ADAPTATION FUND

Version: July 2020

PRE-CONCEPT FOR A REGIONAL PROJECT/PROGRAMME

PART I: PROJECT/PROGRAMME INFORMATION

Title of Project/Programme:	Improving the adaptive capacity of coastal communities in Costa Rica and the Dominican Republic through ecosystem-based adaptation strategies
Countries:	Costa Rica and Dominican Republic
Thematic Focal Area1:	Disaster risk reduction and early warning systems
Type of Implementing Entity:	Regional
Implementing Entity:	CAF Development Bank of Latin America
Executing Entities:	Sistema Nacional de Áreas de Conservación (Costa Rica) and Ministerio de Medio Ambiente y Recursos Naturales (Dominican Republic)
Amount of Financing Requested:	13,919,202 (in U.S Dollars Equivalent)

Project / Programme Background and Context:

1. Tropical islands sustain high-value biodiversity that provides a range of services for human wellbeing (Velmurugan, 2008; Kueffer & Kinney, 2017; Sivaperuman et al., 2018). They have unique ecosystems and an unusual richness of terrestrial and marine endemism (Kier et al., 2009; Tershy et al., 2015). These islands are increasingly threatened by the consequences of global climate change like sea level rise, alterations in weather patterns and more intense extreme weather events such as El Niño Southern Oscillation (ENSO) and tropical storms (Angeles et al., 2007; Stephenson & Jones, 2017; Cai et al., 2018; Wang et al., 2019).
2. Cocos Island (Costa Rica) and Catalina Island (Dominican Republic) confront similar adaptation challenges despite being located in different seas and having different socio-economic conditions.
3. Costa Rica and Dominican Republic are vulnerable to climate change (Table 1). Projections indicate that Costa Rica will be affected by an increase in temperature (2°C by 2050 and 4°C by 2080) and irregular precipitation patterns (changes in seasonal distribution, increased precipitation in some regions and decrease in others) (MINAET,2012; Imbach, 2018; Wold Bank Climate Change Knowledge Portal). The Dominican Republic will also be affected by an increase in temperature (3.0°C by 2050 and 6.0°C by 2070), changes in precipitation patterns and an overall 15% precipitation decrease by 2050 (USAID, 2013; Ministerio Medio Ambiente, 2018). Both countries are highly exposed to sea level rise and will be affected by more frequent and intense extreme weather events such as storms and floods. Rising sea level might generate important economic losses along coastal areas.
4. For Costa Rica the PRECIS climate model projected, under the A2 scenario (IPCC, 2000), an average increase of 1.91°C by 2050 and 3.36°C by 2080 (Table 2). Under the A2 scenario, by 2080, the northern Pacific coast would have a change in the annual temperature pattern, with a peak increase of about 4.3°C in September - October (currently the peak temperature occurs in March - April) (MINAET, 2012). Under the A2 scenario, by 2080, precipitation will greatly decline on the Pacific coast (about 50% of current level). On the contrary, on the Caribbean coast, precipitation will increase. It is projected that the current precipitation pattern will change. A peak of precipitation will develop between June and July with almost double the current level on those months (MINAET, 2012). A more recent analysis by Quesada-Chacón et al., (2020) confirmed a considerable decrease in the yearly total precipitation and a significant increase in temperature.
5. With climate change, the Dominican Republic will become hotter, there will be slightly wetter dry seasons and drier peak rainy seasons, strong variability in rainfall, continuing sea level rise, and more intense tropical storms (USAID, 2013). The projected more frequent and intense ENSO events (Cai et al., 2014; Cai et al., 2015), will contribute to these changes. The analysis of climate models indicates that, by 2050, the minimum and maximum temperatures, will increase between 1°C and 3°C and between 2°C and 3°C, respectively (Ministerio de Medio

1 Thematic areas are: Food security; Disaster risk reduction and early warning systems; Transboundary water management; Innovation in adaptation finance.

Ambiente, 2018). By 2070, the minimum and maximum temperatures, will increase between 2°C and 6°C and between 3°C and 5°C, respectively. Strauss. & Kulp (2018) calculated that in Puerto Plata (located on the north side of the country) sea level will increase in the range of 0.25 m to 0.31 m by 2050.

6. The weather patterns in the Eastern tropical Pacific Ocean (ETP) and the Caribbean are connected. For example:

1. The primary production of the Pacific Central-American Coastal Large Marine Ecosystem is caused by coastal upwelling which develops as a result of locally intense jets of wind blowing from high pressure systems in the Gulf of Mexico and the Caribbean towards the Pacific Ocean; wind jets flow through four passages (i) the isthmus of Tehuantepec, (ii) the Gulf of Fonseca, (iii) the Lake Nicaragua, and (iv) the Panama Canal (Barton et al., 1993; Trasviña et al., 1995; Martínez Díaz de León et al., 1999; Brenes et al., 2003; Belkin & Cornillon, 2003; Heileman, 2009).
2. The moisture contributions to Cocos island, which allows the development of tropical and moist forests in an oceanic island, come from evaporation over the ETP and the westernmost edge of the Caribbean Sea (Durán-Quesada & Alfaro, 2016).
3. El Niño Southern Oscillation (ENSO) has strong influence in the Caribbean. ENSO perturbs tropical and subtropical circulation and interacts with other climate patterns that influence the development of tropical storms and hurricanes in the Caribbean (Giannini et al., 2001; Tartaglione et al., 2003; Chu, 2004; Klotzbach, 2011). El Niño suppresses hurricane activity in the Atlantic basin, while La Niña enhances it. In addition, ENSO is a main driver of rainfall variability in the Dominican Republic (Giannini et al., 2000; Gamble et al., 2008). El Niño conditions lead to drier and longer mid-summer drought, while La Niña causes atypical wet summers.

Therefore, climate change related alterations of circulation and weather patterns will modify the conditions in both areas.

Cocos Island National Park

7. Cocos Island is an uninhabited oceanic volcanic island located in the eastern Pacific Ocean at about 500 kilometres off Costa Rica´s mainland. In 1978, the island was declared a national park – "Parque Nacional Isla del Coco" (PNIC) (Executive Decree 8748-A-MAG, modified afterwards in 1991 and 2001). It includes a land area of 23.3 km^2 and a surrounding marine area of 2,011.53 km^2. In 2011 the neighbouring sea (9,649 km^2) was declared "seamounts marine management area" (Executive Decree 36452-MINAET), in which trawling, semi-industrial and industrial fishing, and hydrocarbon exploration and exploitation are prohibited. The national park was inscribed in the World Heritage List in 1997, declared Ramsar site in 1998, and designated a Blue Park In 2019. Both protected areas are managed by the "Área de Conservación Marina Cocos" (ACMC) of the "Sistema Nacional de Áreas de Conservación" (SINAC) which is ascribed to the "Ministerio de Ambiente y Energía" (MINAE). A group of park rangers are based on the island to guard the protected areas.
8. The island has unique conditions and remarkable biodiversity inland and underwater. It is the summit of a seamount on the Cocos ridge and is surrounded by a platform about 18 km long. The surface of the island is 23.3 km^2. The highest elevation is Cerro Iglesias with 575 masl, and the mean annual rainfall and temperature are 7,000 mm and 27°C, respectively. It is the only oceanic island with a tropical rainforest on the eastern Pacific, holds the cloud forest at the lowest altitude in the world, has abundant freshwater and several rivers that drain into the ocean, has a mature reef ecosystem, and assemble large aggregations of large pelagic species like sharks, billfishes, tuna and humpback whales.
9. On land, there is significant endemism. There are 219 native plant species (48 endemic), 362 insect species (64 endemic), two reptile species (both endemic) and 150 bird species (four endemic) (Estrada-Chavarria et al., 2020). Also, PNIC is the only breeding site on the eastern Pacific Ocean of the common white tern (*Gygis alba*).
10. Underwater, there are about 1,688 species, the most diverse groups are molluscs (545 species), fishes (514 species) and crustaceans (ca., 263 species) (Cortés, 2012; Sibaja-Cordero et al., 2013; Fourriére et al., 2015; Fourriére et al., 2017).
11. The reef ecosystem holds 29 species of hard corals; the main reef building species is the lobe coral (*Porites lobata* listed Near Threatened in the IUCN Red List) (Guzmán & Cortés, 1992; Alvarado et al., 2016). Fifty-eight percent of the known fish species are reef fishes. The most diverse groups are groupers (Serranidae, 23 species), moray eels (Muraenidae, 23 species) and wrasses (Labridae, 19 species) (Fourriére et al., 2015; Fourriére et al., 2017). There are several sharks that thrive on the reefs, the most abundant is the whitetip reef shark (*Triaenodon obesus*, listed Near Threatened in the IUCN Red List) which is a resident species (Zanella et al., 2016).
12. The pelagic ecosystem congregates large aggregations of sharks, tuna (mainly the yellowfin tuna, *Thunnus albacares*), billfishes, and jacks (*Caranx* spp.) Large schools of scalloped hammerhead sharks (*Sphyrna lewini*, listed Critically Endangered in the IUCN Red List) are common. The whale shark (*Rhincodon typus*, listed Endangered in the IUCN Red List), humpback whale (*Megaptera novaeangliae*) and sea turtles [leatherback (*Dermochelys coriacea*, listed Vulnerable in IUCN Red List), olive ridley (*Lepidochelys olivacea*, listed Vulnerable), green turtle (*Chelonia mydas*, listed Endangered), and hawksbill turtle (*Eretmochelys imbricata*, listed Critically Endangered), sea turtles do not nest in the island] are seasonally found in the area (Sibaja-Cordero, 2008).
13. There is important marine endemism. There are (i) an endemic deep water hard coral (*Anomocora carinata*), (ii) two endemic soft corals (*Pacifigorgia curta* and *Leptogorgia tricorata*), (iii) two endemic lace corals (*Pliobothrus fistulosus* and *Stylaster cocosensis*) (Cairns, 1991, Breedy & Guzmán, 2003; Breedy & Cortés. 2011; Cortés, 2012), and (iii) 15 endemic fish species (Fourriére et al., 2015).

