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Nypa fruticans Wurmb leaf collection as a livelihoods strategy: a case study in the Sundarbans Impact Zone of Bangladesh

[Md. Nazrul Islam](#) , [Nabila Hasan Dana, Khandkar-Siddikur Rahman, Md. Tanvir Hossain, Moin Uddin Ahmed & Abdulla Sadiq](#)

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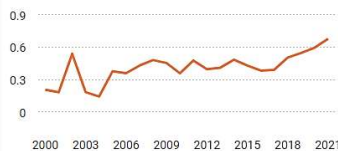
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Manuscript Number: ENVI-D-18-00706

Title: *Nypa fruticans* Leaf Collection as a Livelihood Strategy: A Case Study in the Sundarbans Impact Zone of Bangladesh

Abstract: The *Nypa fruticans* Wurmb. (*Nypa*), a true mangrove palm, is abundant in the Sundarbans reserved forest of Bangladesh. Leaves are the primary product obtained from the *Nypa* palm and used them as thatching materials and they are the income source for forest resource dependent communities in the Sundarbans Impact Zone (SIZ) of southern coastal communities in Bangladesh. This study was aiming at assessing the usefulness of *Nypa* leaf (*Nypa fruticans* Wurmb.) collection as a livelihood strategy in the Sundarbans Impact Zone (SIZ) of Bangladesh. A total of 90 *Nypa* leaf collectors from three coastal unions were interviewed by administering a semi-structured interview schedule. Effects of social and economic factors on the household (HH) total income of the *Nypa* palm leaf collectors were analysed using linear regression and Pearson correlation, respectively. Moreover, the effect of physical factors on the HH total income was analysed by ANOVA and linear regression. Results suggest that income from *Nypa* leaf collection, though making only a quarter percent of household total income, constrained by underdeveloped infrastructure, inaccessibility to fair market price, limitations of financial capital and frequent attack of royal Bengal tiger (*Panthera tigris tigris*). The study, therefore, suggest that *Nypa* leaf collection could not be a sustainable livelihood strategy for the forest dependent communities in the SIZ of Bangladesh, instead by promoting diversified husbandry activities which would reduce further dependency on forests and ultimately conserve the resources of the Sundarbans.

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Based on the comments and suggestions. To improve the quality of the paper, I recommend the authors to make a major revision to the manuscript.

Sincerely yours,

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Nypa fruticans Leaf Collection as a Livelihood Strategy: A Case Study in the Sundarbans Impact Zone of Bangladesh

Abstract

The *Nypa fruticans* Wurm. (*Nypa*), a true mangrove palm, is abundant in the Sundarbans reserved forest of Bangladesh. Leaves are the primary product obtained from the *Nypa* palm and used them as thatching materials and they are the income source for forest resource dependent communities in the Sundarbans Impact Zone (SIZ) of southern coastal communities in Bangladesh. This study was aiming at assessing the usefulness of *Nypa* leaf (*Nypa fruticans* Wurm.) collection as a livelihood strategy in the Sundarbans Impact Zone (SIZ) of Bangladesh. A total of 90 *Nypa* leaf collectors from three coastal unions were interviewed by administering a semi-structured interview schedule. Effects of social and economic factors on the household (HH) total income of the *Nypa* palm leaf collectors were analysed using linear regression and Pearson correlation, respectively. Moreover, the effect of physical factors on the HH total income was analysed by ANOVA and linear regression. Results suggest that income from *Nypa* leaf collection, though making only a quarter percent of household total income, constrained by underdeveloped infrastructure, inaccessibility to fair market price, limitations of financial capital and frequent attack of royal Bengal tiger (*Panthera tigris tigris*). The study, therefore, suggest that *Nypa* leaf collection could not be a sustainable livelihood strategy for the forest dependent communities in the SIZ of Bangladesh, instead by promoting diversified handry activities which would reduce further dependency on forests and ultimately conserve the resources of the Sundarbans.

Keywords: Household, socioeconomic factors, physical factors, income generating activities, market accessibility

Introduction

Since the beginning of human history, non-timber forest products (NTFPs) collection remains the center of interest to the forest dependent communities in the tropics for subsistence and income generation. Around 350 million people directly and another one billion indirectly depend on the forest resources across the world (Belcher et al. 2005). However, income obtained from the NTFFPs ranges from 15 to 39% of the total household (HH) income (Meilby et al. 2014). Yet, NTFFPs collection, a traditional practice, contributes to poverty alleviation by improving the rural livelihood strategies and facilitates the conservation of the natural resources by prohibiting deforestation and forest degradation (Soriano et al. 2017). Poor rural households are highly dependent on the forest products compared to the households with more assets (Meilby et al. 2014). In the last two decades, NTFFPs collection has been highlighted as the rural development and livelihood strategy (Belcher et al. 2005). Like the other NTFFPs collection, leaf collection from the *Nypa* palm is also considered as a livelihood strategy in the Sundarbans Impact Zone (SIZ) of Bangladesh.

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I suggest to cite paper of Malik et al. (2017). They also studied the socioeconomic of households in South Sulawesi Indonesia and they measured number of Nypa palm collection and income of households.

Malik et al. (2017) Mangrove forests decline: Consequences for livelihoods and environment in South Sulawesi

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Did you mean 3 million? if yes, please revise!

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please add "the"



1 The Sundarbans mangrove forest is one of the largest habitats of the monoecious palm *Nypa*
2 *fruticans* Wurmb. in Bangladesh. This native species is also categorized as true mangrove palm (Hossain
3 and Islam 2015). Like the other palm species, the *Nypa* palm does not have above ground stem (Päivöke
4 1985; Carandang et al. 2009; Hossain and Islam 2015). In addition, leaves of *Nypa* palm appear from the
5 ground level and having height around 10m that form the crown (Hossain and Islam 2015). *Nypa* palm
6 provides numerous ecosystem services to coastal ecosystem as well as to the inhabitants – dependent on
7 forest resources. Accordingly, along with the regulating, supporting and cultural services, it provides
8 provisioning services, including leave as thatching materials, fruit as food, new shoots as a source of
9 medicine etc. (Miah et al. 2003). Among these, leaves are the primary product collected from the *Nypa*
10 palm by the collectors in Bangladesh (Miah et al. 2003; Jahan et al. 2006; Tamunaidu and Saka 2011;
11 Hossain and Islam 2015). The *Nypa* palm leaf collectors gather the leaves from the Sundarbans mangrove
12 forest during October to March of each year (Forest Department 2010), and on an average, 60,000 metric
13 tons of *Nypa* leaves are collected each season (Jahan et al. 2006). These leaves are used for the
14 construction of rural housing in the coastal regions of Bangladesh (Miah et al. 2003; Jahan et al. 2006;
15 Tamunaidu and Saka 2011; Hossain and Islam 2015) and are known as poor man's tin sheet (Miah et al.
16 2003). Consequently, the leaves of *Nypa* palm are socioeconomically important for the coastal forest
17 dependent communities of Bangladesh (Aziz and Paul 2015).

