

Ecuador's Efforts in Protecting Biodiversity

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Abstract

Ecuador is one of the 17 megadiverse countries because of its high level of biodiversity. Unfortunately, the biodiversity is being compromised by human-cause. The country is comprised of 40 protected areas under the National Protected Area System, 107 Important Bird Areas, and 12 Ramsar sites. The Galapagos Islands (Galapagos National Park and Galapagos Marine Reserve), Churute Mangroves Ecological Reserve, and Cajas National Park were researched to see the level of protection that is being implemented on the species in these areas. It was found that the Galapagos Islands have updated management plans and place a high amount of focus on the biodiversity. It also focusses on individual species for recovering their populations and individual regions where the habitat is more sensitive. Churute Mangroves Ecological Reserve and Cajas National Park have not updated their management plans since the 1990s, their plans consist of general overviews in different areas and zones. While the plans do protect biodiversity, it focusses on the ecosystem as a whole rather than individual species and habitats. It is important that Ecuador remains as biodiverse as it is and that means creating more areas that are protected so more species are protect, also managers should update the status of the ecosystems and species more regularly.

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Introduction

Ecuador is one of 17 megadiverse countries in the world, it has the largest number of species by area worldwide. Its biodiversity is due to its location of the equator, the Andes Mountains, and two major ocean currents that run along the coast, this creates a wide variety of ecosystems allowing different types of species to inhabit the country. (Lehenbauer, 2016) Ecuador only accounts for 0.2% of the world's land area but contains about 8% of amphibian species, 5% of reptile species, 16% of bird species, and 8% of mammal species in the whole world. (Biodiversity Group, 2015) Ecuador is home to about 25,000 species of plants, 1,600 species of birds, 369 mammals, 350 reptiles, about 400 amphibians, and 800 species of fish. (Lehenbauer, 2016)

Ecuador is facing many issues today that may comprise the biodiversity in the future. The issues that are affecting biodiversity in Ecuador include: invasive species, tourism, overharvesting and illegal harvesting, bycatch, habitat destruction, and agricultural practices. There is a low representation of species in the protected areas of Ecuador and often times there are areas that are protected only by a piece of paper. There are 40 state-protected areas that cover about 19% of Ecuador's territory, this includes continental Ecuador and the Galapagos Islands. (Lessmann et al., 2014) (See Appendix Figure 1) This paper researches if the Ecuadorian government is protecting its biodiversity and how they are protecting biodiversity in three locations: the Galapagos Islands, Churute Mangroves Ecological Reserve, and Cajas National Park.

Galapagos National Park and Galapagos Marine Reserve

The Galapagos Islands are 600 miles west of the coast of Ecuador. The islands were created by the Galapagos Hotspot, the Nazca Plate moves east-southeast over the plate making the islands the oldest in the southeast. (White, 1997) Species arrived to the islands by flying, swimming, or by floating on vegetation rafts. There are 42 sea birds, 34 shore birds, and 28 species of reptiles. There are only 32 species of mammals, only 6 can be found on land. There are anywhere between 552 and 614 native species of vascular plants and 825 introduced species. The Galapagos Islands have low biodiversity but the islands are protected due to the high level of endemism. The islands have 80% of birds, 97% of reptiles and land mammals, 30% of plant species, and 20% of marine species only being found in the Galapagos. (Galapagos Conservancy, 2016)

Galapagos Marine Reserve Threats and Management

The Galapagos Marine Reserve (GMR) is 14,110,000 hectares, it protects the ocean surrounding the islands. One of the major threats to the Galapagos Islands' marine species and shore birds is fishery bycatch. The Galapagos Marine Reserve has created areas that are protected, areas where extraction is not permitted, and areas that allow regulated extraction. (See Appendix Figure 2) These areas were created to limit the amount of bycatch and keep the marine species populations healthy. (Jose, 2011)

Another major threat to the marine species in the Galapagos is invasive species. There are six invasive species that are established in the Galapagos Marine Reserve and there are 18 potential high risk species that could affect biodiversity in the GMR if they arrive to the islands. In 2012, the Charles Darwin Foundation, Galapagos National Park Directorate, Galapagos

