PSU Journal of Education, Management and Social Sciences
Vol. 1 No.1, pp. 32-39, December 2017

Analysis of the Ecological Principles Applied in the Development of Rainforestation as a Critical Habitat Management Strategy in Manleluag Spring Protected Landscape

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***Abstract*—Section 25 of RA 9147 strongly advocates the establishment of Critical Habitats to be protected, in coordination with the local government units and other concerned groups from any form of exploitation or destruction which may be detrimental to the survival of the threatened species. Assessment of interested agencies to Manleluag Spring Protected Landscape (MSPL) necessitates the establishment of critical habitat within the protected area, since the site significantly supports a diverse assemblage of floral and faunal species, with a significant number facing the status of extinction promoted by the loss of the habitat due to several threats present like deforestation and mining. One of the strategies recommended by Protected Area and Wildlife Bureau (PAWB) is to implement forest restoration using species of trees that are native and indigenous to the area.**

Forest Restoration and Rehabilitation is one of the priority management strategies in MSPL which has the goal to save, conserve and restore biodiversity and the whole natural ecosystems of the Protected Area (PA). The rainforestation scheme which will utilize *indigenous or local tree species* in the restoration and rehabilitation of denuded areas within MSPL will be adopted. This project is based on the premise that: "the closer the forest tree farming system in its original species composition, the higher the potential for sustainability will be." However, most reforestation efforts in the Philippines focus on the development of forestry and agroforestry system using tree species which are intentionally selected for their fast growth and germination. Unfortunately, in reforestation efforts, the emphasis is still on exotic miracles trees like *Gmelina arborea*, *Acacia mangium*, *Acacia auriculiformis*, and *Eucalyptus* spp. for large-scale reforestation (Milan and Margraf, 1996). The use of exotic trees contributes indirectly to deforestation, landslides and the drastic reduction of local biodiversity (Goeltenboth et al.). Tree species composition of the original forest that once covered the land before logging is rarely taking into account (Milan and Margraf, 1996).

This study seeks to present the operational framework by which the program is anchored from as well the current status of the program as an essential critical habitat management strategy. Several milestones have been accomplished in the program in collaboration Haribon Foundation Inc.'s program Rainforest Organizations and Advocates (ROAD) to 2020 as an environmental conservation movement committed to restore one million hectares of Philippine rainforests using native tree species by year 2020 to sustain provision of ecological goods and services by year 2020 through an informed and engaged public. These include restoration of 22.48 hectares (MSPL has a total land area of 1,935 hectares) maintained by two people's organizations (POs), KAMAPAKA and NAGMACAPAK as well as livelihood activities implemented which include individual and communal Bio-Intensive Gardening (BIG), fish culture, goat raising system.

Keywords — Ecological principles, Rainforestation, Critical management strategy

I. INTRODUCTION

With the unprecedented destruction or depletion of the various ecosystems especially forest ecosystem, the rich fauna and flora with an unusually high degree of endemism are pushed nearer and nearer to the boundary of extinction for many of its most valuable and often even scientifically- unknown species. According to Göltenboth, Fr. & Hutter, C.-P. (2004), "Forest clearance and a lack of erosion control have long-range consequences." This includes erosion which leads to sedimentation in the sensitive coral reefs along the coast which destroys the nursery for many sea inhabitants as well as the basis of life to those whose lives depend on fishing as well as high potential for the creation of different secondary forest as green lungs against the climate change remains unused.

ISSN 2599-4662 (Print) *www.psurj.org/jemss* ISSN 2599-4670 (Online)

During an eight-year bilateral project in the Philippines on the island of Leyte, rehabilitation technologies have been developed to either enrich or reforest depleted or degraded former forest land by farmers and farmer cooperatives under the assumption that "*a farming system in the humid tropics becomes increasingly more sustainable the nearer it is in its species composition and physical structure to the local rainforest ecosystem"* (Milan and Margraf, 1994).

