

## SUPPLEMENTARY MATERIALS

Article

**Spatial Planning of the Coastal Marine Socioecological System: case study Punta Carnero, Ecuador.**

**Supplementary Materials:**

**Table S1.** Environmental and territorial plans of the Punta Carnero sector.

Sector	Environmental and Territorial Plans	Relationship with Ecosystems	Reference Citation
Salinas José Luis Tamayo Parish Santa Elena Province	Territorial development planning.	These land use plans highlight two components: biophysical and economical. The boifísico component shows a diagnosis and baseline of the environmental situation of the ecosystem. The economic part presents the economic activities developed disorderly and that pressure the ecosystem.	[1–3]
Punta Carnero (área protegida REMACOPSE)	Management planning for the coastal marine production reserve Puntilla de Santa Elena.	This planning considers the ecosystem a buffer zone for its conservation with compatible activities in the area.	[4]
Punta Carnero	Management planning for the Punta Carnero beach of the sea.	This plan highlights the need to create a management plan for the adjacent strip to conserve the sector's ecosystems.	[5]
Mar Bravo – Punta Carnero	Conservation planning for the artificial pools of Ecuasal and study of tourist load capacity.	This plan highlights the importance of conserving all the ecosystems interacting with the artificial wetlands of Ecuasal and wild, shorebird and migratory birds.	[6]

**Table S2.** Knowledge base for managing protection and conservation of marine-coastal ecosystems in the Punta Carnero sector.

	Knowledge Base for Ecosystem Protection and Conservation Management	Local And Regional Regulations	Sustainable Development Goals (SDG)
Mangrove	Coastal resource management based on mangrove protection considers the danger of mangroves' extinction [7]. Ordinances related to mangroves and the education levels of the inhabitants [8]. Priority sites for the conservation and restoration of mangroves [9]. Zoning and risk reduction [10]. Valuation of ecosystem services[11]. Presence of threatened species [12].	The [13] establishes preservation, restoration, protection and conservation of environmental ecosystems— sustainable use of biodiversity and threatened ecosystems (e.g., wetlands, dry and humid tropical forests, mangroves). The [14] considers the preparation of plans and projects for protection, sustainable management and restoration of the environment by the decentralized autonomous governments	SDG 12: Guarantee sustainable consumption and production patterns. SDG 14: Conserve and sustainably use the oceans, seas and marine resources. SDG 15: Sustainably manage forests, combat desertification, halt and reverse land degradation, and halt biodiversity loss [17].
Estuary	Protecting estuarine areas establishes Control of land use, land use planning and spatial conflict mitigation plans. Use nature conservation and management plans [18]. Effective participation of the community, local		

	governments, civil society and public or private companies [19].	(GAD), provincial and cantonal. Declaration of protected areas of marine-coastal ecosystems.
Wetland	The relationship of wetlands with anthropogenic threats considers Sustainable management and conservation of ecosystems. Importance of conservation and restoration of coastal wetlands to preserving biodiversity through the sustainable development of the territory [17,20,21].	The [15] determines the prohibition of occupation of accesses to the beaches such as estuaries or channels, crimes against land use for the maintenance and conservation of native ecosystems and their ecological functions.
Protected area	Protected areas are declared and managed: Through legislative tools established by governments [22]. Analysis of the degree of protection provided by ecosystems. Management effectiveness and biodiversity conservation priority [23,24].	The [16] considers the mangroves are not subject to possession or any other means of appropriation. Infraction and penalty for destruction, alteration, commercialization or inappropriate use of forests in mangrove areas, forest products or wildlife. Conservation, protection and management and use of forest resources.
Migratory bird nesting sites	The presence of bird species in the mangroves considers a determinant of conservation. The richness of bird fauna in the mangrove [25]. Prioritization of protection because of the degree of habitat degradation [26].	

