.

Gender of Firewood and Fodder Collectors

In Site 1, 61% of households reported that women and female children were the primary

collectors of firewood and fodder. In 26% of households, males collect the same resources, while in 13%, both males and females collect. In Site 2, 43% female household members are the primary collectors. In 39% of households both male and female members collect these resources, and males family members are the primary collectors in just 17% of households.

In Site 1, females play a larger role as a high percentage of males seek off-farm work leaving female household members to manage farm resources. In Site 2, much of the firewood and fodder resources are collected from their own lands. The better availability of firewood allows for less gender stratification in this task, as males household members can gather resources in close proximity to their fields.

Economic Potential of Specific NTFP Species

By cross-referencing NTFP price lists published by Asian Network for Sustainable Agriculture and Bioresources (ANSAB) with the species that were identified in the study sites, nine species were found to have significant market potential for the respective communities.

Economical species identified in Site 1 were *Acorus calamus* L. (Acoraceae) US$ 1.30-$1.40 per kg, *Asparagus racemosus* Willd. (Asparagaceae) US$ 4.35-$4.70, and *Zanthoxylum armathum* DC. (Rutaceae) US$ 0.48 (ANSAB, 2013a, 2013b). With easy access to urban markets, these species could significantly add to the income of households in this community.

In Site 2, farmers use seven species for their own consumption. *Amomum costatum* Benth. & Hook.f., (Zingiberaceae) US$ 12.35 per kg, and is already semi-cultivated as an agro-forestry crop. Farmers are aware of the medicinal benefits and market value of the fruits from the tree species *Phyllanthus emblica* L. (Phyllanthaceae), *Terminalia bellirica* (Gaertn.) Roxb. (Combretaceae), and *Terminalia chebula* Retz. (Combretaceae), but are hesitant to invest the time or resources for collection or cultivation. Species such as *Zanthoxylum armathum* DC. (Rutaceae), *Saxifraga ligulata* Wall. (Saxifragaceae), and *Swertia angustifolia* Ham. ex D. Don (Gentianaceae) and their relatively high prices, $US 0.47, $1.88, and $8.5 per kg. respectively, may offer the best return on investment for species in this area.

There are several limiting factors that communities are presented with if they are to create entrepreneurial activities from the aforementioned species. Firstly, while some farmers are knowledgeable of the use of a specific species, there is little awareness of the market value. Additionally, community members lack both the technical ability and investment capital to develop certain enterprises. The community forest president of Aitabar Community Forest (ACF) expressed the desire to make bio-char briquettes from *Ageratina adenophora* (Spreng.) King & H.Rob. (Asteraceae), but did not know where to obtain training or capital for such as enterprise. Lastly, as subsistence agriculture persists in both locations, farmers do not wish to put their food security and cash income at risk by deviating from known agricultural practices.

Conclusion and Suggestions

While there is a wealth of NTFP resources available in the ecosystems surrounding the re-

search sites in Nepal, farmers prefer to invest time in known agricultural activities that meet their basic needs, staple cultivation, home garden maintenance and animal keeping rather than investing time in collecting and commercializing NTFP. By the amount of species identified as having food value, NTFPs could be used to tighten food security as many of the identified species, such as *Phyllanthus emblica* L. (Euphorbiaceae) or *Asparagus racenosus* Willd. (Liliaceae), are high in important nutrients. Cultivated vegetables, however, have more appeal to farmers. In addition to food, they also present more certainty in their economic returns when market opportunities are available. There are, nonetheless, two specific NTFP resources that are vital for the functioning of farming systems and food security: firewood and fodder. Harvesting of these NTFPs is an activity mainly carried out by women. Often being the only source of cooking fuel, firewood, has a direct role in the food security of households. Many of the community forest systems in place have been developed to ensure a sustainable supply of firewood. Additionally, livestock and their milk are important sources of protein and their farm inputs such as manure and draught labor are key to the production of crops. Therefore it can be stated that providing an adequate diet rich in nutritious fodder is key to food security and the livelihoods of many households.

Communities lack value adding entrepreneurial activities that could increase their income from NTFPs. Besides the occasional sale of firewood there is no commercialization of NTFP resources, despite there being a market demand for certain species that were identified in the surrounding ecosystems.

In Site 2 transportation to markets poses major limitations on the development of NTFP-based enterprises. Farmers expressed an interest in learning about NTFP potentials, but were aware of the limitations that the lack of infrastructure poses. Farmers in Site 2 are subsistence oriented as well and switching their focus from maintaining their current agricultural practices poses a great risk if NTFP resources do not generate enough income to make up for the loss of time spent for agriculture.

Further research should be conducted to determine the abundance of marketable NTFP species such as *Berberis asiatica* Roxb. ex. DC. (Berberidaceae), *Rubus ellipticus* Sm. (Rosaceae), *Rubus foliolosus* D. Don. (Rosaceae), *Asparagus racemosus* Willd. (Asparagaceae) and various *Mentha* (Lamiaceae) species, to determine if wild harvesting can be done in a sustainable manner. The encouragement of the NTFP sector in the Shivapuri area has the potential to create livelihood opportunities, especially for women and female youth, and to increase grassroots preservation of natural resources. Additionally, key components of the value chain would need to be identified. The amount of investment required to begin cultivation, processing, and transportation to urban markets should be subject of research if developing the NTFP sector in the Shivapuri area were to be considered. However, without access to capital and technical support from civil society as well as private and public sector actors, rural communities will miss out on opportunities to utilize their knowledge of NTFP resources for their own

development. Currently, the potential NTFPs do not provide enough incentives to farmers to make significant changes to known farming systems.

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