

# Community-Based Assessment Of Forest Provisioning Ecosystem Services In The Northern Vietnam

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**Abstract:** Local communities - as direct users and managers of ecosystems - acutely do know about the provisioning services of forests in their area. Their assessment can support policy-making and strengthen the capacity to manage forest ecosystem services and natural resources at the local scale. Hence, the research investigates local people's demands for forest provisioning ecosystem services (FPES), and their evaluation of the resource supply that contributes to their well-being. Methods of data collection are group discussions and household interviews in some villages in the Northern Vietnam. The research illustrates that local people have high demands concerning FPES for domestic use purposes, especially, requirements of timber for stilt - house building, fuel wood and water supply. Although the local demands have changed over time, these services are still of major concern while the supplies were evaluated to be at low level and limited in quantity and quality. Local people highly appreciated the role of forests to their income and their daily lives which indicates their considerable dependence on forests. Based on local people's assessment and awareness of FPES, policy makers and managers could be enabled to perform more effective targeting and forest management interventions.

**Keywords:** community-based assessment; forest provisioning ecosystem services; local demands; local supply; Vietnam-north.

## 1. Introduction

The term of ecosystem services was used and defined in the last decades with exponential increase of scientific papers. The Millennium Ecosystem Assessment (MA), a scientific program commissioned by the United Nations, originally defined ecosystem services as "the benefits people obtain from ecosystems" [5]. Ecosystem services include provisioning services, regulating services, supporting services and cultural services. Based on MA documents, the conception of ecosystem services is variously worded and still being discussed with different viewpoints and arguments from ecologists and economists. In short, the ecosystem services concept comprises two main point aspects, namely (1) ecosystems potential to provide goods and services for human beings and societies, based on their functioning and (2) human needs, demands, expectations and appreciations facing these potentials and their options and assertiveness to realize them. Forest ecosystems do provide multiple benefits to human society, which can be direct or indirect. Based on the concept in MA 2003, forest provisioning ecosystem services (FPES) could be defined as products and goods that people obtain from forests. FPES sustains various aspects of human well - being. Forests provide timber, fuel, energy and other non-timber forest products (NTFPs) such as mushrooms, fruits, leaves, plants and animals, which are used as food, folder, medicine and raw materials. They have significances as sources of income, human health protection and cultural objects. Forest ecosystems also provide various and useful sources of genes for biotechnology. These services do not only reply on forest ecosystem service supply but also depend on the people's demands and their abilities to realize them. The local demand for FPES is considered as the local people's needs for forests and is influenced by the changes in local economics and society [8]. Local communities are the direct users, and are aware of their requirements and goals in forest management. Assessment of FPES with local participation supports public confidence in respective scientific findings, and help to integrate the knowledge and experiences of primary resources users [6].

The community-based assessment of FPES in 14 villages in Thai Nguyen, a mountainous province in the northern Vietnam, evaluates local demand and supply for local FPES and simultaneously assesses the relationship between forests and local society.

## 2. Methodology

### 2.1. Focus Group Interviews

Group interview gives an overview of issues and related opinions or views in within a population in a short time [3]. Group meeting focused on both key information panels and villagers with 12 to 15 participants per meeting. Key informants are local authorities, representatives of local organizations and some local village leaders. The villagers include men and women, elderly and youth and ethnic group. The content of discussion focused on the forest benefits, village demand, and their scoring of FPES.

### 2.2. Household Survey

Household surveys were based on six-page questionnaires that were designed base on the conceptual framework and appropriate indicators of provisioning ecosystem services in MA documents considering local context. The questionnaires contain both opened and closed questions. Some questions are mixed. Likert scale questions were used to assess the FPES importance. For the household survey, we performed 156 face-to-face interviews in 10 villages.

