

# Can forest stand alone? Barriers to the restoration of the last remaining rainforest in Assam, India

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## SUMMARY

This study assesses the causes of forest resource depletion in the Poba reserve forest, Assam, India. Although many activities, such as hunting and grazing, are banned, the Poba reserve forest is being degraded. The results of a household survey show local communities have experienced a decrease in forest resources in 2012 compared to 2002. Lack of community-based institutions and proper forest management plan has opened access to the forest, resulting in illegal logging and over extraction of forest products. These activities have limited the ability of Poba reserve forest to deliver ecosystem goods and services, and prevented forest restoration. Change in forest cover and availability of forest products has adversely affected the livelihoods of more than two-thirds of local households. The study suggests that participatory involvement of local communities in forest management can reverse trends in deforestation and forest degradation and restore the ecosystem. The forest cannot stand alone; it needs active support of the local community.

Keywords: deforestation and forest degradation, forest resources, illegal logging, livelihoods, local community

## La forêt peut-elle survivre seule? Obstacles à la restauration de la dernière forêt vierge en existence à Assam, en Inde

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Cette étude évalue les causes de l'amointrissement des ressources forestières dans la réserve forestière de Poba dans l'Assam, en Inde. Bien que de nombreuses activités soient prosrites, telles que la chasse et la création de pâturages, la réserve forestière de Poba est en voie de dégradation. Les résultats d'une étude auprès des foyers montre que les communautés locales ont été témoin d'une baisse des ressources forestières en 2012, les rendant inférieures à celles disponibles en 2002. Le manque d'institutions à base communautaire et de plan de gestion à proprement parler a laissé un accès ouvert à la forêt, qui a résulté en coupes de bois illégales et une extraction outrée des produits forestiers. Ces activités ont limité la capacité de la réserve forestière de Poba à fournir biens et services de l'écosystème. Elles ont également fait obstacle à la restauration forestière. Le changement du couvert forestier et de la disponibilité des produits forestiers ont impacté négativement les revenus de plus des deux tiers des populations locales. L'étude suggère qu'une implication participative des communautés locales dans la gestion forestière pourrait faire faire demi-tour aux courants de déforestation et de dégradation forestière et restaurer l'écosystème. La forêt ne peut survivre seule; elle a besoin du soutien de la communauté locale.

## ¿Puede el bosque mantenerse por sí solo? Barreras a la restauración de la última pluviselva de Assam en la India

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Este estudio evalúa las causas del agotamiento de los recursos forestales en la reserva forestal de Poba en Assam (India). A pesar de la prohibición de muchas actividades como la caza y el pastoreo, la reserva forestal de Poba sigue degradándose. Los resultados de una encuesta en hogares muestran que las comunidades locales experimentaron una disminución de los recursos forestales en 2012, en comparación con 2002. La falta de instituciones comunitarias y un Plan de Manejo Forestal adecuado han abierto el acceso al bosque, lo que ha resultado en talas ilegales y la sobreexplotación de los productos procedentes del bosque. Estas actividades han limitado la capacidad del bosque de la reserva forestal de Poba para proporcionar bienes y servicios ecosistémicos y han impedido la restauración del bosque. El cambio en la cobertura forestal y la disponibilidad de productos del bosque han afectado negativamente a los medios de vida de más de dos tercios de los hogares locales. El estudio sugiere que la participación de las comunidades locales en el manejo forestal puede revertir las tendencias de deforestación y degradación forestal y restaurar el ecosistema. El bosque no puede mantenerse por sí solo; necesita el apoyo activo de la comunidad local.

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## INTRODUCTION

Environmental conservation in the Himalayas has received global attention following the introduction of the theory of Himalayan environmental degradation, which identified population growth as a main driver of deforestation and forest degradation (Guthman 1997). This has contributed to a paradigm shift in forest management in the Himalayan region. A number of participatory forest management models have been introduced to encourage local participation in forest management; for instance, community forest, collaborative forest management and buffer-zone community forest in Nepal and joint forest management (JFM) in India (Acharya 2002, Niraula *et al.* 2013, Ojha *et al.* 2016, Paudyal *et al.* 2017). These community-based management approaches have been implemented to reclaim degraded forest and supply subsistence forest products to local communities (Bhat *et al.* 2001, Kanel and Shrestha, 2001). Successful community-based forest management programmes in Nepal indicate that the involvement of local communities in entire forest management process contributes to reversing deforestation and forest degradation trends, and significantly improves the restoration of the forest ecosystem (Bhatta *et al.* 2015, Oort *et al.* 2015, Ranabhat *et al.* 2016). Forest restoration is not limited to increase in tree cover, but also increase in forest goods and services.