27 Many researchers have studied the socioeconomic (Nygren and Myatt-Hirvonen 2009; Zohora
28 2011; Stanley et al. 2012, Quaedvlieg et al. 2014; Soriano et al. 2014) and physical factors (Coomes et al.
29 2004; Belcher et al. 2005; Zeidemann et al. 2014; Soriano et al. 2017) that determine the livelihood
30 strategies of the NTFPs dependent rural families and/or communities. Economic benefits from the forest
31 products and local provisions have an effect on improving the income and livelihoods of the rural families
32 (Porter-Bolland et al. 2012). Average annual contribution of *Nypa* palm in the Bangladesh economy is
33 about US\$ 16.25 million, while it generates a staggering 3,00,000 employment opportunities for each
34 year. It contributes in the local (southwestern region) economy, thus, to national economy of Bangladesh
35 (Zohora 2011). However, poor access to the local markets negatively affects the price of the products and
36 impedes the income opportunities of the leaf collectors. Eventually, their families remain trapped in the
37 poverty cycle (Coomes et al. 2004; Belcher et al. 2005). It has been reported that the income of forest
38 resource dependent families' increases with the increasing amount of the harvested forest products
39 (Stanley et al. 2012). Improved road infrastructure or access to the market (Zeidemann et al. 2014) and
40 organization (Belcher et al. 2005) also reportedly have a positive effect on the income from the forest
41 products. Negotiation skills of the NTFPs collector further determines the price i.e., income from the
42 forest products (Quaedvlieg et al. 2014). Undeniably, to sustain the livelihood of the forest products
43 dependent communities, access to the resources is essential (Brown et al. 2011). An intensive literature
44 search revealed that Zohora (2011) studied the livelihoods of *Nypa* harvesters implicitly. Because indepth
45 information regarding the effects of socioeconomic and physical factors on the household level income of
46 the *Nypa* leaf collectors with reference to the Sundarbans Intermittent Zone of Bangladesh were not explored
47 by the researcher. This study, therefore, was aimed at assessing the usefulness of *Nypa* leaf collection as a
48 livelihood strategy for people in the Sundarbans Intermittent Zone of Bangladesh. In order to accomplish the objective of this research,
49 we seek the answer of following three research questions: (i) how do the socioeconomic factors affect the




HH income of *Nypa* leaf collectors? (ii) do the physical factors determine the HH income of *Nypa* leaf collectors? and (iii) what are the major challenges of *Nypa* leaf collection from the Sundarbans affecting the livelihood of *Nypa* leaf collectors in the SIZ of Bangladesh?

Methodology


Study area

This study was carried out in three southwestern coastal districts of Bangladesh, namely Bagerhat, Khulna and Satkhira. These areas are identified as ecologically critical area and are situated within the Sundarbans  act Zone (Fig. 1) (Aziz and Paul 2015). From these three districts, *Chila* union under *Mongla* upazila, *Sutarkhali* union of *Dacope* upazila and *Munshiganj* union under *Shyamnagar* upazila were selected purposively, because of their closeness to the Sundarbans mangrove forest (Forest Department, 2010). The unions are situated at north side of the Sundarbans mangrove forest and are relatively flat. The coastal areas are situated 0.8 to 4m above mean sea level. The areas experience sub-tropical climate with identical seasonal variations in rainfall, temperature and humidity. Consequently, the annual rainfall in the area ranges from 1,230 to 2,800 mm, while average temperature remains steady between 12-37°C. The study areas are also prone to tropical cyclones (Shameem et al. 2015). However, the inhabitants of these unions are very much dependent on the NTFPs for the subsistence and income generation (Forest Department 2010; Aziz and Paul 2015). The NTFPs collection varies with seasonal availability (Forest Department 2010; Zohora 2011), such as *Nypa* palm leaves  are available during the period from October to March of each year (Forest Department 2010).


Sampling, data collection and analysis

To achieve the research objectives, the participants – the *Nypa* leaf collectors – were identified and interviewed in a long and excruciating process. The inventory of *Nypa* leaf collectors from three unions were developed with the help of local community leaders. Afterwards, a total of 90 *Nypa* leaf collectors (30  from three unions) were interviewed following cluster random sampling. All the interviewees were male because it is evident that no females were involved in leaf collection from the Sundarbans. It is noteworthy that the informants were actual *Nypa* leaf collectors involved in the collection of *Nypa* palm leaves from  for generations. These people also perform husbandry activities  household income and almost all of them were household head (97%).


By administering a semi-structured interview schedule – containing both open and close-ended questions on socioeconomic conditions and physical factors – the *Nypa* leaf collectors were interviewed by a group of well-trained undergraduate students. The interviewers were trained extensively by the first author, through classroom lectures and role playing, about the research objectives as well as the content of the interview schedule to maintain the uniformity of the survey as well as to keep anonymity of the interviewees. The interviews, conversed in *Bengali* and later converted into English for input, lasted for

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What is the extent and abundance of *Nypa* palm area in the SIZ? if possible please provide it for the study area part.

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Why did you divide 30 samples each from three unions of the total 90? is it really representative sample number of 3 unions?

 Author: USER Subject: Note Date: 2018-11-10 05:08:09

What about the off-farm activities?
What does activities include the income from husbandry and off-farm income? I suggest to put here to understand the issue from the first

 Author: USER Subject: Note Date: 2018-10-26 14:19:20

Please add "the"

1 half an hour. Considering the harvesting period, the fieldwork took three months to complete, from
2 December 2016 to February 2017 that is the pick harvesting period.
3

4 Both quantitative and qualitative data were collected through the interview schedule. The data
5 involves the social factors (age, education level, HH members involved in income generation), economic
6 factors (income from Nypa leaf collection, income from husbandry, off-farm income), physical factors
7 (unions, distance of HH from nearby market, road networks), primary and secondary occupation,
8 frequency of trip to Sundarbans per year, stay in forest per trip, leaves harvested per day, off-farm
9 activities. Moreover, challenges of harvesting Nypa leaves from the Sundarbans were noted. The
10 monetary values were converted from BDT to USD. Total HH income (per month) was estimated by
11 summing up the income from Nypa leaf collection, income from husbandry and off-farm income.
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17 *Statistical analysis*

