I. INTRODUCTION AND OVERVIEW

Mangrove forests have long been recognized for their various ecological and socio-economic services. These forests do not only serve as protection against storms and strong waves, but also as habitat to various terrestrial and marine organisms. Like other coastal ecosystems, mangroves are threatened by both natural and human-induced stresses. Among these stresses are the occurrences of typhoons, pollution, siltation, land reclamation (e.g. wharf, pier and human settlement), its harvesting for timber products, and its conversion to fishponds. The latter appears to be the most significant factor causing the decline of mangrove forests not only in the Philippines, but also in Southeast Asia.

The loss of mangrove forests results in the reduction in biodiversity that leads to the reduction or loss of valuable ecosystem services naturally rendered by mangroves (Duke et al. 2007). Without mangroves, environmental catastrophes such as flooding, typhoons, coastal erosion and landslides will have more severe impacts on humans. With coastal development replacing mangroves and other coastal vegetation, humans are becoming more vulnerable to ecological disasters (Danielsen et al. 2005). The impacts of an accelerated environmental change on coastal landscape, primarily global warming and sea level rise (popularly known as climate change), will result to more severe coastal disasters.

Mangroves are known to be efficient sinks of atmospheric CO_2, and as such, play an important role in mitigating the impacts of global warming. They have five times higher carbon stocks than the terrestrial forest types (Donato et al. 2011). The litter production and organic detritus that are deposited in the sediments help in maintaining surface elevation and therefore help in compensating the effects of sea level rise. The capacity of mangroves to adapt and mitigate the impacts of climate change has led coastal managers to intensify the management and rehabilitation of mangrove forests.

State of Philippine mangroves: forest cover, research and management

Out of the 255,449 ha of mangroves in the Philippines (Long & Giri 2011), around 94,550 ha (37.1%) is found in Mindanao, 51,548 ha (20.2%) in Visayas and 109,351 ha (42.8%) in Luzon. More than half of Luzon mangroves are in Palawan. Reports on Philippine mangrove statistics (in terms of status, extent and distribution) are confusing, and often inconsistent. Before year 2000, there are reports stating that mangroves occupy only around 120,000 ha from as much as 450,000 ha in early 1900s. At least 60% of mangroves losses were due to massive conversion to aquaculture ponds particularly in the 1970s-1980s (Primavera 2000). At the turn of the 20th century, however, the estimates on mangrove forest cover increased to around 240,000 ha (Long et al. 2011, Long et al. 2014).

The validity of these recent figures has been questioned. The differences in these estimates may be attributed to the varying resolutions on the remote sensing images used in mangrove mapping activities. It is also possible that the young planted stands from massive mangrove planting programs, despite not yet fully developed as mature forest, have been erroneously added to these estimates. In addition, there were some local initiatives on mangrove mapping that estimated the actual mangrove extent in a particular locality (see Bani, Pangasinan case study in this report). Manual mapping such as this initiative may have better resolution and an advantage in familiarity in the actual mangrove distribution. The capacity of humans to map out the actual extent may be constrained by its inherent physical limitation to map the entire stretch of a mangrove forest. Nonetheless, despite the advancement of technology, there are still instances where figures derived from remote sensing are either over or under-estimated as reported by local mangrove managers from the site (see Pagkalinawan's report). Thus there is a need to reconcile data from remote sensing and that of field-validated mangrove forest data. Obviously, the extent and types of mangroves determine the type of management action that will be implemented.

There are around 875 studies over a span of 316 years on Philippine mangroves. These studies make Philippines as one of the top research producing country in SE Asia until 1970s, but gradually declined thereafter. Surprisingly, 85% of these are found as grey literature and only 15% as peer-reviewed (Fortes & Salmo 2015). The academic and research institutions contributed 50% while the government accounted 25% of these studies. Areas that have high research outputs are (in order) in Region 7

(Central Visayas), Region 4A (CALABARZON), Region 6 (Western Visayas), Region 4B (MIMAROPA) and Region 5 (Bicol).

Early research studies on mangroves, dating back to the late 1600s up to the mid-1900s, focused on its utilization and basic natural sciences. Subsequent research efforts on mangroves significantly increased covering aspects of its uses, field surveys, taxonomy, biodiversity and conservation. Most studies on mangroves have been conducted near a research institution and on the bases of their presence, degree of usage, and the relevant environmental and socio-economic issues. In the 1970s–1990s, some studies were focused on fishpond development and in Environmental Impact Assessments resulting from industrial and commercial operations. From the 1990s onwards, studies have been heavily focused on its conservation and management, biodiversity and ecology, but often neglect the strengthening of basic sciences. Some studies were linked to national and international-funded programs such as the Coastal Environment Program, Fisheries Sector Program, Coastal Resource Management Program, Integrated Coastal Resources Management Program, among others.

