GREEN INFRASTRUCTURE: AN ALTERNATIVE TO RESTORE THE PROTECTION SERVICES OF THE BIOSPHERE RESERVE OF MARISMAS NACIONALES

Debora Lithgow, Instituto de Ecología (debora.lithgow@inecol.mx)
Valeria Chávez, Instituto de Ingeniería UNAM (vchavezc@ii.unam.mx)
María Luisa Martínez, Instituto de Ecología (marisa.martínez@inecol.mx)
Rodolfo Silva, Instituto de Ingeniería UNAM (rsilvac@ii.unam.mx)

INTRODUCTION

The Biosphere reserve of Marismas Nacionales is a large estuarine complex that covers 220,000 ha. It is located on the north-western Pacific coast of Mexico (22°15'04'', 22°17'07'' N and 105°11'05'', 105°13'36'' W) on the alluvial plain of two states: southern Sinaloa and Nayarit (Figure 1). MaNas is the largest surface of wetlands along the Mexican Pacific coast and represents 22% of national mangrove extension (CONANP 2013). The region is very complex, with complicated topography and high biodiversity. Different habitats are found in the area, which combines an intricate set of ecosystems: dry (foredunes) and flooded (coastal lagoons, coastal wetlands, mangroves, and swamps). Dune slacks are permanently flooded providing habitat to wetlands. MaNas is of conservation relevance and, besides being a Biosphere Reserve, it has been declared as a Ramsar site, and a Wetland of International Relevance (Lithgow et al. 2019). It provides key ecosystem services such as habitats for fisheries, coastal protection and sequestrating carbon, among other services. The mixing of marine and freshwater in its coastal lagoon bodies also makes this wetland system one of the most productive in north-western Mexico. Furthermore, this region functions as a biological corridor of great importance for the refuge, feeding, and reproduction of resident and migratory birds (SEMARNAT-CONANP, 2013). It is also an important area of endemism for vertebrates and insects (Rubio-Cisneros et al. 2017).

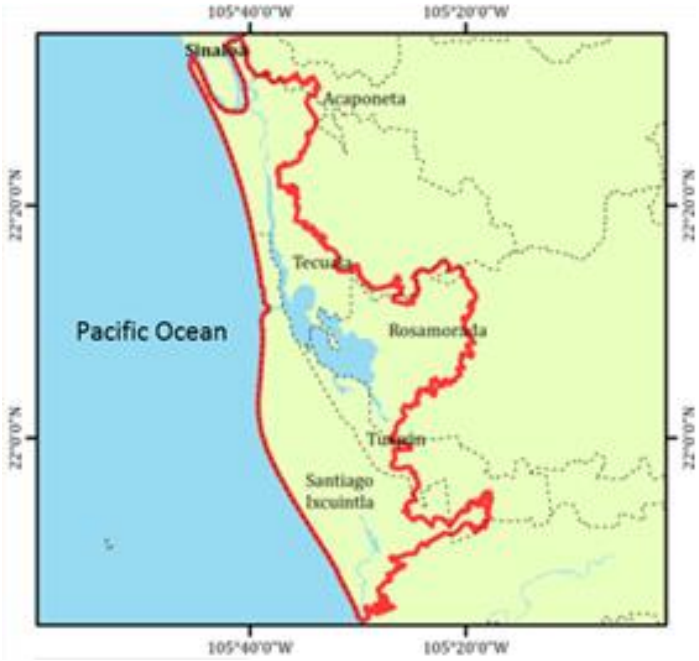

Figure 1. Location of Marismas Nacionales Biosphere Reserve in the Pacific Ocean.

Although a Biosphere reserve, land use changes, intensive shrimp culture and weak management measures have perturbed extensive mangrove patches. Also, the hydrodynamic flux of the zone has been modified, affecting the resistance and resilience of the system. For example, an artificially built inlet have altered the beach and foredunes increasing the vulnerability of the whole system to hydrometeorological events. Furthermore, the protection measures only apply to the wetland while the beach and foredunes ridges are under constant development and perturbation. Paradoxically, beach-foredune systems have been recognised by their importance in the provision of protection ecosystem services. There are several efforts to restore MaNas reserve. However, there is no

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information on the current status and needs of the beach-foredune system, which is necessary to ensure the success of the restoration strategies of the whole system.

