Research article

An Approach for Monitoring the Reforestation and Conservation Efforts by Local Communities

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Abstract Considering Philippines's well defined commitment toward social forestry system since 1970s, we examined its purpose of contribution, motivation and achievement toward reforestation and forest conservation through interviews with related stakeholders, as well as decadal forest cover changes by analyzing the forest type classification map of two different period of time which were prepared based on Earth Observation Satellite (EOS) image data and field sampling. EOS based forest cover change analysis, coupled with field sampling and stakeholder consultation, resulted into definitive facts and figures, which can be used for reforestation and forest conservation decision making process.

Keywords community people, forest restoration, forest land-use plan, satellite image

INTRODUCTION

The Philippines has been carrying out Social Forest Program (SFP) since 1970s in order to preserve the forest properly excluding government owned forest land. In the SFP, indigenous people and local communities have effectively used and managed remaining forest in their territories, and the government took the initiative in developing community based monitoring and information system. Under such circumstance, reforestation through National Greening Program (NGP) and forest plantation with the participation of local communities has been extended throughout the country. This Study has been conducted in Mangatarem area of Pangasinan province where local communities have been dedicating to the forest restoration. Their effort is actively supported by local government, NGO and DENR (Department of Environment and Natural Resources).

The main focus of this study is to analyze change of its spatial distribution in forest coverage in their land by using ASTER satellite images, which is one of the widely used EOS for such purpose.

OBJECTIVE

The forest land cover is concentrated in the hilly area of Mangatarem town. The area has been well managed for restoration of the forest land through series of creation of forestland and conservation

activities by local communities. The area therefore was selected as a study site to examine the effect of those efforts by local communities' participatory forest conservation activities. The location of the study site is illustrated in Fig. 1.

Fig. 1 Location of the study area

METHODOLOGY

In order to analyze decadal forest cover changes, forest land cover types and its distribution has been mapped by using EOS images acquired at two different period of time. Changes of the forest cover were examined in association with the forest land use plan and participatory forest management where local people had been involved in forest restorations.

RESULTS AND DISCUSSION

Current Status of Forest Conservation and Management in Mangatarem LGU

In the mountain of the study site, high endemic species of plants and animals (terrestrial vertebrate species) are found, which has been confirmed by the recent surveys. Municipal Local Government Unit (MLGU) of Mangatarem and DENR, in partnership with Haribon Foundation, have worked together to further educate the Mangatarem community on forest restoration and conservation with the support of donation from Japanese companies for planting trees (Municipality of Mangatarem, 2013). The Forest Land Use Plan (FLUP) was developed for the conservation of the biodiversity of the area. The location of the targeted activities is illustrated in Fig. 2, which form the part of this study site.

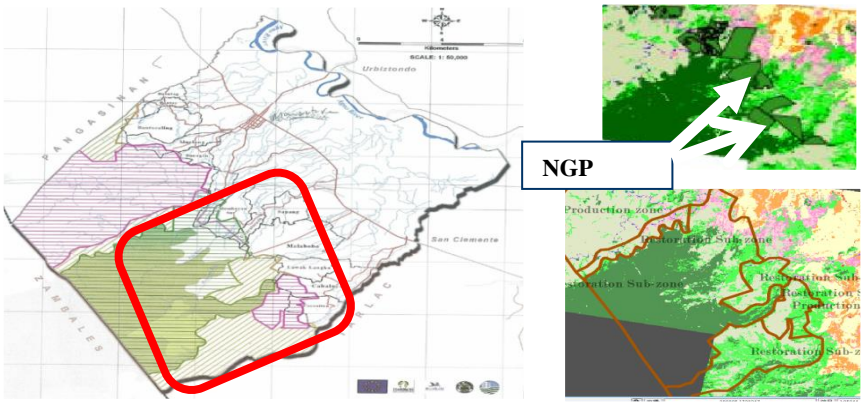


Fig. 2 Forest Land Use Plan (DENR, *LGU (~2040)*) over the study area and reforestation areas (above) by NGP (DENR)

