Improving Forest Dependent Livelihoods Through NTFPs and Home Gardens: A Case Study from Satchari National Park

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Abstract

Non-timber forest product and home gardens play crucial roles in the livelihoods of people living in most tropical countries. They also play important roles in forest conservation. This paper explores the roles NTFPs and home gardens play in improving the livelihoods of forest dependent people and forest conservation in and around a newly declared protected area, Satchari National Park. We conducted an intensive field survey from mid-February to late June, 2006. Study results suggest that 27% of households in the Satchari area receive at least some cash income from NTFPs. Moreover collection, processing and selling of NTFPs constitutes the primary occupation of 18% of these households. We also found that wealthier households with rich homegarden compositions rely less on nearby forests, than poorer households who are mostly dependent on forests to meet their subsistence needs. Based on these results and discussions with various stakeholders in the study area, we suggest that it would be useful to enrich home gardens and buffer zones with commercially important NTFPs. We conclude that a co-management approach should be introduced to reduce local dependency on Satchari National Park.

Introduction

Millions of people throughout the world make extensive use of biological products from the wild (Koziell and Saunders 2001 and Lawes et al. 2004). These items, commonly termed non-timber forest products (NTFPs), are harvested for both subsistence and commercial use, either regularly, or as a fallback during times of need. They add to peoples' livelihood security, especially for forest-dependent people (Posey 1999, Cocks and Wiersum 2003). NTFPs also create new opportunities for entrepreneurial development. The collection and processing of

NTFPs provides major employment opportunities to the poorest rural population of nearly 300,000 (Basit 1995), and contributes about Tk 1.3 billion annually to Bangladesh's national economy (GOB 1993).

The contributions of non-timber forest products have a positive impact on rural livelihoods. The fact that their use is less ecologically destructive than timber harvesting has encouraged the belief that more intensive management of forests for such products could contribute to both development and conservation objectives, and have thus led to initiatives to expand commercial use of NTFPs (Arnold and Ruiz Perez 2001). It is also widely believed that poor rural communities may be less inclined to engage in illegal logging if they are able to derive more material benefits from maintaining forests for various alternative goods and services (Oldfield 1988). Moreover, in many cases, development of non-timber forest resources has assisted stakeholders in obtaining opportunities to merge forest conservation with economic development at the community and national levels (CBD 2003).

Home gardens have a long tradition in many tropical countries. They consist of an assemblage of plants and may include trees, shrubs, vines, and herbaceous plants, growing in or adjacent to a homestead or home compound (Nair 1993). Home gardens represent a well-established traditional land-use system in Bangladesh and about eighty percent of the population lives in villages having small home gardens (Zashimuddin 2004). Such gardens play an important role in the livelihoods of rural poor, and in the rural economy of the country (Chowdhury and Mahat 1993). Moreover, trees and tree products from home gardens play an important role in household food security, as it is a sustainable source of food, fruits and vegetables. Home gardens also play a significant role in forest conservation by providing for subsistence needs of local populations, which they may otherwise have derived from the forest.

Protected areas should help to conserve biodiversity. However, in developing countries like Bangladesh, the declaration of a site as a protected area is often done without thinking about rural communities abutting forests who are traditionally dependent on their resources for subsistence and food security (Sharma et al. 2005). Thus conflicts occur between protected area managers and local forest dependent peoples who maintain their livelihoods with forest resources, particularly non-timber forest products. Our study focuses on the contribution of NTFPs and home gardens in improving rural livelihoods and forest conservation in and around the newly declared Satchari National Park.

Background

Satchari National Park (SNP) is the newest among the seventeen protected areas of Bangladesh. The word "Satchari" comes from "seven streams" (locally called 'chara') and refers to the streams that flow through the forest. The park is located in Chunarughat Upazilla of Habigonj District and is situated nearly 130 km northeast of Dhaka, and about 60 km southwest of Srimongol. The area of the park is about 243 ha and is comprised of forests of Raghunandan Hills Reserve Forests within the Satchari Range. The Raghunandan Hill Reserve borders the park on its northwestern side, while India lies to the south of the park (Fig. 1). Tea estates, coffee and rubber plantations, and rice fields abut other adjacent areas of the park.

The park originally supported a vegetation cover of mixed tropical evergreen forests. However, almost all of the original forest cover has been removed or substantially altered and turned into a secondary forest (Mollah et al. 2004). Now only 200 ha of natural forest remains, which has a higher potential for eco-tourism than the remaining secondary forest. Some areas of the park are subjected to flash floods. Soil texture of the park area is generally sandy loam to silty clay and soils are more acidic than in adjoining ecological zones. The topography is undulating with slopes and hillocks, locally called *tila*, ranging from 10 to 50 meters in elevation. A number of small, sandy-bedded streams drain the forest, all of which dry out in the winter dry season after November. The total annual average rainfall is 4162 mm. July is the wettest month, having an average of about 1250 mm of rain, while December is the driest, with no rainfall. May and October, the hottest months, have an average maximum temperature of around 32^{o}C, while January is the coldest month, when the minimum temperature drops to about 12^{o}C. The relative humidity is about 74% during December while it is over 90% during July-August (Choudhury et al. 2004).