In general, communities in the Himalayas perceive forest as an integral part of their daily activities, as forests provide various products required for farm households (Sunderlin *et al.* 2005). Experience indicates that, if a community is given responsibility for forest management and gains benefits from this, then it will contribute to managing the forest and restoring degraded land by creating local-level institutions (Ostrom 2008). In the absence of proper institutional arrangements, local communities compete to harvest forest products, ignoring the capacity of forest, depleting stocks as in the tragedy of commons (Hardin 1968). Ostrom (1990) showed that local communities manage natural resources more effectively and sustainably than government and private companies. This is achieved because management is based on on-the-ground experience. Communities develop their own rules and regulations to collect forest products and share benefits, which motivates them to work collectively for the benefit of all. This allows them to restore the degraded forest to natural forest conditions in the long term (Ranabhat *et al.* 2016).

Rain forests are considered to be high biodiversity hotspots, providing a significant number of forest products, ranging from timber and fuel wood to food, fodder and other non-timber forest products. A global review showed that demographic, economic and social changes have put substantial pressure on these forests, affecting the flora and fauna (Frederic *et al.* 2002). However, the factors underlying this are poorly understood (Frederic *et al.* 2002). This is more serious in the data-poor region of Hindu Kush Himalaya (Shrestha 2011). With emerging impacts of climate and other changes, these biodiversity hotspots in the foothills of Himalayas are on the verge of extinction (Sharma and Tsering 2009).

The exploitation of natural resources beyond its carrying capacity may provide short-term benefits to local communities, but have negative impacts in the long term for both local and global communities. With population increase, the consumption of limited natural resources increases. Agricultural expansion, shifting cultivation, fuel wood and fodder use, and development activities exploits the nature resources and leads to deforestation and forest degradation. Repeated resource extraction not only affects the tree productivity and regeneration capacity but also have significant negative impact on local communities (Thapa and Chapman, 2010). In the long run this will affect ecosystem health and resilience (Rew *et al.* 2005). Thus, devolution of forest management to the local communities in the Himalayas has proved to be a successful management model (Bampton *et al.* 2007, Pretty and Ward 2001), and can significantly improve forest restoration. Tenure regime and involvement of local communities throughout the forest management process could have greater net impact on forest restoration (Nagendra 2007).

Assessing the impacts on local livelihoods and the perception of local communities on the underlying causes of depletion forest resources and the reasons restoration fails could help to develop a strategy to improve forest condition, while enhancing the welfare of local communities. This study was carried out in Poba reserve forest in the state of Assam, India, in order to gather such information. The reserve forest is probably the last remaining patch of rainforest in the state.

## Study area and methods

### Study area

Nearly 67% of the 27 000 km<sup>2</sup> of total forest are categorised as reserve forest in Assam (Poffenberger 2006). Poba reserve forest, a rainforest, is located in the northeast of India adjoining the district of Dhemaji in Assam state and East Siang in Arunachal state. Poba reserve forest lies between 27° 45' 46.76" N to 27° 53' 44.44" N latitude and 95° 15' 58.28" E to 95° 15' 25.18" E longitude, and covers an area of 102 km<sup>2</sup>, of which 58 km<sup>2</sup> is located in Assam (Kumari *et al.* 2014). In 1924, this forest was designated as a reserve forest, which is defined as "an area notified under the provisions of the Indian Forest Act or other State Forest Acts, having full degree of protection". The government owns the forest and all activities inside the forest are prohibited unless permission has been obtained. The forest is classified broadly into semi-evergreen, mixed deciduous, riverine and cane forests (Champion and Seth 1968). It has rich natural flora and fauna, and is a model habitat for wildlife, with natural beauty with the numerous streams flowing from the foothills of Arunachal State (*The Assam Tribune* 2010).

Poba reserve forest is the only natural forest in the entire Jonai subdivision of Dhemaji district, providing ecosystem services (Kumari *et al.* 2014, Pegu *et al.* 2013). Ethnic groups living on the fringe of the forest area are highly dependent on this forest and forest products. Approximately 122 wild edible plants belonging to 89 genera are consumed by local communities in this region (Pegu *et al.* 2013). In addition, the