Biosecurity Agency, and the Ecuadorian Navy began the Marine Invasive Species Project. This project's purpose is to try and minimize the impact of invasive species on the biodiversity in the GMR by creating risk assessment tools for prevention, early detection, and management of invasive marine species. The Charles Darwin Foundation also recommends that a dive team is established to monitor invasive species in sensitive areas and ports. The traffic in the Pacific Ocean and with growing traffic in the Galapagos Islands allows for invasives to arrive and spread faster so it is important to monitor the ports in particular to ensure that boats are not spreading unwanted species. (See Appendix Figure 3) The Charles Darwin Foundation also surveillances the iconic species (sea lions, sea turtles, fur seals, sea birds, marine iguanas, and cetaceans) of the islands to determine the health of the GMR. This allows them to find new threats to the marine ecosystem and to implement new programs to ensure long-term conservation. (GNPD et al., 2015)

Galapagos National Park Threats and Management

Invasive species are the greatest threat to the biodiversity in the Galapagos Islands on land. Out of the 835 invasive plants, 131 of them are invading natural areas on the islands. Conservation and restoration of the ecosystems are the most effective strategies for the islands. The Galapagos Verde 2050 project seeks to restore the ecology of the islands and have sustainable agriculture on them. This project will help the people inhabiting the islands and the species that are being impacted by invasives. Galapagos Verde 2050 will restore degraded ecosystems, eradicate invasive species in areas of high ecological value, and contribute to economic growth through year-round sustainable agriculture. (GNPD et al., 2015)

The Galapagos tourism industry is leading to social, ecological impacts, and causing the overconsumption of resources. (See Appendix Figure 4) Tourists are choosing the more affordable island-hopping tourism, but it lacks strict regulations. The EcoHelix is an invention that will engage Galapagos tourists as agents of change by allowing them to rate Galapagos businesses. It will push tourists to choose more ecologically conscious businesses and create competition between businesses. This will lead to locals being more aware of environmental issues and lead to improvement in their businesses' impact. This will result in a reduction in the tourists' impact on the islands. (GNPD et al., 2015)

The Charles Darwin Foundation also focusses on individual species whose populations are in danger. Giant tortoises undergo long distance seasonal migration, they travel from the coast to upland farmland. Their migration route is sometimes blocked by human land use. The Charles Darwin Foundation is seeking to have barriers in the tortoises' migration path removed or reduced. The migration is important for the tortoise for them to reach different feeding and nesting grounds during different seasons. The failure to maintain critical habitats and migration connectivity could result in negative impacts on the tortoise population on Santa Cruz. The Mangrove finch is critically endangered from introduced black rats and the fly philornis downsi. Scientists have controlled the rat population and they have collected wild eggs and young to be placed in an artificial incubator and the successful juveniles will be released back into the wild. Scientists then provide the reintroduced species with supplementary food so the individuals can successfully establish themselves in the wild. This method of collecting the wild eggs and young has led to an increase in nesting success and the number of chicks fledged by over 200% in one season. There is also a lack of breeding in the blue-footed boobies leading to a population decline. Between August 2011 and June 2013, no more than 10.9 percent of the adult population

had an active nest. The Charles Darwin Foundation is keeping a close watch on this species to ensure that disease is not contributing to the population decline. (GNPD et al., 2015)

Churute Mangroves Ecological Reserve

The Gulf of Guayaquil is the largest estuary of the Pacific coast in South America, it is also the main port for Ecuador. The Churute Mangroves Ecological Reserve is located in the Guayaquil Gulf Estuary Basin. (See Appendix Figure 5) The El Canclon Lagoon, located inside of Churute, is part of one of the most important endemic bird areas in the Neotropics. Churute's unique habitat type has a high level of bird endemism at about 40 percent. (Jose, 2011) In Churute there are five of the seven species of mangroves present, there are over 300 species of birds, about 8 mammal species, crocodiles and alligators, and many marine species. (Ministerio del Ambiente, 2015)

