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The role of bamboo forest in balancing and sustaining the development of local livelihood and human well-being in rural areas of Vietnam

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Abstract [use this style font, Calibri 13 point, for 1st level headings]

The balanced maintenance between forest development, human health, and well-being is the key to sustainable forest landscape management. My research aims to find out the current status of that relationship in Muong Hinh community (North-Central Vietnam) with the focus on lung bamboo forest - the vital natural resource of local communities. Lung bamboo (*Bambusa longissima* sp.nov) is an endemic species of Vietnam and is considered a strategic species for development in rural areas. However, due to the over-exploitation and unplanned management, the lung bamboo forests have been remarkably degraded and are even at risk of being depleted. Muong Hinh, currently, has 712 ha of lung bamboo forests and the payment from lung bamboo harvesting is the most important income for the local dwellers. However, it does not meet the local needs due to the low price and low added value. Besides, after years of applying wrong harvesting techniques with high harvesting intensity, local people are losing their forest both in terms of the forest area and quality. There is also a lack of knowledge on sustainable bamboo forest management within the community. Based on the current situation, some recommendations are given on essential techniques for sustainably managing and using bamboo forests. Of which, the proper harvesting intensity and the rotation of exploiting areas are the most critical issues. If the local people are going to apply the suggestions, they probably earn about 440 US\$/ha/year from their lung bamboo forest (three times higher than their current income), and it could be increased up to 1,200 US\$/ha/year shortly. Moreover, there is also a need to have alternative incomes for stable livelihood development. Several options are developing post-harvesting activities or possessing facilities, setting up a lung bamboo value chain, and reasonable collecting of other potential forest products such as timber or NTFPs.

Keywords: forestry, lung bamboo forest, forest landscape management, sustainable livelihood development.

Introduction, scope and main objectives

Bamboo is the most important non-wood species which is abundantly growing in most of the tropical and subtropical zone (Chaowana.P, 2013). In Vietnam, forest resources are abundant and diversified, with bamboo playing an important role in socio-economic development and ecological environment, especially in biodiversity conservation (Tran.V.H, 2010). Bamboo and bamboo products are increasingly being widely used to replace wood in the market. According to Vu and Le (2005) cited in Tran.V.H (2010), approximately 400 million bamboo culms are used in Vietnam annually, of which a large number of culms are used for handicraft making.

Lung bamboo (*Bambusa longissima* sp.nov) is an endemic species of Vietnam with a very narrow distribution in border regions with Lao DRC in Nghe An, Thanh Hoa and Son La province. Que Phong district is so-called the kingdom of lung bamboo because lung bamboo has developed well and brought a high economic value for local people recently. Numerous studies have documented the expansion of household incomes and poverty reduction through increased bamboo production as well as the silvicultural techniques for bamboo forest management (Nguyen.H.N, 2005; Nguyen.N.B & Pham.D.T, 2007; Hogarth & Belcher, 2013). However, while

there is an increasing scientific interest for different bamboo species, little attention has been paid to lung bamboo species in Que Phong district, Nghe An province.

In this paper, we show our assessment on how the utilizing of lung bamboo impacts the forest resources in Que Phong district, thereby recommending solutions and suggestions for supporting local communities to develop a sustainable forest use strategy focused on lung bamboo forest areas.

Methodology/approach

1. Village selection

With the support of local government officers who in charge of natural resources management, one village was selected for carrying out the research in Dong Van commune, Que Phong district based on the following criteria: (1) To assess the quality of lung bamboo forest in all of its types, including mixed timber-lung forest, mixed lung-timber forest and mono-lung bamboo forest; (2) To compare the effects of different management methods of different forest owners on the quality of natural forest; (3) the village could be purposively selected based on the highest dependence level of local people on the forest resources with at least half of total household in village are engaging in lung bamboo harvesting.

