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Human threats and climate change impacts on mangrove ecosystem

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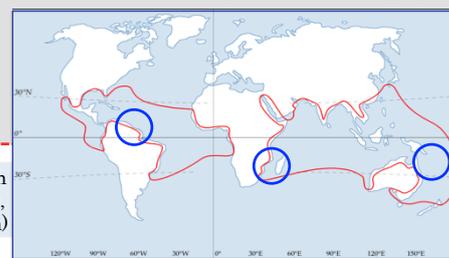
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1. Mangrove forest is a major ecosystem of tropical coasts that supports a wide range of ecosystem services, including protection against coastal erosion, a significant carbon storage capacity, nursery site for marine species, and retention of terrigenous pollutants.
2. However, mangroves have been largely threatened by direct human activities especially with the development of shrimp farming, urban expansion and agricultural practices over the last decades. Globally, around 40% of mangrove forests have been lost since the mid-twentieth century.
3. Mangroves are particularly sensitive to climate change, with various impacts on ecosystem structuring, functioning and dynamics. Sea level rise, increase in air and water temperatures, changes in tropical storm frequency and intensity are the factors that are the most likely to affect the integrity of mangrove forests.

Where they have not been directly disturbed by man, mangroves can be regarded as sentinels of climate change. This is true for the mangroves of French tropical overseas territories, that are specifically monitored in the framework of the CNRS/IRD's 2015 Year of the Mangrove initiative.



The global distribution of mangroves : Western and Eastern areas and localisation of the French overseas territory mangroves respectively French Guiana and West Indies Islands (Atlantic area), Mayotte and Scattered Islands (West Indian Ocean), New Caledonia and Wallis Island (Pacific Ocean)



1. At the interface between land and sea and through adapted root system, mangrove forest acts (i) as a buffer protecting coastal areas from erosion and inland areas from high waves and flooding, and (ii) as a biofilter limiting coastal sewage pollution. Due to high photosynthetic efficiency and rapid growth, mangroves are characterized by high productivity and biomass and are considered as among the most carbon-rich forests in the tropics. Occupying less than 1% of the world coastal area, mangroves contribute up to 15% to coastal sediment carbon storage. (a) Mayotte Island (b) French Guiana.



2. In recent decades, shrimp aquaculture has been the main driver of mangrove loss ($\approx 40\%$ of the total loss). Indonesia, the world's great mangrove country (21% of the world mangrove surface), is also one of the country with the highest mangrove loss rate worldwide, due to shrimp aquaculture. Here in Mahakam Delta (Kalimantan), 80% of the original mangrove have been destroyed since the 1980s.



3. Mangrove establishment and development is narrowly linked to sea level, wave and tidal energy, coastal marine currents and sedimentological dynamics. Changes in these parameters, in the context of climate change, lead/will lead to major disturbances for mangrove ecosystem. Nevertheless, the resilience capacity of mangrove can allow the mangrove to adapt to changes. In French Guiana (c), pristine mangrove is naturally adapted to a very strong coastal dynamics, and could have a better capacity to adapt to climate change than in other region. In the uninhabited Europa Island (French Scattered Islands) (d), important decaying processes appear within mangrove communities and may be interpreted as a sign of global or regional climate change.

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