This study aims to determine the status of the beach and foredunes in MaNas and to explore the feasibility of implementing green infrastructure projects as a strategy to achieve multiple socioecological objectives such as the restoration the protection services provided by these ecosystems. The ReDune index (Lithgow et al., 2015) will be applied to evaluate the need for action (conservation, restoration or rehabilitation) while a new method has to be developed to evaluate the feasibility of green infrastructure strategies. The green infrastructure approach to be applied will be the categorisation by Silva et al. (2017).

AVAILABLE BACKGROUND INFORMATION & DATA

There is information about coastal erosion, water quality, and land use change trends. Also, a previous study identified the stress factors and the marine climate. The main ecosystems in the area are beach and foredunes that protect a mangrove forest

BRIEF STATE OF THE ART

The main economic activities at the study site include agriculture, cattle ranching, fisheries and shrimp farming. Many of these activities have been implemented without considering key environmental elements of the system, such as hydrology, resulting in erratic land use changes, deforestation, the expansion of the agricultural area, the use of pesticides, salinization of soils, hydrological changes, and tourist and residential developments (Blanco et al. 2011). Such activities have affected both the dune-wetland system, as well as the beach (de la Laza et al., 1996). For instance, Lithgow et al. (2019) observed that 1997 to 2013, herbaceous wetlands and croplands have been lost while grasslands, urban areas, aquaculture and mangroves have increased. Intense and chronic shoreline erosion occurred after the artificial creation of an inlet (Canal de Cuautla -Cuautla Channel). This inlet was built in 1976, and its original dimensions were 40m wide, 2 m deep and 4 km long. The inlet induced very severe shoreline erosion, and its current dimensions are 3km wide and 20m deep. More than 500 ha of croplands and mangroves have been lost (Ochoa et al., 2012).

SUMMARY

The Biosphere reserve of Marismas Nacionales is a large estuarine complex (220,000 ha) located on the north-western Pacific coast of Mexico. The region is highly biodiverse and a conservation global and national priority which has been declared as a Ramsar site, and a Wetland of International Relevance. In spite of the recognition of the conservation relevance, the protection measures only apply to the wetland area while other ecosystems are under constant development and perturbation. The degradation of beach and foredunes has a direct impact on the resilience of the whole system, increasing the vulnerability to hydrometeorological events. This study aims to perform a diagnosis of the beach and foredunes and to explore the feasibility of implementing green infrastructure projects to recover protection ecosystem services while other social and ecological benefits are maximised. The diagnosis is performed using a multicriteria index called ReDune while a framework to evaluate the feasibility of a green infrastructure project is proposed.