For this study, Muong Hinh village was selected because this is a village with the largest lung bamboo forest area in Que Phong district. Therefore, researching the relationship of lung bamboo forest, local forest landscape and human society in Muong Hinh village will be highly representative for the whole region. In addition, the local forest landscape was negatively affected by the construction of Hua Na hydropower plant from 2008 to 2013. The hydropower plant caused various difficulties for local livelihood including the relocation of households to resettlement areas, a lack of productive lands, a poor clean-water and irrigation system, a deteriorated road, an unstable electricity supply, and indirect caused an inappropriate forest and land allocation strategy.

2. Primary data collection

- Key informant interviews

The key informant interviews (KII) are done with semi-structured questionnaire. The interviewees are those who have experience about the current situation of forest management and development in Que Phong district and Dong Van commune. Both qualitative and quantitative data were collected with the semi-structured questionnaires. A variety of general and specific questions will be asked and open for interviewees to extend the discussion on any interesting topic. This interview aims to have a deeper understanding of the current management perspectives and development strategies of the forestry sector in the future at both the district and commune levels.

- Forest inventory

A forest inventory was carried out to get an accurate assessment of the impact of harvesting and managing methods on the quality of the forests as well as the inputs to suggest a sustainable forest use strategy. The information was collected about the forest areas and distribution of lung bamboo in the local landscape, the current stock and regeneration of lung bamboo in different types of forest. The forest inventory aims to gain real and trusted data on the forest status which cannot be precisely provided by villagers or even local forest managers

- Focus group discussion

Focus Group Discussion (FGD): In this research, the researcher used FGD to figure out the overall background of the selected village from the perspective of village dwellers, and to get advice for the whole questionnaire for the household survey. Participants were identified purposively based on the recommendations of the village head; however, the participants had to be related to the bamboo collecting and selling processes. During the FGD, PRA tools had been employed for capturing the results of discussion such as ranking, seasonal calendar, time-line, etc. In this research, I carried out three different kinds of groups (village leaders, forest owners, and lung bamboo harvesters and local traders) with 6 members in each group.

- Household survey

To develop forest sustainable management strategies, there is a need to have an understanding of the role of forests in the livelihood of the local community and the factors that influence land and natural resource utilization in their areas. Therefore, it was necessary to carry out the questionnaire-based survey in a way to collect detailed information from the households about the production processes, the productivity and the demand of people on their resources. 35 households (represented for 35% of total number of households in Muong Hinh village) were randomly selected for the survey.

- Observation and Informal interviews

To increase the accuracy and reliability of information, both observation and unintended conversations with random persons were used to observe and uncover new or sensitive topics of interest that might have been overlooked. This information is useful to check or compare with the data collected from FGD and household interviews.

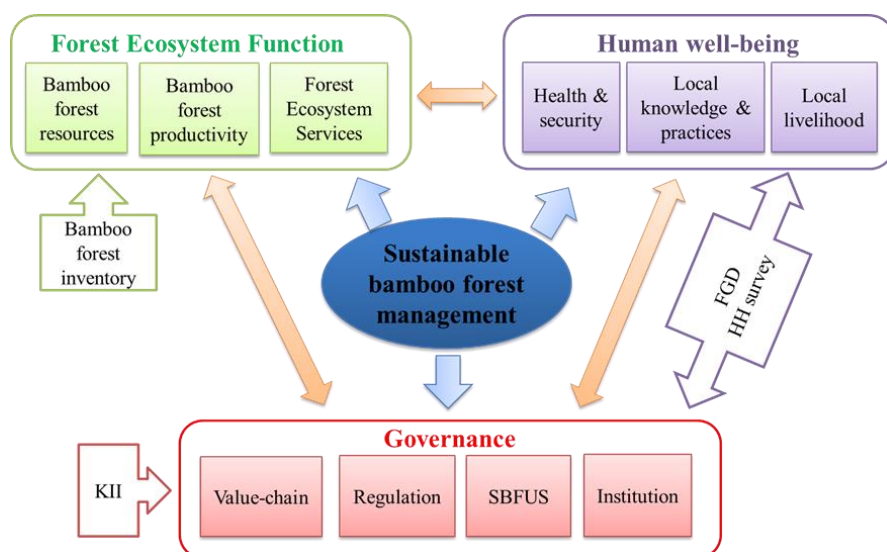


Fig. 1: Conceptual framework to assess lung bamboo resource and develop a sustainable bamboo management plan (Source: Developed from Reinecke et al., 2018)
 FGD: focus group discussion, KII: key informant interview, HH: household, SBFUS: sustainable bamboo forest use strategy]