The park is very rich in flora (about 241 species) and fauna. From various secondary sources we found that a total of 6 species of amphibians, 18 species of reptiles, 220 species of birds and 24 species of mammals (including 6 species of primates) have been recorded from this forest (Mollah et al. 2004). Moreover, it is one of the last habitats in Bangladesh for hoolock gibbons (*Bunopithecus hoolock*) and the rare Hooded Pitta (*Pitta sordida*). But in recent years, the biodiversity of the park has become highly degraded. Already a number of animals and tree species have become locally extinct, while many more are on the verge of disappearing. Overall, a large number of species are variously threatened due to habitat destruction, illegal poaching and over-exploitation.

A total of 19 villages with varying degrees of interaction with SNP have been identified. Of them, one village (Tiprapara) is located inside the park and the rest are located from 5 to 8 km away. Table 1 lists the degree of dependency the various villages have on the park. Local people have traditionally collected various resources from SNP and other adjacent reserved forests. Many households, particularly poor households from the identified villages, rely either entirely or partially on the park for collecting fuelwood, timber, and bamboo.

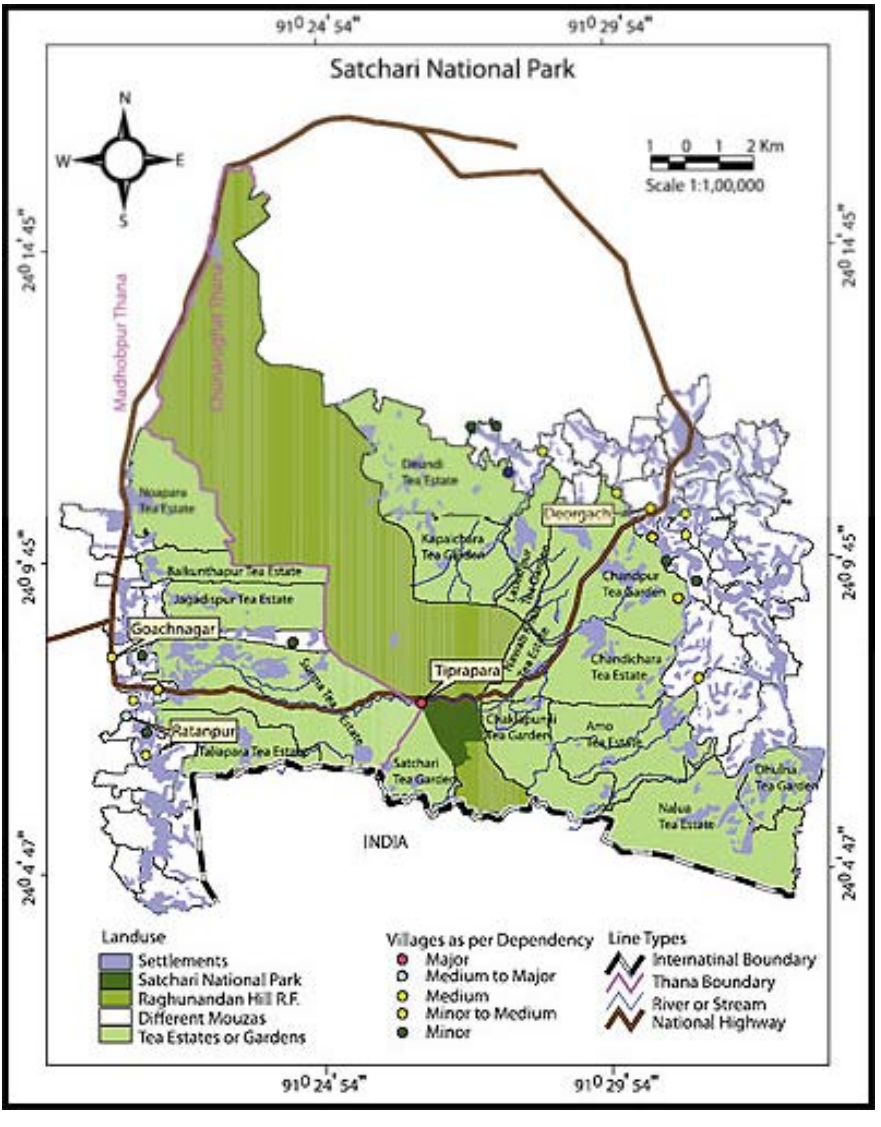

Figure 1. Map of Satchari National Park (Source: Nishorgo Support Project 2007)

Little is known about the availability and collection of NTFPs in Satchari National Park. According to Mollah *et al.* (2004) people extract about 12 different types of NTFPs from the park and adjacent forests. Fuelwood is extracted on a large scale; bamboo and building materials are extracted on a medium scale, and other resources are extracted on a minor or negligible scale. Extraction of resources from the forest is seasonally dependent. Villagers extract forest resources primarily for meeting household needs, as well as for earning additional income to support or supplement their livelihoods.

An average household owns approximately 0.10 ha, though the amount of land owned varies with the household's economic condition. Within the homesteads people usually have home gardens and plant various timber species, horticultural species and seasonal vegetables to meet their own needs and sometimes to sell for additional cash income.