FIGURE 1 Study area of Poba reserve forest

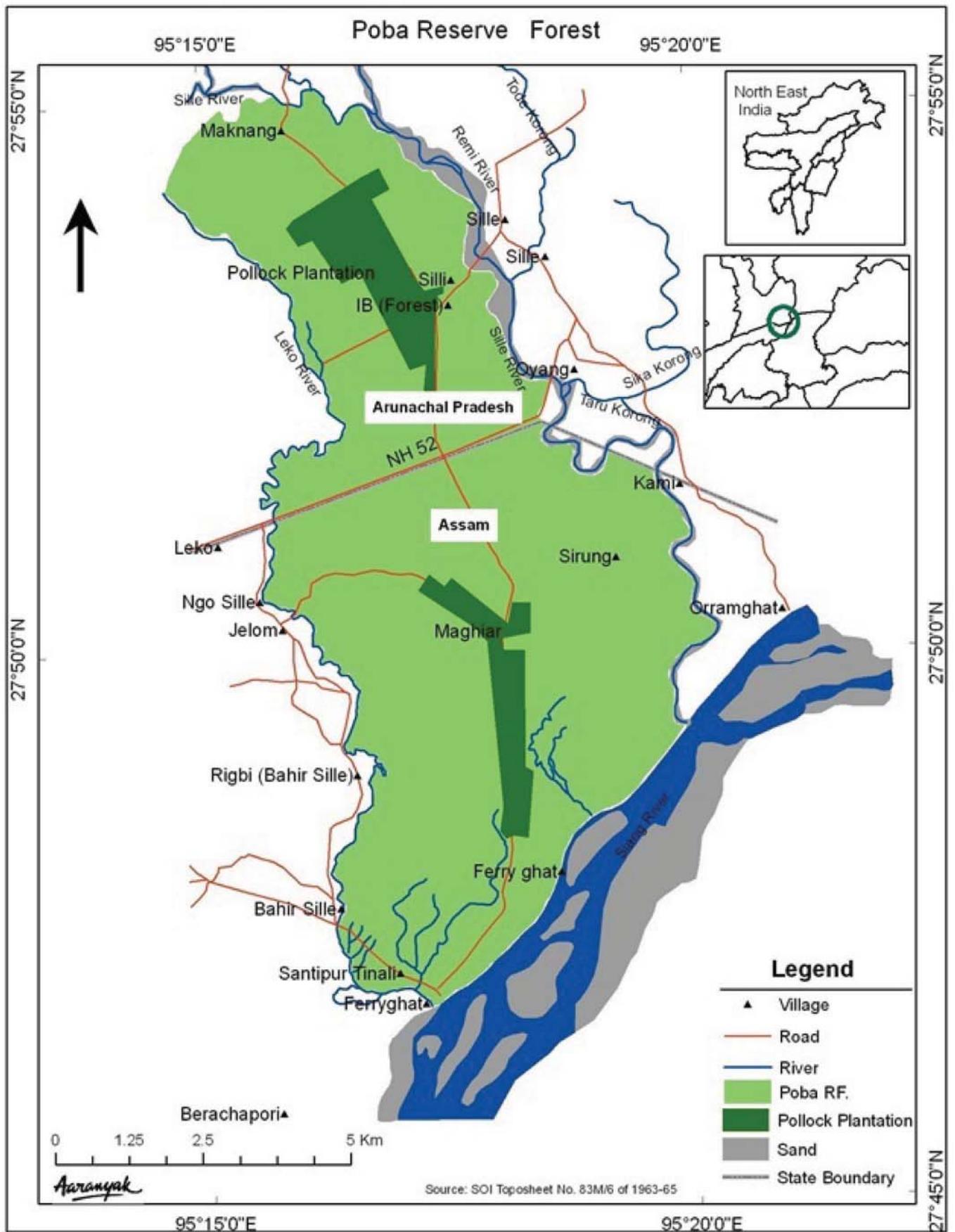


TABLE 1 Land Use and Land use change in Poba forest (Adapted from Kumar *et al.* 2014)

Land Use and Land Cover Class	Area in 2005 (sq. km)	Area in 2010 (sq.km)	Area change (sq. km)	Net Change (%)
Semi Evergreen Dense Forest	32.74	22.29	- 10.45	-31.92
Semi Evergreen Open Forest	13.43	17.6	4.17	31.05
Scrub Forest	2.46	5.12	2.66	108.13
Agriculture Land	7.22	10.61	3.39	46.95
Water Body	0.3	0.94	0.64	213.33
River, Sand/ Boulders	1.85	1.44	-0.41	-22.16
<b>Total</b>	<b>58</b>	<b>58</b>		

forest serves as a corridor for elephants, as it shares border with Arunachal state and Saikhowa forest reserve towards Dibrugarh.

However, this forest is under immense pressure from anthropogenic activities and natural disasters. Within the half decade between 2005 and 2010, approximately one-third of the semi-evergreen dense forest was either degraded or converted for other land uses (Table 1). Increases in population, deforestation, illegal tree cutting, rapid erosion, flash flooding, etc., are major threats to the sustainability of this natural forest (Kumari *et al.* 2014).