Through the years, research priorities responded to the need to address economic and environmental problems of each period. Massive mangrove planting programs have proliferated in the country since 1990s. It is timely and interesting to know the actual contributions of these planted mangroves in terms of the delivery of the perceived ecological and socio-economic benefits. If done properly, restored mangroves have the potential to abate the impacts of typhoon, storm surge, global warming and even mitigate the impacts of sea level rise. Such performance will be influenced by the state and health of the planted mangroves. However, these mangroves were planted in sub-optimal conditions (i.e. highly inundated and saline), resulting to poor survival and stunted growth. Unfortunately, there are very few monitoring reports on the success or failure of mangrove planting programs in the Philippines.

Unless conservation and management issues are addressed, the further loss of mangroves will result in less stable coastal environments. There are several existing laws that define mangrove management (for examples, see Primavera 2000). Some policies related to mangrove management are the Philippine Forestry Code (PD 705 and the revised version, RA 7161), Philippine Fisheries Code (RA 8550 revised version), and the Local Government Code (RA 7160). The jurisdiction of mangrove management in the country have long been disputed, apparently because, on one hand, mangroves are viewed as habitats critical for biodiversity and as bio-shield against natural disasters, and on the other hand, as source of fisheries products that provide livelihood and source of income for the coastal communities. Some national programs overlap in areas as a result of such conflicts. On the bright side, there are some successful initiatives on the ground that are either implemented by the local government or community-based organizations. These initiatives include, for example, the declaration of mangrove protected areas, eco-tourism zones, and development of enterprise derived from non-extractive use of mangrove products.

A national coordinating body, similar to the National Mangrove Committee (NMC) in the mid-1980s, is needed. The NMC should be reactivated to oversee the national mangrove management plan. As originally envisioned, a regular updating of mangrove status in the country will be institutionalized. As of this writing, there are pending bills in Congress seeking the formation of a committee similar to the functions of the NMC. With the long absence of such a committee, however, critical reviews and inputs to guide the NMC are needed.

The Need for a Mangrove Summit

Given the important role of mangroves, the lack of consolidated data and some resource constraints, there is an urgent need to have the first Mangrove Summit. The summit will serve as a pioneering activity to help revitalize the NMC. It envisions institutionalizing a national State of the Mangrove biannual workshop that consolidates monitoring data (e.g. growth and biodiversity). This information, collated in an accessible online database, will also be useful in estimating the carbon sequestration of mangroves and in assessing vulnerability against sea level rise.

The summit will start with the northern West Philippine Sea biogeographic region, but is envisioned to cover the entire country. This biogeographic region covers three administrative regions (Regions I, II and III), eight provinces (Bulacan, Bataan, Pampanga, Zambales, Pangasinan, Ilocos Sur, Ilocos Norte and Cagayan), and one autonomous region (Subic Bay Metropolitan Area). The municipalities of Masinloc (Zambales) and Bani (Pangasinan) were also invited to share their lessons and experiences in mangrove management. The region still has

a substantial extent of mangroves but is highly vulnerable against anthropogenic and natural disasters.

The northern West Philippine Sea is home to several key marine biodiversity areas and marine corridors accounting for 22% of the Philippines' fisheries production. The provinces of Bulacan and Pangasinan have a notably high aquaculture production. Most coastal areas are highly vulnerable against natural hazards such as typhoons and the imminent danger of sea level rise. The region has a rich history of employing various mangrove management strategies – from declaration of protected areas, to locally initiated mangrove mapping, community-based approach and monitoring activities, among others. Some of these strategies were successful, others were not, but nonetheless are important to draw and share lessons with other mangrove managers in the country.

In all provinces, mangrove planting is a regular activity held at least once a year. Planting sites are usually along the shoreline using species from the genus *Rhizophora* (Salmo & Duke 2010). Survival rate is low, usually attributed to wrong species-substrate matching, and the inappropriate location and timing of planting. Similar to most mangrove rehabilitation programs in the country, most mangrove planting activities in the region are more of afforestation (which affects the nearby habitat – seagrass bed and mudflats) rather than reforestation of denuded mangrove areas. The planted stands are usually mono-specific (Walters 2004, Primavera & Esteban 2008, Salmo et al. 2013) with stunted growth and poor survival (Samson & Rollon 2008).

Summit Objectives

The **1st State of the Mangrove Summit** aims to complement the State of the Coast Reports of the UP Marine Science Institute in providing a more comprehensive overview of the status of coastal ecosystems in the Philippines. The summit provides an opportunity for mangrove managers to discuss the status of mangrove forests in the region.