18
19
20 Statistical analysis of the data was carried out by using MS office excel (version 2016), statistical package
21 for social science (version 16) and ATLAS.ti (version 8) software system. In order to answer the first
22 research question, i.e. to observe the effect of social factors on HH total income, a linear regression with
23 enter option was carried out as the unstandardized residuals followed the normal distribution. In this case,
24 age, education level and number of HH members involved in income generating activities (IGAs) were
25 independent variables and HH total income was dependent variable. Moreover, to analyze the effect of
26 amount of leaf harvest on the income from Nypa leaf collection, we conducted a linear regression with the
27 number of leaf collection (independent variable) and income from Nypa leaf collection (dependent
28 variable), because unstandardized residual followed normal distribution. Later, relationship between
29 economic factors, including income from Nypa leaf collection, income from husbandry and off-farm
30 income and HH total income, was analyzed following Pearson's correlation as the unstandardized
31 residual followed normal distribution.
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40 Second research question was answered by analyzing the effect of physical factors on income
41 from Nypa leaf collection and HH total income. To find out the spatial difference of income from Nypa
42 leaf collection as well as from husbandry and off-farm sources, we conducted the ANOVA
43 (unstandardized residual followed normal distribution) separately between the areas and mentioned
44 economic activities. Moreover, we repeated the similar procedure with the areas and HH total income to
45 observe the spatial difference in HH total income as the unstandardized residual followed normal
46 distribution. In the meantime, to assess the effect of road networks on HH total income, ANOVA with
47 road types and HH total income was conducted, because unstandardized residual followed normal
48 distribution. Further, effect of distance to nearby market on HH total income was analyzed by using a
49 linear regression due to the fact that the unstandardized residual followed normal distribution.
50 Furthermore, we analyzed the challenges that the Nypa leaf collectors face to collect the leaves from the
51 Sundarbans to answer the third research question. We employed ATLAS.ti (version 8) by qualitative
52 coding each challenge as reported by the interviewees.
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Results

Effects of socioeconomic factors on HH income

Among the social factors, age and education level did not affect the HH total income (Fig. 2A and Fig. 2B). However, HH members involved in IGAs positively affected the HH total income of Nypa leaf collectors in the SIZ of Bangladesh (Fig. 2C) (Table 1).

Income from Nypa leaf increases with the increasing amount of Nypa leaf collection from the Sundarbans mangrove forest (Linear regression, Regression coefficient= 0.003, N=90, p<0.05) (Fig. 3). Moreover, income from Nypa leaf collection and off-farm activities moderately correlated to HH total income (Fig. 4A and Fig. 4C) (Table 2). Surprisingly, it was evident that the income from husbandry highly correlated to the HH total income, i.e. HH total income of Nypa leaf collectors highly depend on income from husbandry (Fig. 4B) (Table 2).

Effects of physical factors on HH income

Income from Nypa leaf collection (ANOVA, F2,87=1.668, P>0.05) (Fig. 5A) and off-farm activities (ANOVA, F2,55=0.149, P>0.05) (Fig. 5B) did not vary among the unions (ANOVA, F2,87=1.668, P>0.05 and ANOVA, F2,55=0.149, P>0.05) though the income from husbandry significantly varied among the unions (ANOVA, F2,87=20.866, P<0.05). Accordingly, HH total income of Nypa leaf collectors varied spatially (ANOVA, F2,87=21.245, P<0.05) (Fig. 6A). Moreover, HH total income varied depending on the road networks (ANOVA, F2,87=21.245, P<0.05) (Fig. 6B). In addition to the road networks, HH distance to nearby market negatively affected the HH total income of Nypa leaf collectors (Fig. 6C) (Table 1).

Challenges of Nypa leaf collection

Apart from socioeconomic conditions, the Nypa leaf collectors were also asked to address the major constraints they were facing while collecting and marketing the Nypa palm leaves. The first thing they mentioned was the occurrence of tiger attack or fear of being attacked in the SIZ was a major hurdle for these people. Lack of financial capital for seasonal leaf collection also hampered the life and livelihood opportunities of the Nypa leaf collectors. Moreover, the monopoly business of the buyers in local markets, a syndicate who set the price of the leaves much lower than the expectations, was another challenge for these marginal poor depending on NTFPs for living.

Discussion

This study explored the livelihoods, HH total income, factors affecting the HH total income, and challenges of Nypa leaf collectors in the SIZ of Bangladesh. The results revealed that specific socioeconomic and physical factors affect the HH total income of Nypa leaf collectors in the SIZ of Bangladesh. Furthermore, the frequent tiger attack along with monopolized market systems are they key

Author: USER Subject: Note Date: 2018-10-26 14:51:58

line 40-41 are method statements. So I suggest to move in the method part

Author: USER Subject: Note Date: 2018-11-10 13:36:40

To improve the quality of discussion part, I suggest to the author to more in depth address how to face the constrains (based on the research findings) of Nypa leaves collector for sustainable livelihood strategy than just to suggest to promote husbandry activities though it also the one of the research findings. See also my comments on page 7 line 44-49 and page 8 line 30-33

Author: USER Subject: Note Date: 2018-11-05 11:22:50

Page 5 line 55-60 to page 6 line 1 are the purpose and the findings of this study not a discussion. So I suggest to delete

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challenges faced by the *Nypa* leaf collectors in the SIZ of Bangladesh.

Effects of socioeconomic factors on HH total income

In this study, our expectation was that along with the number of HH members involved in income generation, age and education level would have an effect on the HH total income (Fig. 2A and Fig. 2B), because age might be related to experience and education level might have an effect the negotiation skills. However, number of family members involved in IGAs only has positive effect on HH total income (Table 1). Because, the income from *Nypa* leaf collection largely depends on availability of fresh leaves rather than the number of collectors, while the income from husbandry is more related to investing time to manage the farms that might increase with the helping hand from the same HH and eventually increase HH income from husbandry. Average age of the *Nypa* leaf collectors was 38 years that is comparable to the findings of Zohora (2011) who reported the average age around 40 years in other SIZ of Bangladesh. NTFPs collection behaviors were quite different from the results reported by Coomes et al. (2004). The researchers reported that young collectors collect more NTFPs than the older collectors do, which affect the HH total income. However, our results showed that age does not have any effect on HH total income. Our study also reveals that the local people of the study areas have very poor education, averaging only 4 years of schooling, and 14.4% of the total leaf collectors are totally illiterate. This is supported by the results regarding the poor education level of the forest dependent peoples in SIZ of Bangladesh (Forest Department 2010; Zohora 2011). The poor educational outcome, therefore, does not influence the HH total income in the study areas. In contrast to the findings of this study, Baiyegunhi et al. (2016) found that education level has a significant effect on the HH income. However, the number of family members involved in IGAs definitely has a positive effect on HH total income and such findings are in line with the study of Soriano et al. (2017).