Table 1: Degree of Dependency on Satchari National Park Found in Various Villages

Degree of dependency	Name of the Villages
Major	*Tiprapara*
Medium to major	Gazipur, *Ratanpur*
Medium	Kalishiri, Ghanoshyampur, Doulatkhabad, *Deorgach*
Minor to medium	Baghbari, Teliapara, *Goachnagar*, Ektiarpur, Marulla, Nayani Bongaon
Minor	Shanjanpur, Rasulpur, Promnandapur, Bhaguru, Enatbad, Holholia

Source: Mollah et al. (2004); Names of case study villages are in italics.

Study Objectives and Methodology

The aim of our study was to illustrate the role and importance of NTFPs to local people's subsistence and income and to find out the potential of NTFPs as well as home gardening in forest conservation and poverty alleviation among the people living in and around Satchari National Park.

Our study was based on a literature review and primary data collection. We reviewed reports from existing studies done by the government and various national and international non-governmental organizations (NGOs) concerning Satchari National Park and protected area management. We randomly selected one village from each of the first four forest dependency categories as identified by Mollah et al. (2004 - Table 1) including the only village inside the park - Tiprapara. We did not select any villages with only minor dependency on the park. As key

informants, we chose the residents of the villages who had a broad and in-depth knowledge about their village and its various households. We conducted focus group discussions (FGD) to construct community maps and community profiles. During field visits we walked transects in order to observe and verify the information we recorded during the community mapping exercises.

We conducted intensive household surveys in our four sample villages - Tiprapara, Ratanpur, Deorgach and Goachnagar - from mid-February to late June, 2006. We classified households within each village into three forest dependency strata or classes: "totally or most dependent", "moderately dependent", and "less dependent". To calculate a household's level of forest dependency we considered the contribution of forest to the household's annual cash income - i.e., the direct cash derived from selling of forest products, and the cash value of products they consume from forest, which they may have otherwise purchased from the market. We also considered local peoples' perceptions regarding their dependency on forest.

In Tiprapara, we took a 100% sample, as villagers are highly dependent on the park for their subsistence. In Ratanpur, Deorgach, and Goachnagar we took a 10% sample of households from each of the forest dependency classes using a stratified random sampling approach. We used a semi-structured questionnaire to collect data on each household, their relationship with the forest, resources exploited from the forest, quantity and frequency of exploitation of resources, traditional patterns of resource utilization, major threats and causes of forest destruction and each household's perception of conservation and park management, their home garden composition and its role in households food security and livelihoods. Samples of unknown or difficult to identify species were collected and verified by botanists. We also gathered additional data on the market potential of different locally available NTFPs, and their probable contribution to a household's socio-economic enrichment. Furthermore, on each topic the respondents were free to express their own views.

Results

Community livelihoods in and around Satchari National Park

Demographically, the sample households in our study area fall into four categories: forest villagers, local poor people from villages outside the forest, tea estate laborers, and auctioneers (*moholdars*). In our sample villages there are about 818 households with an average family size of around six members (Table 2). Among

818 households we interviewed about 96 households having 597 members (49% female). The primary occupation in our study area is agriculture (37%), mainly paddy cultivation, followed by NTFP extraction (19%), timber poaching (18%), day labor (15%), small business (5%), service in government agencies or NGOs (4%), and overseas employment (2%) (Fig. 2). The scenario is different in Tiprapara; here there are no agricultural lands as in other villages, and so the main income generating activities observed are day labor (38.5%) followed by extraction of NTFPs (mainly fuelwood, 32%). Forest patrolling is the main service conducted by residents of Tripura. Moreover, day laborers also collect fuelwood on their days off.

During the time of our household survey we have categorized the households into three different income classes i.e., extremely poor (monthly income below Tk. 2,000); medium to poor (income is below Tk. 7,500 but above Tk. 2,000 /month) and rich (monthly income is Tk. 7,500 or higher) by asking them two basic question, i.e., what is their monthly expenditure and monthly savings (if any). Based on this categorization, approximately 37% of the households in our sample villages fall into extremely poor group followed by medium to poor (32%) and rich (31%). Beside this, the literacy rate in the villages is about 54%, among which children who read at the primary level comprise the largest group (61 %).

Table 2: Information of Selected Villages Having Interests in Satchari National Park

Name of village	Approximate No. of HHs	Location	Union	Level of dependence	Forest practices
Tiprapara (Forest village)	18	Inside Satchari NP	Paikpara	Major	Collect fuelwood, house building materials, fruits and other NTFPs, cultivate lemon and others
Ratanpur	156	Outside Satchari NP	Sahajanpur	Medium to major	Mainly involved with illegal tree felling, and majority of HHs collects fuelwood
Deorgach	316	Outside Satchari NP, east	Deorgach	Medium	Mainly collect fuelwood, some involved with illegal tree felling
Goach Nagar	328	Outside Satchari NP, west	Sahajanpur	Minor Medium	Same as above