Results

1. The role of lung bamboo forest in the local livelihood

Muong Hinh village currently has 107 households with 410 people and 98 per cent of the villagers are Thai people – an ethnic minority people in Vietnam. On average, each household has a total income from 100 – 150

US\$/month. When compared to the national or regional income level, Muong Hinh village is taking a very low position, below the average of Vietnam in 2018 (560 US\$/household/month) and North-Central region (430 US\$/household/month) (Vietnam Statistical Yearbook 2018).

In 2012, the resettlement had changed the livelihood of the local communities by opening the gate to modern life. In that context, lung bamboo harvesting becomes the most important source of income, with the involvement of more than 90 percent of the households in Muong Hinh village. After the relocation, due to the loss of livelihood assets, Muong Hinh villagers had to try to adapt to the new situation by increasing the harvesting intensity of lung bamboo forest, leading to the degradation of lung bamboo forest in both quality and quantity in the long run.

In terms of specific income, one household can earn about 750 US\$/year from lung bamboo harvesting on average (42 per cent to 62 per cent of the total annual income of the household). However, the income from lung bamboo harvesting of different households is very different and it depends on the availability of labor and the frequency of harvesting (Table 1).

Table 1: The gross income per annum of a lung bamboo harvester in Muong Hinh (Source: Household survey, 2019)

Harvesting capacity (tons/people/day)	Price (US\$/ton)	No. of working days per month (days/month)	No. of months per harvesting season (months/year)	Gross income per annum (US\$/person/year)
0.2 – 0.25	50	15 – 20	3 - 4	450 – 1,000

The price has been maintained from the 2000s until now: US\$50 for a ton of fresh lung bamboo culms. The price is mainly regulated by traders. Local people have no voice or power in negotiating the price. According to most of the respondents, this price is relatively low. With that price, local people can only earn 6.8 to 9 US\$/day for the full working day, and they can do that job in some months of the year only. Thus the income is not enough to cover the living costs of households. Besides, the lung bamboo value chain in the locality is very simple with the lack of post-processing facilities and the monopoly of traders. Thus, the local harvesters have no alternative choice to sell their product for looking at a better price.

2. Common lung bamboo harvesting practices

Regarding the forest status, 100 per cent of respondents from household surveys stated that the forest in their local region was seriously damaged in both quality and quantity in the last decades. There are some most significant drivers leading to deforestation and forest degradation in Muong Hinh village, including over-harvesting of timber and bamboo, hydropower construction, agricultural and plantation expansion.

The total lung bamboo forest area in Muong Hinh village is 712 ha, of which 415 ha is mono-lung bamboo forest and 297 ha is mixed lung-timber forest. Local people started to harvest lung bamboo in 1997 when the traders from other provinces came to collect lung bamboo culms. Over time, they get used to the harvesting process and it became their traditional works. People usually collect lung bamboo in the surrounding forest areas around the last 4-5 months of the year (dry season in Vietnam).

Normally, people can only sell lung bamboo culms that are 1 year old and older, so they collect the culms at least 1-year-old – the mature age in local perception. To identify mature culms, people rely on the colour of lung bamboo culms, old culms (mature culms) have a dark green colour, shiny shells, and white spots of mould on the shells; whereas, young culms (immature culms) have a light green colour, white powdery and no mould.

On average, people spend about 8 hours one working day to carry out all of the above steps (Table 2). Although local people are not applying any formal harvesting techniques, they have been doing the same method over a long time they exploit lung bamboo together in their local region.