By following this assumption, it was possible to show that conservation and rehabilitation of the local biodiversity and sustainable economic development in rural areas of the Philippines is not a contradiction. The technologies which were developed through rainforestation farming and the research results which will be presented combine possibilities of sustainable rural development, biotope, and biocoenosis protection. (Goeltenboth *et al.*)

This year, having thoroughly assessed the status of MSPL by the concerned agencies like PAWB and DENR, it was strongly recommended that an area within MSPL be established as a Critical Habitat to be supported by a Municipal Ordinance or Resolution of Mangatarem, Pangasinan. This program aims to reduce or eliminate the rate of deforestation and protect the endemic and threatened species within the area. Results of the assessment also show that more than 90% and almost all species of mammals and herpetofauna recorded in the area are forest-dependent species. Thus the area would instead provide shelter and refuge necessary to the survival of these forest-dependent species, many of which are endemic and threatened.

In 2010, a reforestation program in MSPL was launched with the objective of restoring 12.5 hectares within the Manleluag Spring Protected Landscape, Mangatarem, Pangasinan by using the rainforestation technology through its close partnership with Haribon Foundation, Inc. with the MOA on the GOLDEN (Governance and Local Development for Endangered Forests). One of the provisions of MOA is the 200 hectares restoration and rehabilitation within MSPL, by which Haribon will look for partners who will support and implement the restoration and rehabilitation initiatives.

The MOA includes the improvement of Manleluag watershed for biodiversity purposes and to re-establish forest corridors for the wildlife species. According to MSPL Management Plan of 2012, a number of endemic bird species recorded are forest inhabitants. As such, vegetation types significantly influence their presence in an area. While some species can tolerate thriving in the open/disturbed areas and plantations (as in the case of residents and migratory species), others can only be found in forested habitats, some even restricted to higher elevations as in the case of most of the endemic species.

Along with rainforestation as a primary driver of preserving the area's biodiversity, a continuous monitoring system was done to detect possible threats that may significantly magnify the risk to the biodiversity of the area such as encroachment of extractive industry such as mining and other agricultural activities surrounding the site. Strengthened collaboration and coordination among and between agencies and stakeholders was established for conservation-related activities like "Adopt-an-Area." It was also recommended to capacitate surrounding communities and people's organizations (POs) for forest conservation and sustainable livelihood.

II. OBJECTIVES

This study seeks to discuss the ecological principle applied or adopted in the program as well as to present the operational framework and the implementation process by which the program is anchored from and finally provide current status/updates of the program as an essential critical habitat management strategy based on the data gathered.

III. METHODOLOGY

The researcher chose the Manleluag Spring Protected Landscape in Mangatarem, Pangasinan over Hundred Islands of Alaminos City Pangasinan because of practical reasons though the latter is equally worth-considering for this study.

This study utilized interview as one of the significant data-gathering tools. The researcher personally conducted a semi-structured interview with the principal informant who was most knowledgeable about MSPL. During the first phase of the interview, the interviewer obtained comprehensive baseline information about MSPL and the current status of the PA. The second phase of interview was concerning the establishment of critical habitat within PA with along with various programs being implemented, one of which is rainforestation. Some interviews were conducted via SMS and/or

ISSN 2599-4662 (Print) *www.psurj.org/jemss* ISSN 2599-4670 (Online)

phone call as the need arises. Also, a soft copy of the MSPL Management Plan, some updated data with regards to Establishment of Critical Habitat and other relevant, informative tools were provided to the researcher. This enabled her to provide substantial information on this paper.

Locality

Mangatarem's forest is part of the Zambales Mountain Important Biodiversity Area (IBA) with an estimated forest cover of 6500 hectares, the largest remaining forest cover in the entire province of Pangasinan and where the Manleluag Spring Protected Landscape (MSPL) is located. MSPL covers an approximate area of 1,935 hectares. However, most of these areas have been denuded and needed restoration and rehabilitation (MSPL Management Plan, 2012).

The Protected Area (PA)'s main entry point, and hot spring resorts facilities are located at Brgy. Malabobo, Municipality of Mangatarem, province of Pangasinan with coordinates 15°40'00" to 15°45'00" latitude and 120°15'00" to 120°17'00" longitude. Other barangays within the periphery of the PA are Barangay Catarataraan, Calomboyan Sur, Lawak Langka and Pacalat, all within the town of Mangatarem, Pangasinan. The park is bounded on the north by a Reforestation project which is about 2,125 hectares, on the East by Alienable and Disposable lands which is approximately 2,014.90 hectares, on the West by unclassified public forest and on the South by reforestation project with an approximate area of 1,620 hectares. It is nearly 15 kilometers southwest of the town proper of Mangatarem, Pangasinan.