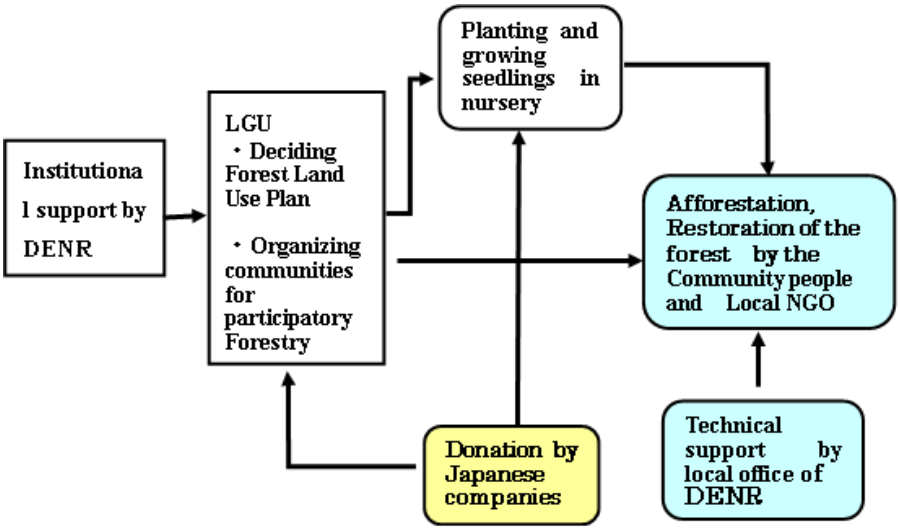


Fig. 3 Schematic diagram of forest restoration by the community

Villagers of the communities, participating in the activity of restoration and conservation, are dedicating themselves to planting trees, growing seedlings and taking care of the forest under the FLUP. And the work is coordinated by MLGU with the technical and financial support from Haribon Foundation; a local NGO; and Japanese companies respectively. For Japanese companies, it is part of their CSR activities, while for Haribon Foundation, it is non-profit social contribution. The concept is shown in Fig. 3. The generous contribution from all collaborating institutions, mentioned above, resulted into the formulation of a Forest Land Use Plan (FLUP) (Borlagdan et al., 1990).

Land use in the forest land is restricted not to log without permission in accordance with the FLUP (Fig. 2) and preserved strictly in some area. In parallel with the FLUP, afforestation has been conducted since 2013 under the National Greening Program of DENR.

Social-Economic Factors of the Communities Surrounding the Forest Land

As discussed in previous section, effort of the local communities and LGU toward the participatory forest conservation and restoration in the area is significant. Considering this fact, the study was conducted through interviews to the stakeholder consisting of villagers in order to grasp the purpose of contribution, dependence on the forest, livelihood and motivation to get involved in the Community-based Forest Management (CBFM). We therefore examined Mangatarem villagers' considerations and activities toward the Forest Management & Conservation using outcome of the interviews. As a result, following facts were found.

a. Profile of the community: Local government of Mangatarem consists of 82 barangays. Most of the community people are engaging in farming rice and vegetables. Out of 82 barangays, 9 get involved in CBFM. Furthermore, 10 barangays are participating in restoration of the forest under NGP.

Table 1 Involvement in the forest restoration and conservation

Type	No. of Barangays	Remarks
CBFM	9	
NGP	10	
Total No. of Barangays	82	Including CBFM and NGP

b. Interviewee and findings: We interviewed 27 villagers in the barangays whose average age was 44.6 years old. Among them, the oldest interviewee was 78 years old and the youngest was 24 years old. In the interviews to the villagers, from relevant community, the main questions were (1)

motivation to participate in the forest management and conservation, (2) main method of contribution to the forest management and conservation activities, (3) expectation from their involvement in the forest management and conservation, and (4) measure to improve livelihood. The obtained replies have been listed as shown in Table 3.