Ecuador began managing its mangrove forests when the shrimp mariculture industry began rapidly growing in the 1970s. In 1978, the National Forestry Directorate prohibited the use of mangrove forest for shrimp farm construction. The directorate also required zoning plans to be prepared for areas where mangrove cutting would happen. Churute has lost only about 4.3 percent of its forest cover, this is mostly due to the implementation of the Ecological reserve in 1978. The directorate controlled the cutting, transportation, and export of mangroves in 1980. Destruction still exists in Churute due to urbanization, wood production, shrimp mariculture, and damage from a bag worm. (Bodero, 1995)

Churute Mangroves Ecological Reserve Management

The management plan for Churute has created several zones to allow for the best conservation in the reserve. The Regional Scope zone consists of areas with environmental

deterioration, these areas indirectly affect the management of the conservation unit. It includes the areas of the Guayas lower basin and the Gulf of Guayaquil. (Yanez, 1996) The Gulf of Guayaquil has become the sink for receiving point and non-point sources of pollution in the last 80 years. (Jose, 2011) In the Regional Scope zone measures to prevent and control contamination will be taken. The Area of Influence zone is an area of environmental deterioration that directly and indirectly affects the management of the reserve. This zone acts as a buffer between the Regional Scope and the Protected Area. Locals living in the Area of Influence will be given programs to understand the reserve. The Untouchable Zone is an area that has had limited human disturbance, the protection of this area is necessary to preserve samples of the ecosystems in this area. This area will remain undisturbed by human influences. The Primitive Area surrounds the Untouchable Zone, it is slightly altered but it is still natural. The Recovery Zone is an area that has been altered but still retains natural features. This zone will be preserved and there will be limited public use. The Multiple Use Zone are areas where humans have established themselves in the reserve, this area also serves as a buffer zone. The zone also provides opportunities for scientific research. The last zone is the Public Use Area, where administrative, education, and recreational activities take place. This area consists of natural areas and disturbed areas, although it is a public area the activities that take place are still limited to: fishing in permitted areas, boat use in authorized sites, and picture taking. (Yanez, 1996)

Churute Mangroves Ecological Reserve has an abundance of flora and fauna so they are a hotspot for ecotourism. Churute is the only example of a government-operated reserve, it controls public access areas, strict limits on physical changes in the reserve, active research and monitoring programs, environmental interpretation, fisheries management, and mitigation on environmental impacts on development in surrounding areas. (Bodero, 1995) Ecuador has signed

international conventions that aim to conserve and protect the biodiversity and environment, these conventions include: Convention on Biological Diversity, World Heritage Convention, Convention on Migratory species, Convention on International Trade in Endangered Species of Wild Fauna and Flora, Ramsar Convention on Wetlands. Churute Mangroves Ecological Reserve is protected as a Ramsar site. (Jose, 2011)

Cajas National Park

Cajas National Park is located in south Ecuador where the Andean cordillera is older, this area is less volcanically active than the Andes in northern Ecuador. The park is between 3800 meters to 4200 meters above sea level. Cajas National Park is 90.6 percent herbaceous wilderness. (National System of Protected Areas) Due to the park's close proximity to the Pacific Ocean, the western foothills receive a lot of humidity from the westerly winds. Glacial advance and retreat are responsible for the many valleys that exist in this area. There are a total of 786 bodies of water in Cajas. The Tomebamba, Mazan and Yanuncay rivers are all created from the water in Cajas. A majority of the park is a mix between moorland and wooded areas. The wooded areas are constructed of paper trees, polylepis forest. Cajas National Park is home to 600 species of vascular plants, 43 mammals, 157 birds, 17 amphibians, and 4 reptiles. (Ministerio del Ambiente, 2015)

There are eight priority problems in Cajas National Park. The first problem is the poor utilization of natural resources because there is not enough scientific knowledge in the local culture, areas for research and recreation has not been identified, and there is a lack of financial cooperation. In this area there are high levels of poverty and there are high levels of unsatisfied basic needs. There is low quality and functionality of the basic education system because of the

lack of proper equipment and teachers. In Cajas National Park there is a disorganization of spaces used for recreational purposes. Tourism policies and standards are not applied properly offering tourist services with low professionalism. Local communities expect the tourism business in Cajas to be much larger than it is. There is conflict of the limits of certain sectors in the park. The last priority problem is that there is low institutional capacity for environmental management. (National System of Protected Areas)