14. The island provides two direct services: tourism and food provision through fisheries.

1. Tourism. The main attraction is diving with large schools of scalloped hammerhead sharks. Liveaboard diving tours embark and disembark on Puntarenas and offer 10-days trips with seven days of diving and three dives per day. During the trip, tourists will have a day visit to the island. One of the diving companies has a three-person submarine that offer up to 300 m dives. About 3,500 persons per year visit the national park. In 2010, tourism in PNIC generated a gross income of USD 8.3 million (Moreno-Díaz, 2012) for the supply chain mostly based in Puntarenas.

2. Fishing. Before fishing was banned in the area, PNIC was a traditional fishing ground for tuna. The island provides exceptional habitats (e.g., coral reef, seamount) for large pelagic fish (mainly tuna and sharks) which move along the eastern Pacific Ocean and are captured by commercial fleets (overspill from the protected area into the fishery). The Costa Rican longline fleet that capture large pelagic fish is mostly based in Puntarenas (60.9% of the 515 vessels).

Catalina Island

3. Catalina is a small (9.6 km^2) uninhabited island located on the southern coast of Dominican Republic, about 2.4 km offshore south of La Romana city. It is one of the three islands located along the country´s south-eastern coast (Saona is the largest and Catalinita the smallest; Catalina and Saona islands belong to La Romana municipality). It is a low-lying island (most of the island is 5 masl) with a tropical xeric macrobioclimate (Cano et al., 2012), with mean annual temperature and rainfall of 27.1°C and 980 mm, respectively.

4. In 1995, Catalina was declared a natural monument (General Law on Environment and Natural Resources Law 64-00 amended by the Sectoral Law on Protected Areas Law 202-04). The protected area includes the island and a 500 m band around, with a total surface of 16.24 km^2. It is administered by the "Ministerio de Medio Ambiente y Recursos Naturales". In 2009, the Southeast Reefs Marine Sanctuary (SRMS) was created (Executive Decree 571-09), covering a large marine area of 7,862.59 km^2 which encompasses Catalina, Saona and Catalinita islands (the last two are part of the Cotubanama National Park, established in 1975). For administrative purposes, the sanctuary is divided in two zones (East and South), Catalina is located within the South zone. The sanctuary is administered though co-management agreements with consortiums of local organizations. The management of the South zone has been delegated to the Consorcio Arrecifes del Sur; the agreement was signed on February 2018.

5. Catalina´s flora is similar to that found in the mainland. It has three components: coast (vegetation that grows on sand and rocks), salt flats and interior. The interior is covered with subtropical forest on calcareous substrate. Zanoni et al., (1989) reported 216 species of vascular plants, no endemic flora is present.

6. Two-thirds of Catalina´s coast are sandy beaches that are located on three distinctive areas on the north, east and west of the island. The west beach (between Punta Pérez and Punta Acuador) is the only area open for tourism and is used for sun and beach day tours.

7. The island is surrounded by fringing reefs followed by a short continental shelf. On the northwest quarter of the island, outward of the fringing reef, there is a spur and groove formation stripe (TNC Dominican Republic Global Airborne Observatory Maps).

8. There are two reef sites: (i) a leeward reef on the west coast, and (ii) La Pared (i.e., “the wall”) on the northern tip of the island. The leeward reef has been severely degraded by anchoring of tourist vessels and the installation of a mooring structure to tie cruise ships (Geraldes, 2003). La Pared extends 500 m along the shore and is formed by a dense and healthy coral conglomerate which extends vertically for about 40 m (Geraldes, 2003). In 2016, Cortés-Useche et al., (2017) found that La Pared had the highest live coral coverage (64%) in south-eastern Dominican Republic. This was confirmed in 2018 by TNC which found >12% live coral cover on that site (TNC Dominican Republic Global Airborne Observatory Maps). A main species in La Pared is the staghorn coral (*Acropora palmata*, listed Critically Endangered in IUCN Red List). The corals of Catalina are part of the fringing reef complex which extend along the mainland´s coast to Isla Saona.

9. Despite its small size, Catalina Island support valuable biodiversity:

1. Forty-eight fish species have been found in La Pared (32% of the species found in the Southeast Reefs Marine Sanctuary), most of them are reef fishes (Cortés-Useche et al., 2018). Three species are listed in the IUCN Red List: masked goby (*Coryphopterus personatus*, listed Vulnerable), broadstripe goby (*Elacatinus prochilos*, listed Vulnerable), and nassau grouper (*Epinephelus striatus*, listed critically endangered).

2. Two sea turtle species nest in Catalina: the green turtle and the hawksbill turtle (*Eretmochelys imbricata*, listed Critically Endangered) (Revuelta et al., 2012). These species also nest in Saona Island.

3. The west Indian manatee (*Trichechus manatus*), which is rare to see, is found in La Pared.

4. The island provides two direct services: tourism and food provision through fisheries.

1. Tourism. The main attractions are (i) sun-and-beach on the west beach and (ii) diving on La Pared (snorkel and SCUBA). Sun-and-beach visitors have day-tours, arriving in the morning and leaving at mid-afternoon. They arrive on small boats from the mainland and in cruise ships. Cruise lines include Catalina Island as a beach-break in their itineraries. In La Romana there is a cruise terminal that can accommodate two ships. Also, in front of the west beach there is a mooring structure where two cruise ships can anchor. On the beach there are concessionaires that provide tourist services to the visitors (e.g., beach chairs, toilets, beverages, souvenirs). About 90,000 tourist per year visit Catalina (Ministerio Medio Ambiente, 2017), they ship from sites in La Romana and Bayahibe.

2. Fishing. Fishing is banned in the protected area, but the island reefs export fish biomass that is captured by local fishermen. The fisheries along the southeast coast are artisanal, fishermen capture reef fishes for household use and selling in the local market.

Need for climate change adaptation

3. Global climate change will impact PNIC and Catalina island by disturbing their valuable biodiversity and therefore its contribution to human wellbeing and the associated human activities (mainly tourism and fishing). It is anticipated that anthropogenic global warming will lead to (i) changes in the structure and dynamics of the terrestrial flora, (ii) coral bleaching, (iii) outbreaks of coral diseases, (iv) more intense and frequent ENSO events (which affects both islands) and (v) more severe hurricanes and tropical storms in the Caribbean. In addition, ocean acidification will limit coral growth and their capacity to overcome natural pressures (e.g., predation), and sea level rise will lead to coastal erosion and flooding. The degradation of both islands will affect the numerous persons associated to the tourism supply chains and will reduce the provision of seafood which in turn will compromise food security.

4. In PNIC, Maldonado & Alfaro (2012) analysed several scenarios and concluded that, by 2080, the island will have an increase of temperature between 1°C and 3°C and there are contradictory projections for precipitation increase and decrease. Maldonado & Alfaro (2012) found that 77% of projected monthly precipitation showed an increase, and 33% showed precipitation decrease. This results in annual variation, with years of increased precipitation and years of reduced precipitation. Meehl et al., (2007) found a slight increase in the average annual precipitation in the area where Cocos island is located. ENSO events have a strong influence in weather conditions in the island, therefore the projected increase in more frequent, intense and stronger ENSO events (Cai et al., 2014; Cai et al., 2015; Cai et al., 2018), will definitely affect the land-based and marine habitats. The increase in surface temperature and the changes in atmospheric circulation will greatly affect the habitat conditions. The cloud forest will be seriously threatened, since they will not be able to move altitudinally and their adaptation may not occur (Porras-Jiménez et al., 2014). There are no specific projections of sea level rise for Cocos island, but the Climate Central sea level rise simulator shows that the coastal border will be flooded with an increase of one foot (30.48 cm) (Figure 6).

5. As indicated before, with climate change, the Dominican Republic will become hotter. The available information indicates that La Romana province (where Catalina island is located) will have a marked increase in temperature and a reduction in precipitation. In the area were Catalina is located, seven of the eight models analysed project that annual precipitation will reduce 14.1% by 2050 and 21.3% by 2070. As indicated before, there is a teleconnection between ENSO events and tropical storms in the Caribbean, therefore, more frequent, intense and stronger ENSO events will influence the development of tropical storms and their impact in the Dominican Republic. There are no projections of sea level rise for the area where Catalina island is located, but the Climate Central sea level rise simulator shows that the northern part of Catalina will be flooded with an increase of one foot (30.48 cm) (Figure 6). This will be critical for Catalina island which has low lying areas; it could lose the current nesting beaches of sea turtles and the areas used by tourists.