Nypa leaf collection, husbandry and off-farm activities are considered as economic factors in this research. As expected, per day income from *Nypa* leaf increased followed by the increasing quantity of *Nypa* leaf collection per day from the Sundarbans mangrove forest (Fig. 3). This might be attributed to the fact that all the leaf collectors tend to increase their income within short time. Our result is supported by Soriano et al. (2017) where the researchers observed increased HH income of NTFPs dependent communities with higher harvest of NTFPs. However, *Nypa* leaf collection, i.e. income generation from *Nypa* palm leaf, depends on leaf quantity and leaf availability that might be the reason for lower quantity of leaf collection. Moreover, the presence of undergrowth and other obstacles are the issues that might affect the harvesting efficiency of *Nypa* palm leaves. Even the collectors have to clear dead and undesired *Nypa* leaves to get access to the desired leaves, hence, reduce the income from *Nypa* leaves per day (Carandang et al. 2009).

Income from *Nypa* leaf collection contributed up to 28.21% of the HH total income – a moderate contribution to HH total income in the SIZ of Bangladesh (Fig. 4A). The syndicate of the buyers in local market set the price of the leaves, which in turn, reduce the income from *Nypa* leaf collection as market price of palm leaves is way down than the expected value, considering the obstacles and danger of

Author: USER Subject: Note Date: 2018-11-05 12:23:45

You have compared your findings to other previous researchers, but you need to clearly address, why the age and poor education don't effect to HH total income? and why are different from other previous researchers?

Author: USER Subject: Note Date: 2018-11-05 14:32:35

you need to more address about the leaf quality that you meant here. Is It related to and due to collection tools as you said on page 7 line 42 or more than it? In addition, what did you meant also with depends on the leaf availability? as you said in abstract the *Nypa* palm is abundance in this area

1 collecting the NTFPs. Moreover, the leaf collectors, generally poor people, have insufficient financial
 2 capital for their venture of leaf collection in each season. Henceforth, the leaf collectors borrow money
 3 from the local money lenders, who are also member of syndicate, with high interest, and with certain
 4 conditions, such as the leaf collectors are bound to sell the collected leaves in a minimum price set by the
 5 money lenders - a handful of people monopolized the local market of *Nypa* palm leaves. As a result, leaf
 6 collectors remain trapped by losing grip on the collected materials and hardly have any share over the
 7 profits made by the syndicate. This might be another reason that reduces the contribution of income from
 8 *Nypa* leaf collection in HH total income compared to that of from husbandry. The findings suggest that
 9 the HH total income of *Nypa* leaf collectors largely depend on income from husbandry as it contributes
 10 63.39% of HH total income (Fig. 4B), and depending on the HHs, it also varied from US\$ 54 to US\$ 138
 11 per month. The husbandry activities include shrimp farming, fish farming, agro farming, and poultry
 12 farming. There is a provision for selling husbandry products in the local market and price of the products
 13 varies reasonably in time compared to *Nypa* palm leaves. Hence, the contribution of husbandry income is
 14 highly significant in the HH total income, considering its lion share in HH income. Despite the aforesaid
 15 drawbacks, the contribution of income from *Nypa* leaf collection (28.21%) in HH total income is in the
 16 range of income from NTFPs collection (15-39%) as reported by Meilby et al. (2014). Moradi et al.
 17 (2017) documented comparable findings that contribution of oak fruits in family income is about 29%.
 18 Soriano et al. (2017), on the contrary, found that income from Amazon nut has greater contribution (44%)
 19 in HH total income in Bolivian Amazon. Meanwhile, in Iran significant contribution (51%) of wild
 20 pistachio to the family income was recorded by Moradi et al. (2017). The differences, however, might be
 21 attributed to the differing management system of Amazon nut in Bolivian Amazon and *Nypa* palm in
 22 Bangladeshi Sundarbans. Moreover, the 44% income also includes income from timber harvesting. In
 23 Bolivia Amazon nut trees are managed through community based management (Soriano et al. 2017),
 24 while in the Sundarbans – a reserve forest – it is managed by the Bangladesh Forest Department (BFD)
 25 (Forest Department 2010). As a result, the *Nypa* palm leaf harvesters do not have ownership over the
 26 resources and have to pay revenue to the BFD. In addition, the only way to transport the leaves from the
 27 Sundarbans to the nearby local markets is water vehicle, which is expensive. All these factors inversely
 28 related to the net income from *Nypa* palm leaves. The situation is further worsen as the quality of
 29 collected leaf may have been affected by the cutting tools, which eventually influence the price of the
 30 leaf, thereby, reduce the chances of more income from *Nypa* leaf. The income from *Nypa* leaf collection,
 31 though meagre compared to husbandry as livelihood option, can help at its best to reduce poverty through
 32 increasing the number of HH members involved in income generating activities, and improve the life
 33 style and living conditions of forest resource dependent communities (Stanley et al. 2012).

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Though the effect of off-farm income on HH total income was significant (Fig. 4C), its contribution in HH total income constitutes a mere 9%. Findings suggest that more than sixty percent (64.4%) of the *Nypa* leaf collectors are involved in off-farm activities, including day laborer, van pulling etc., yet its contribution is very poor compared to husbandry and palm leaves collection. The reasons for least input in HH income can be attributed to the leaf collector's irregular involvement in these works. They may also have minimum time at their disposal to earn money through these ways or the opportunities to get involved in off-farm activities may be scarce or uncertain in their localities, though it

Author: USER Subject: Note Date: 2018-11-05 15:56:59

Since the selling price have highly significant in the HH income, I thought and suggest the paper text need to provide information of the selling price of the *Nypa* palm leaves and other prices from husbandry activities and off-farm activities. So it make the readers more understand the comparison each other of the activities.

Author: USER Subject: Note Date: 2018-11-10 13:08:59

Although, oak fruits, Amazon nuts, and wild pistachio include in NTFPs, but comparing to the income of same product (*Nypa* leaves) in other places is better. Each of product have different in way of collection and challenges, price, market, management system. So it can be influence to the income contribution. In addition, it also can provide readers with new insights related to the livelihood of *Nypa* palm collectors in various places

Author: USER Subject: Note Date: 2018-11-10 12:37:04

This statement (lime 44-49) contrast with the statement in conclusion and abstract "Nypaleaf collection from the Sundarbans alone could not be a livelihood strategy". I suggest this statement include in conclusion and abstract as one of recommendations beside to promote husbandry activities as alternative.