Cajas National Park Management

The Cajas National Park has created management policies to ensure that the park's natural systems are not being jeopardized in any way. The park was broken up into two zones: water catchment area and recreation and tourism zone. The water catchment area will be maintained to ensure the current minimum flow will provide the right conditions for wildlife and the environment's needs. The recreation and tourism zone will be given regulations for development and there will be strict rules applied to eliminate the impacts of the tourists. The development and management areas correspond to areas that are occupied by facilities, research, and tourism and recreation. (National System of Protected Areas)

In order to protect biodiversity Cajas was broken up into areas. One area is known as the Conservation Area, it is the territory where the basins of the Mazan and Llaviuco rivers are. These rivers provide water for the people in the valley of Cuenca. This area is the largest continuous vegetation cover in the park. It has protection and monitoring systems put into effect by the municipality of Cuenca. This area cannot be used by fisherman, tourists, and recreationists. There is no extractive activity of natural resources permitted in this area. Water catchment and conduction in the park must be regulated to define the impacts it will have on the

biodiversity and the water quality. Another area in Cajas is known as the Protection Zone, where there are a set of micro-basins of the Jerez and Angas rivers. In this area a control system of timber harvest in remaining patches of forest will be established. Hunting and fishing are under a strict control system. Activities are regulated in the bodies of water located in this area. The Moorland Recover Zone consists of the basins of Soldados, Ishcayrumi, Synincocha, and Atugyacu rivers, moorland areas, and patches of polylepis. In this area managers will keep track of grazing sites and communities and monitor biodiversity. (National System of Protected Areas)

Conclusion

In Ecuador there are 40 protected areas under the National Protected Area System, 37 of those protected areas are a part of continental Ecuador, 2 are marine reserves, and the last is Galapagos National Park. The continental protected areas account for 18% of Ecuador. The country is also compromised of 107 areas that are designated as Important Bird Areas and 12 Ramsar sites. All of these were created for the conservation and protection of biodiversity in Ecuador. One of their main purposes is to protect threatened and endangered species. (Jose, 2011) Based on the three locations observed, Galapagos National Park and the Galapagos Marine Reserve are doing the best at staying updated on their management and conservation for biodiversity. The management plan for Churute Mangroves Ecological Reserve and Cajas National Park were last updated in the 1990s, the plans were provided by a website updated in 2015, meaning that another plan has not been proposed or published for either of those locations. With things constantly changing it is important that the protected areas are monitored and information is updated to ensure the biodiversity persists in the protected regions.

Such a small portion of Ecuador is protected and little biodiversity is represented in these areas, this makes it all the more important to ensure that these areas remain as biodiverse as they are. While the protected areas do show that they are successful in mitigating negative impacts, it is important that the Ecuadorian government and international governments push for more protection and regularly updated plans. Only three areas were observed in this study, but if the rest of the protected sites show outdatedness like Cajas National Park and Churute Mangroves Ecological Reserve, they should be updated. One of the major complications for the regular updating of management plans for conservation is the lack of financial availability, this is why it is important for international governments to assist the Ecuadorian government. The loss of biodiversity and natural habitats will negatively impact the ecosystem services that are provided to the country. Also a loss in biodiversity and natural habitats can negatively affect the ecotourism the county receives. It is in Ecuador's best interest to ensure that the biodiversity remains well intact for the future.