6. Ocean warming will contribute to coral bleaching and to make corals more sensitive to diseases (Bruno et al., 2007; Smith & Liebrock, 2009; Hoegh-Guldberg et al., 2017). UNEP (2017) estimated that, under the high-emissions global warming scenario (RCP8.5), by 2039 42% of Dominican Republic corals will be affected by bleaching. For Cocos island, it was estimated that 91% of the corals will be affected by bleaching between 2040 and 2044. In addition, ocean acidification will weaken corals and make them more vulnerable to breaking and susceptible to other pressures (Anthony et al., 2008; Mollica et al., 2018). It will also affect shell forming and calcifying organisms, including plankton and other marine biota (Hendricks et al., 2010; Harvey et al., 2013). All this will probably generate changes in the composition of pelagic and benthic communities.

7. The island ecosystems of the two protected areas can naturally adapt to the new climate circumstances. Depending on conditions, island flora has potential adaptive capacity to changes in temperature and precipitation (Harter et al., 2015). Also, corals may be able to respond to thermal stress and ocean acidification (McCulloch et al., 2012; Comeau et al., 2013; Logan et al., 2014; Palumbi et al., 2014; Baggini et al., 2015; Thomas et al, 2018; Morikawa & Palumbi, 2019). But adaptive capacity in PNIC and Catalina is limited by several local anthropogenic stressors that hinder the natural capacity of these island ecosystems to adapt to the new climate conditions, like pollution from land-based and marine sources, and sediment runoff. But, the main causes of anthropogenic stress are tourism, fishing, and invasive species.

8. Tourism. Careless divers disturb marine fauna on reefs and open waters, stir up sediments and touch corals which may result in skeletal breakage. Also boat anchoring damage reefs and benthic communities. In Catalina, dense aggregations of tourists on the beach degrade the coastal habitat, also sea turtles´ nesting sites overlap with the areas used by tourists. In both islands, attending visitors in land is a pathway to inadvertent introduction of pests and invasive species.

9. Fishing. Purse seiners and long-liners illegally operate in Cocos Island National Park. They capture mainly yellowfin tuna (*Thunnus albacares*) and sharks, mostly the silky shark (*Carcharhinus falciformis*) which is listed vulnerable in IUCN Red List (Lopez et al., 2016; Rodríguez & Rosero, 2018). But other species are also affected like the green turtle which has been found trapped on abandoned longlines (Lopez et al., 2016). White et al., (2015) documented decline in the relative abundance of sharks and mantas caused by illegal fishing. Likewise, in Catalina artisanal fishers illegally operate around the island and loot sea turtle eggs (Herrera, 2017). Fishers fish along the reef system of the South zone of the Southeast Reefs Marine Sanctuary and capture species that are vital for ecosystem functioning like the parrotfish (*Scarus* spp.) which regulate algal abundance in coral reefs (Steneck et al., 2014; Williams et al., 2016; Holbrook et al., 2016).

10. Invasive species are present in both islands. PNIC has feral populations of pigs (*Sus scrofa*), cats (*Felis domesticus*), white-tailed deer (*Odocoileus virgininanus*) and rats (*Rattus rattus* and *R. norvegicus*) (Sierra & Herrera-Villalobos, 2005; Madriz, 2009). Whereas Catalina is affected by rats, cats, raccoons (*Procyon lotor*) and rabbits (*Oryctolagus cuniculus*). These species have profound impact on the island ecosystems. For example, in Catalina raccoons consume sea turtle eggs and hatchlings, and in PNIC is has been estimated that feral pigs root annually about 10 - 20 % of the island surface and generate an erosion rate of about 200 kg ha^{-1} $year^{-1}$ (Sierra, 2001). Rats have serious deleterious effects on island ecosystems, they alter the composition of native forests and prey on native fauna like invertebrates, birds and sea turtle eggs and hatchlings (Harper & Bunbury, 2015). In PNIC, rats prey on three endemic species [cocos flycatcher (*Nesotriccus ridgwayi*), cocos cuckoo (*Coccyzus ferrugineus*) and cocos finch (*Pinaroloxias inornata*)], the common white tern, and the endemic anole (*Anolis townsendi*) (Gómez, 2006; Soto, 2015).

11. A number of measures have been implemented to protect the condition of these island, but these have been insufficient to halt their degradation. Under the circumstances of the present scenario the biodiversity of PNIC and Catalina will not be able to adapt to the future climate conditions. Three main barriers that limit the implementation of adaptation measures have been identified:

12. Management instruments. PNIC has a sound suite of tools but does not have sufficient capacity to deter illegal fishing operations. In contrast, Catalina lacks most of the instruments needed to manage the protected area like a public use plan and a surveillance and enforcement plan. In addition, there are no regulations for the use of the surrounding marine area. The first management plan for the Southeast Reefs Marine Sanctuary is just being prepared. Both PNIC and Catalina lack tools to prevent anchor damage and the introduction of invasive alien species.

13. Funding. Both protected areas have financing limitations, specially to undertake major investments or to sustain new initiatives. For example, PNIC and Catalina have not had resources to install buoy signalling and mooring facilities or to eradicate invasive species, nor will have resources to carry out ecosystem restoration measures.

14. Behaviour of user groups and stakeholders. The beneficiaries of the goods and services are not aware of the consequences of their current actions and the future implications of climate change on their business operations. An example is the capture of parrotfishes which are fished in all the Caribbean. In Dominican Republic parrotfishes are sold to fishmongers, tourists, and resorts as cheap food fish. In 2017, the Ministry of Environment imposed a two-year ban on parrotfish fishing. However, despite important communication campaigns there was no behavioural change. Fishers strongly protested the ban and capture of parrotfish has continued (Cid, 2017, Pache, 2018; Alvarez, 2018).

15. In summary, the proposed theory of change is (Figure 7):

1. Current scenario. PNIC and Catalina island, like other tropical islands, have valuable terrestrial and marine biodiversity (including endemic species) which provides important environmental services for human populations, mainly nature-based tourism and seafood production. Their condition is affected by the impacts from (i) invasive mammals which deteriorate terrestrial and marine habitats and (ii) tourism and fishing activities. Costa Rica and the Dominican Republic have limitations to confront the current impacts.

2. Climate change scenario. Climate change will have similar impacts in both islands:

1. Global warming will lead to (i) changes in the structure, composition and distribution of terrestrial habitats, (ii) coral bleaching, (iii) make corals more sensitive to diseases, (iv) more intense and frequent ENSO events, and (v) more severe hurricanes and tropical storms in the Caribbean.
2. Ocean acidification will limit coral growth and their capacity to overcome natural pressures (e.g., predation) and will affect shell forming and calcifying organism.
3. Sea level rise will lead to coastal erosion and flooding. Increased sea level together with stronger tropical storms will generate large storm surges.
4. The changes in marine communities most probably will result in changes in the production of biomass which is used by fishers and a reduction of the natural attractions (e.g., corals) for tourism.

1. Proposed change. The aim is that PNIC and Catalina island continue to provide valuable ecosystem products and services under the new climate conditions. For this, both islands will have to naturally adapt to the new climate scenario, which requires that terrestrial and marine habitats are healthy and resilient.

2. Change route. To move from the current scenario to a condition in which both islands have healthy and resilient terrestrial and marine habitats, it is proposed to focus on four lines of work:

    1. Ensure that terrestrial habitats recover from their current degraded condition by eradicating invasive mammals, implementing actions to prevent introductions and an insurance policy to cover rapid response in case of rodent reintroduction.
    2. Reduce existing pressures from marine tourism and fisheries by strengthening the management of both protected areas.
    3. Protect reefs and ensure that there are means to restore corals after external shocks (e.g., bleaching, storm damage) by developing coral restoration capacities, and an insurance policy to fund coral restoration when needed.
    4. Promote behaviour change of key stakeholders in support of conservation of island ecosystems to reduce vulnerability to the effects of climate change.

    All this supported by a long-term reporting mechanism which provides key information to aid decision making and adaptive management.

5. The present project aims to implement strategic measures to confront the main anthropogenic pressures that hinder island resilience in PNIC and Catalina and to develop mechanisms to support long-term action to protect key ecosystems. The exchange of experience and cross fertilization between stakeholders and practitioners of PNIC and Catalina will generate lessons that will be useful for tropical islands worldwide.

Project / Programme Objectives:

6. The project objective is to improve local adaptive capacity to reduce the vulnerability to climate change of Cocos and Catalina islands and the production sectors that depend on their ecosystem services.
7. The project will have four components and six interlinked outcomes. The first component will address the pressures generated by (i) tourism and fisheries activities (outcome 1.1), and (ii) terrestrial invasive species (outcome 1.2). The second component will implement mechanisms for reef conservation and coral restoration in the south region of the Southeast Reefs Marine Sanctuary (outcome 2.1). The third component will develop and implement novel parametric policies to cover quick response in cases of coral damage and rodent reintroductions (outcome 3.1). Finally, the fourth component will establish a long-term strategy for behaviour change (outcome 4.1) and will facilitate the exchange and dissemination of lessons (outcome 4.2).

Component 1. Reduction of main anthropogenic pressures.

