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A community-based approach to solid waste management for riverine and coastal resource sustainability in the Philippines

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ABSTRACT

Improper solid waste management practices are harmful to riverine and coastal ecosystems. In the Philippines, the Ecological Solid Waste Management Act (Republic Act No. 9003) decentralized the management structure and mandated Local Government Units (LGUs) to adopt new integrated solid waste management (SWM) plans. However, LGUs often lack the capacity, understanding, and enforcement authority for effective SWM. With minimal SWM awareness leading to socio-economic and environmental problems, alternative management approaches may be effective. This paper discusses the creation and implementation of a community-based program to educate community members and develop sustainable initiatives to improve SWM practices that have been observed to affect riverine and coastal environments in Tabaco City, Albay, Philippines. The *Save the Rivers, Save the Sea* program was designed as a way to engage students and local youth in environmental issues in their communities. The program's first year mobilized a team of students and collected data from a community needs assessment, water quality analyses, and workshops, which we utilized to create a sustainable action plan for the remainder of the program. The action plan provides the program with goals and objectives in order to affect SWM change in Tabaco City's rivers and coastal environments. First-year program and observational findings demonstrated that community-based programs are effective tools for addressing SWM challenges but, to be sustainable, need to co-exist with a supportive and committed LGU.

1. Introduction

Rivers are vital connections in many aquatic agricultural systems. They link upland, coastal, and marine ecosystems, while providing social, economic, physical, and cultural value to communities (King and Brown, 2006; Nilsson et al., 2007). These are some of the most productive ecosystems in the world, and are critical for coastal and marine ecosystem protection, biodiversity, and economies (CGIAR Research Program on Aquatic Agricultural Systems, 2012).

Globally, river and coastal degradation has increased over the years because of natural and human-induced factors, thereby making these ecosystems vulnerable to pests, waste, and biological dead zones (Intergovernmental Panel on Climate Change, 2012; Woodroffe, 2007). Alterations to river systems over time have implications not only for their biological makeup, but culturally and socio-economically as well.

Poor waste disposal in rivers and coastal areas also stresses marine ecosystems by inhibiting them from performing services important to local, national, and global economies, decreasing biodiversity, and leaving populations increasingly vulnerable to natural disasters through the degradation of protective habitats such as coral reefs, seagrass beds, and mangrove forests (Chandler and Walter, 1998).

The effects of river and coastal ecosystem pollution are being felt worldwide, but in the Philippines, a biodiverse archipelago located within the coral triangle whose population and economy are tied to the coastline, the consequences are even greater, threatening food security and livelihoods and deteriorating important marine resources (Carpenter and Springer, 2005; King and Brown, 2006). The Philippines, along with a small number of other developing countries, is a major contributor of solid waste flowing into the ocean (Jambeck et al., 2015). This can be seen around the country, particularly in Manila and

Abbreviations: LGU, Local Government Unit; BUTC, Bicol University Tabaco Campus; DENR, Department of Environment and Natural Resources (Philippines); DENR-EMB, Department of Environment and Natural Resources – Environmental Management Bureau; MOA, Memorandum of Agreement; IEC, Information, education, communication

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other urban areas, as nearshore waters are often littered with debris. In 1996, only 51% of the classifiable rivers in the Philippines still met the standards for beneficial use (Congress of the Philippines, 2004) and the Philippine Department of Environment and Natural Resources (DENR) found domestic wastes to be the biggest pollution contributors in freshwater and marine ecosystems (Philippine DENR-EMB, 2006). Community river use and improper solid waste management (SWM) introduce foreign contaminants into Philippine river systems, thereby threatening the sustainability and functionality of both local and global water resources.

Riverine and coastal ecosystems complicate management decisions because of the need to account for physical and political trans-boundary interactions (Lookingbill et al., 2009; Rivera and Newkirk, 1997; Wohl et al., 2005). Over the past few decades, the Philippine government has made efforts to revamp SWM and coastal resource management (CRM) policies by transferring more authority to regional and municipal government units (Christie et al., 2005; Lowry et al., 2005; Premakumara et al., 2014; White et al., 1998). The Ecological Solid Waste Management Act (Republic Act No. 9003) established guidelines to protect the environment and public health through the creation of ecological SWM plans (Congress of the Philippines, 2000). It places responsibility for SWM implementation and enforcement with local government units (LGUs) and also details proper waste segregation, waste collection and transfer, municipal use of recycling and composting, and means of disposal. The Philippine Clean Water Act (Republic Act No. 9275) was put in place to protect the country's water resources from both point and non-point source pollution (Congress of the Philippines, 2004). It addresses the management of watersheds, river basins, and water resource regions through the creation of multi-sector governing boards and prohibits, among other things, the discharge of any pollutant into a water body or soil (Congress of the Philippines, 2004).