1. Abiosis

A. Climate

Climate is characterized by two pronounced seasons: dry and wet. The wet season occurs during the months of May to October, while the dry season is from November to April. Although the dry season is characterized to be hot and humid, fresh atmosphere prevails within the mountains due to the presence of much vegetation in the area. Relative humidity ranges from 70% to 85% with an average annual temperature ranging from 23.3 ℃ to 32.4 ℃.

B. Geological Characteristics/Landform

The soil of Mangatarem is classified into seven main groups, namely: Bani Clay, San Manuel Fine Sandy Loam, Bantog Loam, San Fernando Clay, San Manuel Silt Loam, Alaminos Loam, and Mountain Soils, differentiated type. The soil in MSPL is generally of Alaminos loam. Its structure and consistency are friable, granular and slightly compact.

C. Other Environmental Properties

1. Hydrology

MSPL is supplied by two bodies of water: the freshwater and mineral hot springs. The fresh water comes from the two rivers namely; the Barabac and Basican Rivers and a free-flowing natural spring which supplies the reforestation nursery and other water needs of the park.

The mineral hot springs supplying the two swimming pools of the protected area is believed to originate from the volcanic block of dormant volcanoes namely Mt. Malabobo and Mt. Mangatarem which drain at the base of the ultrabasic formations. Water temperature is about 50 ℃ with sulfur as its primary content

2. Biological resources

2.1 Flora

A total of 65 species of plants were recorded in the area during the survey. Of this total, 57 are trees and eight species are shrubs, herbs, climbing bamboos and climbing vines. Several of the trees and other plant species have been known to have one or more economic uses (Fox, 1952). Examples are tibig (*Ficus nota*), dita (*Alstonia scholaris*), antipolo/kalanat (*Artocarpus blancoi*), banaba (*Lagerstroemia speciosa*), palosapis (*Anisoptera thurifera*), and kupang (*Parkia roxburgii*), which are used for medicinal purposes. The fruits of palosapis and pahutan (*Mangifera altissima*) are edible. Moreover, tibig can produce drinkable water and the sap of *kalanat* is used by locals in trapping birds and other small animals.

The flora survey conducted by Haribon was done in the four forests or habitat types within and outside Manleluag Spring

ISSN 2599-4662 (Print) www.psurj.org/jemss ISSN 2599-4670 (Online)

Protected Landscape. These are lowland, base camp (transition of lowland-montane), montane and mossy forests.

2.2 Fauna

Bird Species Composition and Distribution

A total of 63 species of birds belonging to 38 families were recorded in Mangatarem, Pangasinan. Of this total, 28 species are endemic to the Philippines and one species, Coleto (*Sarcops calvus*), is regarded as near-endemic, or found mainly in the Philippines but also occurs on a few nearby small islands in other countries (Kennedy et al., 2000). Among the endemic species, the Philippine duck is included in the list of threatened animals (IUCN, 2006).

Only thirty-three species were observed in the lowland forest, 12 species just in the montane forest and two species in the mossy forest. These data are insufficient to base any conclusion regarding the pattern of distribution of birds in the Zambales Mountains IBA. For instance, the Grey Wagtail (*Motacilla cinerea*) and the Long-tailed Shrike (*Lanius schach*), which the survey recorded only in the lowland forest, may also be found at higher elevations. Additionally, the Ashy Ground-Thrush (*Zoothera cinerea*) and the Brush Cuckoo (*Cacomantis variolosus*), which were observed in the montane forest, may also be found at all elevations (Kennedy *et al*., 2000). Other bird species seen during the survey were more widely distributed.