8. This component will implement the tools needed to better control the impacts that tourism and fisheries are having on the two islands which, in turn, limit their capacity to adapt to the future climate conditions.
9. In PNIC, resources will be invested to advance implementation of the "Plan for Prevention, Protection and Control of Cocos Marine Conservation Area" (SINAC, 2018) (output 1.1.1). The project will also work on the operational inter-institutional arrangements to ensure the long-term operation of the surveillance station. In addition, the project will support implementation of the updated regulation for marine tourism that will issued in 2020 (output 1.1.2). A key element will be to invest in key infrastructure like (i) signalling buoys to aid operations, and (ii) mooring buoys to prevent anchoring damage.
10. In Catalina the project will support the development and implementation of key management instruments: (i) the public use plan for Catalina, (ii) the zoning plan and fisheries and diving regulations for the South zone of the Southeast Reefs Marine Sanctuary, and (iii) the surveillance and enforcement plan for Catalina and the sanctuary. These instruments will be developed through a highly participatory process with local stakeholders and contributions from the experience of PNIC on these matters. The project will provide key investments like signalling buoys, mooring buoys and surveillance equipment.
11. The project will ensure eradication of mammals from both islands (outputs 1.2.1 and 1.2.2). All invasive species cannot be eradicated simultaneously, therefore a strategic collaborative approach will be applied to complement eradication actions with two other initiatives.
12. In PNIC, deer will be eradicated through a medium-size GEF funded project2. This work will prepare local capacity to undertake the more demanding eradication of feral pigs, cats and rats to be executed with support of the

2 Safeguard the biodiversity of Cocos Island National Park by enhancing biosecurity and implementing the first in a series of invasive mammal eradications.

present project. In Catalina, racoons and rabbits will be eradicated through a project that has been proposed to the Ecosystem-based Adaptation Facility of the Caribbean Biodiversity Fund (CBF), and the present project will eradicate rats and cats.

13. Eradication of rats is crucial for ecosystem restoration, it has been observed that vegetation and seabirds recover rapidly after rat removal (Varnham, 2010; Russel & Holmes, 2015; Le Corre et al., 2015; Wolf et al., 2018). To aid rapid recovery active measures will be implemented like planting in damaged plots in PNIC and in Catalina enrichment planting, seabird attractants and artificial egg incubation of sea turtles.
14. To prevent re-infestation (e.g., rats) and further introduction of non-native species biosecurity plans will be prepared and implemented in both islands (output 1.2.3). The project will also invest in key infrastructure and equipment that will be needed.

Component 2. Conservation of coral reefs

15. Coral protection and restoration are a key adaptation measure. The project will support establishing a long-term programme to conserve the reefs between Higuamo river and Saona island. This programme will build upon the experience developed by the Fundación Dominicana de Estudios Marinos (FUNDEMAR) and TNC´s Caribbean coral initiative and will be part of the management strategy of the marine sanctuary. FUNDEMAR has a laboratory in Bayahibe and works with coral gardens and facilitated sexual reproduction (larval seeding), and develop participatory conservation and restoration actions together with local stakeholders like diving operators, fishers and resorts.

16. The project will potentiate current actions by:

1. developing a multi-stakeholder collaboration platform to give social basis to the long-term programme,
2. participatory development and initial implementation of a detailed reef conservation and coral restoration plan for Catalina and the south region of the Southeast Reefs Marine Sanctuary,
3. designing a financial mechanism to sustain coral conservation and restoration, and
4. investing in basic infrastructure and equipment to expand coral restoration capacity.

5. A similar investment will not be necessary in PNIC because corals are in better condition.

Component 3. Insurance tools for emergency action

6. The use of insurance instruments for financial protection of natural ecosystems against potential climate-related damages is still a developing field. The project will design two new types of conservation-focused insurance products to increase resiliency:

1. A policy for climate-change induced damage to coral reefs like bleaching and storm damage to cover coral restoration and maintenance (output 3.1.1).
2. A policy against rat re-infestation to cover rapid response to prevent population expansion (output 3.1.2).
3. In collaboration with the United Nations Environment Programme Finance Initiative (UNEP-FI), an international insurance company (e.g., Swiss Re, Allianz), and CAF the risk-models and insurance instruments will be developed and implemented in both sites. This development will build upon recent developments like the hurricane-related damage policy that cover the reefs in Quintana Roo (Mexico) that was developed by Swiss Re and The Nature Conservancy (Reguero et al., 2019), and the explorations about considering invasive species an insurable peril (Chin et al., 2018) and applying insurance for adaptation to climate change (Jarzabkowski et al., 2019; PSI, 2020).
4. Complementarily, the project will develop financial mechanisms to cover the cost of the premiums and deductibles. An existing option is to adapt CAF´s “regional contingent credit line for extreme climate events, earthquakes, polluting accidents and epidemics” to provide resources to cover the premiums and deductibles when necessary (M. Velasquez, pers. comm., May 2020). The project will cover the premiums of the first two years until the financial mechanisms are operational.
5. The GEF medium-size project previously mentioned undertake an initial exploration of partners and will prepare a roadmap for the development of the rat re-infestation insurance instrument for PNIC.

Component 4. Knowledge management

6. A long-term strategy will be developed to improve adaptation behaviour on each site (output 4.1.1). Climate change adaptation is a complex human process that is linked to individual motivation, beliefs and social identity, among other factors (Amel et al., 2017; Van Valkengoed & Steg, 2019a; Van Valkengoed & Steg, 2019b; USAID, 2019). Therefore, this strategy will focus on the generation of information and knowledge for greater appropriation and social empowerment. It will accompany the project's intervention and at the same time, built key stakeholders’ capacities so they can empower themselves for future action under the new climate scenario.
7. For each site a long-term reporting mechanism will be assembled based on the existing actions (e.g., forest plot and coral monitoring) and incorporating new indicators about presence of invasive species and social and economic trends.
8. Finally, throughout project implementation knowledge exchange and cross-fertilization between stakeholders of both countries will be fostered. Lessons will be documented and disseminated through executing entities and project partner channels.

Project / Programme Components and Financing:

Project/Programme Components	Expected Outcomes	Expected Outputs	Countries	Amount (US$)
1. Reduction of main anthropogenic pressures	1.1. Reduction of tourism and fisheries impacts on the islands	1.1.1. Marine surveillance station in Cocos Island National Park	Costa Rica	500,000
		1.1.2. Implemented updated regulations for marine tourism	Costa Rica	150,000
		1.1.3. Implemented public use plan for Catalina Island	Dominican Republic	80,000
		1.1.4. Implemented zoning plan for the south zone of the Southeast Reefs Marine Sanctuary	Dominican Republic	400,000
		1.1.5. Implemented fisheries and diving regulations for the south region of the Southeast Reefs Marine Sanctuary	Dominican Republic	100,000
		1.1.6. Implemented surveillance and enforcement plan for Catalina Island and the Southeast Reefs Marine Sanctuary	Dominican Republic	150,000
	1.2. Main terrestrial invasive species have been eradicated from both islands	1.2.1. Eradication of rats, cats, and pigs of Cocos Island National Park	Costa Rica	3,310,000
		1.2.2. Eradication of rats, and cats of Catalina Island	Dominican Republic	1,600,000
		1.2.3. biosecurity plans to prevent future introduction of terrestrial invasive species	Costa Rica	160,000
			Dominican Republic	140,000
			Subtotal component 1	*6,590,000*
2. Conservation of coral reefs	2.1. Established long-term mechanism for reef conservation and coral restoration in the south region of the Southeast Reefs Marine Sanctuary	2.1.1. Multi-stakeholder collaboration platform	Dominican Republic	25,000
		2.1.2. Reef conservation and coral restoration plan for Catalina Island and the Southeast Reefs Marine Sanctuary	Dominican Republic	300,000
		2.1.3. Financial mechanism to sustain long-term conservation and rehabilitation actions	Dominican Republic	50,000
		2.1.4. Basic infrastructure and facilities	Dominican Republic	150,000
			Subtotal component 2	*525,000*
3. Insurance tools for emergency action	3.1. Insurance policies available and operating	3.1.1. Insurance policy for climate-related damage to coral reefs	Costa Rica & Dominican Republic	2,000,000
		3.1.2. Insurance policy for rapid response to rodent reintroductions	Costa Rica & Dominican Republic	1,500,000
		3.1.3. Financial mechanism to sustain implementation of policies	Costa Rica & Dominican Republic	50,000
			Subtotal component 3	*3,550,000*
4. Knowledge management and behaviour change	4.1. Better adaptation behaviour	4.1.1. Strategy for behaviour change under implementation	Costa Rica & Dominican Republic	350,000
	4.2. Project lessons shared worldwide	4.2.1. Long-term reporting mechanism	Costa Rica & Dominican Republic	50,000
		4.2.2. Project lessons documented and disseminated	Costa Rica & Dominican Republic	310,000
			Subtotal component 4	*710,000*
			Subtotal component 1 to 4	*11,375,000*
5. Project/Programme Execution cost				1,513,150
6. Total Project/Programme Cost				12,888,150

Project/Programme Components	Expected Outcomes	Expected Outputs	Countries	Amount (US$)
7. Project/Programme Cycle Management Fee charged by the Implementing Entity (if applicable)				1,031,052
Amount of Financing Requested				13,919,202

Project Duration: four years (48 months)

PART II: PROJECT / PROGRAMME JUSTIFICATION

The project / programme components, particularly focusing on the concrete adaptation activities, how these activities would contribute to climate resilience, and how they would build added value through the regional approach, compared to implementing similar activities in each country individually.