#### Data collection and analysis

Two stage random sampling was carried out in this study. First of all, out of 22 villages in the fringe of Poba reserve forest, 40% of the villages (i.e. 9) were randomly selected without replacement as first stage sampling, to assess the impacts on local communities' livelihoods and the underlying causes of forest resource depletion. For second stage sampling, total households were listed in the nine villages through key informant survey and 101 households were randomly selected for interview. The questionnaire asked about households' perceptions of the trend of change in the, forest products availability, impacts on livelihood, and on drivers/major reasons of forest resources change in Poba reserve forest. Here, we consider forest resources as both tangible and intangible goods provided by forest. In addition, qualitative information was collected through focus group discussions with local communities, consultation with government officials and a participatory forest walk.

We employed a recall method to assess the trends in forest products. Respondents were asked to compare the current status of particular forest products to 10 years ago. The drivers of forest ecosystem changes were ranked based on respondents' perception from 1 to 6, where 1 represented the least and 6 the most important drivers. Based on rank value, weighted means were computed to determine the most influential driver of forest resource change.

Forest cover change analysis for 1992–2016 was performed to supplement the socio-ecological survey. Landsat 4-5 TM and L8 OLI/TRIS images of row (41) and path (135) for the acquired date of December were downloaded from [earthexplorer.usgs.gov](http://earthexplorer.usgs.gov) to evaluate forest cover in 1992 and 2016, respectively. Supervised classification was done for

forest cover mapping in ERDAS IMAGINE 2014. The forest was classified according to the crown density as open forest (having crown density 10–40%) and dense forest (having crown density >40%). If the forest covers is declining and there is reduction on the capacity of a forest to provide goods and services, it is considered as degraded forest (FAO 2011).

## RESULTS

### Socioeconomic and demographic characteristics of households

Table 2 illustrates the sample characteristics of the study area. Most of the respondents were male and more than half of the respondents had got formal education. The average age of respondents was 41.4 years. The average family size in the study area was 6.59, which is more than average family size of Assam district (i.e. 4.9) (Census of India 2011).

The area is dominated by farming, as most of the households (85%) employ agriculture as the main source of household income, followed by business and waged employment. The average agricultural land holding, both non-irrigated and irrigated land, was 2.01 ha where paddy, lentil, mustard, potato, sesame, turmeric, sugarcane were grown. Buffalo, cattle, goats, pigs and poultry were the major livestock in the area, with 93% of the sample households owning livestock. The average livestock holding per household was 9 tropical livestock units. The study area also accommodates a migrant population; 37% of sample households had migrated to the study area.

### Trends in forest ecosystem services

Poba reserve forest is the only forest in the study area that provides forest resources to local communities. All respondents rely on this to some extent for their daily needs. Figure 2 reports the stated change in availability of forest products experienced by local households in 2012 compared to 2002. Local households collect various forest products for daily consumption and for sale in the study area (Figure 2, Table 3). The results of the household survey indicated that most of the respondents have experienced a decrease in availability of forest products over the decade, with few exceptions.

TABLE 2 Socio economic and demographic characteristics (standard deviation in parentheses)

Variables	Poba reserve forest
Gender (respondent) %	
Male	90
Female	10
Age (years)	41.4 (14.2)
Family size	
Over 18 years old	3.78 (2.10)
Under 18 years old	2.81 (2.56)
Education (%)	
Illiterate	45.54
Secondary education	49.50
Higher education	4.96
Agriculture land (ha)	
Non- irrigated land	1.95 (1.84)
Irrigated land	0.06 (0.53)
Livestock unit	9.06 (6.53)
Resident (%)	
Born in current place of residence	63
Not born in current place of residence	37

There was near consensus among the respondents that the availability of timber, fuel wood, fodder, fruits, vegetables, thatch, bamboo and rattan, medicinal and aromatic plants, fish, drinking water and wildlife have decreased over the decade. However, there was no agreement over a change in ornamental flower and irrigation water availability.

The perception of respondents of trends in forest products was verified by follow-up questions regarding the quantity of forest products required daily that were collected over the given time period (Table 3). Timber showed the greatest

decline of all collected forest products between 2002 and 2012, followed by fish, vegetables, fuel wood and thatch, and bamboo and rattan (Table 3).

This change in the supply of forest product influenced the livelihoods of forest-dependent communities. The results of the household survey indicated that two-thirds (67%) of respondents have experienced negative impacts on their livelihoods, while 19% have not experienced any impacts and 10% were unable to evaluate the impacts of a change in ecosystem services on their livelihoods. However, still a small section of the community (4%) benefited from such changes.

#### Drivers of forest resource change in Poba reserve forest

Respondents identified four major causes of the depletion in resources of Poba reserve forest (Figure 3). Illegal logging was strongly emphasised as a main driver of forest degradation, followed by the lack of a proper forest management plan and institutional setup.

Respondents were also asked about the causes of changes in particular forest products. The majority indicated that overexploitation was the main cause of depletion of timber, fodder, thatch, bamboo, rattan and fish. In addition, they stated that natural disasters as another main cause of depletion of timber, while pollution and the use of poison drove the depletion of the fish population.