Table 2: Time spent for harvesting activities in Muong Hinh region (*Source: Household survey, 2019*)

No.	Activity	Time spent (hour)
1	Move from home to exploitation location	0.5
2	Harvest lung bamboo culms in the forest	3
3	Hauling lung bamboo culms to landing areas	1.5
4	Cutting, splitting and bunching	3.5
Total		8.5

According to the result of this survey, due to the lack of detailed information about the harvesting season or techniques in the community regulation, local people are still harvesting lung bamboo forest spontaneously and the exploiting intensity is highly exceeding the growing potential of the forest. Therefore, the forest areas and quality of lung bamboo culms are degrading year by year. In addition, people are applying their traditional techniques in the exploitation process and causing damage to the existing culms as well as restricting the development of the next lung bamboo generations. In brief, unsustainable harvesting of lung bamboo is one of the most important issues in Muong Hinh region.

The cause of this situation was the very low percentage of people who has enough knowledge about the requirements for using and maintaining their lung bamboo forest. On the one hand, due to the low education level and awareness of local people on forest nurturing and protection, the forest is not managed rigorously. On the other hand, the government agencies, particularly forest protection agencies had not fully provided people with knowledge about the protection and harvesting techniques for lung bamboo forest.

Discussion

Recently, the role of bamboo forests in the socio-economic development of localities has been increasingly recognized. Economically, the forestry sector plays an important role in environmental protection, biodiversity conservation, hunger eradication and poverty reduction, especially in remote and mountainous areas, contributing to social stability and national security. In the neighboring province (Thanh Hoa province), between 2006 and 2008, poverty fell by 8 percent among households engaged in cultivating, processing or trading bamboo while poverty remained unchanged for households without bamboo incomes. Ecologically, lung bamboo forest could play a principal role to stabilize the landscape with the extensive root system which helps to control erosion and retain water, while leaf litter or remaining materials after harvesting could contribute to soil fertility. Figure 2 is a causal loop diagram of the farming system in Muong Hinh village, in that lung bamboo forest takes a role as the main factor affecting the forest region, the local livelihood and the development of the community.

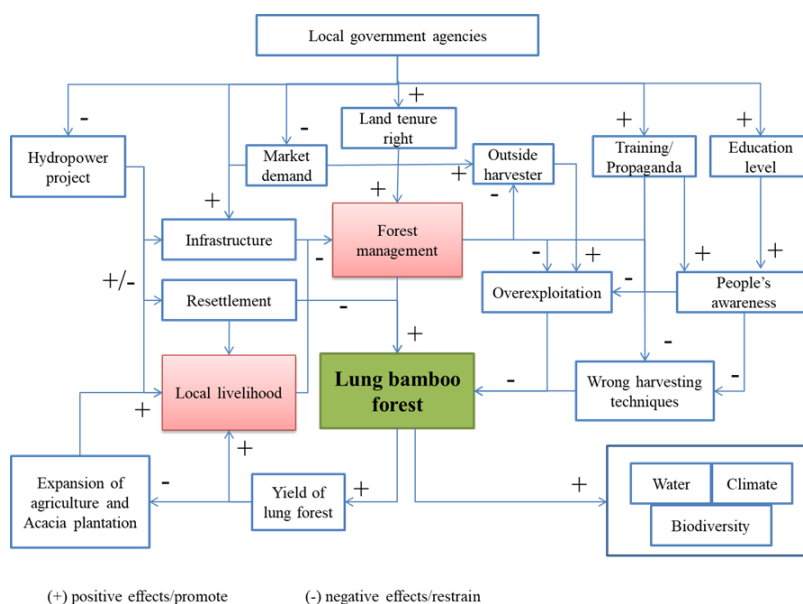


Fig. 2: The causal loop diagram of the farming system in Muong Hinh region (Source: Own drawing by the author)

With favorable natural conditions and a significant role of lung bamboo in the local economy, it is necessary to apply reasonable strategies and silvicultural techniques to manage and develop lung bamboo forest sustainably and to contribute to strengthening the local economic development. In bamboo forest management, harvesting is one of the most important activities to maintain the production of bamboo stands in both quantity and quality (Roxas, 1998) – as cited in Tran.V.H (2010).