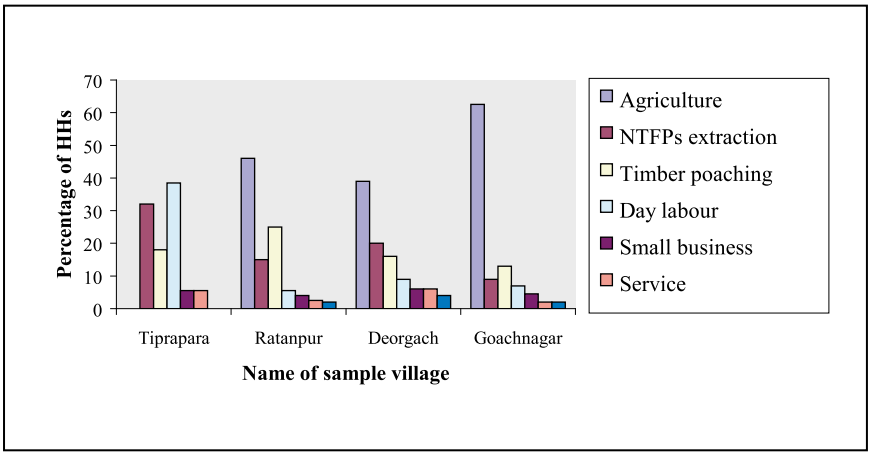

Figure 2: Households Involved in Various Livelihood Activities in and Around Satchari NP

Dependency of Households on Forest

The local inhabitants have traditionally used Satchari National Park and adjacent forest area for centuries. Our study suggests that, about 13% of households of our sampled villages are totally dependent on the forest for their livelihoods, while the others are moderately or less dependent (Fig. 3). In Satchari National Park many poor households are entirely or partially dependent on the forest for collection of fuelwood, timber, and bamboo. All of households in Tiprapara depend on the forest for their fuelwood. They also cultivate lemons in a confined area of the national park.

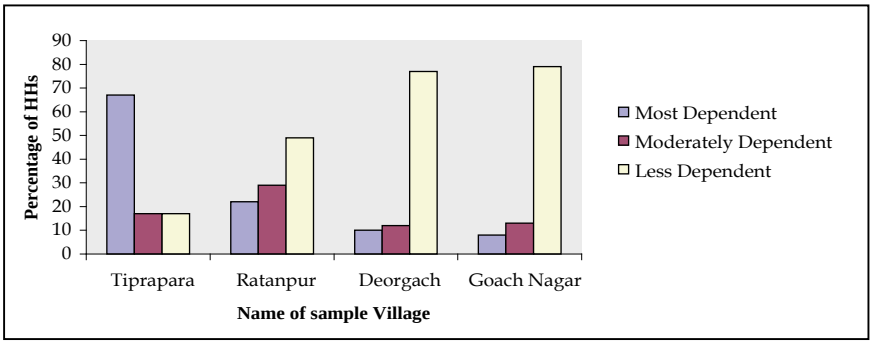

Figure 3. Forest Dependency of the villages by household

NTFP Diversity and Households Dependency on NTFP Collection

In the Satchari area about 27% of the sampled households gets at least some of their cash income from the extraction and sale of NTFPs and NTFP-based products. These contribute, on average, 19% of household cash income. However this figure varies from village to village, household to household and season to season, and usually ranges from Tk. 2,500 to Tk. 15,000 annually and from Tk. 40 to Tk. 120 daily. Our study reveals that the sale of NTFPs is the primary occupation for 18% of households in the sampled villages, and that 76% of these households are poor to extremely poor. Income from NTFPs supplies households with extra cash on occasion, and provides security in emergencies. A local person from Deorgach Village said:

> When we have no work to do or when there's a crisis of money in our family we go to the forest and collect some NTFPs for sale and thus these forest products secures our livelihoods. Furthermore, during other times it provides us with some extra cash income, which ultimately improves our living standards (Deorgach village, personal communication, March 2006).

During the household surveys, interviewees named a total of 14 NTFPs that they extract from the forest (Table 3). However, only a few of these NTFPs make a significant contribution to their household income. In our study area, four NTFPs - fuelwood, *menda* bark (used for herbal medicine and mosquito coils), *taragota* (used for its aromatic properties) and *kumbi* leaves (used to wrap tobacco) - account for more than 90% of NTFP-based income. However, the importance and collection of these NTFPs in our four sample villages was not uniform. We observed that, people's dependency on nearby forest for various NTFPs varies with their socio-economic condition as well as from their distance from the nearby forest. Fuelwood is the most harvested NTFPs of all. All the households of Tiprapara (100%) collect fuelwood from the national park, compared with 60% of households from Ratanpur, 55% of households in Deorgach and 56% of those in Goachnagar. Fig. 4 presents a comparison of household involvement in different NTFPs collection in the area of Satchari NP.

Among the NTFPs, medicinal plants possess a great diversity in Satchari. Although people mostly depend on modern medicines, some households (25%) use medicinal plants for treating various common ailments. We observed a total of 39 species in our study area that have some sort of medicinal properties and are collected by local users for commercial purpose (63%) or for their own consumption (37%) (Appendix 1).