9. Costa Rica and Dominican Republic coincided on the advantage of joining efforts towards shared articulated approaches to confront adaptation in important island ecosystems. Green and soft adaptation measures will be applied in both islands. Green measures include strengthening management performance of protected areas, coral restoration and eradication of invasive species. Soft measures include the development of regulations, financial mechanisms, insurance instruments and a strategy for behaviour change.

How the project would promote new and innovative solutions to climate change adaptation, such as new approaches, technologies and mechanisms.

10. The development of insurance tools is a major innovation that could have global benefits. The insurance for climate-related damage to coral reefs will allow to have resources to invest in coral restoration after bleaching events. In addition, having a policy against rodent re-infestation will allow to implement rapid measures to control the plague. Generally, governments do not have the resources to respond to this kind of events.

The cost-effectiveness of the proposed project / programme, explaining how the regional approach would support cost-effectiveness.

11. The project will ensure the cost – effectiveness by (i) allocating funds to strategic activities and outputs with high catalyst potential, and (ii) complement actions with existing national initiatives and complementary projects. The collaborative work and exchange of experience between Costa Rica and Dominican Republic will accelerate the learning process to confront similar adaptation challenges.

How the project / programme would be consistent with national or sub-national sustainable development strategies, including, where appropriate, national or sub-national development plans, poverty reduction strategies, national communications, or national adaptation programs of action, or other relevant instruments, where they exist. If you wish and if applicable, you can also refer to regional plans and strategies where they exist.

12. As the project addresses the core threats to Cocos Islands conservation, it is aligned with Costa Rica's environmental and sustainable development policies and plans. For instance, the project is aligned with the National Climate Strategy and Action Plan, the National Climate Change Policy 2018 – 2020 (axes 3 and 5), the National Policy for the Adaptation to Climate Change 2018-2030 (axis 3), the National Decarbonization Plan 2018-2050 (axis 10), the National REDD+ Strategy (policy 3), the National Biodiversity Strategy 2016-2025 (strategic topic 2), the Development and Public Investment National Plan (goal 15), SINAC´s strategic plan 2016-2026 (objectives PPI09 and PPI15), PNIC´s management plan 2017-2026 (programmes 2, 3 and 4), among others. Costa Rica is as well in the process of mainstreaming gender into the country's Action Plan of the National Strategy on Climate Change, which is linked to the country's development structure and its Constitution (article 50). Likewise, in Dominican Republic the project is aligned to its main regulations and policy instruments, notably to its Constitution (article 194) and the National Development Strategy 2030 (Law 1-12, goals 3.5, 4.1, and 4.3). With regards to the specific climate change policies and plans the project is in line with the National Adaptation Plan for Climate Change 2015 – 2030 (axes 4, 5, and 6), the National Strategy for Adaptation to Climate Change in the Agricultural Sector 2014-2020, and the Gender Action Plan for Climate Change, among other key instruments.

The learning and knowledge management component to capture and disseminate lessons learned.

13. At the core of the project is south-south cooperation to address similar adaptation challenges. Actions will include exchange visits, joint working groups, documenting lessons, and integrating information into a reporting mechanism based on a set of agreed indicators.

The consultative process, planned to be undertaken during project preparation, with particular reference to vulnerable groups, including gender considerations, in compliance with the Environmental and Social Policy of the Adaptation Fund.

14. The key stakeholder are (i) the local actors of the tourism and fisheries supply chains, (ii) the entities that manage both protected areas and the south zone of the Southeast Reefs Marine Sanctuary, (iii) the entities responsible for key actions (e.g., coastguard, fishing authority) and (iv) conservation and development partners (e.g., FAICO, FUNDEMAR). The most vulnerable groups are local fishers and tourist operators with limited capacity to invest in improving their activities and that will be heavily impacted by restrictions to be implemented. At the start of project preparation local workshops with stakeholders will be organized to present the concept and to receive

feedback and recommendations. This will be followed by in-depth interviews and focus groups to get a more in-depth perspective of their views, motivations and barriers. A gender analysis will be applied to identify the role of men and women in the fisheries and tourism supply chains. Finally, the draft project proposal will be presented for analysis in local workshops. In all cases the meetings will be designed to be inclusive with gender perspective. CAF will carry out an Environmental and Social Assessment. The results of the assessment will be used to design appropriate measures for risk mitigation and the project´s Social and Environmental Management Plan.

How the sustainability of the project/programme outcomes would be taken into account when designing the project / programme.)

15. The sustainability of the outcomes will be guaranteed by the commitment of the pertinent authorities, the financial mechanisms and insurance instruments to be developed, and the improved awareness and engagement of key stakeholders. In addition, the project will include NGOs that have long-term commitments like FAICO and FUNDEMAR which mobilize resources to the sites.

How the project / programme would provide economic, social and environmental benefits, with particular reference to the most vulnerable communities, and vulnerable groups within communities, including gender considerations, and how it would avoid or mitigate negative impacts, in compliance with the Environmental and Social Policy of the Adaptation Fund.

16. On each site, the project will provide to the most vulnerable communities different economic, social and environmental benefits. The main benefit for local groups will be to sustain their nature-based economic activities under the new climate conditions. The project will strengthen the capacities of local stakeholders to empower them to implement adaptation actions. Also, the project will contribute to make visible the role of women, to advance gender equality, to incorporate gender-sensitive actions.

17. The most vulnerable populations are those located in coastal municipalities where the employment and income generated by the tourism and fisheries supply chains are extremely important:

1. In Costa Rica, this is the Puntarenas municipality which has a population of about 150 thousand persons and low levels of development. In 2014, the human poverty index was 20.1% (ranked 54 among 82 municipalities) and in 2017 the social development index was 40.55 (ranked low development) (PNUD, 2016; MIDEPLAN, 2018). In 2017, Puntarenas had the highest poverty and extreme poverty levels of the country, 29.9% and 9.8%, respectively (UCR, 2018). Puntarenas is part of the Central Pacific Region, an area with severe limitations to generate employment (Anon, 2019). In the first trimester of 2020, this region had 9.1% unemployment, 16.3% underemployment and 54.1% informal employment (INEC, 2020).
2. In the Dominican Republic, these are the coastal municipalities of Villa Hermosa and La Romana (La Romana province) and the Bayahibe municipal district (San Rafael de Yuma municipality, La Altagracia province). In 2010 these localities had (Morillo, 2014; ONE, 2016; ONE, 2018; ONE, 2018a):
    1. Villahermosa had a population of 89,204 persons, 8.1% unemployment and 60.1% of poor households.
    2. La Romana had a population of 139,671 persons, 7.5% unemployment and 33.3% of poor households.
    3. Bayahibe had a population of 2,260 persons and 43.4% of poor households, and the San Rafael de Yuma municipality had 5.8% unemployment.

How the project / programme would meet relevant national technical standards, where applicable, such as standards for environmental assessment, building codes, etc., and comply with the Environmental and Social Policy of the Adaptation Fund.

18. Contained in the answers to the previous item and the item referring to the consultation process. The implementing environmental authorities will ensure compliance with pertinent standards and regulations.

Duplication of project / programme with other funding sources.

19. In none of cases is there any duplication of funding sources. As indicated before, for eradication of invasive species the project will complement actions with a GEF project in Costa Rica and a CBF proposal in Dominican Republic. In addition, the project will establish synergies with (i) GIZ triangular cooperation actions between both countries and (ii) the programmes of key entities like FAICO, FUNDEMAR and TNC.

Justification for funding requested, focusing on the full cost of adaptation reasoning.

20. Cocos and Catalina islands are rapidly deteriorating and it is urgent to take measures to secure that they can continue to provide key environmental services under the new climate scenario. However, the investments proposed in this project cannot be undertaken by the countries alone, specially under a post-COVID financial scenario. In addition to invest in urgently needed measures, the project will develop the mechanisms that will allow to sustain long-term adaptation activities.

The environmental and social impacts and risks identified as being relevant to the project / programme.

21. At present, the main identified risks are (i) fishers fear that new regulations will jeopardise their activity, (ii) apprehension of national authorities to engage in collaborative undertakings (e.g., fisheries, marine traffic), (iii) stakeholder reluctance to engage in adaptation actions, (iv) change in political directions due to government change, and (v) impacts from ENSO event or tropical storm. In the subsequent development of the proposal this will formally confirmed and the possible existence of pertinent risks from project activities will be evaluated.

PART III: IMPLEMENTATION ARRANGEMENTS

22. The Sistema Nacional de Áreas de Conservación of Costa Rica (SINAC) and the Ministerio de Medio Ambiente y Recursos Naturales of the Dominican Republic will be the executing entities. CAF Development Bank of Latin America will be the implementing entity. SINAC, the Ministerio de Medio Ambiente y Recursos Naturales of the Dominican Republic, and CAF will form a regional steering committee to oversee project implementation and to provide strategic guidance. An administrative executing partner (AEP) will be identified during project preparation, this entity will solely concentrate on project administration, strategic decisions will be taken by the project board. Specialised entities (contractors) will execute local actions under the supervision of SINAC and the Ministerio de Medio Ambiente y Recursos Naturales of the Dominican Republic, as appropriate. The administrative executing partner will contract the specialised entities and a small project unit which will be responsible for project monitoring, communications and documenting lessons, among other tasks to be defined during project preparation.