Despite the presence of these national policies and management structures, Philippine rivers and coastal environments remain largely unrestricted (Premakumara et al., 2014). While many LGUs employ department-level staff for environmental protection and waste management, SWM is oftentimes not satisfactorily integrated into LGU frameworks due to information miscommunication, lack of municipal level technical and managerial skills and resources, false levels of commitment and/or understanding of objectives, poor law enforcement, budgetary constraints, and minimal accountability from higher level agencies (Christie et al., 2005; Larsen et al., 2011; Lowry et al., 2005; Premakumara et al., 2014). The lack of understanding and awareness pertaining to SWM contributes to pollution and solid waste accumulation in coastal and marine ecosystems and leads to inefficient social and economic outcomes.

The Millennium Ecosystem Assessment of 2006 recommended community-based management programs and local stakeholder participation in decision-making as a response to resource degradation and depletion (United Nations Environment Programme, 2006). Community-based management is a bottom-up approach, which recognizes communities and residents as the best resource managers and active participants in governance (Arceo et al., 2013; Marques et al., 2013; Rivera and Newkirk, 1997) who can actively facilitate the discussion and reorganization of ideas and policies. This approach differs from command-and-control methods, which are often used for their linear and defined approach (Holling and Meffe, 1996; Knight and Meffe, 1997).

Community-based management became popular in the Philippines in the 1980s after the fall of the Marcos regime (Pomeroy et al., 1997; Rivera and Newkirk, 1997), and various Philippine governmental organizations, non-governmental organizations (NGOs), and businesses have successfully implemented community-based SWM programs across the country. DENR's *Adopt-an-Estero* program and the ABS – CBN Foundation's *Kapit Bisig para sa Ilog Pasig* (Linking arms for the Pasig River) river restoration program were both designed to solve water

pollution problems (i.e. water-borne diseases, prolonged flooding), restore Philippine rivers to their natural state, and encourage community involvement and partnerships (ABS – CBN Foundation, 2012; Philippine DENR-EMB, 2012). Many Philippine LGUs, such as Cebu City, have also had success with municipal SWM programs by first assessing community issues and needs and encouraging local partnership and capacity building (Premakumara et al., 2014).

While there have been efforts to synthesize and evaluate community-based programs in the Philippines, particularly those concerned with CRM and Marine Protected Areas (Pomeroy et al., 1997), many efforts go unreported or undocumented or receive little input from those directly involved (Rivera and Newkirk, 1997). This paper looks at the creation and implementation of one particular community-based SWM effort, the *Save the Rivers, Save the Sea* program, in Tabaco City, Albay, Philippines. Using data analysis and participant observation from this case study, the paper then seeks to further examine the challenges facing SWM in the Philippines and how community-based efforts can serve as effective solutions, while also providing additional socio-economic benefits to surrounding communities and their residents.

1.1. Study site

Located at 123°44'58.3" E longitude and 13°21'34.3" N latitude in the center of the Bicol Region, Tabaco City is a fourth class municipality with a population of 125,083 (Tabaco City Planning and Development Office, 2011). The city lies on the eastern coast of Albay province facing the Lagonoy Gulf and Pacific Ocean (Fig. 1), making it susceptible to typhoons and flooding. Tabaco City's coastal habitats include mangrove forests, seagrass beds, and coral reefs, and the city is also traversed by nine major rivers (Fig. 2; Tabaco City Planning and Development Office, 2011). One of these, the Bombon River, is a 5-km long freshwater river that originates in the foothills of the Mayon Volcano and flows into the Lagonoy Gulf. It is channelized by concrete embankments and winds through three *barangays* (neighborhoods) and some of the most populated areas in Tabaco City. It is classified as a Class C waterway, meaning its beneficial uses include: 1) fishery waters; 2) recreational waters; and 3) industrial water supply for manufacturing processes after proper treatment (Philippine DENR-EMB, 1990).

The Bombon River (123°43'56.99" E longitude and 13°21'52.56" N latitude) serves a lively, yet struggling community home to many local homeowners and squatter families. Many businesses and residences line the riverbank. In addition to the recreational, economic, and social opportunities the river provides, the presence of infrastructure also subjects it to waste intrusion and improper waste disposal, thereby affecting downstream coastal and marine habitats which many of the city's inhabitants rely upon. The sheer volume of riverbank residents, including many illegal squatters, has made it difficult for the LGU of Tabaco City to monitor and treat the amount of waste entering the river. Many *barangays* lack proper disposal facilities and resort to littering or burning of waste (Tabaco City Planning and Development Office, 2011). Tabaco City lacks sufficient participatory programs addressing SWM and CRM that would help empower current residents. There were no previous studies on local SWM practices, and therefore, baseline data were not available to inform policy, develop action plans, and protect the city's coastal ecosystems.

2. The *Save the Rivers, Save the Sea* program

Conceptualized in 2013, the *Save the Rivers, Save the Sea* program is a community-based program which seeks to address SWM in Tabaco City, involve local youth at the *barangay* level and at Bicol University Tabaco Campus (BUTC), and provide co-management opportunities to local residents and stakeholders. It intends to increase community awareness of the value of local coastal resources and proper SWM, while also empowering youth to take environmental action, repair

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