Because there are no scientific instructions on managing and harvesting lung bamboo so far, the author suggests some techniques which have been applied to similar bamboo species in the surrounding regions. Some instructions for the main steps of lung bamboo harvesting process are mentioned below:

- *Harvesting time:* the period for harvesting starts from the end of the bamboo shooting season (when all potential shoots reached their full height) and ends one month before the next bamboo shooting season of the next year. For Muong Hinh village, lung bamboo harvesting should be carried out during the dry season, from the end of September to the following March.
- *Harvesting intensity:* the proper harvesting intensity is based on the number of mature culms per clumps, of which, the harvesters should retain all of the immature culms and at least 10 mature culms per clump, and the number of culms harvested must be smaller than the number of immature culms. But in all cases, it should not exceed 30 per cent of total mature lung bamboo culms.
- *Harvesting techniques:* After pre-determine the harvesting areas and selecting clumps and culms, use the knife to cut bamboo culms with the cutting position is lower than 20 cm. During this step, the harvester must be careful and try not to damage the young culms close to the culms cut. And clean the forest after harvesting activities to ensure the growth space for next generations.
- *Harvesting cycle:* If the one-year cutting cycle is applied, 30 per cent of the total number of bamboo culms can be harvested, and in case of two-year cutting cycle, a percentage of 40 is recommended.

The lung bamboo harvesting process is described in Figure 3 with the corresponding descriptive pictures.

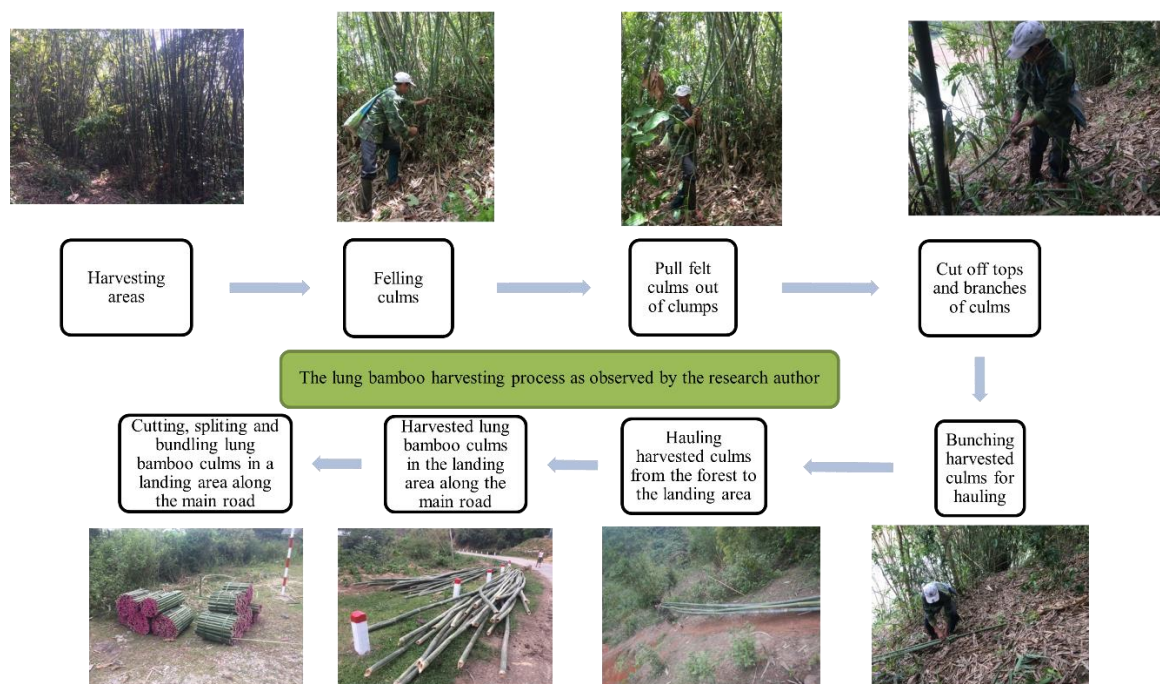


Fig.3: The lung bamboo harvesting process (Source: Own drawing by the author)