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Appendix

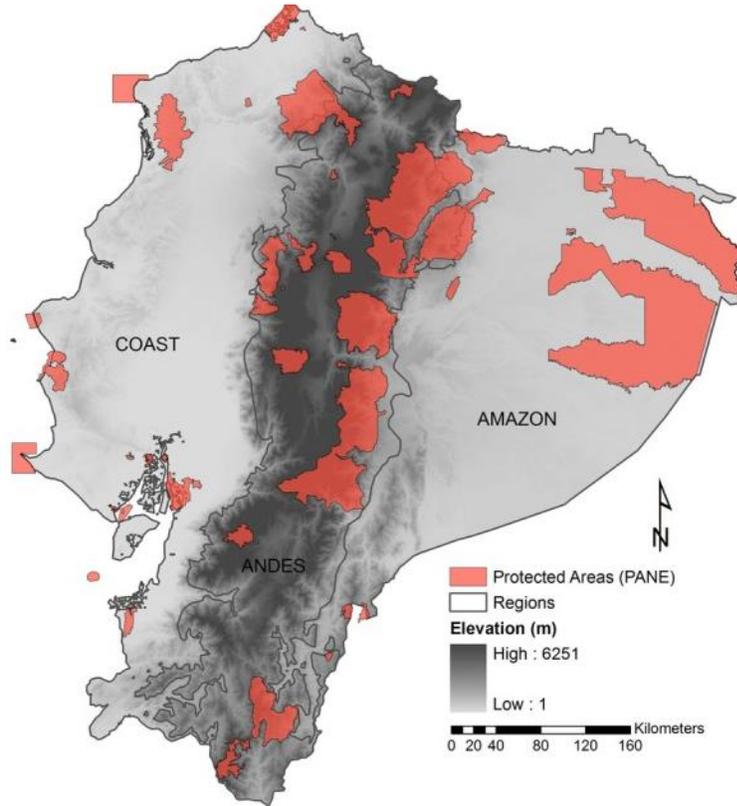


Figure 1: Current protected areas in continental Ecuador. (Lessmann et al., 2014)