Specifically, the summit aims to accomplish the following objectives:

- Provide a venue for provinces to share and discuss the status of mangrove forests in the Philippines, especially in the light of climate change vulnerability;
- Invite experts in the field of mangrove ecology and management, climate change vulnerability, and blue carbon sequestration to share state of the art knowledge to enrich the workshop and action planning;
- Consolidate more accurate data from each province; and
- Come up with a plan of action to enhance mangrove management.

Content and Structure of the Proceedings

The first part of the Proceedings came from individual provincial and municipal reports. Prior to the summit, a survey form was sent to the eight provinces, the municipalities of Masinloc and Bani, and to SBMA. This survey was implemented through the Philippine Higher Education Research Network (PHERNet) project funded by the Commission on Higher Education, entitled "Assessing the Success of Mangrove Rehabilitation Projects in Northern Luzon, Philippines: Comparative Rates of Carbon Deposition in Natural versus Planted Mangrove Stands"

The survey yielded information on:

1. Province/area geographic and socio-economic profile (e.g. population in coastal areas, barangays and threats);
2. Mangrove assessment status (including areas of old-growth and planted stands, presence of protected mangrove area, importance of mangroves to the community, mangrove products utilized, managers of the mangroves, causes of decline, effects of decline, steps taken to address decline, and presence of mangrove protection/planting/rehabilitation efforts); and
3. Provincial mangrove projects/programs (specifying the type of project, objectives, funding groups, implementing groups, partners, budget, area replanted/rehabilitated, growth and survival rate, presence of monitoring programs, community engagement, and community benefits).

Information gathered from the survey was organized into a matrix and formatted into a comprehensive and accessible online database to supplement existing mangrove information. An outline was prescribed for both oral and written reports. Each partner institution was then requested to submit an oral presentation and written report. Oral presentations were delivered during the Mangrove Summit while the written reports were submitted on 30 November 2014. The Secretariat reviewed the submitted documents for formatting and copy-editing to achieve consistency (while

retaining the original contents submitted) throughout the Proceedings. In cases where the reporters did not provide data, the Secretariat labeled it as "no data provided." These individual reports constitute the bulk of the Proceedings, which is available at http://mangroveecology.com.

The second part is composed of four technical reports covering topics on: (1) mangrove mapping using remote sensing, (2) adaptation and vulnerability of mangroves against sea level rise, (3) inter-institutional networking, and (4) incentivizing blue carbon. These presentations were intended to complement mangrove status reports and provide an inter-disciplinary perspective on how to improve mangrove management. The needed improvements on mangrove management pertains to the viability and quality of mangroves in adapting to the effects of sea level rise, formation of a mangrove network to sustain the gains of this summit, and the inclusion of estimation of carbon stocks and sequestration rates in both natural and planted mangrove stands.

The third part is the summary of workshop-planning outputs drawn from three groups composed of academe/ NGO, provinces from Bulacan to Zambales, and provinces from Pangasinan to Cagayan. Each group was asked to identify data gaps, the priority issues and problems, and the activities they suggest to address the identified problems. In addition, all groups were asked to suggest strategies that will form and sustain the mangrove network. The workshop outputs were printed as submitted by the groups.

The last part is a synthesis of the 1st State of the Mangrove Summit. Information from all reports, technical presentations and workshop outputs were consolidated. Statistics on mangrove forest cover for the NW Luzon in terms of species composition, distribution and extent of old and planted stands are reported. Technical information (e.g. how to survey and monitor mangroves) and management gaps (e.g. issues on jurisdiction) were identified. Current and emerging issues that pose threats on the existence of mangroves (e.g. coastal poverty, habitat conversion and sea level rise) were discussed. Varying management approaches across sites were summarized to identify common strategies that will help improve mangrove management in the region. In this section, we incorporated our insights and perspectives based on the identified data gaps and the needed research to complement the current management strategies.

Summary and Challenges

Around 65 participants from the academe, NGOs, NGAs and the local government attended the 1st State of the Mangrove Summit. There were a total of ten case study presentations from mangrove managers and four technical presentations from resource persons. The sharing sessions on mangrove statistics, the perceived threats and management responses as well as the difficulties and lessons learned on mangrove management were valuable. The concerns mentioned in the workshop and planning session will serve as inputs in crafting national mangrove management plan. This document will also be available online for public access.

Indeed, the summit has accomplished its objectives, paving the way for future mangrove summits both at the regional and national levels. Organizing a summit however is not without its challenges, namely matters on funding, coordination, participation and publication of proceedings, among others. As we attempt to complete the Philippines' mangrove status report, we invite and encourage all concerned mangrove stakeholders to participate and help improve mangrove management in the country.

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