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increases the HH total income (Soriano et al. 2017). Hence, it could be a source of additional income rather than livelihood strategy for the *Nypa* leaf collectors in the SIZ of Bangladesh.

Effects of physical factors on HH total income

Spatial variation in income from *Nypa* leaf and off-farm activities was not significant (Fig. 5A and Fig. 5C), but the income from husbandry was significantly different among the unions (Fig. 5B). The price of *Nypa* leaves fixed by the local market syndicate, who remains in the top of value chain and govern the trade of *Nypa* leaves at sub-district and union levels. This might be the fact for no spatial variation in income from the *Nypa* leaf collection. Zohora (2011), however, reported a significant spatial variation in income from the NTFPs, including *Nypa* leaf collection, honey collection and goran (*Ceriops decandra*) harvesting. It is due to the opportunistic behavior of the local buyers to maximize their own profit and income from other NTFPs. It was not the case for this study. Moreover, off-farm activities are rare in the studied unions and it might be the reason for no spatial variation in income from these activities. This result also complements the results of Zohora (2011) regarding the income from and availability of off-farm activities like day laborer. Unlike off-farm activities, income from husbandry activities was statistically different for three unions and the reason could be related to the availability of resources and support from the family members and external agents, like government and non-government agencies. Similar results regarding the spatial variation in income from husbandry activities (alternative income generating activities) in the other parts of SIZ of Bangladesh was evident in the work of Zohora (2011). The increasing income from husbandry activities, therefore, could be a potential solution to reduce forest dependency and livelihood strategy of the *Nypa* leaf collectors, because it contributes substantially in the HH total income.

Significant spatial variation in HH total income of *Nypa* leaf collectors observed among the unions, where Chila union has the highest HH income followed by Munshiganj and Sutarkhali unions (Fig. 6A). This variation can be attributed to the spatial variation as well as significant contribution of income from husbandry activities. Zohora (2011) reported similar results about the HH income of NTFPs collectors in other areas of SIZ in Bangladesh. In contrast, HH income of Brazil nut collectors varied among the HH rather than between geographical spaces and those differences mostly depended on income from NTFPs collection (44%) rather than husbandry or off-farm activities (Soriano et al. 2017).



Findings indicated that HH total income varied depending on the different types of road networks in the three unions (Fig. 6B). Basically, there are four distinct forms of the road networks in the study areas, *paka* (concrete), semi-*paka* (semi-concrete) and *kacha* (soil road) and *paka*, and waterways. Lower HH total income resulted from under developed road networks (waterways and *kacha* road) in *Sutarkhali* union, on the contrary *Chila* union has better roads (*paka*) connecting local markets with adjacent areas, thus, the HH total income is way better than *Sutarkhali*. It is strongly believed that high transportation cost along with wastage of time to reach outside markets from local area with underdeveloped road networks might have compelled the *Nypa* leaf collectors to sell the NTFPs in a minimum price set by local buyers or money lender. Subsequently, the local market remains under

1 control of the syndicate of the local buyers (Forest Department 2010), which in turn negatively influence
2 the HH total income. Furthermore, the HH total income of *Nypa* leaf collectors also inversely related with
3 HH distance from nearby market (Fig. 6C). Because, long distance means substantial increase of
4 transportation cost regardless of products, including both NTFPs and husbandry. Similar findings were
5 reported by Melaku et al. (2014) that the distance to the market negatively affect the HH income from
6 NTFP collection in Ethiopia. The finding of this study, however, do not comply with the result of Soriano
7 et al. (2017) regarding the dependency of NTFP collectors on the income from NTFP collection.
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11 ***Challenges of Nypa leaf collection and livelihood***

14 Apart from socioeconomic and physical constraints, the *Nypa* leaf collectors also mentioned tiger attack
15 as a key challenge during leaf collection from the Sundarbans. In Sundarbans, the leaf collectors often
16 enter into the deepest areas, roamed by the tigers, therefore, become an easy picking for the tigers during
17 the leaf collection season. Every year, a number of harvesters either lost their lives or become
18 handicapped. Zohora (2011) also reported the incidences of tiger attack during the harvesting of *Nypa*
19 palm leaves in the Sundarbans. Among other hurdles, as mentioned by the harvesters, the insufficient
20 financial capital during leaf collection season and the syndicate of local buyers to influence the price of
21 goods are major issues. The *Nypa* leaf collectors, belonging to the poor families, do not earn much to
22 have savings and they are not organized enough to form an association, which eventually force them to
23 borrow money from local money lenders or to take advance from the possible buyers at the local markets.
24 Hence, the collectors remain trapped in the cycle of lending money and selling the products at minimum
25 cost without having any control of both money and goods, and such result also reported by Zohora
26 (2011). The author, however, also reported the interference of forest bandits during and after harvesting
27 of *Nypa* palm leaves and other NTFPs from the Sundarbans (Zohora 2011). This indicates the need for
28 group or association formation of NTFPs producers/collectors, and policy makers and development
29 practitioners might be interested in it.
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40 **Conclusion**

41 This research highlighted the livelihood options, HH total income, factors affecting HH total income and
42 challenges of the *Nypa* leaf collectors, which would be helpful to take further necessary actions for
43 improving their livelihood strategy. However, findings of this research are context specific, but it might
44 be applicable for the other palm leaf collectors across the world. Results of this study revealed that *Nypa*
45 leaf collection from the Sundarbans alone could not be  livelihood strategy. It does not contribute much
46 in the household income compared to husbandry, additionally, it involves life threatening challenges, e.g.,
47 tiger attack during leaf collection.  of effective husbandry livelihood activities for *Nypa* leaf
48 collectors in the SIZ of Bangladesh would be a better alternative livelihood strategy to reduce forest
49 resource dependency, as it possesses substantial prospects in the southwestern regions of Bangladesh.
50 Therefore, this study emphasizes the need for not only formulation and strengthen the policy regarding
51 the sustainable livelihood development of the coastal inhabitants but also to ensure the access to the social
52 safety net programs.
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Decision reached by the Editor on ENVI-D-18-00706R1

em.envi.0.62b96b.9d1bcddf@editorialmanager.com on behalf of
Environment, Development and Sustainability (ENVI) <em@editorialmanager.com>

Sun 4/21/2019 4:44 PM

To: Abdul Malik <jwp495@alumni.ku.dk>;

Dear Dr. Malik,

The Editor has made a decision on ENVI-D-18-00706R1, which you recently reviewed for us.