#### Forests cover change and potential risk of increased deforestation and forest degradation

A matrix was used in the Arc GIS environment to evaluate historical forest cover change in the area (Table 4 and Figure 4). During 1992–2016, deforested and degraded forest areas were found across a greater area than new forest and improved forest. Mostly forest area adjoining the settlement were converted to non-forest area (Figure 4) which has resulted decrease in forest product availability to local communities (Figure 2). This result clearly indicates that the forest of study area is under pressure from deforestation and forest degradation.

FIGURE 2 Trend in forest product change during 2002–2012

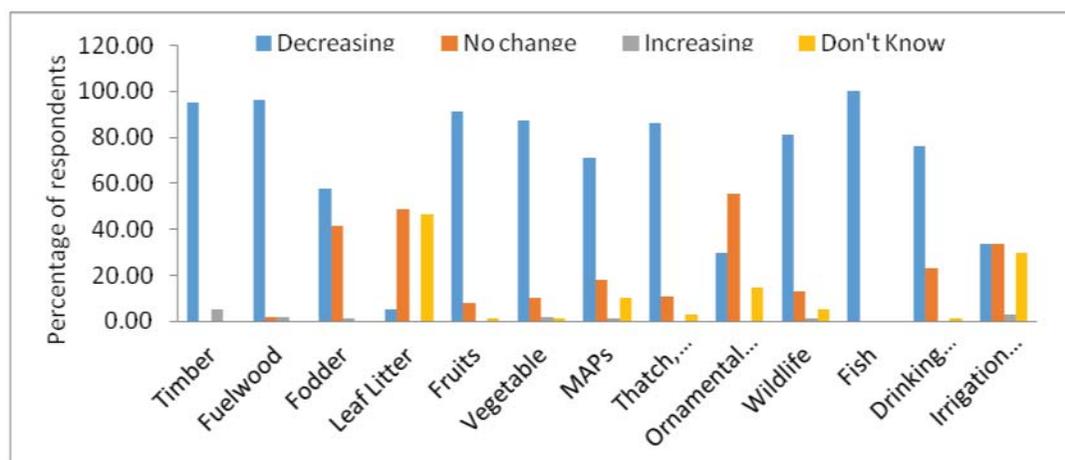
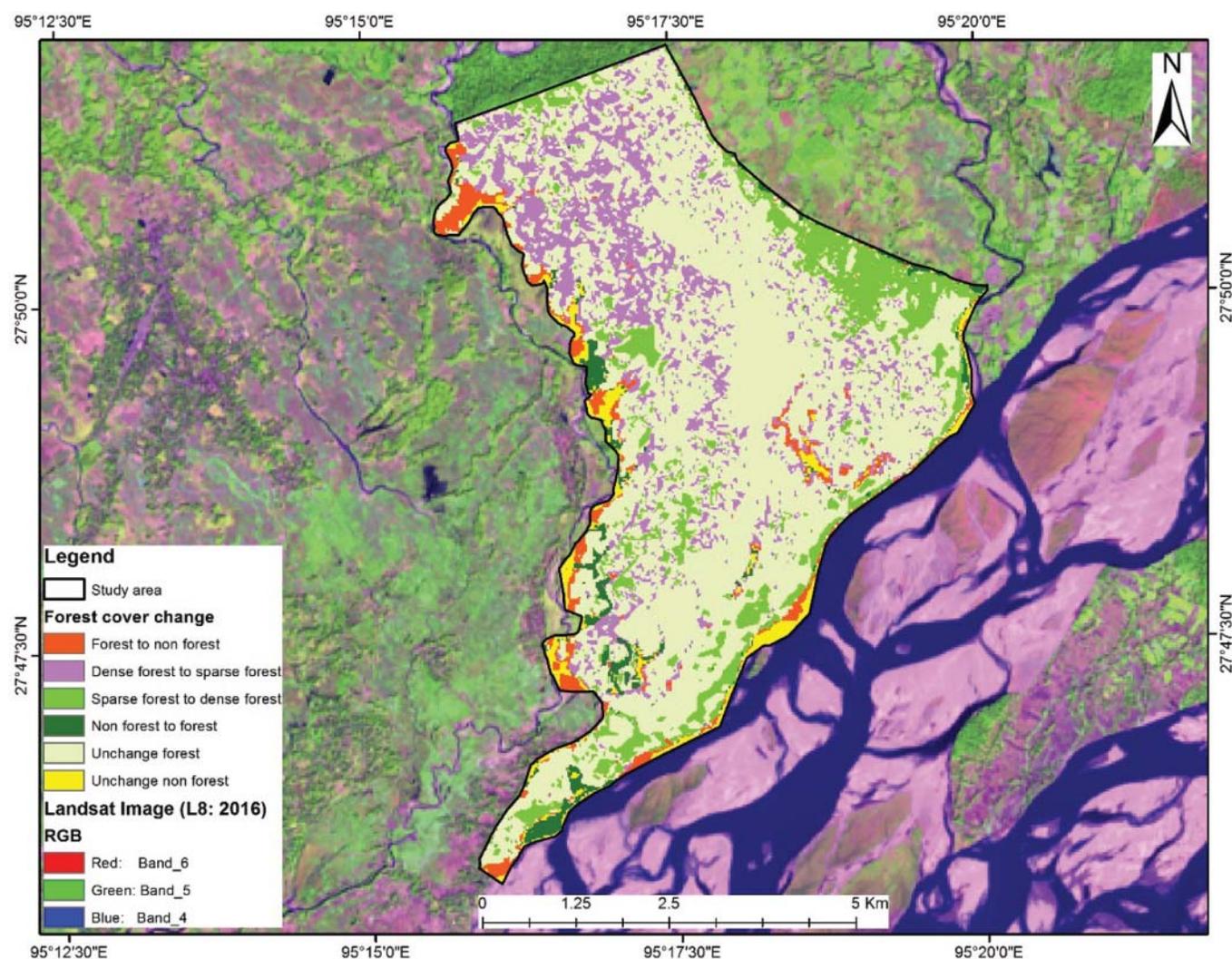


