JANUARY 2022

MANGROVES: AT THE HEART OF NATURE BASED SOLUTIONS

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WHY IS IT IMPORTANT?

Mangroves play an essential role in supporting human livelihoods and wellbeing. They are one of the key ecosystems illustrating the potentials of nature based solutions for climate adaptation/mitigation and against the loss of biodiversity.

1. **The role of mangroves in climate adaptation:**

Mangroves act as a nature-based solution to prevent natural disasters. They mitigate the impact of cyclones and tsunamis on shorelines, notably by protecting against waves' actions, which also prevents against coastal erosion. They also help mitigating the effects of floods due to their roots system as well as their ability to enhance sedimentation. Indeed, mangroves act as "land expanders" [1], the extent of this action depending on the species of mangroves - *Avicennia* mangroves have numerous respiratory roots, which enhance their ability to trap suspended sediment, for example - and the type of forests (riverine, basin or fringe).

2. **The role of mangroves in climate mitigation:**

Mangroves remove CO2 from the atmosphere using photosynthesis mechanism - "the mangroves fix greater amounts of CO2 than what the phytoplankton do in the tropical oceans" [2], as a result, "mangroves are among the most carbon-rich tropical forests" [3]. Additionally, mangroves deal well with intense sunlight rays - they are screening solar UV-B radiaton. Therefore, "this ability of mangroves makes [their] environment free from the deleterious effects of UV-B radiation" [4].

KEY FACTS:

"(...) studies have shown that mangroves can reduce up to 66% of wave energy in the first 100 metres of forest width. Moreover, restoring mangroves to protect communities from storm surges is “two to five times cheaper than building engineered structures like underwater breakwaters” and also contributes to storing carbon and improving water quality." (World Disaster Report, 2020)

Between 1994 and 2002, in Vietnam, the planting of 12,000 ha of mangrove has cost USD 1.1 million but has helped reduce maintenance cost of the sea-dyke by USD 7.3 million per year (*World Disaster Report, 2002, quoted by KATHIRESAN K (2012), Importance of Mangrove Ecosystem, International Journal of Marine Science, Vol 2, No.10, pp.70-89)*

"Nearly 80% of the fish catches are directly or indirectly dependent on mangrove and other coastal ecosystems worldwide" *(KATHIRESAN K (2012), Importance of Mangrove Ecosystem, International Journal of Marine Science, Vol 2, No.10, pp.70-89)*

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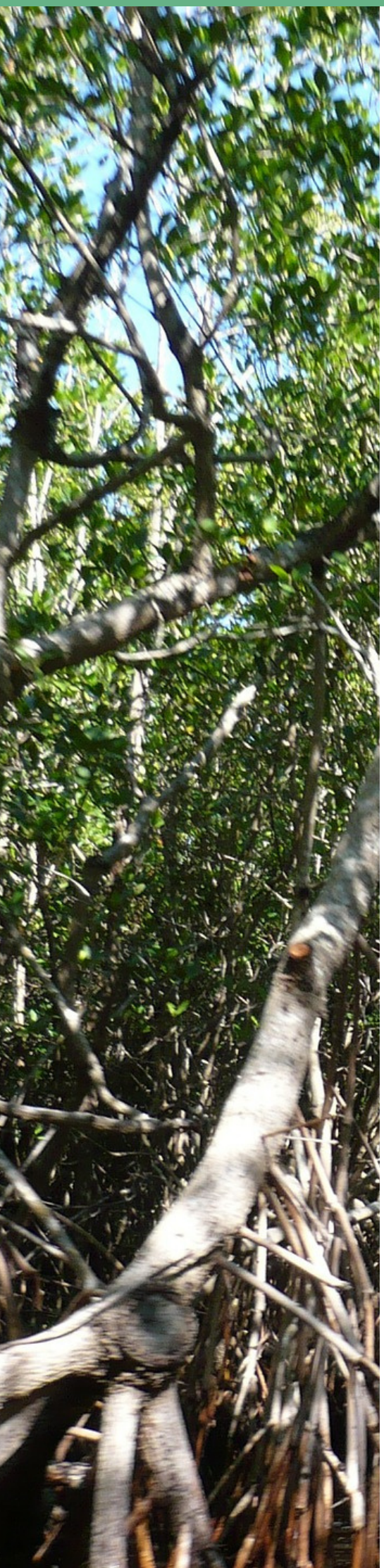


3. **The role of mangroves in supporting wildlife and biodiversity**

Mangroves are home for many species that use them as nursery, feeding and breeding grounds. Mangroves trap nutrients and recycle carbon, nitrogen and sulphur, making these substances assimilable to other organisms. Finally, they absorb and hold heavy metals - preventing their spread on coastal areas. These abilities support fishes and wildlife, more broadly - sea turtles, snakes, insects, birds, among others.