The decision is: Major revisions.

You can also view the decision letter and the reviewers' comments at the Editorial Manager Website.

Your username is: AbdulMalik-995

If you forgot your password, you can click the 'Send Login Details' link on the EM Login page at
<https://www.editorialmanager.com/envi/>

Thank you again for your contribution to Environment, Development and Sustainability.

Best regards,

Luc Hens
Editor in Chief
Environment, Development and Sustainability

Reviewer #4: The second review is much like the first, and my comments are much the same.

The English is not always clear. I strongly recommend that the manuscript be reviewed by someone for whom English is his/her first language. Such a reviewer could spot the numerous errors and smooth out the style of the writing. As it stands, the writing is so bad that I cannot recommend publication, no matter how novel, useful or interesting the findings.

An example:

P. 10, lines 19, 20: "Because, long distance means a substantial increase of the transportation cost regardless of products, including both NTFPs and husbandry." This is not a complete sentence.

The correct name of the palm is *Nypa fruticans* Wurmb - with no full-stop, as Wurmb is not an abbreviation. The authors failed to correct this the first time and, in fact, compounded the error by adding a spurious authority.

P. 2, line 3: "Like the other palm species, the *Nypa* does not have an above ground stem" should read "Unlike most other palm species, *Nypa* does not have an above-ground stem...." *Nypa* is unusual in having a prostrate, dichotomously branching stem. An important reference for this statement is: Dransfield, J., N.W. Uhl, C.B. Asmussen, W.J. Baker, M.M. Harley & C.E. Lewis. 2008. *Genera Palmarum - the Evolution and Classification of Palms*, ed. 2. Royal Botanic Gardens, Kew, Richmond, UK. Pp. 732.

The conclusion seemed self-evident: leaf collection is not a viable livelihood strategy, which is why collectors are not doing it full time, and it is not the sole source of household income. I think some of the discussion could be removed to tighten the narrative.

I again stress that the bar graphs should have some indication of significance/non-significance among the bars. In most publications, this is simply accomplished by adding letters to each bar, such that bars with the same letters are not significantly different and bars with different letters are significantly different.

Reviewer #8: Methodology

1) Study area: Frequent repetitions of same information.

2) Theoretical framework: I am not sure why this subhead is here. I don't see anything under this subhead that talks about theoretical framework of Methods. And I believe, 'Methodology' should be replaced with 'Methods'. However, the two paragraphs (composed mostly of some definitions and conditions) written under this subhead are not needed at all. The readers of this article are considered know these preliminary definitions.

3) Sampling and data collection:

- What is the basis of sampling size being 90? I did not see any rationality. This is too small a sample to represent the population, and thus, the results are not beyond question.

- What surprised me most is choosing 'cluster random sampling' to select households. I don't think clustering is a valid sampling method for this particular case. Again, what are the variables considered for cluster sampling?

- "The sample size for each union was determined at confidence interval of 95% and precision level of $\pm 5\%$ " - Where is it from? What does it mean? What estimate is it talking about?

- The authors selected three villages "because of their closeness to the Sundarbans mangrove forest". Proximity could be a better word for closeness. However, this choice of villages does not match with the third research question specified in the Introduction section- "what are the major challenges of Nypa leaf collection from the Sundarbans affecting the livelihood of Nypa leaf collectors in the SIZ of Bangladesh"? (SIZ) Sundarbans Impact Zone is no way confined to small adjacent villages. Thus, the results from such sampling cannot be generalized for the SIZ.

- The whole article contains repetitive and unnecessary description of both relevant and irrelevant matters. For example, let's look at this quote - "By administering a semi-structured interview schedule - containing both open and close-ended questions on socioeconomic conditions and physical factors - the Nypa leaf collectors were interviewed by a group of well-trained undergraduate students. The interviewers were trained extensively by the first author, through classroom lectures and role playing, about the research objectives as well as the content of the interview schedule to maintain the uniformity of the survey as well as to keep the anonymity of the interviewees. It is noteworthy that to facilitate the interviews, the interview schedule was translated into Bengali language and all the interviews were conversed in Bengali to ease the communication with the participants as all of them had lower educational background. However, for data input the information was converted into English. Each of the interview lasted for half an hour. Considering the harvesting period, the fieldwork took three months to complete, from December 2016 to February 2017 - the prime time for harvesting". This whole paragraph is seemingly irrelevant for any peer-reviewed article.

4) Statistical analysis

- What is the use of this - "Statistical analysis of the data was carried out by using MS office excel (version 2016), statistical package for social science (version 16) and ATLAS.ti (version 8) software system"? Would the results be different if other statistical packages were used?

- "In this case, age, education level and number of HH members involved in income generating activities (IGAs) were independent variables and HH total income was dependent variable." - My guess is some pair of the explanatory variables (Education and HH members, for example) are most likely significantly correlated. Thus, the models so run are likely affected by multicollinearity issues. This has inflated regression R-squared from its actual value.

- In many places the author claimed- "unstandardized residual followed normal distribution"! This is unbelievable for a sample size of just 90!

- "we conducted a linear regression with the number of leaf collection (independent variable) and income from the Nypa leaf collection (dependent variable)" - what is the justification of this regression? The more leaves one collects, the higher would be one's income - do we need to test it?

- "Later, the relationship between economic factors, including income from the Nypa leaf collection, income from husbandry and off-farm income and HH total income, was analyzed following Pearson's correlation as the unstandardized residual followed normal distribution." The authors did it later. But it was required to be done earlier the regressions were run. Ordinary least square regression, which the authors appear to have run, needs to declare that the regressors are uncorrelated.

- "In the meantime, to assess the effect of road networks on HH total income, ANOVA with road types and HH total income was conducted, because unstandardized residual followed normal distribution." - What is the use of this activity in this study? How is Nypa related to it? By the way - using the clause "unstandardized residual followed normal distribution" everywhere is extremely irritating. It doesn't make sense.

Results

- "Surprisingly, it was evident that the income from husbandry highly correlated with the HH total income." - Why is it surprising? It is obvious and we don't actually need a regression to prove it.

- Throughout the result section the authors have reported all the insignificant estimates ($P > 0.05$). We don't really need it. There are hundreds of events that are not significantly related to this study; should we report them all? It appears to be irrational from scientific standpoint.