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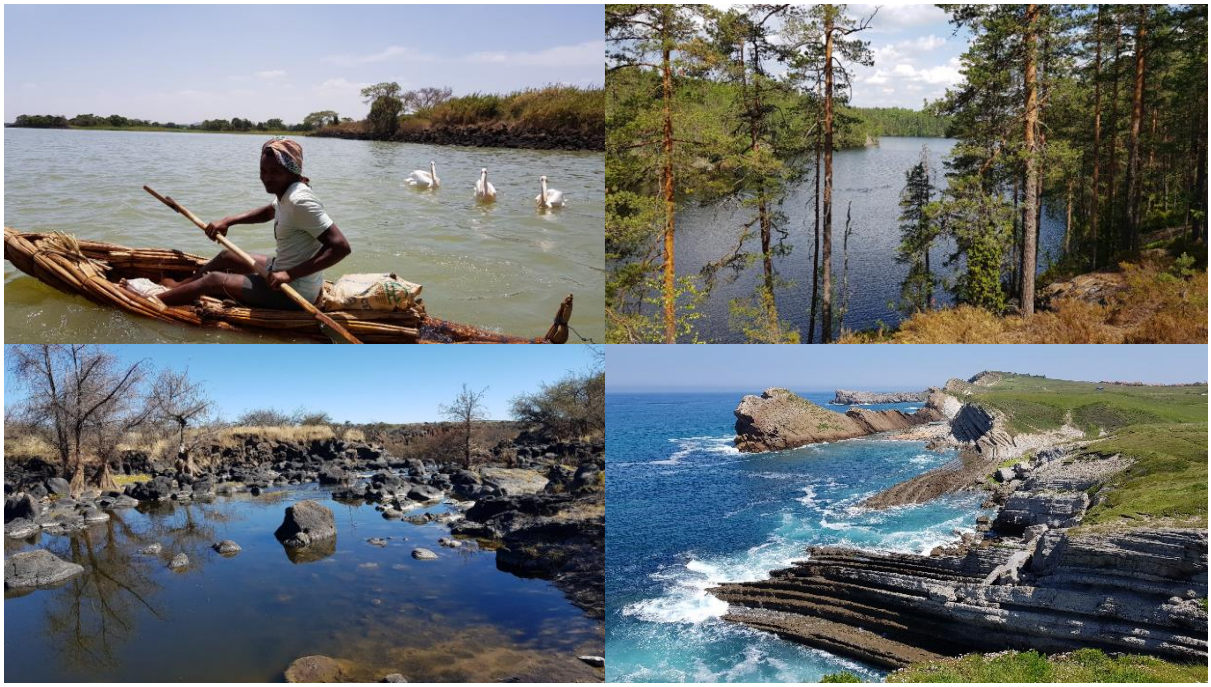

Programme and Book of Abstracts

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DAAD

PROGRAMME

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Sunday, 13th			Arrival
19:00	-	21:00	Welcome cocktail

Monday, 14th			Conference Day 1
08:30	-	09:00	Registration
09:00	-	09:30	Opening Ceremony • Norbert Dichtl • Andreas Haarstrick • Rodolfo Silva • Local authority
09:30	-	10:00	Keynote speech • Norbert Dichtl
10:00	-	10:10	Break
Session 1: The impact/performance/role of SDGs Chairman: Valeria Chávez			
10:10	-	10:30	Exploring some ocean energy possibilities in Latin America (Jassiel Hernández)
10:30	-	10:50	Water energy nexus in the MENA region (Abbas Al-Omari)
10:50	-	11:10	Ocean energy and marine biodiversity affectations: a life cycle assessment review (Dora Ruiz-Méndez)
11:10	-	11:40	Coffee Break
Session 2: Water-Energy-Nexus (I) Chairman: Dwi Andreas Santosa			
11:40	-	12:00	Wastewater/waste to energy in MENA region: A review for opportunities (Zeinab Abou Elnaga)
12:00	-	12:20	Water-energy nexus in a wastewater treatment plant: Energy efficiency and recovery (Wang Hongtao)
12:20	-	12:40	From wastewater treatment plants to a resources recovery facility (Marcelo Nolasco)
12:40	-	13:00	Seasonal assessment of the energetic potential associated with salinity gradient: Champoton River, Mexico (Gregorio Posada Vanegas)
13:00	-	14:30	Lunch
Session 3: Water, ecosystem and socio-economic integrating aspects (I) Chairman: Germán Rivillas			
14:30	-	14:50	Decolourization and mineralization of acid green 25 dye through single and catalytic ozonation (Liliana Amaral Féris)