Mangroves are a complex and varied ecosystem - they produce litter (leaves, twigs, branches and seeds) enriching the source forest or exported in rivers. These micro-organisms enrich and enhance the possibility of life and fertilize the surrounding waters and soils - it works as a system. Mangroves provide clean and nutrient-rich water for the associated ecosystems like coral reefs, seaweeds and seagrass beds. When removed or destroyed, the sediment contained in mangroves gets deposited on these associated ecosystems and destroy them. By all of these complex webs of ecological functions, mangroves support biodiverdity and wildlife, but also human development and livelihoods as well as economic benefits (notably from fisheries, shorelines protection, or again, forests productions).

STATE OF MANGROVES COVERAGE

The Global Mangroves Alliance states that mangroves used to cover 141,957 km2 worldwide in 1996, this number decreased to 135,882km2 in 2016, a net loss of 6,075 km2 (4.3%). Nevertheless, the gains and losses patterns are complex. Rates of losses are declining - from 0.26% per year between 1996 and 2010 to 0.11% per year between 2010 and 2016. Between 1996 to 2016, approximately 15,262 km2 (10.8%) of mangrove were lost, but this has been countered by 9,204 km2 (6.5%) of gain - indeed, it appears that "mangroves are often opportunistic, and changes can occur relatively fast" [5].

REGION	1996	2007	2008	2009	2010	2015	2016
North & Central America & the Caribbean	22,591	21,888	21,986	21,849	20,875	21,205	20,962
South America	19,512	19,105	19,146	19,145	19,127	18,907	18,943
West & Central Africa	20,016	19,913	19,933	19,930	19,916	19,807	19,767
East & Southern Africa	7,577	7,317	7,341	7,332	7,311	7,271	7,276
Middle East	330	321	324	325	324	315	315
South Asia	8,625	8,497	8,493	8,483	8,495	8,404	8,414
Southeast Asia	46,491	44,355	44,378	44,314	44,051	43,587	43,767
East Asia	170	169	167	165	164	170	171
Australia & New Zealand	10,278	10,172	10,186	10,187	10,201	9,980	9,983
Pacific Islands	6,368	6,325	6,326	6,326	6,333	6,278	6,285
GRAND TOTAL	141,957	138,064	138,279	138,054	136,798	135,925	135,882

@ Mangroves Extent over Time (total area in km2), Global Mangroves Alliance report (2021)

“Greatest net losses of mangroves were in Southeast Asia (6%) and North and Central America and the Carribean (7%)" [6]

MANGROVES UNDER PRESSURE

Mangrove loss is caused by a multitude of activities – aquaculture, agriculture, urban development, harvesting of forests products... There are also indirect factors – climate change and associated sea-level rise, changes in hydrological parameter and increased pollution, for example.

The Global Mangroves Alliance report (2021) is partly based on a mapped analysis using one million satellite images, which allows to observe evolutions of mangroves' coverage as well as the causes of losses. Since 2000, "over 60% of losses were due primarily to direct and indirect human impacts” [7]. The first cause of loss (47%) is the conversion of mangroves for the production of commodities (mostly aquaculture). The second human-related cause is mangrove deforestation (12%) for timber and charcoal extraction primarily. It is worth saying that the legends/myths around mangroves favoured its deforestation and general degradation. Indeed, while it is now known that mangroves ecosystems are actually benefiting societies, they were once perceived as dangerous and hostile environments. Finally, the conversion of mangroves to infrastructure/urbanization and coastal tourism represents 3% of the total anthropic mangroves loss.