- "The first thing almost all the respondents mentioned that the occurrence of tiger attack or fear of being attacked in the Sundarbans was a major hurdle for these people. For example, "people know that most of the tiger attack happens inside the

Sundarbans during the leaf collection, but they have to go to Sundarbans for increasing their income as much as possible". In addition, lack of financial capital for seasonal leaf collection also hampered the life and livelihood opportunities of the Nypa leaf collectors as described by 75% respondents. Moreover, the monopoly business of the buyers in local markets, a syndicate who sets the price of the leaves much lower than the expectations, was another challenge for these marginal poor depending on NTFPs for living." - Extremely irrelevant to this article. Remove it.

Conclusion

Extremely choppy. Poor language and irrelevant to the study data and facts. The conclusion failed to give us a succinct take home message as to why this study is important.

Overall:

- 1) Language: The manuscript needs a thorough revision of its English. Some of the many concerns are: subject-verb disagreement, poor choice of appropriate words, mixing of tenses, and unclear sense of sentences, redundant and repetitive information.
- 2) Information: Some information are just willingly made. For example- Unions are not geographical units; it is an administrative unit. Again, this is not the smallest local government unit; a ward is probably the smallest. Again, upazilas are NOT sub-districts in Bangladesh.
- 3) Final Comment: Rejected. The article cannot be published in its current form.

Reviewer #10: Dear authors

Overall, the manuscript highlights an important topic and shows some interesting results, especially those on the challenges for nypa leaf collectors. It deserves to be published after revisions. Unfortunately, a clear message seems to be lacking, instead the authors are proposing to promote animal husbandry as viable livelihood strategy, which is already the case. The presentation of the results and parts of the discussion need improvements and the conclusion needs to be more clear and backed up by the results. Below please find specific comments:

P1, L 10 - 13 In these two sentences you should mention which specific factors you are talking about.

P1, L 18 - 20 This conclusion seems rather too obvious.

P1, L 28 - 30 NTFP collection prohibits forest degradation? This is not a direct link. NTFPs can also be overharvested, which can in some cases lead to degradation. Whether something is prohibited or not depends on rules and laws and the management plan of that forest area, not on the actual collection of NTFPs. Please clarify.

P2, L 6 Ecosystem services are per se the benefits that humans obtain from nature, not services to the ecosystem. Please adjust your wording.

P2, L 7 Which are the regulating and cultural services from Nypa? Please specify.

P2, L 33 - 35 Do you mean your intensive literature research? In that case delete. If you mean Zohora 2011 did the extensive literature research please write it accordingly.

P2, L 35 - 37 Suggest formulating sentence as: "However, in depth information regarding ... had not yet been explored."

P2, L 40ff Without a more detailed clarification of which factors you are talking about, the research questions are not well understood. E.g. for R.Q. II: physical factors could be anything from climatic conditions over road infrastructure to the property of boats. Please clarify.

P3, L 2 - 3 Suggest: "what are the major challenges for Nypa leaf collectors in the SIZ of Bangladesh?" for a better wording.

P3, L 12 Is closeness to the Sunderban mangroves the only selection criteria for your unions? Are they representative for a larger area? Please indicate what this could mean for the results (in the discussion).

P3, L 18 If you talk about NTFPs in general, you should at least mention a few other than Nypa.

P3, L 27 "livelihoods" (throughout)

P4, L 10 - 14 I am not convinced this is true. Furthermore, please adjust the sentence so it is clearer and easier to read.

P4, L 23ff It would be nice if you could give information on the total number of households collecting nypa leaves within the studied communities. This information could also be included in the description of the study area.

P4, L 24 delete "excruciating"

P4, L 28 This is interesting. In other countries, women mostly benefit from nypa (although mostly men collect the leaves, women thatch them and get an income). Maybe you can add an explanation here.

P4, L 31 "animal husbandry" (throughout)

P4, L 32 please explain "agro-farming"

P6, L 9ff I need to stress that for a better understanding of the results you need to explain the individual factors in advance. E.g. L 15 - 16: How did you measure / ask this? Do you mean the available leaves per area or do you mean the collected leaves? Please clarify directly in the text.

P6, L 15 - 18 To give a better foundation to your results, I suggest adding some numbers here to show just how much nypa collectors depend on income from nypa (percentage of total HH income??)

P6, L 17 - 20 Can you add information on the type of correlation?

P6, L 28 - 29 It would be very interesting to have this result specifically for income from nypa. Please add. Or clarify the term market (is it for nypa or for the sale of animals or ...)

P6, L 31 Can you specify a number or percentage instead of "almost all"?

P7, L 1 - 3 Please specify.

P7, L 5 "these marginal poor depending on NTFPs for living": Firstly, when did you define your respondents as generally marginal poor? Secondly, in the results you showed that total HH income mostly depends on the income from animal husbandry as well as off-farm income. That means they do not depend primarily on NTFPs... Please state your message clearly. Again, it is important that you present the percentage of total hh income they get from nypa.

P7, L 18 - 19 also Nypa?

P7, L 28 - 30 As these are very different contexts, you need to elaborate.

P8, L 4 - 7 This is the first time you talk about this. Is it part of your results? If not, please give a reference and also discuss how that relates to your results.

P8, L 12ff Very interesting paragraph. But these are all results, which should be presented in the results section and only discussed in more detail here (as you do starting from L 30ff).

P9, L 8 - 9 Yes, good conclusions. You should also refer to the fact that this is exactly what people are doing, they depend much more on other income sources because nypa alone is not a viable livelihood strategy.

P11, L 11 Before you mentioned that one of the main challenges is the low price and limited bargaining power of nypa collectors. If you suggest now to adjust the mangrove and nypa management, you need to base it on your findings. Should the emphasis be on improved natural resource management or market access?

P11, L 15 - 19 From this paper we do not know any details about effective animal husbandry. We only know that people already follow this strategy (mostly animal husbandry and nypa in addition), so what exactly do you recommend to improve? Are poorer households limited to follow this strategy? If so, please already discuss this earlier.

Reviewer #12: 1. On Introduction (Page 1 Line 32), the word "In the last two decades" might be better to be written "Since the 1980s". This is important to avoid readers' misunderstanding in terms of time frame (period), because you cited a reference published in 2005 (Belcher et al. 2005). In fact, studies and interests in NTFPs started in the 1980s in response to calls for using forest resources sustainably for the benefit of the wider society, especially for the rural people.

2. Page 2 Line 3, the sentence "Like the other palm species, the Nypa does not have an above ground stem" is not correct and should be revised, as many or most palm species do have above ground stem. However, some of the palm species do not have it, like *Nypa fruticans*, *Raphia regalis*, *Johannesteijsmannia altifrons*, *J. magnifica*, etc. Just for an additional information for Page 2 Line 7-8, *Nypa fruticans* is a very potential source of sugar, by tapping the inflorescences/infructescences.