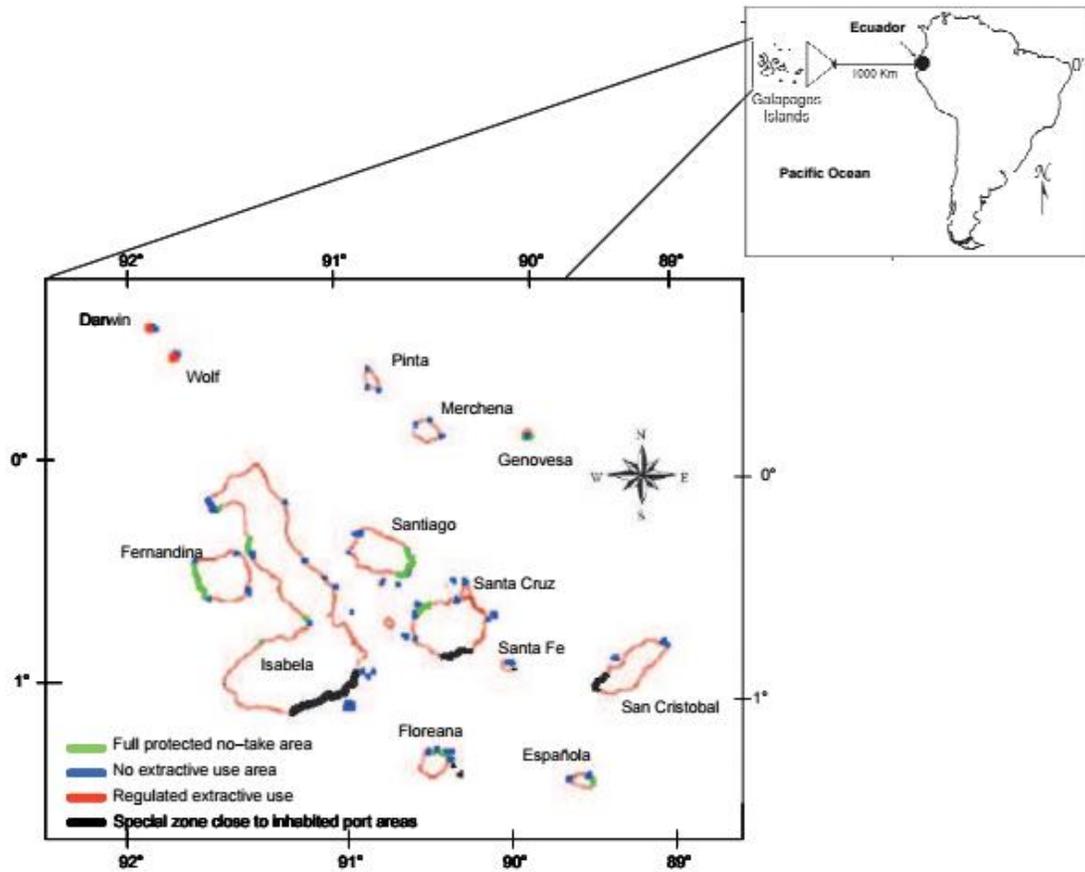


Figure 2: Location of the Galapagos Islands and the coastal zoning created by the Galapagos Marine Reserve. The green line symbolizes areas of full protection and no-take, the blue line symbolizes areas of no extractive use, the red is regulated extractive use, and the black symbolized zones that are inhabited by port areas. (Jose, 2011)

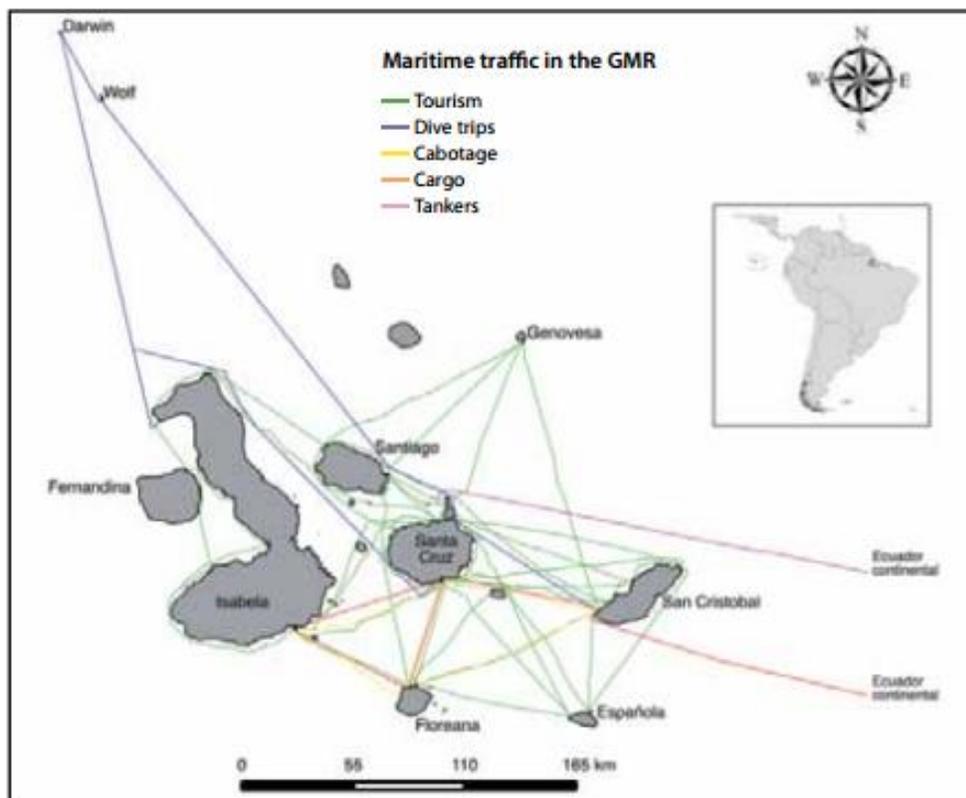


Figure 3: Marine traffic routes in the GMR. (GNPD et al., 2015)