Table 2 Profile of interviewee

Type	Age
Average age	44.6 years old
Youngest	24 years old
Eldest	78 years old
Number of Interviewee	27 Villagers

Table 3 Mangatarem villagers' considerations and activities toward the forest conservation and restoration

Factors noted	Outstanding Answer
Motivation	・Improve livelihood (80% of villagers interviewed) ・Yield and gain the co-benefits from the forest (80%) ・Preserve the forest for sustainable environment (88%)
Main Method of Contribution	・Nursery of seedling (80%) ・Plant seedlings (92%) ・Preserve forest for sustainable environment (81%) ・Grow and take care of planted trees (62%)
Expectation from their activities	・Increase income and by-product (50%) ・Restoration of natural environment and biodiversity (95%) ・Mitigation of disasters (90%) ・Better landscape for people inhabiting (62%)
Measure to improve livelihood with forest management	・Plant valuable trees (75%) ・Enhance natural resources for Ecotourism (75%)

Degradation and Restoration of the Forest in the Area

To know what have happened in the areas where the people of the communities involved in restoration and preservation of the forest under the FLUP, decadal forest cover changes has been analyzed using the forest type classification map of two different period of time.

a. Land use and forest type classification: Land use including forest types, which is useful input for forest management practice, were classified using ASTER satellite image. There are four different types of forest cover in the study area (Fig. 4). The definition of each category of forest types is given below.

Closed forest: A type of forest with canopy cover over 70%

Degraded forest: A type of forest which possess uneven sizes of crown with some noticeable open land

Open forest: A type of forest with vegetation cover almost below 50% and grass land with scattered trees

Agro forest: A type of forest categorized as man-made plantation

Degraded forest is mostly found in hilly land adjacent to Zambales Mountains, whereas the closed forest on relatively steep slopes of the mountain. And the open forest is embedded among them.

b. Forest Cover Change in FLUP Forest Land: The change in area of forest land during 10 years (2001-2010) was estimated to verify the significant change between the forest relatively close to the communities involved in reforestation and conservation and the other forest land areas. The summary of the result is shown in Table 4.

As shown in Fig. 5, forest area in the "Strict Restoration-Zone "decreased while the forest in Restoration Zone-1 even increased slightly.

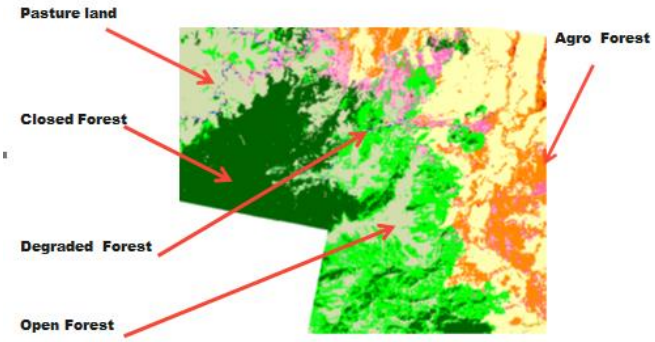
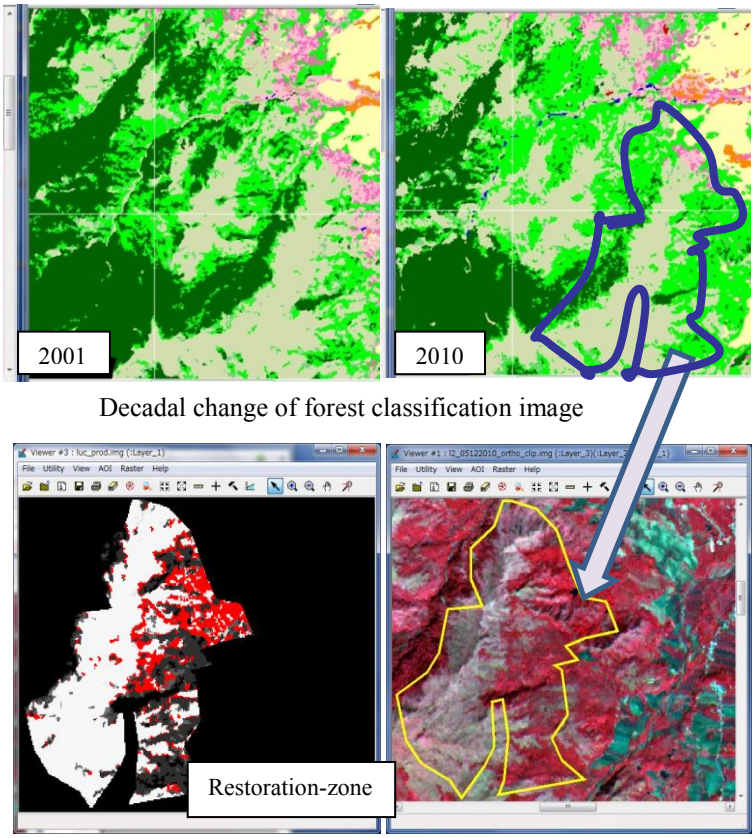