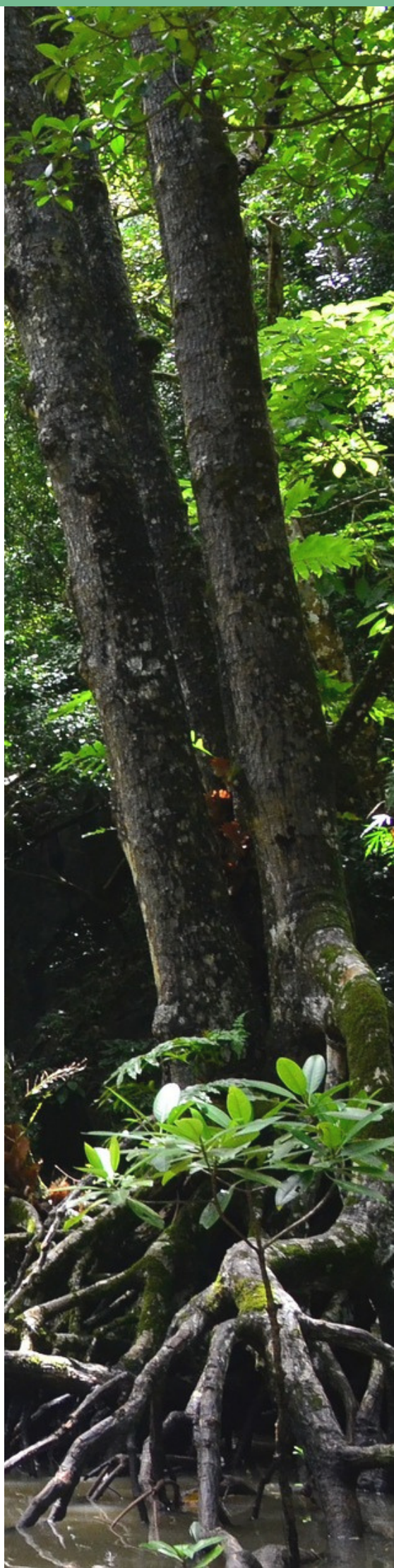
80% of anthropic losses occur in 6 nations (upon 116 mangroves-holding nations) – Indonesia, Myanmar, Malaysia, the Philippines, Thailand and Vietnam.

There are also natural drivers, enhanced by climate change – shoreline erosion (notably from sediments delivery changes and river discharge), sea level rise, hurricanes and drought. Shoreline erosion represents 27% of mangroves loss, extreme weather events - 11%.

"Mangrove forests are one of the worlds most threatened ecosystems" [8]

WHAT CAN BE DONE?

42% of all remaining mangroves are located in protected areas. But the levels of real/effective protection is, nevertheless, variable. A lot of losses still occur in those areas – there are natural losses caused by extreme events, for example, but also losses driven by an inefficient management or capacity shortfalls, which prevent regulations’ proper implementation.



RESOURCES:

KATHIRESAN K (2012), Importance of Mangrove Ecosystem, International Journal of Marine Science, Vol 2, No.10, pp.70-89

LIFE Adapt'Island project, url: https://www.cayoli.fr/life-adaptisland/

The state of the World's mangroves (2021), Global Mangroves Alliance

TURSCHWELL M. et al (2020), Multi-scale estimation of the effects of pressures and drivers on mangrove forest loss globally, Biological Conservation 247, pp.1-11

World Disaster Report (2020), IFRC

"Over the last 20 years, mangrove forests have shifted from being one of the fastest-diminishing habitats on Earth to being one of the best protected" [9]

Mangroves are mostly protected in South America (74% of all mangroves fall in protected areas) as well as in North America and the Caribbean region (68%), while in East Asia and the Pacific Islands only 13% and 9% of mangroves fall in protected areas, respectively.
These areas can be of variable sizes, and other protections' initiatives can work along these – local or community ownership of mangroves, regulations on urban development, "no net loss" regulations planned to compensate losses...

Lost or degraded mangroves can also be restored. It can take many forms – removing specific threats/pressures for a natural regeneration, re-establishing hydrological connectivity, sediment balance and/or soil conditions when necessary, replanting trees...These initiatives have been seen led by private and/or public actors.

THE LIFE ADAPT'ISLAND PROJECT:

The LIFE Adapt'Island project is an EU funded project, led by the Grand Port Maritime de Guadeloupe (GPMG) and aiming at restoring key ecosystems (coral reefs, seagrass beds and mangroves) in Guadeloupe.

The project foresees over 5,600 ha of protected coastline and the restoration of at least 80,000m2 of mangrove forests by planting 10, 000 young mangroves trees of three targeted species - *Rhizophora mangle, Avicenia germinans, Conocarpus erectus*.

Those actions are coupled with sensitization actions, notably through the Cáyoli and the Cáyoli Junior program demonstration and engagement programs- Different classes of primary schools familiarized themselves with mangroves. Some students have written and illustrated a book on the topic, and others planted black mangroves in nurseries. The project also developed actions and facilities to promite ecotourism

[1]. KATHIRESAN K (2012), Importance of Mangrove Ecosystem, International Journal of Marine Science, Vol 2, No.10, p.77
[2]. Ibid, p.72
[3]. Ibid
[4]. Ibid
[5]. The state of the World's mangroves (2021), Global Mangroves Alliance, p.20
[6]. Ibid, p.22
[7]. Ibid, p.24
[8]. TURSCHWELL M. et al (2020), Multi-scale estimation of the effects of pressures and drivers on mangrove forest loss globally, Biological Conservation 247, p.1
[9]. The state of the World's mangroves (2021), Global Mangroves Alliance, p.28

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