### 2.3. Data Analysis

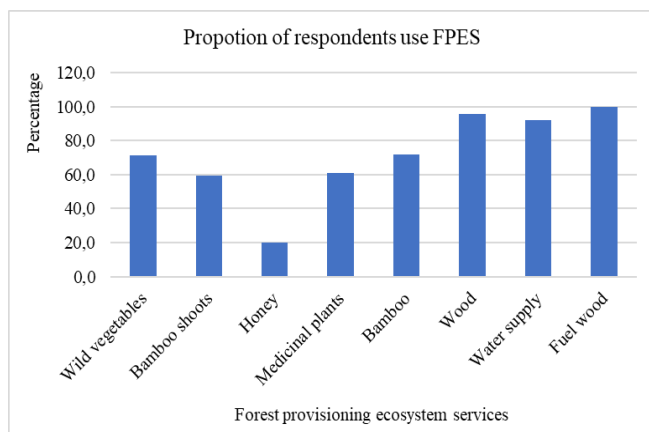
Quantitative data was analysed using Excel version 2013 and Statistical Package for the Social Science (SPSS) version 22.0.

### 3. Results

#### 3.1 Demand for forest provisioning ecosystem services

##### FPES use

The survey result gives proportion of people used FPES (figure 1). In general, local people have high demand for wood, fuel wood and water supply from forests with over 96% respondents used these FPES. Over 70% of people applied bamboo shoot and vegetable as foods. Number of households using bamboo accounted 71.8% in total. Medicinal plants were used by 60.9% of interviewees.



**Figure 1:** Proportion of respondents using FPES

Local people have high demand of wood for construction and sub-construction (66% of people using wood). They live in a stilt house, a typical wood-house architecture in northern mountainous areas. Stilt houses are made of wood, bamboo, with a roof of palm leaves or tiles. The frame structure of a stilt house is a system of beams and stilts, which are connected each other and made of strong and durable wood. Other structures of house are made of normal wood, for example, the walls are made of wood planks; floor is made of either bamboo or wood planks. From results of household interviews, 95% of households live in wood-made house, in which 86% are stilt houses. Over three quarters of interviewees said that their family still needed more wood to wide their old house or to build a new one for their children or repairing/completing their own house. Besides the main house, the local people use wood for sub-constructions such as kitchen; sheds; courts for drying agricultural products; pens for livestock and poultry. Local people also required wood to make their furniture (tables, chairs, wardrobes) as well as production tools. Firewood was a main fuel for cooking and heating in the area. Local people consumed a big amount of fuel to cook mash for pig feeding, a popular feeding way in these areas. The statistical data shown that, normally, each household spent from one backpack of firewood for one or two days, estimation for one year from eight to twelve cubic meters of firewood. They stored firewood in ground or under floor of stilt houses. In the winter, big firewood logs were burned to keep the heat for the whole houses. Firewood demand also increased in later of winter and earlier of spring when big festivals happen in this area as well as in Vietnam, and they need more fuel to cook traditional food in festivals. Local people gathered forest vegetables, bulbs, roots, fruits, mushrooms and bamboo shoots for food. Some kinds of food were collected

during the years while some others were harvested seasonally in growth and development of species, for example bamboo shoots. Selling forest vegetables can make extra but impermanent income for households.

With indigenous knowledge of traditional medicine, local people can produce many drugs to treat diseases from various forest floras. In some cases, the traditional drugs were even more effective than modern medicine and no one can explain how and why. They use parts of plants and herbs (flowers, leaves, barks, roots, seed, fruits...) and animal viscera. Medicine can be applied in fresh or sun-drying materials. People used bamboo for sub-construction (house's floors, drying courts, fences, pens) and for tool and furniture production (tables, chairs, shelves, tool's handles). They can knit bamboo baskets, wattle, and lattice as partition. Knitters are usually women who are skilful and precise. They make knitting products in free time between two crops or on rainy days. Knitting products are kept dry above cooking fire for a long time before using. Surface water from forests is the main water supply for over 12 thousand of households in research areas. Almost 90% interviewees obtained waters from rivulets or small stream for cooking and washing (figure 2). Water was carried directly from forests by pipe system made of bamboo, rubber or plastics. Around 12% of correspondents obtain water from dug-wells or deep well equipped with a pump. Irrigation water supplies are very important with farmers whose main subsistence is paddy cultivation. Each year, hundred hectares of paddy fields need irrigation. Water provision comes from streams, rivers and amount of rainwater. The local people are good at in making irrigation system to carry water in various terrains such as ditches, trenches. Irrigation tools made of wood or bamboo, simple and available materials in regions, for example, water wheel, a traditional irrigation tool to lead water into fields.