PART IV: ENDORSEMENT BY GOVERNMENTS AND CERTIFICATION BY THE IMPLEMENTING ENTITY

1. Record of endorsement on behalf of the government3 *Provide the name and position of the government official and indicate date of endorsement for each country participating in the proposed project/programme. Add more lines as necessary. The endorsement letters should be attached as annexes to the project/programme proposal.*

(Enter Name, Position, Ministry)	Date*: (Month, day, year)*
(Enter Name, Position, Ministry)	Date*: (Month, day, year)*
(Enter Name, Position, Ministry)	Date*: (Month, day, year)*

B. Implementing Entity certification *Provide the name and signature of the Implementing Entity Coordinator and the date of signature. Provide also the project/programme contact person's name, telephone number and email address*

I certify that this proposal has been prepared in accordance with guidelines provided by the Adaptation Fund Board, and prevailing National Development and Adaptation Plans (Costa Rica: Development and Public Investment National Plan, National Policy for the Adaptation to Climate Change 2018-2030 | Dominican Republic: National Development Strategy 2030, National Adaptation Plan for Climate Change 2015 – 2030) and subject to the approval by the Adaptation Fund Board, commit to implementing the project/programme in compliance with the Environmental and Social Policy of the Adaptation Fund and on the understanding that the Implementing Entity will be fully (legally and financially) responsible for the implementation of this project/programme.	
Name & Signature Implementing Entity Coordinator	
Date: *(Month, Day, Year)*	Tel. and email:
Project Contact Person:	
Tel. And Email:	

Each Party shall designate and communicate to the secretariat the authority that will endorse on behalf of the national government the projects and programmes proposed by the implementing entities.

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Annex 2. Tables

Table 1. Climate change vulnerability indexes for Costa Rica and the Dominican Republic.

Index	Costa Rica		Dominican Republic		Source
	Score	Risk level	Score	Risk level	
Climate Change Vulnerability Index 2014 [a]	7.70	Low	1.01	Extreme	CAF (2014)
Climate Risk Index for 1999–2018 [b]	88.17	95 among 181 countries	58.50	50 among 181 countries	Eckstein et al., (2019)
ND-GAIN Country Index adjusted for GDP 2018 [c]	4.2	33 among 177	-3.3	108 among 177	Notre Dame Global Adaptation Initiative (ND-GAIN)

[a] The Climate Change Vulnerability Index evaluates the risk of exposure to climate change and extreme events, with the current human sensitivity to that exposure and the capacity of the country to adapt to, or take advantage of, the potential impacts of climate change. The index has a range between 0 and 10, where values closer to 0 represent higher risk and values closer to 10 represent lower risk.

[b] The Climate Risk Index (CRI) indicates a level of exposure and vulnerability to extreme events, it analyses to what extent countries have been affected by impacts of weather-related loss events like (storms, floods, and heatwaves. The table shows the CRI average for the period 1999 - 2018. Lower values indicate higher risk, higher values indicate lower risk. The country with the highest risk (1 among 181 countries) was Puerto Rico with a CRI value of 6.67.

[c] The ND-GAIN Country Index summarizes a country's vulnerability to climate change and other global challenges in combination with its readiness to improve resilience. The GDP adjusted ND-GAIN is defined as the distance of a country's measured ND-GAIN score and its expected value based on the regression of ND-GAIN and GDP. Positive values reflect better resilience than expected. Higher values are better, lower values are worse. For 2018, the highest score was 14.6 for New Zealand (1 among 177 countries).

Table 2. Projected Increase in mean temperature in Costa Rica using the PRECIS climate model.

Year	Minimum	Mean	Maximum
A2 scenario			
2020	0.55	0.9	1.38
2050	1.18	1.91	2.92
2080	2.07	3.36	5.15
B2 scenario			
2020	0.46	0.61	0.78
2050	0.98	1.29	1.66
2080	1.72	2.27	2.92

Source: MINAET (2012).

Annex 3. Figures

Figure 1. Location of Cocos Island and Catalina Island.

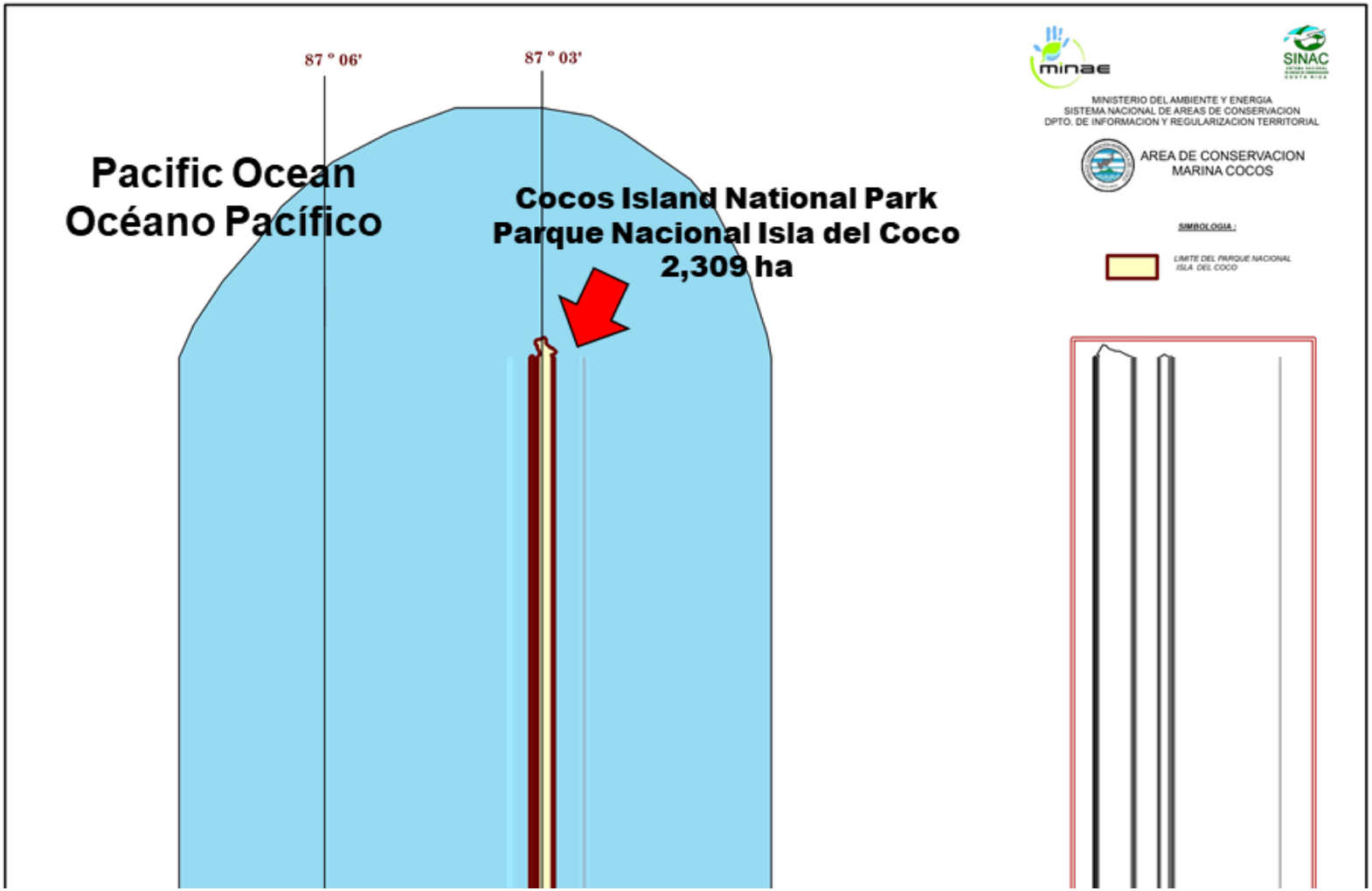

Figure 2. Cocos Island National Park in Costa Rica.