The most common species in the lowland forest based on encounter rate (ER) is the Philippine Bulbul (*Hypsipetes philippinus*) followed by the Blue-throated Bee-eater (*Merops viridis*) and the Metallic-winged Sunbird (*Aethopyga pulcherrima*). In the montane forest, the Blue-headed Fantail (*Rhipidura cyaniceps*) was the most prominent species followed by the Philippine Bulbul and the Elegant Tit (*Parus elegans)*. The Blue-headed Fantail was also the most prominent species in the mossy forest followed by the Philippine Bulbul, the Velvet-fronted Nuthatch (*Sitta frontalis*) and the Elegant Tit. The high ER values and the distribution of the Philippine Bulbul and the Blue-headed Fantail at all elevations on the Zambales Mountains suggest their adaptation to the conditions in all the habitat types, including wind speed, air temperature, and food sources. On the other hand, the high ER values for the Velvet-fronted Nuthatch and the Elegant Tit in montane and mossy forests suggest that both species thrive best at higher elevations.

What is Rainforestation Farming?

With the current trend on illegal timber poaching and extension of farming into forest areas, it is to expect that the Philippine primary forest will be further reduced significantly and alarmingly. To save at least some of the precious and vulnerable Philippine forest tree species and therefore also their associated fauna and flora, the "rainforestation" farming could provide both, a sustainable income and the conservation and even restoration of some parts of the biodiversity.

In the early 1990s, Visayas State University and the German Agency for Technical Cooperation (GTC) started to develop an agroforestry system known as "Rainforestation Farming." The goal was to use native tree species to rehabilitate degraded landscapes and restore key ecosystem services and functions while providing forest-dependent communities with an alternative source of livelihood.

Since 1994 twenty-two rainforestation farming sites are using the technologies on about 24.4 ha on various locations throughout Leyte with more than 20,000 trees planted. Other places in the Philippines include the islands of Palawan, Bohol and Mindanao. Although the VSU-GTC program ended in 1999, the VSU Institute of Tropical Ecology (VSU-ITE), which was established in 1998, continued to expand its research and implementation of rainforestation farming to other parts of the country. In pursuing this work, VSU-ITE received strong support from various local government units, peoples' organizations, non-government organizations (i.e., Haribon Foundation, Foundation for the Philippine Environment, and Philippine Tropical Forest Conservation Foundation) and government agencies.

Having proven itself as a very cost-effective and widely-applicable method, Rainforestation Farming was adopted by the Philippine National Department of Environment and Natural Resources (DENR) through Memorandum Circular 2004-06 as an official reforestation strategy.
What ecological principle/s is applied to this strategy?

ISSN 2599-4662 (Print) *www.psurj.org/jemss* ISSN 2599-4670 (Online)

Rainforestation farming is a system that closely resembles the structure of the natural Philippine rainforest ecosystems or home gardens that promotes the use of native or local trees commonly grown in the area. It is based on the preliminary working hypothesis *the closer a farming system in the humid tropic it is to the natural ecosystem, the more sustainable it is.* Also, native trees are more adaptive to the forest being restored. They have a higher chance of survival. Aside from reviving the life support system of forest, they also ensure the flourishing of native plants and animals in the area. The buzz word that the agency I worked with in this study was "No home, No food, No sex." This means that if exotic trees are planted in the area, then it would not produce the necessary food types or derivatives that local fauna can feed on. These exotics do not support the survival of local wildlife species, including important pollinators and seed dispersers. Therefore, there will be no reproduction among species.

Rainforestation farming also evolves from various efforts to sustain human food production and simultaneously preserve the biodiversity of terrestrial ecosystems and their vital ecological services or functions to humanity.

Rainforestation in MSPL operates on the following framework:

I. Habitat restoration

Habitat rehabilitation is geared towards providing quality habitats for wildlife particularly within the identified critical habitat and nesting sites for indicator species. Improvement of the habitat management zone shall involve the restoration of open/denuded and degraded areas.

Rainforestation was undertaken to regenerate the once-lush forests, through assisted natural regeneration (ANR) and enrichment planting. However, species to be planted must be indigenous to the area to attain its original vegetative cover. Species shall include Apitong (Dipterocarpus grandiflorus), White lauan (Shorea contorta), Tibig (Ficus nota) and Palosapis (Anisoptera thurifera) Likewise; fruit trees shall comprise one of the reforestation species to provide food for wildlife. Also, indigenous ornamental plants can be introduced to enhance the aesthetic value of the area.