Table 3: Different NTFPs Exploited from Satchari NP and Adjacent Forest by Local HHs

Products/ Service	Origin	Amount of collection (based on peoples perception)
Fuelwood	All woody species	High
Bamboo	*Bambusa vulgaris* Schard.	Medium
	Melocanna baccifera Roxb.	
Fruits	*Artocarpus heterophyllus* Lamk.	Low
	Artocarpus chaplasha Roxb.	
	Artocarpus lakoocha Roxb.	
	Citrus limon L.	
	Syzygium spp.	
Menda bark	*Litsea monopetala* (Roxb.) Pers.	Medium
Taragota	*Ammomum aromaticum* Roxb.	Medium
Sun grass	*Imperata cylindrical* L.	Medium
Forage and fodder	Various species	Low
Herbal remedy	Different medicinal plants	Low
Rattan	*Calamus guruba* Ham.	Low
	Daemonorops jenkensianus Mart.	
Broomsticks	*Thysanolaena maxima* Roxb.	Medium
Kumbi leaf	*Careya arborea* Roxb.	Medium
Sand	Sylhet sand	Medium
Honey	*Apis* florae	Very low
	Apis dorsata	
Bushmeat	*Gallus gallus*	Very low
	Sus scrofa	

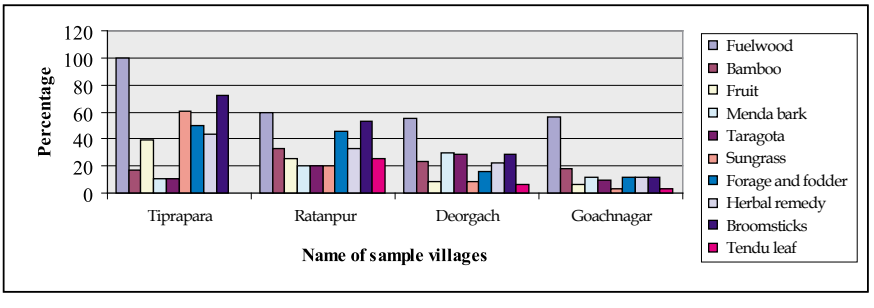

Figure 4: Percentage of Households Involved in Different NTFP Collection Activities

Box 1: Income from NTFPs (Some Examples from Satchari)

1. Menda

In our study area we found four *menda*-based small-scale processing factories that use *menda* bark as a material to make mosquito repellent. All of the factories are located in Deorgach. Approximately fifty to sixty laborers work in these factories and the majority of them are women (53%) followed by children (27%) and men (20%). The average wage rate for men is Tk 100*/day, for women is Tk 50/day and for children is Tk 40/day. Work in these factories is entirely seasonal; the factories only operate when there is enough *menda* bark from the adjacent forests. People from other areas are generally involved with the collection of *menda* bark from the national park, as well as from adjacent reserve forests, and they sell the bark to local factories at the rate of Tk 25 per kg. The quantity of *menda* trees in the forest has decreased alarmingly due to illegal logging and unsustainable collection of bark. A *menda* factory owner in Deorgach said, "The raw material for our factory seems to be declining day-by-day as the species is decreasing from the forest. Already one factory has moved from this area and others face various crises, since menda factories require high capital investments and an adequate supply of raw materials. Moreover, we have no loans or support to keep our factories running" (Deorgach village, May 2006, personal communication).

2. Taragota (Wild cardamom)

Taragota is a common species in our study area, which is used as an alternative for cardamom as well as for manufacturing *Unani* preparations (a type of herbal medicine). About 32% of people in our sample villages collect *taragota*, both for their own use and for sale in the market. Usually people collect *taragota* during the onset of the monsoon. We also found that a person can sell dried taragota in the local market for Tk 60/kg, while fresh taragota sells for Tk 18/kg.

3. Kumbi pata (Tendu leaves)

In Satchari National Park a number of local people collect *kumbi* or *tendu* leaves (*Careya arborea*), which are used to wrap tobacco to produce a kind of cigarette known locally as *biri*. We found that people usually collect tendu leaves twice a week and supply it to the nearby Teliapara market, which yields about Tk 500 per week. *Biri* manufacture is a well organized and flourishing small-scale industry in India (Nair 1993), and if properly managed it can also create some employment opportunities in the areas surrounding Satchari NP.

* 70 Tk = 1US$

People's Perceptions of the Impact of NTFP Collection on Forest Conservation

Our study shows that the extraction of resources from the forest is seasonally dependent. Most of the fuelwood is collected during the dry season due to easy access and mobility inside the forest. Bamboo extraction also takes place mainly in the drier months to meet local needs for house construction at that time of year. The following quote from some local informants highlights the perceived role of NTFP collection in forest conservation (Ratanpur village, personal communication, February 2006):

> "We have collected NTFPs from Satchari since prehistoric times, but it doesn't damage the forest ecosystem as illegal felling does. Moreover we collect NTFPs seasonally, so it has enough time to recover."

In addition, one villager from Tiprapara said, "NTFP collection keeps the forest safe from sudden fire and also destroys harmful organisms. It also accelerates the growth of seedlings and saplings by reducing the competition for nutrition" (personal communication, June 2006). People's perceptions regarding different NTFPs collected from Satchari National Park Forest and their impacts on the Park's ecosystem are summarized in Table 4.

Table 4: Perceptions of Amounts, Impacts and Risks of Collection of Various NTFPs

Item	Amount collected	Impacts on the park	Future risks
Fuelwood	High	Loss of habitat and forest biodiversity.	High risk
Building materials	Medium to high	Reduce abundance of small trees, loss of habitat, and loss of wildlife.	Medium to high risk
Fruits	Medium	Causes low -level damage to forest regeneration low	Low risk
Vegetables	Less	No apparent impact.	Low risk
Medicine	Medium to less	Negligible.	Medium risk

Box 2: Reasons for Unsustainable Resource Extraction in Satchari National Park

- ***Poverty and unemployment:*** Poverty and unemployment are common problems in and around SNP. About 37% of the population in our study area is extremely poor and most people have no steady income or occupation. 63% of our respondents cite poverty as the main threat to the forest destruction and

unsustainable resource extraction, and 42% of them think unemployment is the major source of unsustainable exploitation of resources from the protected area.