1. Gobierno Autónomo Descentralizado Provincial de Santa Elena Plan de Desarrollo y Ordenamiento Territorial Provincial Available online: [http://app.sni.gob.ec/sni-link/sni/PORTAL\\_SNI/data\\_sigad\\_plus/sigadplusdocumentofinal/0968580510001\\_PDyOT%20%20SANTA%20ELENA%20DOCUMENTO\\_FINAL\\_16-05-2016\\_09-31-46.pdf](http://app.sni.gob.ec/sni-link/sni/PORTAL_SNI/data_sigad_plus/sigadplusdocumentofinal/0968580510001_PDyOT%20%20SANTA%20ELENA%20DOCUMENTO_FINAL_16-05-2016_09-31-46.pdf) (accessed on 25 July 2022).
2. Gobierno Autónomo Descentralizado del cantón Salinas Plan de Desarrollo y Ordenamiento Territorial Del Cantón Salinas. Available online: [http://app.sni.gob.ec/sni-link/sni/PORTAL\\_SNI/data\\_sigad\\_plus/sigadplusdocumentofinal/0960001380001\\_DIAGNOSTICO%20PDOT%202015%20marzo\\_13-03-2015\\_20-29-41.pdf](http://app.sni.gob.ec/sni-link/sni/PORTAL_SNI/data_sigad_plus/sigadplusdocumentofinal/0960001380001_DIAGNOSTICO%20PDOT%202015%20marzo_13-03-2015_20-29-41.pdf) (accessed on 11 June 2022).
3. Gobierno Autónomo Descentralizado de José Luis Tamayo Plan de Desarrollo y Ordenamiento Territorial de José Luis Tamayo Available online: [http://app.sni.gob.ec/sni-link/sni/PORTAL\\_SNI/data\\_sigad\\_plus/sigadplusdiagnostico/0968552060001\\_PDyOT-DG\\_JOSELUISTAMAYO%20version%20final\\_24-06-2015\\_11-47-44.pdf](http://app.sni.gob.ec/sni-link/sni/PORTAL_SNI/data_sigad_plus/sigadplusdiagnostico/0968552060001_PDyOT-DG_JOSELUISTAMAYO%20version%20final_24-06-2015_11-47-44.pdf) (accessed on 19 July 2022).
4. Ministerio del Ambiente *Plan de Manejo Reserva de Producción de Fauna Marino Costera Puntilla de Santa Elena*; 2020; Available online: <https://www.ambiente.gob.ec/wp-content/uploads/downloads/2020/07/Acuerdo-Ministerial-Nro.-MAE-2020-006.pdf> (accessed on 20 July 2022).

5. Proyecto Red de AMCP Proyecto de Red de Áreas Marinas y Costeras Protegidas Available online: <https://servicios.turismo.gob.ec/areas-naturales-del-ecuador> (accessed on 25 July 2022).
6. Agreda, A. Aves y Conservación-BirdLife Ecuador; Ecuatoriana de Sal y Productos Químicos C.A. In Plan de Conservación de Las Piscinas Artificiales de Ecuasal Período 2012–2015 y Estudio de Capacidad de Carga Turística; Unigraf Offset: Guayaquil, Ecuador, 2012.
7. Damastuti, E.; de Groot, R.; Debrot, A.O.; Silvius, M.J. Effectiveness of Community-Based Mangrove Management for Biodiversity Conservation: A Case Study from Central Java, Indonesia. *Trees, Forests and People* **2022**, *7*, doi:10.1016/j.tfp.2022.100202.
8. Genio, E.L.; Rejesus, R.M.; Pomeroy, R.S.; White, A.; Smith, B. Factors Affecting Fisherfolk's Support for Coastal Resource Management: The Case of Local Government-Initiated Mangrove Protection Activities. *Ocean and Coastal Management* **2007**, *50*, 808–828, doi:10.1016/j.ocecoaman.2007.05.010.
9. Worthington, T.A.; Andradi-Brown, D.A.; Bhargava, R.; Buelow, C.; Bunting, P.; Duncan, C.; Fatoyinbo, L.; Friess, D.A.; Goldberg, L.; Hilarides, L.; et al. Harnessing Big Data to Support the Conservation and Rehabilitation of Mangrove Forests Globally. *One Earth* **2020**, *2*, 429–443.
10. Menéndez, P.; Losada, I.J.; Beck, M.W.; Torres-Ortega, S.; Espejo, A.; Narayan, S.; Díaz-Simal, P.; Lange, G.M. Valuing the Protection Services of Mangroves at National Scale: The Philippines. *Ecosystem Services* **2018**, *34*, 24–36, doi:10.1016/j.ecoser.2018.09.005.
11. Thompson, B.S.; Rog, S.M. Beyond Ecosystem Services: Using Charismatic Megafauna as Flagship Species for Mangrove Forest Conservation. *Environmental Science and Policy* **2019**, *102*, 9–17.
12. vanden Eede, S.; Laporta, L.; Deneudt, K.; Stienen, E.; Derous, S.; Degraer, S.; Vincx, M. Marine Biological Valuation of the Shallow Belgian Coastal Zone: A Space-Use Conflict Example within the Context of Marine Spatial Planning. *Ocean and Coastal Management* **2014**, *96*, 61–72, doi:10.1016/j.ocecoaman.2014.04.022.
13. Asamblea Nacional del Ecuador. Constitución de La República Del Ecuador, Quito; 2008; pp. 1–216. Available online: [https://www.asambleanacional.gob.ec/sites/default/files/documents/old/constitucion\\_de\\_bolsillo.pdf](https://www.asambleanacional.gob.ec/sites/default/files/documents/old/constitucion_de_bolsillo.pdf) (accessed on 2 May 2022).
14. Asamblea Nacional del Ecuador. Código Orgánico Del Ambiente, Quito; 2017. Available online: [https://www.ambiente.gob.ec/wp-content/uploads/downloads/2018/01/CODIGO\\_ORGANICO\\_AMBIENTE.pdf](https://www.ambiente.gob.ec/wp-content/uploads/downloads/2018/01/CODIGO_ORGANICO_AMBIENTE.pdf) (accessed on 4 May 2022).
15. Asamblea Nacional del Ecuador. Código Orgánico Integral Penal, COIP, Quito; 2014. Available online: [https://www.defensa.gob.ec/wp-content/uploads/downloads/2021/03/COIP\\_act\\_feb-2021.pdf](https://www.defensa.gob.ec/wp-content/uploads/downloads/2021/03/COIP_act_feb-2021.pdf) (accessed on 2 May 2022).