3. Page 2 Line 35, the word "Because" is not appropriately used and it can be replaced with "However".

4. Page 2 Line 35, page 3 line 22 and 23, the word "Nypa" should be written in italics, please check this word throughout the paper carefully.

5. Page 3 Line 7 (Study Area), the word "an ecologically critical area" needs to be explained or elaborated a bit further in the paper, why is it important, as you mentioned that the three study areas belong to an ecologically critical area but then you did not explain the importance of choosing an ecologically critical area in your study (research), but rather because of their closeness to the Sundarbans mangrove forest.

6. Page 3 Line 16 (Study Area), the sentence "while the average temperature remains steady between 12-37oC" needs to be revised, as it is not an average but a range. In a tropical condition, the temperatures range from 12 to 37oC indicate a wide temperature variation, and not a steady temperature. I am wondering whether a temperature of 12oC could be experienced somehow or sometime in the Sundarbans mangrove, coastal, tropical forest? Did you measure the temperature range by using your own equipment?

7. Page 3 Line 23-25, is there any information gathered that *Nypa* leaf was collected from specific habitat or certain population condition, e.g. from abundant or small population, or from ecologically critical area, or core zone of the forest? Such information would be important in order to develop a sustainable collection management.

8. Page 3 (Study Area), it will be informative and useful if the distance of each union/*Nypa* leaf collection location to the main road (e.g. concrete or semi-concrete road) is provided.

9. Page 4 Line 30-33 (Sampling and data collection), you mentioned/included husbandry and off-farm activities (aspects), but you did not sample or collect data on these two activities in the Sundarbans Impact Zone. Husbandry and off-farm

activities are not included (reflected) in the paper title either. However, you put some results on the off-farm activities on Page 6 Line 17-18 and the husbandry on Page 6 Line 18-20. It seems that you expanded the scope of your study but not represented in the paper title, and no keywords mentioning about off-farm activities and husbandry either.

10. Page 5 Line 15, the abbreviation of "BDT" and "USD" should be written completely.

11. Page 5 Line 27-29, is there any information gathered in your survey on the actual or average amount of Nypa leaf collected by collectors per clump per year? You have mentioned (on Page 8 Line 7 using references) that leaf availability was 3 leaves on average per clump per year, but this is not the actual (current) collection practised by the local collectors.

12. In the Discussion session (e.g. on Page 7 Line 36, Page 8 Line 24-28, Page 9 Line 34-37, Page 9 Line 8, and others), you performed some data and information on the husbandry and off-farm activities and the comparisons to Nypa leaf collection, but again, you did not sample or collect the data/information on these two aspects on the Methodology (Methods).

13. Page 8 Line 7, is there any regulation from the Bangladesh Forest Department on the Nypa leaf collection/harvest, for instance the maximum quantity of Nypa leaves that can be harvested by each HH per season or per year? If such regulation is available, it would be informative (useful) to be included and discussed in the Discussion session.

14. On Page 8 Line 12-13, income from the Nypa leaf collection is considered a moderate contribution (28.21%), but on Page 9 Line 8 it is only meagre (very little) compared to husbandry (63.39%) as livelihood. Please clarify this statement!

15. Page 9 Line 10-11, the statement "Though the effect of off-farm income on HH total income was significant (Fig. 4C), its contribution in HH total income constitutes a mere 9%" needs to be explained further in a more logical sense.

16. Page 9 Line 13, remove the word "etc." and please do/check throughout the manuscript.

17. On Discussion session, it will be worthwhile to discuss whether the ongoing (current) Nypa leaf collection affects the regeneration or sustainability of the Nypa population in the Sundarbans forest, especially for the long run. Unfortunately, such important information is not available in this paper.

18. In Conclusion session (Page 11), it is important to recommend the establishment of a better management system of Nypa leaf collection (e.g. developing community based management or farming association) in collaboration with the Bangladesh Forest Department. A strong support from the government as well as non-government organizations seems to be crucial particularly to control the local market syndicates. A practical training on the Nypa leaf collection technique particularly for the local collectors is also required in order to manage the Nypa population sustainably in the Sundarbans mangrove forest and consequently for achieving sustainable forest management.

19. On References (Page 12 and afterwards), some references are not correctly written in order. Baiyegunhi et al. should be put before Barik et al. (Page 12), Carandang et al. should go before Carney et al. (Page 12), and Ha et al. (Page 15) should be placed on before Hossain & Islam (Page 13).

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Decision reached by the Editor on ENVI-D-18-00706R2

em.envi.0.64f717.1f5f91fe@editorialmanager.com on behalf of
Environment, Development and Sustainability (ENVI) <em@editorialmanager.com>

Thu 8/1/2019 4:24 PM

To: Abdul Malik <jwp495@alumni.ku.dk>;

Dear Dr. Malik,

The Editor has made a decision on ENVI-D-18-00706R2, which you recently reviewed for us.

The decision is: Accept.

You can also view the decision letter and the reviewers' comments at the Editorial Manager Website.

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Nypa fruticans Wurmb leaf collection as a livelihoods strategy: a case study in the Sundarbans Impact Zone of Bangladesh

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Abstract

The *Nypa fruticans* Wurmb (*Nypa*), a true mangrove palm, is abundant in the Sundarbans reserved forest of Bangladesh. Leaves are the primary product obtained from the *Nypa*, which are often used as thatching materials and source of income for the forest-dependent communities in the Sundarbans Impact Zone (SIZ) of Bangladesh. Hence, this study aimed to assess the usefulness of the *Nypa* leaf collection as a livelihoods strategy in the SIZ of Bangladesh. A total of 90 *Nypa* leaf collectors from three coastal unions were interviewed by administering a semi-structured interview schedule. Effects of social factors [age, education level and household (HH) members involved in income generation] and economic factors (primary, secondary and tertiary

occupation) on the HH total income of the *Nypa* leaf collectors were analyzed using linear regression and Pearson's correlation, respectively. Moreover, the effect of physical factors on the HH total income was analyzed by ANOVA and linear regression. Results suggested that income from the *Nypa* leaf collection, though making only a quarter percent of HH total income, was constrained by underdeveloped infrastructure, inaccessibility to fair market price, limitations of financial capital and frequent attack of Royal Bengal tiger (*Panthera tigris tigris*). The study, therefore, suggests that *Nypa* leaf collection from the Sundarbans alone could not be a sustainable livelihoods strategy for the forest-dependent communities in the SIZ of Bangladesh. Diversified and advanced husbandry activities, which have the potential to further reduce dependency on forest resources, would strengthen the livelihoods strategy and ultimately conserve the resources of the Sundarbans.

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