Fig. 4 Land use and forest type classification

It should be noted that the area falling on the restoration-zone 1 is situated in the vicinity of communities and villagers that have positively contributed to afforestation and planting trees.

Table 4 Decadal change of each forest type accommodating FLUP

Zone	2001 Area in (Ha)				2010 Area in (Ha)			
	Closed Forest	Degraded Forest	Open Forest	Total	Closed Forest	Degraded Forest	Open Forest	Total
Strict Restoration Zor	*3,498.0*	*658.9*	*88.7*	**4,245.5**	*3,152.4*	*705.0*	*38.4*	**3,895.8**
Restoration Zone1	*365.0*	*473.2*	*176.4*	**1,014.7**	*212.5*	*758.7*	*108.2*	**1,079.3**
Restoration Zone2	*117.9*	*189.6*	*27.3*	**334.8**	*19.7*	*272.9*	*16.4*	**309.0**
Production Zone	*46.5*	*128.8*	*26.3*	**201.6**	*34.7*	*237.8*	*10.9*	**283.4**
	4,027.4	**1,450.5**	**318.6**	**5,796.5**	**3,419.2**	**1,974.4**	**173.9**	**5,567.4**



Decadal change of forest classification image

Fig. 5 Comparison of decadal change of the forest area

(*Features in red color on the left picture in below line depict the recovery of young forest*)

Focusing on the change in each zone of the FLUP, the Closed Forest inside "Strict Restoration-zone" has been preserved relatively well, say 90% of existing forest remain unchanged, while the forest area decreased accounting for 48% in other restoration zones. On the other hand, restoration of forest has been found in Restoration-zone resulting in increase of the forest cover by 48% overall, however they fall in degraded forest (secondary forest in this case).

These facts infer the seedlings or shrub in the grassland in the study area have grown high and bigger after nearly 10 years as seen in Fig. 6.

Since Mangatarem LGU have been dedicating to encouraging the villagers to participate in the restoration of forest, where each barangay shall establish at least 10 hectares of woodlots within the production zone identified under FLUP. Their effort seems to bring significant effects in the forest restoration.

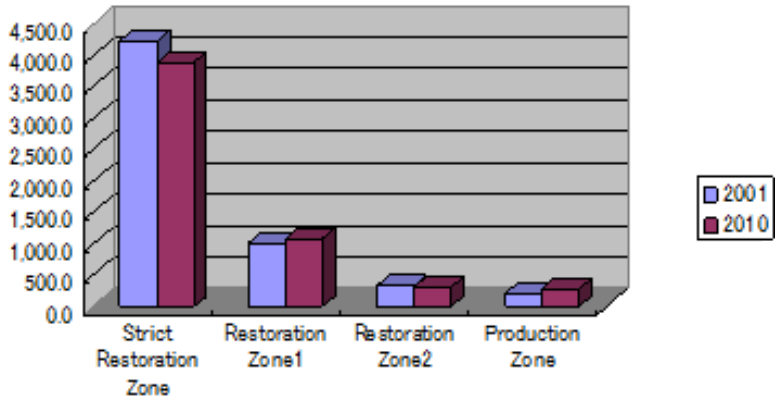


Fig. 6 Restoration of the grass land with shrub after 10 years

CONCLUSION

Monitoring of the forest change in the forest land where local people of the communities are involving in restoration of the forest was examined and proved to be effective to certain extent in order to verify their efforts. To make it more conclusive that the forest conservation can be sustainably continued, method to evaluate the effect brought from participatory restoration of the forest seems to be more important. It is because of the stakeholders can be encouraged to sustain their incentives for participating in forest conservation activities since increase of the biomass will be valued as a credit under the scheme such as REDD+ mechanism.

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