- ***Forest Department corruption and other limitations:*** Local people in our study area maintain a poor perception/image of Forest Department staff. In our study area, about 71% of respondents blame Forest Department staff for unsustainable collection of resources in the national park and adjacent forests. Moreover FD staff enforces its power only against the rural poor who traditionally harvest forest resources for their subsistence but overlook their duty in case of local elites and politically influential persons who are sometimes involved in illegal poaching and resource collection from the forest. Furthermore, the department suffers from inadequate and unskilled personnel, modern equipment, and poor infrastructure and facilities.

- ***Lack of awareness:*** About 44% of the population of our study area is illiterate and few people have a clear understanding of protected areas or sustainable resource exploitation.

- ***Poor socio-economic conditions in adjoining tea estates:*** Eight tea estates surround Satchari National Park and are part of the attraction of the park for eco-tourists. Laborers on the tea estates earn very low or subsistence wages, and unemployment is very high among tea estate families. Most tea laborers collect their daily fuelwood and housing materials from the nearby national park and reserve forest.

- ***Sawmills and brickfields:*** There are 18 sawmills in the Satchari area that produce timber products. According to local people they are one of the main causes of forest destruction in Satchari. Local people illegally collect timber poles from the park and sell them to the sawmills at lower than market prices. In addition, fifteen nearby timber merchants supply timber products from the park and reserve forests to different areas of the country, including Dhaka. We also found several brickfields in close proximity to the national park, which use fuelwood for firing their kilns. Local poor people often extract fuelwood illegally from the national park to supply to the brickfields.

Status of Home gardens in and Around Satchari National Park

Home gardens can provide families with important protection against food insecurity. From our household surveys we found that the home gardens in our study area (except Tiprapara village) are rich in diverse species. Families in the Satchari area have always cultivated a variety of timber, fruits and edible plants in their home gardens. They fulfill a traditional subsistence role

in our sampled villages. Now, with the declaration of the protected area, these gardens are expected to play a more important role in food security.

A total of 39 species were found in the home gardens of our study area (Table 5) but none of these species were ubiquitous. We recorded 10 timber species, 9 fruit species, 5 species that produce timber and fruit, 12 vegetable crops, and 3 multipurpose species and medicinal plants from the home gardens. Around 70% of the species in our study area are edible. It also seems that most villagers prefer to grow fruit and timber rather than vegetables in their home gardens. For timber production people usually prefer fast growing species. The livelihood benefits of home gardens go well beyond simply meeting subsistence needs. In many cases, the sale of products produced in home gardens significantly improves the household's financial status.

Table 5. Composition of a Typical Home Garden in the Study Area

Common Name	Botanical Name	Abundance	Performance
Timber Species			
Acacia	*Acacia spp.*	C	+++
Chapalish	*Artocarpus chaplasha*	FC	+
Mahagoni	*Swietenia macrophylla*	C	+++
Koroi	*Albizzia spp.*	C	+++
Rain tree	*Albizzia saman*	FC	++
Chatim	*Alstonia scholaris*	R	++
Eucalyptus	*Eucalyptus camaldulensis*	FC	++
Menda	*Litsea monopetala*	FC	++
Teak	*Tectona grandis*	FC	++
Chalta	*Dillenia indica*	R	++
Fruit Species			
Lemon	*Citrus spp.*	C	+++
Papaya	*Carica papaya*	C	++
Pineapple	*Ananas comosus*	FC	++
Banana	*Musa sapientum*	FC	++
Star fruit	*Averrhoa carambola*	FC	++
Batabi lebu/ Pomelo	*Citrus grandis*	FC	++
Guava	*Psidium guajava*	FC	++
Coconut palm	*Cocos nucifera*	C	++
Betel nut	*Areca catechu*	C	++
Timber and fruit bearing species			
Mango	*Mangifera indica*	C	++
Jack fruit	*Artocarpus heterophyllus*	C	+++
Sajna	*Moringa oleifera*	C	+++
Jaam	*Syzygium spp.*	FC	++
Neem	*Azadirachta indica*	C	+++
Vegetable Crops			
Radish	*Raphnus sativus*	C	+++
Bean	*Dolichos lablab*	C	++

Common Name	Botanical Name	Abundance	Performance
Vegetable Crops			
Eggplant	*Solanum melongena*	C	++
Bottle gourd	*Lagenaria siceraria*	C	++
Lal shak	*Amaranthus tricolor*	C	+++
Indian spinach	*Basella alba*	C	++
Lai shak	*Brassica rugosa*	FC	++
Chillies	*Capsicum frutescens*	C	++
Cabbage	*Brassica oleracea*	FC	++
Ladies finger	*Abelmoschus esculentus*	FC	+++
Tomato	*Lycopersicon lypopersicum*	FC	++
Pumpkin	*Cucurbita maxima*	C	++
Others Species with Multipurpose Use			
Bamboo	*Bambusa spp.*	C	+++
Patipata	*Schumannianthus dichotoma*	FC	+++
Rattans	*Calamus spp.*	FC	+++

KEY: C = common, FC = fairly common, R = rare; +++ = very good, ++ = good, + = not so good.