TABLE 3 Average quantity (household/year) of locally important forest resources collected by the surveyed household

Forest products	Units	In 2002	In 2012	% change
Timber	cu. ft	71.02 (8.58)	11.35 (24.80)	-84
Fuel wood	Kg	3,169 (383.75)	1,937 (265.515)	-39
Vegetable	Kg	161.94 (20.94)	74.62 (9.79)	-54
Thatch, bamboo and rattan	Kg	272.78 (87.87)	196.45 (85.75)	-28
Fishes	Kg	244.96 (42.16)	56.19 (7.54)	-77

FIGURE 3 Forest cover change in Poba reserve forest during 1992–2016



### Restoration efforts

Restoration of the Poba forest in order to protect and restore its biological diversity and high species endemism is a main priority of the Assam forest department. Realising the increased deforestation and forest degradation, the Assam Forest Department introduced JFM to protect and restore the forest ecosystem. Six Joint Forest Management Committees (JFMCs) were constituted in 2003–04 in the villages surrounding the Poba reserve forest, which were dependent on

TABLE 4 Drivers of forest resources change in Poba reserve forest

Drivers of forest resources change	Mean	Standard deviation
Illegal logging	2.31	1.60
Flooding	0.67	1.43
Lack of local institutions	1.52	1.62
No government plan	1.09	1.61

TABLE 5 Forests cover change in Poba reserve forest during 1992–2016

Forests cover change	Description	Area (ha)	Remarks
Forest to non-forest area	Dense forest (DF) or Sparse forest (SF) in 1992 change into non forest area	143.56	Deforested area
Dense forest to open forest	SF in 1992 change into DF in 2016	553.88	Degraded forest
Open forest to Dense forest	DF in 1992 change into SF in 2016	396.44	Improved forest
Non forest to forest	Non forest in 1992 change into SF or DF in 2016	99.68	New forest
Unchanged forest	SF in 1992 to SF in 2016 or DF in 1992 to DF in 2016	2272.04	Unchanged forest
Unchanged non forest	Non forest in 1992 to non-forest in 2016	134	Unchanged non forest

the forest resources. The Lekhu JFMC (205 ha), Jelem JFMC (80 ha), Rigbi JFMC (95 ha), Bahir Sile JFMC (50 ha), Oyan Jelem JFMC (85 ha) and Berachapori JFMC (50 ha) were allotted a specific area for afforestation and encroachment control. Similarly, 56 families belonging to Kemi and Oyan Jelem villages were granted concessions, such as being allowed to cultivate crops like vegetable, beans in the Poba reserve forest in addition to collecting of fruits, fuelwood fodder and timber, on condition that they would protect and render services for regeneration according to Assam Forest Regulation, 1891. Forest condition and restoration improved after the introduction of JFM, however, these committees have not been active in recent years. Based on focus group discussion, local communities claimed that the incentive for their efforts in restoration and protecting Poba reserve forest was not ensured. Nearly 87% of the respondents in the study area mentioned that the lack of an effective institutional setup that work proactively for management and conservation of Poba reserve forest had led to its decline and negatively impacted the restoration objective.