16. Congreso Nacional del Ecuador. Ley Forestal y de Conservación de Áreas Naturales y Vida Silvestre, Quito; 2004 [https://www.galapagos.gob.ec/wp-content/uploads/downloads/2016/08/25\\_Ley\\_Forestal\\_y\\_de\\_Conservacion\\_de\\_Areas\\_Naturales\\_y\\_Vida\\_Silvestre\\_29\\_dic\\_2014.pdf](https://www.galapagos.gob.ec/wp-content/uploads/downloads/2016/08/25_Ley_Forestal_y_de_Conservacion_de_Areas_Naturales_y_Vida_Silvestre_29_dic_2014.pdf) (accessed on 4 May 2022).
17. ONU Objetivos de Desarrollo Sostenible Available online: <https://www.un.org/sustainabledevelopment/es/objetivos-de-desarrollo-sostenible/> (accessed on 29 March 2022).
18. Rodrigues, C.; Fidélis, T. Distinctive Features of Spatial Planning Nearby Estuaries – An Exploratory Analysis of Water-Related Rules in Municipal Master Plans in Portugal. *Estuarine, Coastal and Shelf Science* **2021**, *255*, doi:10.1016/j.ecss.2021.107352.
19. Katikiro, R.E.; Kweka, O.L.; Minja, R.; Namkesa, F.; Ponte, S. Stakeholder Engagement and Conservation Outcomes in Marine Protected Areas: Lessons from the Mnazi Bay-Ruvuma Estuary Marine Park (MBREMP) in Tanzania. *Ocean and Coastal Management* **2021**, *202*, doi:10.1016/j.ocecoaman.2020.105502.
20. Li, Y.; Mao, D.; Wang, Z.; Wang, X.; Tan, X.; Jia, M.; Ren, C. Identifying Variable Changes in Wetlands and Their Anthropogenic Threats Bordering the Yellow Sea for Water Bird Conservation. *Global Ecology and Conservation* **2021**, *27*, doi:10.1016/j.gecco.2021.e01613.
21. Eppink, F. v.; Brander, L.M.; Wagtendonk, A.J. An Initial Assessment of the Economic Value of Coastal and Freshwater Wetlands in West Asia. *Land (Basel)* **2014**, *3*, 557–573, doi:10.3390/land3030557.
22. Ullah, S.M.A.; Tani, M.; Tsuchiya, J.; Rahman, M.A.; Moriyama, M. Impact of Protected Areas and Co-Management on Forest Cover: A Case Study from Teknaf Wildlife Sanctuary, Bangladesh. *Land Use Policy* **2022**, *113*, doi:10.1016/j.landusepol.2021.105932.
23. Morelli, F.; Benedetti, Y.; Floigl, K.; Diego Ibáñez-Álamo, J. How Are Natura 2000 Protected Areas Covering Different Components of Avian Diversity in Spain? *Ecological Indicators* **2021**, *133*, doi:10.1016/j.ecolind.2021.108452.
24. Starnes, T.; Beresford, A.E.; Buchanan, G.M.; Lewis, M.; Hughes, A.; Gregory, R.D. The Extent and Effectiveness of Protected Areas in the UK. *Global Ecology and Conservation* **2021**, *30*, doi:10.1016/j.gecco.2021.e01745.
25. Mohd-Azlan, J.; Lawes, M.J. The Effect of the Surrounding Landscape Matrix on Mangrove Bird Community Assembly in North Australia. *Biological Conservation* **2011**, *144*, 2134–2141, doi:10.1016/j.biocon.2011.04.003.
26. Maleki, S.; Baghdadi, N.; Rahdari, V. Which Water Bird Groups Need Greater Habitat Conservation Measures in a Wetland Ecosystem? *Ecological Engineering* **2020**, *143*, doi:10.1016/j.ecoleng.2019.105677.