Moreover, to stabilize riverbanks, creeks, ditches and trails, enrichment planting, construction of check dams and gabions, and planting of Napier/Vetiver grass and Kakawati should be introduced to improve the riparian vegetation, which serves as an essential corridor for wildlife. It will be noted that some nesting and breeding sites are usually found along rivers and creeks or steep slopes. Likewise, slope stabilization shall be done using a combination of engineering and vegetative schemes to prevent soil erosion.

II. Biodiversity conservation

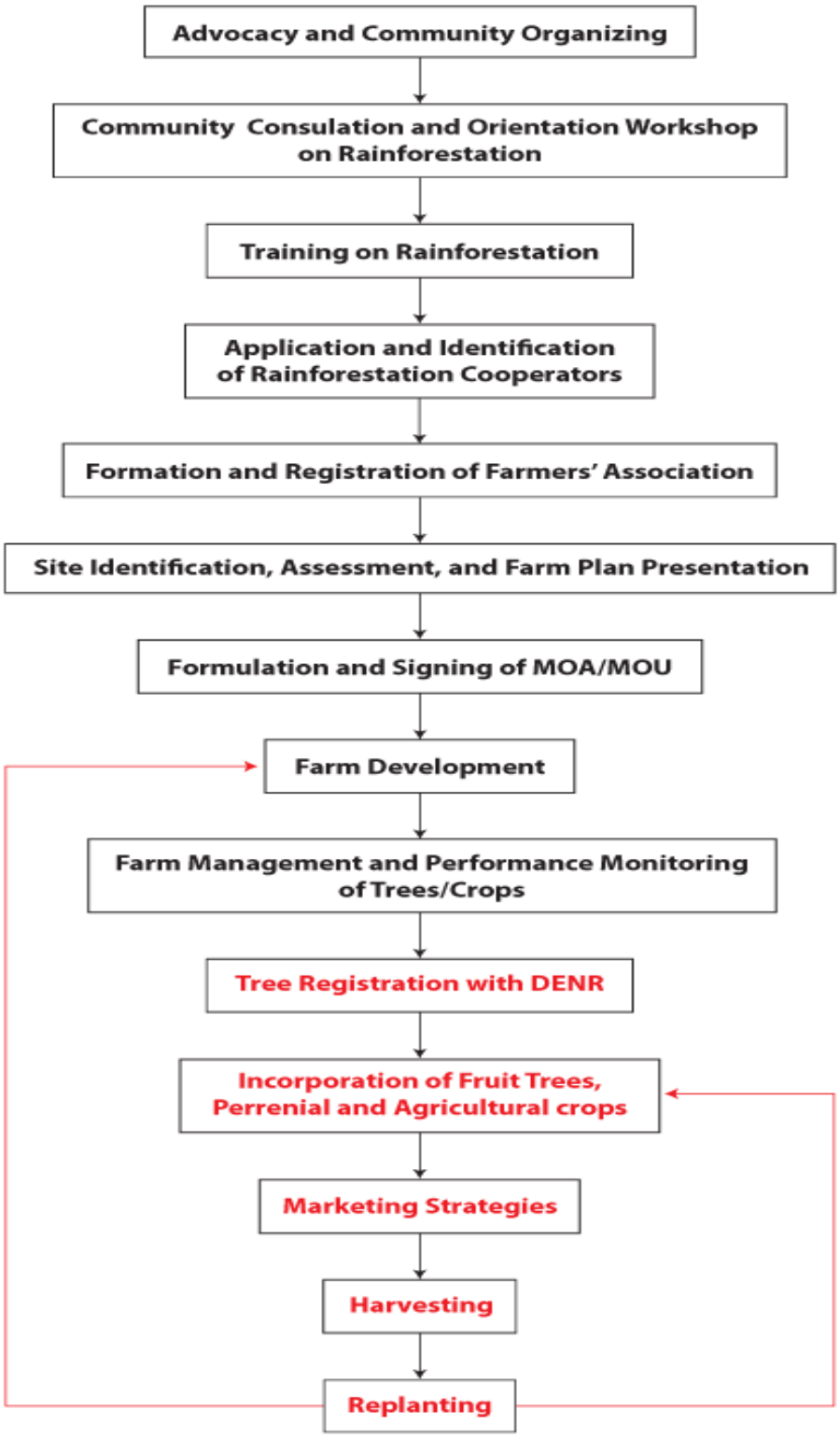
Manleluag Spring Protected Landscape is one of the pilot areas in the country for the implementation of Biodiversity Monitoring System (BMS). In its 10th year of implementation in the protected area, this activity has been providing reliable information to the Protected Area Management Board (PAMB) as the basis for management intervention. The focus is on identifying trends in biodiversity and its use. It is noteworthy that the PA staff is not solely undertaking this monitoring system but the community as well, thus, urging them to PA management. It comprises of four (4) field methods: Focus Group Discussion (FGD), Field Diaries, Photo documentation and Transect Walk.