## DISCUSSION

Local communities living in the vicinity of the Poba reserve forest enjoy various ecosystem services from the forest. In India, 350–400 million people rely on forest resources either for household consumption or for commercial purpose (MoEF 2009). The people living close to the forest and within the forests, especially ethnic communities, are inextricably linked to the forest ecosystem. A study carried out in northeast mentioned that tribal communities are more dependent on forest than other communities for various non-timber forest products, edible fruits and vegetables, firewood and house construction material, with these contributing 19–32% of total household income (Saha and Sundriyal 2012). Local and indigenous people depend to varying degrees on the forest for their livelihoods (Chao 2012, TEEB 2010). However, both proximate causes (such as agricultural expansion, wood extraction and infrastructure expansion) and underlying causes (such as policy/institutional, economic, demographic, cultural and technological) drive the deforestation and forest degradation in tropical forest (Geist and Lambin 2002).

Anthropogenic pressures on forest followed by natural disaster are major drivers of change in the availability of forest resources. Increasing population and high dependency of local people on forest resources results in forest degradation (Arjunan *et al.* 2005, Davidar *et al.* 2010, Karanth and De Fries 2010, Mishra *et al.* 2008). An increase in the population by one third over the decade has put additional pressure on the existing forest resources in Poba reserve forest. The respondents living near the forest has reported the decline in availability of forest products because forest along the settlement area is converted to non-forest area and the dense forest is converted to open forest (Figure 4). Kumari *et al.* (2014) have also observed decrease in area of dense forest while increase in area of open forest, scrub forest and agricultural land between 2005 and 2010. Similar trends have been observed in reserved forests of Maharashtra State in India as well (Agrawal *et al.* 2016). A report by Poffenberger *et al.* (2006) also mentioned that there was massive deforestation and forest degradation in Assam state over the 2 years between 1997 and 1999, which has resulted decline in the availability of forest resources. Many studies reported that unsustainable harvesting or overexploitation of forest resources has drastic effects on forest ecosystems (Anitha *et al.* 2003, Ranabhat *et al.* 2016) and local livelihoods. Ultimately, forest and local communities suffer the most and then regional and global communities.

Households in the vicinity of the Poba reserve forest have explicitly expressed that the lack of local institutions and a forest management plan are the key underlying causes of forest resources depletion. The absence proper policies – such as forest management plan and effective local institutions to regularise forest management may contribute to forest resources depletion. This policy gap has led to illegal logging and over extraction of forest resources. Ultimately, depletion of forest contributes to soil erosion and flooding to lowland areas. Insufficient oversight by government agencies allows forest to become an open access resources (Tucker 1999) and this eventually led to depletion of common resources.

Therefore, development of local institutions in communities- such as community forest user groups in Nepal, where forest resources are major inputs of households' production function, has overcome the problem of overuse of common property resources in many developing countries. In developing economies, communities have managed natural resources

better than companies and governments (Ostrom 1990). These local institutions, represented by local communities, prepare management plans for better management of the forest resources (Rai *et al.* 2016). Studies show that forest managed by local institutions for the production of goods and services are also effective in maintaining forest cover (Bray *et al.* 2008, Ellis and Porter-Bolland 2008, Nepstad *et al.* 2006). For example, community forest and collaborative forest management in Nepal are good examples of community participation in forest restoration in small forest patches and block forest (Acharya 2002, Rai 2007). Buffer-zone community forests are able to restore the degraded tropical forest and provide the subsistence needs of local people in Nepal (Ranabhat *et al.* 2016). Despite community involvement, the restoration of Poba reserve forest is failing. Lack of communities' participation in rule-making, lack of autonomy of financial transaction and less forest rights secure to local communities are some to issues related to JFM in India (Shyamsundar and Ghate 2014). Besides, lack of ownership of forest land, significant incentives and economic alternatives has made the restoration of forest unsuccessful (Oviedo 2005). These reasons for the failure of JFM in India have also been reported by Sarker (2009). The structure of JFM in India does not fully recognise the participation of local communities and is skewed towards the forestry department (Sarker 2009). Mansourian (2016) has also mentioned that financial disincentives, poor institutional set up, unclear tenure and lack of local empowerment are the governance challenges the hampers forest restoration. Therefore, local institutions, with rights equal to those of the forestry department (Sarker 2009), will provide local ownership and autonomy in rulemaking to positively influence forest outcomes (Chhatre and Agrawal 2009) and restore the forest resources.

## CONCLUSION

The contribution of Poba reserve forest for the welfare of local communities is immense, by providing an array of forest resources. Local communities rely heavily on the Poba reserve forest for their daily livelihoods. However, there is a decrease in the availability of required forest products due to the depletion of forest. Lack of proper institutions and forest management plan are the main underlying causes behind the depletion and the failure of forest restoration. This role of local communities has not been fully recognised in the existing forest management strategy, which allowed local communities to exploit forest resources haphazardly for household consumption and commercial purposes, further affecting the livelihoods of local communities.