In Satchari we found that the average rich household owned approximately 0.18 ha of land, while medium, poor, and extremely poor households owned less than 0.08 ha. Rich households usually plant different plant species in their home gardens to meet their subsistence needs. On the other hand, people in poorer households mostly depend on the forest for their fuelwood and other needs, as they have no land for home gardens. Study results suggest that home gardens are negatively correlated with dependency on the forest.

Discussion

Our results paint an interesting picture of the use and role of NTFPs and home gardens for livelihoods and forest conservation by the communities under study (Appendix 2 contains photographs of the study site). Non-timber forest products make a vital contribution to livelihoods for a large proportion of the poor living in, or close to, the forest in most tropical countries (Arnold and Perez 2001). In the Satchari area villagers collect a large number of NTFPs-more than 14 products were identified. Some NTFPs, including the medicinal plants we have looked at in this study, hold real potential for livelihoods, and as an incentive to conserve forest. Our study suggests that the sale of NTFPs and NTFP-based products provide an important source of cash income for villagers in and around Satchari National Park. The most important point is that NTFPs represent a significant component of their livelihoods strategies, accounting for 19% of their total annual income. In addition, about 18% of households receive cash income only from the sale of NTFPs. These findings are comparable to the results of others studies done in Southeast Asia (Table 6). We also found that a majority of the people (76%) who benefit from the

extraction and sale of NTFPs are poor. If they didn't derive these benefits they might not have an incentive to manage it as sustainably. This finding agrees with the observations of Cavendish (2000) in Zimbabwe who also found that NTFPs benefit mostly the poorest populations.

Home gardens provide livelihood benefits in terms of nutrition and daily subsistence. The data in our study identified 39 different species in home gardens in the Satchari area, of which approximately 70% are edible. All of the wealthier people in our study depend on their home gardens for fuelwood and other needs. Hence the study suggests that home gardens can play an important role in forest conservation by shifting the dependency for fuelwood and other forest products from the forest to home gardens. This finding also agrees with Caron (1995) i.e., home gardens could play an important role in forest protection by shifting the dependency for food and income from the forest onto home gardens.

Table 6: A Comparison of Cash Incomes Obtained from NTFPs in Various Studies

Topics	Our Study	Other Studies
Contribution of NTFPs to households cash incomes	19%	14% (Mahapatra et al. 2005) 17% (Malhotra et al. 1991) 24% (Ganesan 1993) 21% (Gunatillike et al. 1993)
Households receive at least some cash income from NTFPs	27%	-
Households receive cash income only from NTFPs	18%	12% (Mahapatra et al. 2005)

Conclusion and Recommendations

The main conclusion from our study is that NTFPs, NTFP-based products, and home gardens in and around Satchari National Park play important roles in improving the livelihoods of forest dependent people and forest conservation. Understanding the dependency of households on the forests of Satchari National Park is critical for developing effective management strategies. The data presented here suggest that the production and sale of NTFPs and NTFP-based products provide an important source of cash income for villagers in and around Satchari National Park. This study also found that households in villages with diversified home gardens are less dependent on the national park for forest products.

Our study suggests some new policy avenues such as enriching forest and buffer zones with commercially important NTFPs, which may be used for establishing

NTFP-based small-scale enterprises. In addition, protected area management strategies should be coordinated with the overall development of communities that depend on the protected areas. Management plans should give these people the right to collect forest resources in a sustainable way, enable them to enrich the park and buffer areas with different subsistence crops (i.e., NTFPs, fruits, vegetables), and give them incentives like seeds and seedlings to develop their home gardens.

Managers should take a cautious approach. First, a comprehensive feasibility analysis of the contribution that NTFPs, NTFP-based small-scale enterprises, and home gardens can make to forest conservation and livelihoods must be conducted. This analysis must consider the social, economic and ecological aspects of the proposed changes. Secondly, a co-management plan that involves local people in forest management and which ensures equity in decision-making and benefit sharing must be developed. The plan should specify both short-term and long-term objectives and goals. Thirdly, institutions must be identified to facilitate the implementation of the plan and ensure equitable distribution of benefits to local communities.

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Appendix 1: Medicinal Plant Diversity and their Traditional Use in SNP