III. Provision of ecological functions/ services

Rainforestation farming has the additional benefits besides improving the watershed like replacing the more destructive and unsustainable form of slash-and-burn or kaingin system being practiced in the area, to form a buffer zone around the forest and to provide farmers with additional income. Regarding site quality, rainforestation also has likely effects such as improvement of soil chemical properties, soil structure and water holding capacity, soil organic matter and soil color, site nutrient status, site biological activity and microclimate.

ISSN 2599-4662 (Print) *www.psurj.org/jemss* ISSN 2599-4670 (Online)

FLOWCHART OF RAINFORESTATION IMPLEMENTATION PROCESS



Source: Modified from Margraf and Milan, 1996

ISSN 2599-4662 (Print) *www.psurj.org/jemss* ISSN 2599-4670 (Online)

Rainforestation advocates have adopted a community-based implementing strategy (described in the flowchart above). In this scheme, the planting of the trees occurs only after an extended period of consultation with all relevant stakeholders to ensure support for the development and sustainability of the site.

Status of Rainforestation in MSPL

MSPL's Restoration Management Committee (RMC) is responsible in the development of identified restoration areas (200.72 hectares) through rehabilitation of the degraded habitat and watershed areas for biodiversity enrichment purposes and other ecological functions through rainforestation. The committee ensures and monitors the implementation of biodiversity monitoring system at MSPL, notably flagship and priority species.

With the goal of rehabilitating the denuded and degraded areas of the MSPL and restore its natural state, the following accomplishments/activities have been initiated:

1. Establishment of restoration mechanism and forging to Restoration MOUs with People's Organizations.
2. Nursery establishment to raise different native seedling for the 200 hectares restoration area.
3. Involvement of women and youth and other stakeholders in restoration and monitoring.
4. Identification and mapping of mother trees.

Trainings

To date, 22.48 hectares was restored and maintained by two people's organization (POs), KAMAPAKA and NAGMACAPAK. Livelihood activities were implemented which include individual and communal Bio-Intensive Gardening (BIG), fish culture and goat raising system. Income earned from forest restoration was used to purchase some equipment. Though there is more work to be done, the Adopt-an-Area program provides comprehensive tree-planting activities. Wherein specific sites will be adopted by different stakeholders like LGUs, POs, NGOs, Academe, religious groups and other private sectors like business establishments for an environmental activity like tree planting to species that are indigenous to the area considered for planting.

RMC is hopeful that with the close partnership with Haribon Foundation, plus the Establishment of Critical Habitat within MSPL this 2013, more synergistic and positive endeavors will be realized soon.

IV. CONCLUSION

Indeed, rainforestation is a promising and effective strategy in establishing biodiversity corridors in MSPL. With almost two years since the start of Haribon's Foundation Inc.'s GOLDEN, the program has done the significant transformation in the restoration and rehabilitation of the protected area, with a promise of sustaining the endemic and native species of flora and fauna in the ecosystem. With rainforestation, we can ensure to mitigate further loss of biodiversity in the area and preserve and conserve the remaining wildlife, especially that in MSPL, a significant number of forest species are dependent on trees like birds and some species of reptiles. It was also apparent that rainforestation strategy supports sustainable development through organic practices in agricultural and forestry production (agro-forestry) and lastly, to provide ecological services to the area in the form of improved condition of the watershed and the ecosystem in general. Finally, through this program, a more involved and informed community and stakeholders take their part in the saving that habitats for today, tomorrow and the next generations to come.

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ISSN 2599-4662 (Print) *www.psurj.org/jemss* ISSN 2599-4670 (Online)