



## Nature-based Solutions for disaster risk reduction - How many people do coastal ecosystems protect from tropical cyclones globally?

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Recently, Nature-based Solutions (NbS) have received increasing attention for their potential to contribute to climate change mitigation, as well as disaster risk reduction and adaptation to climate change. Previous research has used a variety of methods to assess NbS and ecosystem-based risk reduction. The overarching question we aim to answer is: How many people do coastal ecosystems protect from the impacts of tropical cyclones and resulting storm surges?

The combination of event-based risk modelling and ecosystem modelling data is a novel approach. This research uses the probabilistic model CLIMADA and ecosystem service data to quantify the coastal protection provided by coastal ecosystems. First, a baseline of the number of people impacted by tropical cyclones in the low-elevation coastal zone globally and the number of people simultaneously within the protection distance of coastal habitats is established. Next, the baseline is compared with historical habitat and population data from 1992. Looking to the future, we investigate changes in coastal protection under climate change (SSP585 in 2050). Finally, scenarios of different options for human action in protecting, managing, and restoring nature in the near future (2050) are appraised: continued forest conversion, agroforestry, mangrove restoration, and reforestation.

Currently, the annual average number of people in the global low-elevation coastal zone protected from tropical cyclones by coastal habitats is 13.84 million, which corresponds to approximately a quarter of all people impacted annually by tropical cyclones in this zone. Historically, the share of protected people has decreased by approximately 4%, both due to population developments and habitat loss. With climate change, the average annual number of people impacted will increase by up to 40%, however, there is a slight decrease in the share of people protected by coastal ecosystems. Protecting, managing, and restoring nature is important to prevent a further decrease in the protection provided by coastal ecosystems globally, but especially on a local scale. While the number of people protected globally only increases slightly across the nature management and protection scenarios, protection in individual countries can increase by around 30% under

reforestation or mangrove restoration, and around 5% under agroforestry. These findings form an important basis for NbS policy and use for disaster risk reduction and adaptation to climate change, e.g. by highlighting areas which have both a need for protection and a potential for NbS.