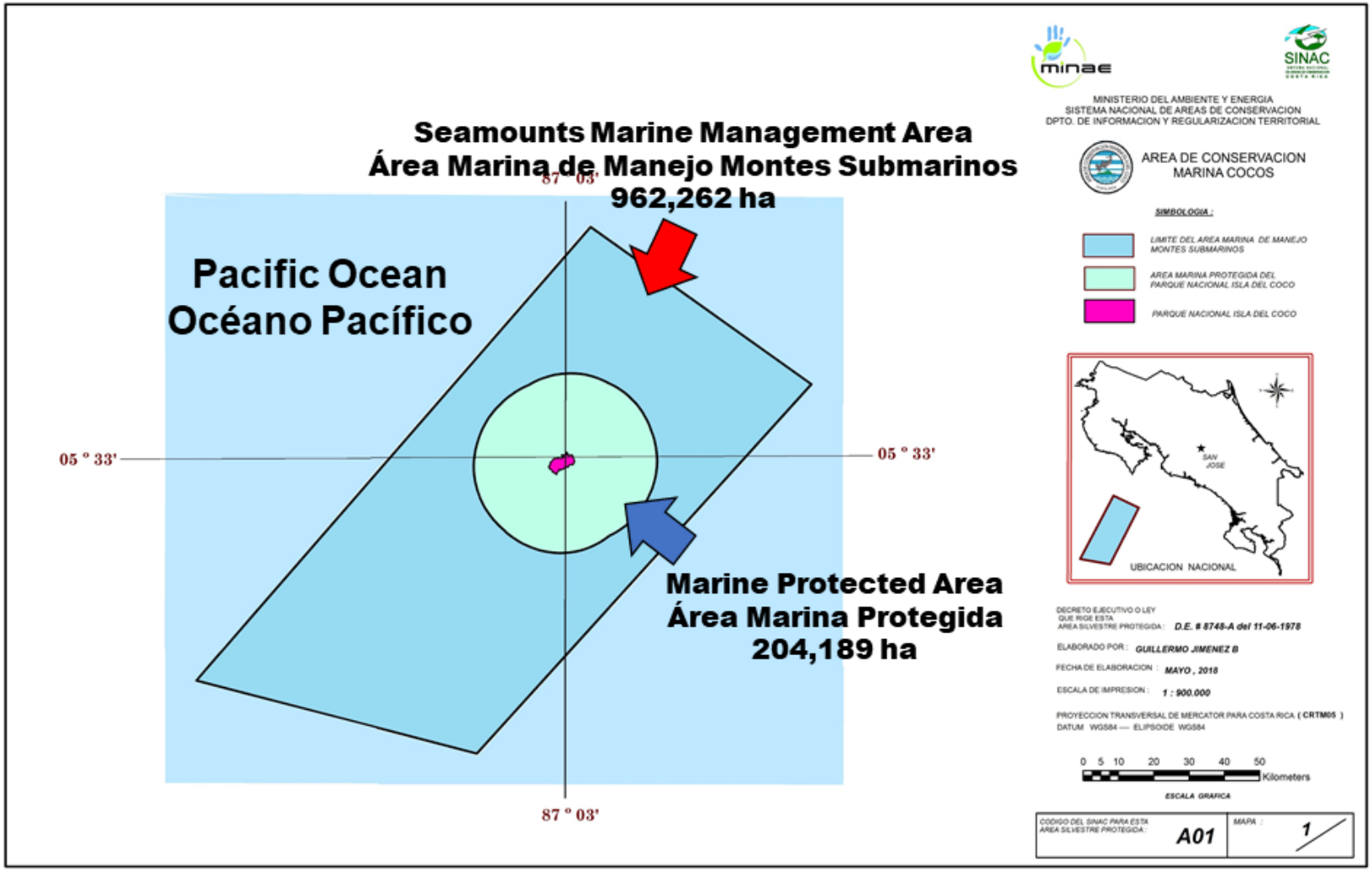

Figure 3. Seamounts Marine Management Area in Costa Rica.

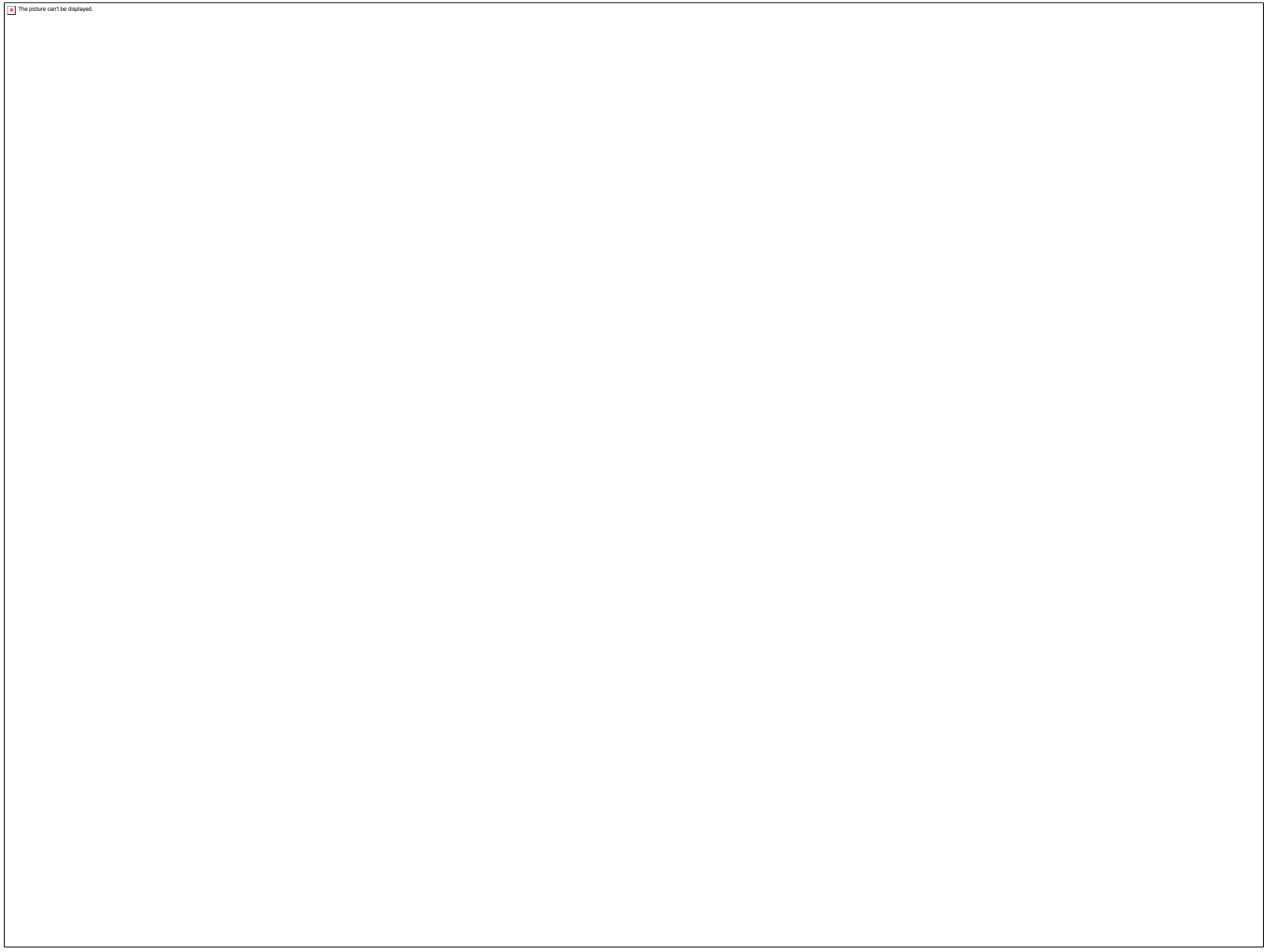

Figure 4. Catalina Island and the Southeast Reefs Marine Sanctuary in Dominican Republic.

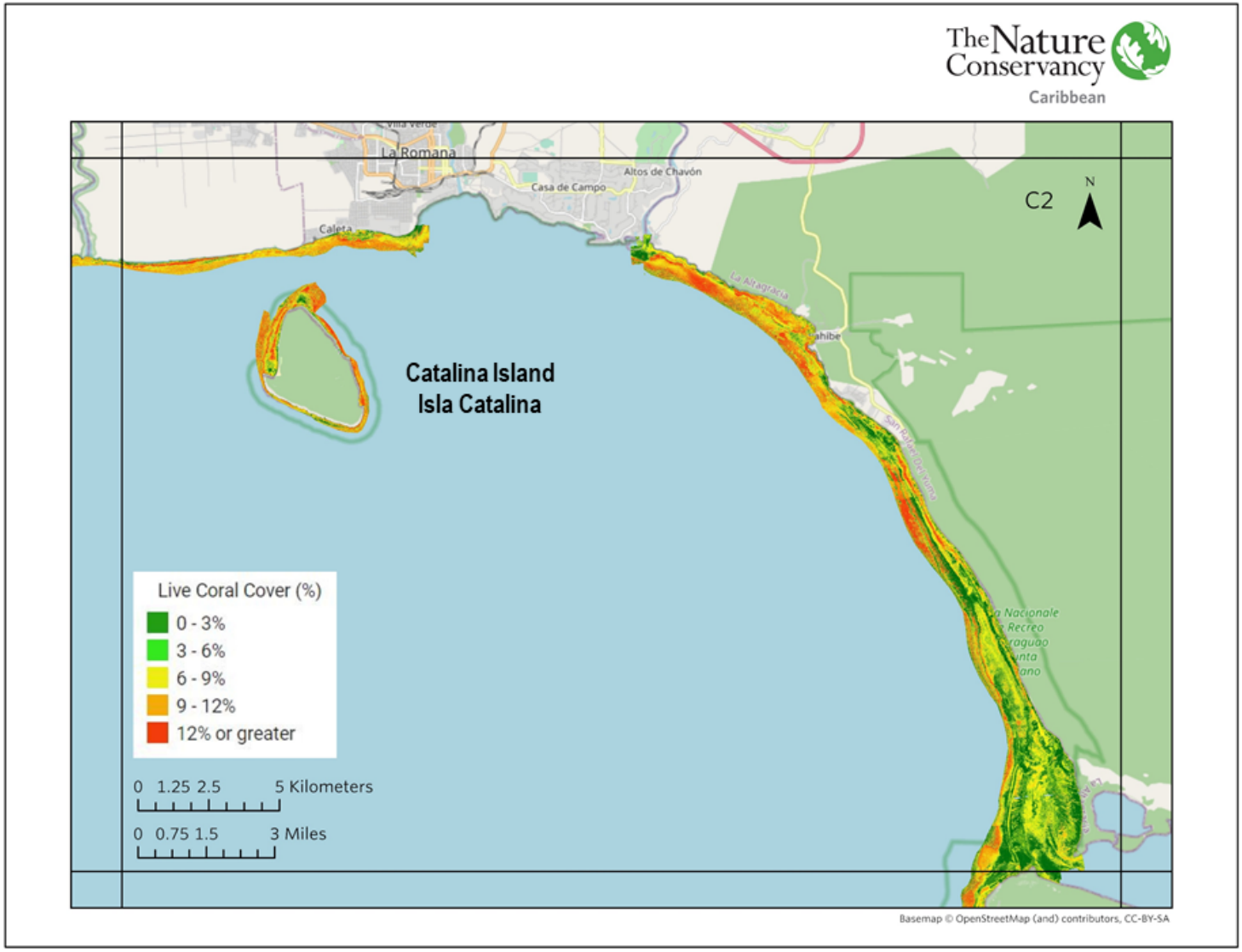

Figure 5. Live coral cover in the reef system South Zone of the Southeast Reefs Marine Sanctuary. Source: TNC Dominican Republic Global Airborne Observatory Maps.