Sustainable lung bamboo management is an effective and important strategy for Muong Hinh village or Que Phong district. Because lung bamboo is naturally distributed, very suitable to the local natural conditions and can be profitably exploited, it is highly appreciated not only for its contribution to the balance and maintenance of the ecological functions but also for its contribution to the social-economic development of the locality. However, for sustainable development, the local people should consider building up all three models as follows:

- In the mixed lung-timber forest: Maintaining the current forest structure, however, it is necessary to facilitate the regeneration of timber trees by clearing vines or cutting down lung bamboo culms that affect the growth of these regenerated timber trees.
- In the mono-lung bamboo forest: Apply silvicultural treatments including pruning, tending and selective harvesting measures to create a reasonable structure for bamboo stand with an optimal growing space (200 - 250 clumps/ha, 30 - 40 culms/clump) parallel to select and plant some native timber species to enrich and improve the forest structure.
- In the marginal areas or agricultural lands: People can use the existing seed sources (rhizome) from the natural forest to plant lung bamboos in the form of windbreak belts around agricultural land (rice, maize, cassava) or create lung bamboo plantation intercrop with medicinal plants under the bamboo stand.

Besides, the needs to have post-harvesting activities and develop commodity chain in Que Phong district are very important. At the moment, the profit generated from bamboo forests is too low (about 400 US\$/ha/year). Meanwhile, according to the local authority, the expected income from lung bamboo forest is about 1,200 US\$/ha/year, and maybe even go up to 4000 US\$/ha/year as some models in the neighboring villages. Therefore, it needs to be increased both the forest quality (for a higher harvesting amount) and the benefit generated from the product (to get a higher selling price as well as added values from post-harvesting activities). Presently, lung bamboo post-harvesting and processing activities are very limited, resulting in a very low purchase price and value generated from lung bamboo. According to the preliminary survey, Muong Hinh village has about 46% of the population of working age. Therefore, alongside limiting the sale of cheap raw

materials to the outside traders as at present, local people can build facilities to produce bamboo and rattan products for export, incense sticks, chopsticks or toothpicks.

The development of other alternative incomes is also crucial for long-term development. It is not only reducing the pressure on lung bamboo forest resources but also creating a stable and safe social-economic situation for local communities. According to respondents in the interview, some potential alternative livelihoods include fish-cage farming in the hydropower reservoir, NTFPs under the forest canopy, expanding areas of rice and crop cultivation, etc.

Conclusions/ wider implications of findings

Lung bamboo is the most important forest resource and the main source of income for local people in Muong Hinh village. The natural forests of this region are being degraded due to the over-harvesting, the construction of hydropower plant, and the expansion of agricultural and plantation activities. Local people are using the wrong techniques for harvesting lung bamboo culms. Some of the most serious problems are the high cutting position, the high cutting intensity, the high impact harvesting and the unstable harvesting season. Besides, the knowledge of silvicultural treatments and sustainable bamboo forest management are lacking.

The value chain of lung bamboo is very simple and is controlled by outside traders. The local people are mainly joining in the harvesting process. The post-harvesting processes are poor with nearly no added value for the local community.

Based on the situation of Muong Hinh regions, some suggestions are given to support the local community to achieve a sustainable bamboo management system. The suggestions focus on the bamboo forest management plan, the right harvesting techniques with low impact to the rest of the forest; the silvicultural treatments including harvesting time, pruning, tending and fertilizing; and the potential directions to develop the post-harvesting process as well as to diversify sources of income.

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The views expressed in this information product are those of the author(s) and do not necessarily reflect the views or policies of FAO.

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