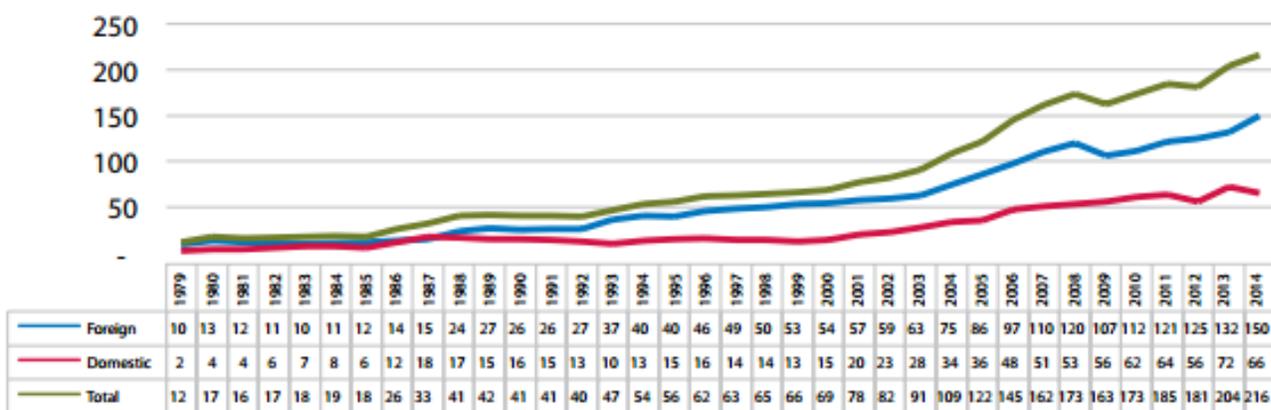


Figure 4: The statistics of visitors from 1979-2014, in the thousands. The blue line represents foreign visitors, the red domestic, and the green it the total amount of visitors. (GNPD et al., 2015)

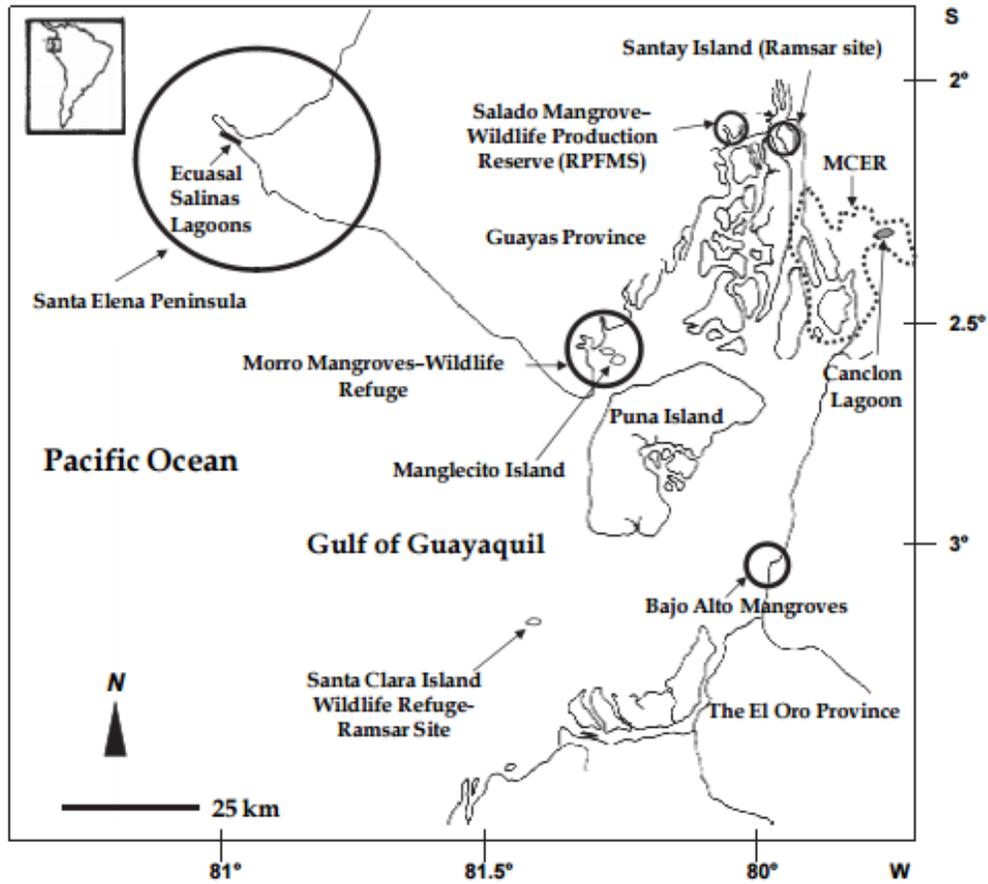


Figure 5: A map of mangroves surrounding the Gulf of Guayaquil, Churute Mangroves Ecological Reserve is noted on the map as MCER. (Jose, 2011)