Family	Botanical Name	Local Name	Parts used	Traditional use	Habit	Occurrence	Remarks
Acanthaceae	*Adhatoda vasica* Nees	Basak	Fresh green leaves	Cough, cold ailments and asthma	Sh	C	W
Apocynaceae	*Alstonia scholaris* (Linn.) R. Br.	Chatim	Leaf	Fever	Tr	R	D
Aslepiadaceae	*Calotropis gigantea* (L.)	Akanda	Leaf, latex	Gout pain, cut and wounds	Sh	C	W
Bromeliaceae	*Ananas sativus* (Lindley) Schultes f.	Anaras	Fruit	Jaundice	Sh	FC	D
Caricaceae	*Carica papaya* L.	Pepe	Fruit	Stomach trouble	Sh	C	D
Combretaceae	*Terminalia arjuna* W & A	Arjun	Bark	Heart disease, cough	Tr	R	W
Combretaceae	*Terminalia belerica* Roxb.	Bohera	Fruit	Constipation, stomach trouble, eye disease	Tr	FC	W
Combretaceae	*Terminalia chebula* Retz	Horitaki	Fruit	Constipation, fever, heart disease, cough, urinary problems	Tr	FC	W
Compositeae	*Chromolaena odorata* (L.) King & H.E. Robins	Assam lata	Green leaves	Anti-hemorrhoid	Cl	C	W
Compositeae	*Eupatorium odoratum* L.	Assam pata / Uzaru	Green leaves	Anti-hemorrhoid	Sh	C	W
Convolvulaceae	*Ipomoea fistulosa* Roxb.	Donkalos	Whole plant	Cold ailments	Sh	C	W
Cucurbitaceae	*Coccinia cordifolia* Linn.	Telkucha pata	Green leaves	Cold ailments	Cl	FC	W
Dilleniaceae	*Dillenia indica* Lmn.	Chalta	Fruit	Hair falls	Tr	FC	D
Euphorbiaceae	*Phyllanthus emblica* Linn.	Amoloki	Fruit	Dysentery, skin diseases, hair falls, digestive problem	Tr	FC	D
Euphorbiaceae	*Trewia nudiflora*	Chagalledi	Leaf	Fever	Tr	R	W
Gramineae	*Cynodon dactylon* (L.) Pers.	Durba grass	Tender leaves	Tooth ache, cut and wounds	H	C	W
Hydrocotylaceae	*Centella asiatica* (Linn.) Urban	Thankuni	Whole plant	Dysentery, diarrhea, gastric	H	C	W
Labiatae	*Ocimum sanctum* Linn.	Tulsi	Fresh green leaves	Cough, cold ailments, cut and wounds	H	FC	D

Lauraceae	*Litsea monopetala* (Roxb.) Pers.	Menda	Fresh green leaf and bark	Amoebic dysentery, diarrhea, constipation	Tr	C	W
Leguminosae	*Cassia fistula* Linn.	Sonalu	Fruit, bark	Constipation	Tr	R	W
Meliaceae	*Azadirachta indica* A. Juss.	Neem	Fresh green leaf and seed	Skin diseases, chicken pox, fever, dysentery, diabetes	Tr	FC	D
Meliaceae	*Melia azedarach* Linn.	Bokain	Green leaves	Scabies, insecticidal use	Tr	FC	D
Mimosoideae	*Mimosa pudica* Linn.	Lazzabati	Roots	Not-specified	H	C	W
Moringaceae	*Moringa oleifera* Lamk.	Sajna	Bark	Cold ailments	Tr	C	D
Orchidaceae	*Cymbidium aloifolium* (L.) Sw.	Kuntus pata	Leaves, seeds	Ear ache, cut injury	H	C	W
Piperaceae	*Piper betel* Linn.	Paan	Fresh green leaves	Indigestion	Cl	C	D
Poaceae	*Cymbopogon citratus* (DC.) Stapf	Lemon grass	Leaves	Not-specified	H	FC	W
Polygonaceae	*Polygonum hydropiper* L.	Biskatali	Green leaves	Insect bites, anti-venomous	H	C	W
Rutaceae	*Glycosmis pentaphylla* (Retz).	Fatikgila	Leaf	Fever	Sh	C	W
Rutaceae	*Aegle marmelos* (Linn.) Correa	Bel	Fruit	Weakness, colitis, diarrhea	Tr	FC	D
Rutaceae	*Citrus acida* (Linn.)	Jambura	Fruit	Jaundice	Tr	C	D
Rutaceae	*Citrus limon* (Linn.) Burm. f.	Lebu	Fruit, Leaf	Digestive trouble	Sh	FC	D
Sterculiaceae	*Abroma augusta* (L.) Lf.	Ulatkambal	Bark, root	Dysmenorrhea	Sh	R	W
Theaceae	*Camellia sinensis*	Chaa	Tender leaves	Heart disease, cold ailments, refresher	Sh	C	Cu
Verbenaceae	*Vitex negundo* Linn.	Nimunda	Green leaves	Tooth ache, insecticidal use	H	C	W
Zingiberaceae	*Curcuma longa* Linn.	Holud	Rhizome	Skin ailments	Sh	FC	Cu
Zingiberaceae	*Zingiber otficinale* Roscoe	Ada	Rhizome	Cough, cold ailments	Sh	FC	Cu
Zingiberaceae	*Ammomum aromaticum* Roxb.	Taragota	Seed	Used as spices and for manufacturing Unani medicine	Sh	C	W
		Horin paya	Whole plant	Diarrhoea, dysentery	Sh	C	W

KEY:
Cl-climber, **H**-herb, **Sh**-shrub, **Tr**-tree, **C**-common, **FC**-fairly common, **R**-rare
Cu-cultivated, **D**-domesticated, **W**-wild

Appendix 2: Photos from Study Sites

Plate 1: NTFPs gathered for sale.

Plate 2: A local person returns from the forest with fuelwood.

Appendix 2: Photos from Study Sites (Continued)

Plate 3: Saw mills located near the forest represent a serious threat.

Plate 4: An ethnic Tripura woman weaving their traditional cloth.