##### Changes of local demand changes

Human demands of forest ecosystem benefits change in different period of time (table 1). Timber products and firewood are considered significantly in every period of time because they are available materials of house building, cooking and heating. In the past, hunting products and non-timber products such as vegetables, bamboo shoots were the main nutrient sources of local people in self-sufficient economics. However, at the present and in the future, in market economy, commodities exchange easily wherever, people can plan variety of vegetable and raise domestic livestock, they do not depend on the nutrient resources from forests. Therefore, these groups are evaluated in lower level. The significance of forests in water supply is also assessed the highest at present. As a result of deforestation in recent years, the shortage of water in dry seasons has affected directly on the life and cultivation of local farmers whose water resources originate from the forests. Provisioning service of medicinal plants seems unchanged position in every period in medium level. With indigenous knowledge of traditional medicine, local people can make many drugs to treat diseases from various floras in forests.

**Table 1:** FPES importance and their change over time

FPES	Past	Present
Timber products and firewood	1	2
NTFPs	2	4
Medicinal plants	4	3
Hunting products	2	5
Water supplies	5	1

Note: Ordinal numbers from 1 to 5 refer to the order of important levels, in which, 1 means the most important level and 5 means the least important level.

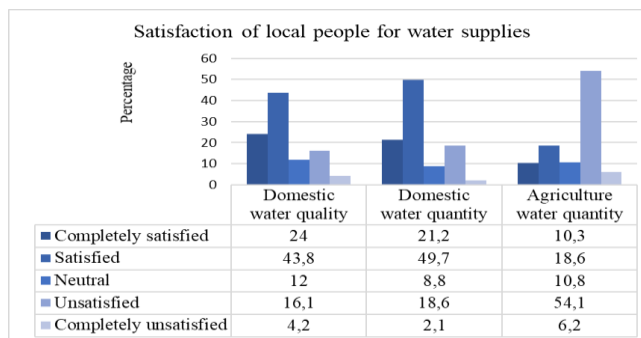
### 3.2. Supply of Forest Provisioning Ecosystem Service

#### FPES Supply

In the assessment of FPES supply, local people compared the FPES availability at present and in the past to give the answers (table 2). In general, the evaluation shows that most of FPES recently have been scarcer than before. Especially, wild animals and wild honey was at extremely shortage level with 97.8% and 94.9% of evaluation respectively. Nowadays, local people almost do not see or meet the trace of this species in the local forests any more. Some kinds of wild animals seem only exist in the pictures or the stories of old people. Sources of wood, bamboo, bamboo shoot, ornamental species and wild vegetables were also evaluated at over 70% of scarce level. However, supply of medicinal species remains at 39.6% of plentiful assessment and 21.4% of neutral. Though fuel wood supply was estimated less than before, it still meets local requirements, due to growth of plantation forests. The local people assessment of water supply based on their satisfaction of water quality and quantity (figure 2). Two third respondents highly satisfied with their domestic water supply in both quality and quantity, although they claimed that the amount of water has declined recently. Over 60% of interviewees has displeasure attitude about agriculture water supply. They complain that their field has not been provide enough water to growth two paddy crops a year. In dry season, the field either grow other types of farm crops or leave fallow. The shortage of water in dry seasons directly has affected the life and cultivation of local farmers whose water resources originate from the forests and depend on annual precipitation.