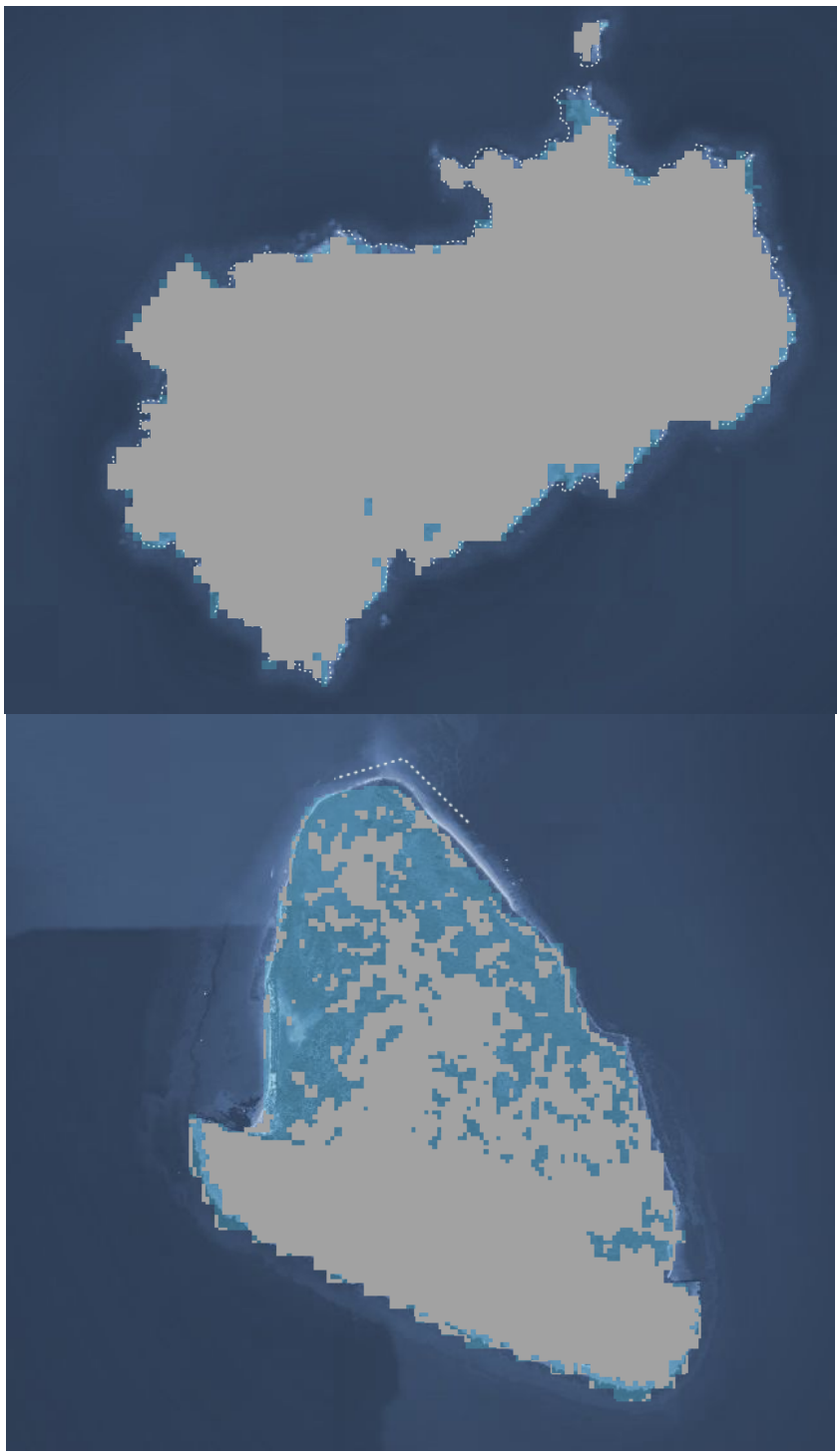

Figure 6. Flooded areas in Cocos (above) and Catalina (below) islands by the increase of one foot (30.48 cm) in sea level. Source: Climate Central.

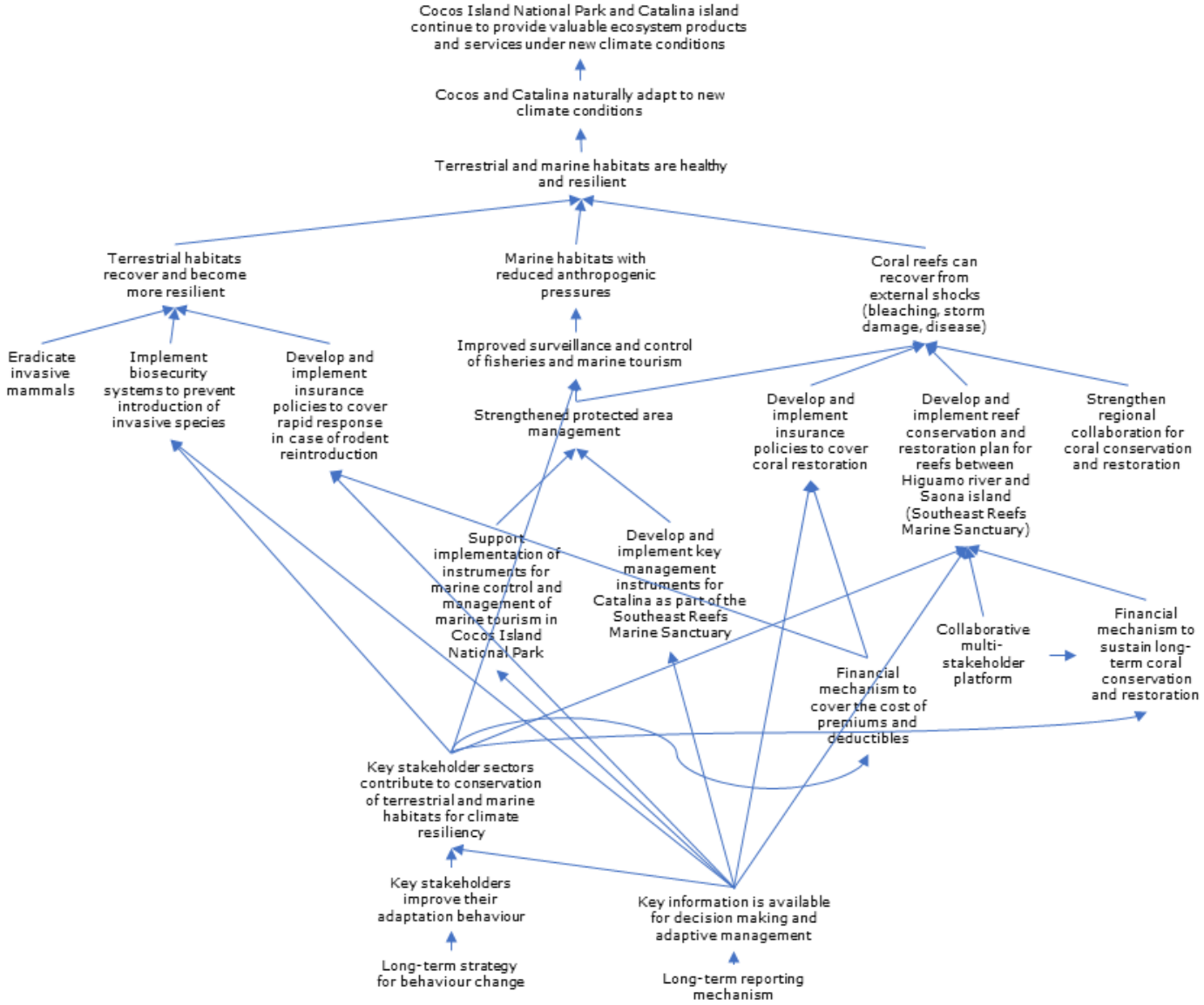

Figure 7. Draft theory of change for the project.