14:50	-	15:10	Adsorption of naphtholate-as dye in wastewater of batik industry using green synthesized zn layered hydroxyl salts (Sri Juari Santosa)
15:10	-	15:30	Adsorption of hexavalent chromium in coal benificiation tailing in fixed bed column (Liliana Amaral Féris)
15:30	-	15:50	Kinetics of the adsorption of anionic and cationic dyes in aqueous solution by low-cost activated carbons prepared from sea cake and cotton cake (Ibrahim Tchakala)
15:50	-	16:10	Distribution of microplastics in water and sediment in a Biosphere Reserve (Cecilia Enriquez)
16:10	-	16:30	Evaluation of microplastics contamination in the margins of the Patos Lagoon in south of Brazil (Eduardo Saldanha Vogelmann)
16:30	-	17:00	Coffee Break
Session 4: Water, ecosystem and socio-economic integrating aspects (II) Chairman: Rodolfo Silva			
17:00	-	17:20	Hydrodynamic modelling of the Huave Lagoon System, Oaxaca (María Fernanda González Amador)
17:20	-	17:40	Impact effects of hard infrastructure in Salamanca Natural Park (Juan Carlos Caez-Perez)
17:40	-	18:00	The decision-making in face to coastal squeeze, analysis between social and economic impacts: Case study of Campeche, Mexico (Debora L. Ramírez-Vargas)
18:00	-	18:30	Keynote speech • Elvis Carissimi
20:00			Dinner

Tuesday, 15th			**Conference Day 2**
Session 5: Water, ecosystem and socio-economic integrating aspects (III) Chairman: Arwa Naser Damen Hamaideh			
09:00	-	09:20	Dispersion of submarine groundwater discharges in reef lagoons and associated environmental effects (Arlett Rosado Torres)
09:20	-	09:40	Salt intrusions into a freshwater spring in a tropical coastal lagoon, Yucatán, Mexico (Xaní Malagón)
09:40	-	10:00	Variability of the saline gradient in a hypersaline coastal lagoon (Brenda Natalia Fitch Geymonat)
10:00	-	10:20	Sedimentation and water quality status of lake Tana, the headwaters of the Blue Nile, Ethiopia (Seifu A Tilahun)
10:20	-	10:40	An innovative approach to mitigate risks on the existing iron tailings dams in Brazil (Jose Araruna)

10:40	-	11:00	Urban sustainable water management and water efficiency improvement for buildings – a case study for Istanbul (Ahmet Baban)

11:00	-	11:30	Coffee Break
Session 6: Water-Energy-Nexus (II) Chairman: Eduardo Saldanha Vogelmann			
11:30	-	11:50	Reverse electrodialysis for energy and water: coupled systems based in salinity gradients (Mateo Roldan-Carvajal)
11:50	-	12:10	Development of graphene oxide membranes for its use in reverse electrodialysis systems (Eddie López Honorato)
12:10	-	12:30	Development of graphene oxide based materials for water treatment (Ana Cecilia Reynosa Martinez)
12:30	-	12:50	Laboratory experiences on marine energy conversion devices for supplying electricity demand of remote coastal communities (Jassiel Hernández)
12:50	-	13:10	Plate type obstacles used for coastal protection and power generation (Luis Eduardo Pérez Paez)
13:10	-	14:40	Lunch
Session 7: Water, ecosystem and socio-economic integrating aspects (IV) Chairman: Thi Thanh Van Ngo			
14:40	-	15:00	Evaluating combinatorial water treatment by locally available materials (Chrispin Kowenje)
15:00	-	15:20	Desalination by capacitive deionization as a tool to provide drinkable water to small communities in the Brazilian semiarid (Luis Augusto Martins Ruotolo)
15:20	-	15:40	Fluoride ions removal from groundwater by alumina adsorption (Elvis Carissimi)
15:40	-	16:00	Bio-refineries: A new concept towards green energy production from agroindustrial wastewater (Víctor Alcaraz)
16:00	-	16:20	The importance of water and nutrients management in paddy fields as an effort to increase crop yields and producing an electrical energy through microbial fuel cells (Dwi Andreas Santosa)
16:20	-	16:50	Coffee Break
16:50	-	17:20	Keynote speech • Klaus Fricke
16:50	-	18:00	Panel discussion Moderators: Edmilson Santos de Lima and Norbert Dichtl
20:00			Gala dinner