**Table 2:** Local people's assessment for FPES supply

FES	Very plentiful	Plentiful	Neutral	Scarce	Very scarce
Wood	1.80	12.57	14.97	47.31	22.75
Fuel	12.90	17.74	22.04	42.47	4.84
Vegetable	3.31	8.84	13.26	56.35	18.23
Bamboo shoot	1.63	5.43	10.33	48.91	33.70
Honey	-	4.57	0.57	36.57	58.29
Medicinal plants	5.03	34.59	21.38	34.59	4.40
Bamboo	2.19	8.74	16.94	48.09	24.04



**Figure 2:** Local people's satisfaction for water supplies

#### FPES Sources

A survey of where people obtain FPES was done with someone who uses these services. Most of FPES are obtained from natural forests. Over 80% of people took vegetable, hunting products, medicine, wood and ornamental species in natural forests. Fuel wood and bamboo shoot sources are not much different between natural and plantation forests. Local people grew culms of bamboo around their living place or along streams near their house to produce bamboo, therefore almost 80% of mature bamboo was taken from plantation forests. However, natural forests supplied various of bamboo shoot that are good for food, so percentage of people get this product from natural forest was higher from natural forests. Besides, people also easily bought this kind of food in the local markets. The survey also conducted that the purchase of FPES in this area was unpopular and only happen in community scale. Wood for local stilt-house construction came from natural forests and was logged in the past. Recently, plantation forests have been developed in both area and reserve; however, local people have not appreciated this source of wood because of its low quality. Plantation forests have grown and sold outside areas to make materials for wood processing or for fuel. Local people only concerned the benefits from wood selling, but not concerned to how to use this kind of wood to fit their wood demand.

### 3.3. Local Assessment of FPES

The local people evaluated the important role of local forests to three different sectors including their household income, water supply, water regulation (figure 3). Forests were highest appropriated to be importance with their water source such as water supply and regulation by 93.85% and 90.26% respectively. Proportion of respondents who gave neutral answers or evaluated at low level exhibited in meagre of under 10% in total. The role of forests for climate regulation and soil nutrition were also highly appreciated, though not as high as for water. These evaluations prove that local community has awareness of the important role of forests with their life environment. About 70% interviews agreed that forests were important with their income while 15.9% people have neutral answers and 13.84% answers were not important. Some people said that forests have no effects on their household income because their livelihoods were not originated from forests.

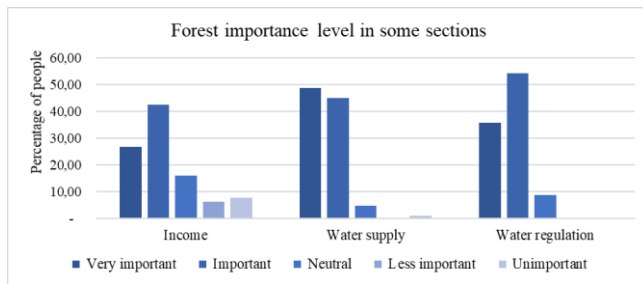


Figure 3. Importance level of FPES in different sectors

#### 4. Conclusion

The study shown that people at the research areas have high demand for FPES and their demand changes over time. At present, they have high demand for water supply, construction wood and fuel wood. The FPES supply, followed the local people's assessment, has been reduced although supply of some FPES still meet the local demand like water supply, medicinal plants and some NTFPs.

Due to forest ecosystem service supply and human demand, people access ecosystem to benefit and improve their well-being. The benefits of ecosystems do depend on both. The actual benefits from an ecosystem service represent the match between ecosystem services supply and respective human demand [4]. However, in practice, not all human demands are fulfilled by the existing service supply. Ecosystem service demand and consumption can also be limited by accessibility [1] or by societal exclusion, or if the natural capital stock gets depleted or degraded [2]-[7] Thus, the community-based assessment of FPES demonstrates a visualize supply-demand relation and show the match or mismatch between the ecosystem's capacity for service provision and the services that people desire.

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#### Author Profile

Thi Phuong Mai Nguyen received the B.S. and M.S. degrees of Environmental Sciences in Hanoi National University of Sciences (Vietnam) in 2004 and 2007, respectively; the PhD. Degree in George-August Gottingen University (Germany) in 2016. Since 2004, she has been a lecturer and researcher in Thai Nguyen University of Sciences (Vietnam). Her researches focus on ecosystem services, human ecology, natural resource management and conservation, environment issues and sustainable development in rural mountainous areas.