Local communities expressed that illegal harvesting and the lack of a management plan and local institutions are drivers of deforestation and forest degradation in the Poba reserve forest. But participatory forest management approaches have reversed the trend of forest resource depletion in the Himalayas. These approaches may motivate local communities to protect their forest against illegal logging,

haphazard collection and land conversion, as they can get benefits legally.

Forest management should contribute to the local economy, national consumption and human welfare to achieve sustainable development goals. For this, forest management has to involve local communities throughout the forest management process. This study clearly indicates that the concerns of local communities should be considered in forest conservation and restoration.

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# Understanding state and drivers of change in forest resources in Poba Reserve forest, Dhemaji district, Assam, India

Household code: ..... Address: ..... District ..... Block .....  
 Village: ..... Date of interview: .....  
 2013

## PART I: Personal Information

### 1. Individual

- 1.1. Age: ..... Yrs.
- 1.2. Gender: (a) Male (b) Female
- 1.3. Family Size: (i) Over 18 years old ..... (ii) Under 18 years old.....
- 1.4. Ethnicity:
- 1.5. Education: ..... Years
- 1.6. Occupation (main income source first): (i) ..... (ii)..... (iii).....
- 1.7. Name of the Forests from where you mostly use products/services:
- 1.8. Living in this area: (a) Born here (b)..... years
- 1.9. Landholding and Tenure:

Land characteristics	Area (Kathha/Bigha)	No. of crops grown per year	Name of crops
Irrigated			
Unirrigated			
Forest			
Others			

- 1.10. How long your production can meet your household food demand?  
 (a) <3 months (b) 3 to 6 months (c) 6 to 9 months (d) 9 to 12 months (e) >12 months
- 1.11. Indicate whether your household possesses the following items and how many

Car	Motorbike	Bus	Truck	Solar	Cooking gas	.....
Tractor	Television	Cycle	Radio	Biogas	Improved cook stove	.....

- 1.11.1. Mention the type of improved cook stove: (a) Mud (b) Metal (c) Others .....

- 1.12. Major crops, and quantity produced and sold in the last year

Crops	Unit	Total production	Unit sold	Unit price (Rs)	Income from selling (Rs)
Rice					
Maize					
Wheat					
Potato					
Vegetable					
Fruits					
Others					

1.13. Livestock (number)

(a) Buffalo ..... (b) Cow..... (c) Ox ..... (d) Goat..... (e) Others .....

1.14. Income from livestock products

Product	Unit	Total Production	Unit sold	Unit price (Rs)	Total income (Rs)
Milk					
Meat					
Egg					
Other milk products					
Others					

**PART II: State of the Forest**

We are interested in your opinions about the management of forest area. We are interested in only your household’s use of the forest, not use by other households in your village or other villages.

**1. Ecosystem services – driver of change and trend (compared to last 10 years)**

Items	Trend <sup>1</sup>	Reasons for change (drivers)	Impact on livelihood <sup>2</sup>
Timber			
Drinking water			
Irrigation water			
Fuelwood			
Fodder			
Leaf litter			
Edible plants (fruits)			
Medicinal and aromatic plants			
Wild life, if considered for consumption			
Edible plants (Vegetables)			
Other construction materials (thatch, bamboo, rattan,)			
Ornamental plants (flowers etc)			
Fish			
Any other products			
Flood control			
Any other services (please use separate page if needed)			

<sup>1</sup>Trend — Decreasing =1, No-change =2, Increasing = 3

<sup>2</sup>Impact — Negative =1, No-impact =2, Positive = 3

## 2. Major Forest products collection

Forest products	Unit	Frequency (Weekly/ Monthly/ Yearly)	Collected quantity (2012)	Price per unit (IRs)	Collected quantity (10 yrs back)	Price per unit (IRs)
Timber						
Fuelwood						
Fodder						
Leaf litter						
Vegetable						
Thatch, bamboo, rattan etc						
Fish						
Any others....						

## 3. Driver of Forest resources change

In your opinion, what are the major reasons (drivers) of change in Poba reserve forests? Kindly suggest in priority order

- a) illegal logging    b) river cutting/flood    c) no government plan    d) lack of institutional set up  
e) any others... please list

## 4. What are major natural calamities in your area?

Calamities	Frequency of occurrence (times/year)	Damage to your household/ property *	Damage to Forest*	Way to control
Landslides				
Flooding				
Draught				

\* Mention – Land (Irrigated, Unirrigated, Others) in Ropani, Livestock Number, Other property (monetary value), if production has decreased compared with the past year.

## PART III: Forest management

6. Are there any institutional set up or management modality available to manage Poba forests? For example, community management groups, management plan.?

- a) Yes    b) No

If Yes... what are those mechanism – please elaborate

7. Was there any change observed due to such intervention? Yes/no

If no—do you support to establish institutional set up to manage Poba forest?