

Coastal adaptation against sea level rise makes economic sense

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Coastal zones in Europe contain large human populations, significant socio-economic activities and assets, and fragile ecosystems. Coastal communities will face increasing risk of floods as climate change could cause extreme sea levels to rise with one meter or more by 2100. Coastal

adaptation, however, could prevent 95% of the projected economic losses. These findings come from a new JRC study published today in *Nature Communications*.

In the absence of climate action and with continued demographic pressure and urbanization along coastlines, annual damages from [coastal flooding](#) in the EU and UK could increase sharply from €1.4 billion today to almost €1.6 trillion by 2100, with 3.9 million people exposed to coastal flooding every year.

The study underlines that coastal adaptation measures can protect Europe's communities from coastal flooding while also being economically efficient.

Around 95% of flood impacts could be avoided through coastal adaptation focusing on human settlements and economically important areas along the coastline. The extent to which adaptation can lessen the effects of coastal flooding and at what cost depends on the investment strategy adopted.

Past emissions will cause major sea level rise in the centuries to come, irrespective of our actions. Even if and when global warming is curbed, societies will need to adapt and better protect the coast. Adaptation is a global goal in the Paris Agreement on climate.

Rising seas, rising risk

Projected sea level rise is expected to expose Europe's coasts to unprecedented levels of coastal flood risk.

Between the year 2000 and 2100 extreme sea levels of coastal storms in Europe are very likely to increase by 34-76 cm under a moderate emission mitigation policy scenario, and by 58-172 cm under a high-

emissions scenario.

Under these scenarios, from 2050 higher seas would render a large part of the Mediterranean exposed every five years to extreme events that nowadays only occur once every century. This could apply to most European coastlines by 2100, with the only exception being the North Baltic Sea.

In the absence of further investments in coastal adaptation in the EU, the present average annual loss from coastal flooding of 1.4 billion € is projected to increase by two to three orders of magnitude, ranging between 210 billion € and 1.3 trillion € by 2100.

At present each year around 100,000 people are exposed to coastal flooding in the EU, and this number is projected to reach 1.6—3.9 million by the end of the century, again in the absence of adaptation.

Estimating costs and benefits of coastal adaptation

This study combines climate change projections and scenarios of socio-economic development from the Intergovernmental Panel on Climate Change (IPCC). It estimates the expected range of [economic losses](#) from coastal flooding during the present century under different greenhouse gas emission scenarios.

JRC scientists explored how different levels of coastal adaptation can reduce the projected losses and evaluated the costs and benefits of such interventions, allowing them to estimate the level of protection which is economically optimal.

The costs were calculated as the sum of national-level capital investment costs to raise dykes and maintenance costs. The benefits are the damages avoided by increasing the dyke height, comparing the difference

between future damages with and without raised dykes.

By no means hard protection is considered as the only or preferable adaptation option. Nature-based solutions create multiple benefits in addition to flood protection, such as increasing CO₂ storage, restoration of biodiversity, and offering recreational opportunities.

Dykes are considered in this first European level study, as they have been the most common approach so far and they can be implemented in parallel with more sustainable practices.

Such 'hybrid' solutions could not only deliver coastal protection but also ecological benefits, but need local planning and therefore demand for follow up action at smaller scale.

Differentiated adaptation challenges

A different adaptation approach is required per region. The concentration of human development renders adaptation very economically beneficial.

Benefits tend to outweigh costs in areas where population density is larger than 500 people per square kilometer. In urbanized and economically important areas the benefits tend to exceed the costs by at least an order of magnitude.

The Commission is already working to address these challenges

The EU is committed to mitigating climate emissions and tackle climate risk through adaptation. With the Green Deal for Europe it strives to achieve climate neutrality by 2050 and adopt a new, more ambitious

climate change adaptation strategy.

The EU Strategy on Adaptation to Climate Change aims at making Europe more resilient and minimize the impact of unavoidable climate change.

It stresses that [coastal zones](#) are particularly vulnerable to the effects of climate change, which challenges the climate resilience and adaptive capacity of our coastal societies.

This requires a strong EU Strategy and preparedness actions by Member States aimed at reducing the vulnerability of their citizens and economies to coastal hazards in order to minimize future [climate](#) impacts in Europe.

The EC published its recommendations for Integrated Coastal Management that build further on the principles and elements set out in the Council Recommendation on Integrated Coastal Zone Management of 2002, and the Protocol to the Barcelona Convention on Integrated Coastal zone Management, ratified by the EU in 2010.

This policy instrument requires establishing a coastal setback zone, extending at least 100 m landward from the highest winter waterline, taking into account, inter alia, the areas directly and negatively affected by [climate change](#) and natural risks.

The EC Floods Directive requires Member States to assess if all water courses and coast lines are at risk from flooding.

This includes mapping the flood extent, identifying the assets and humans at risk in these areas and taking adequate and coordinated measures to reduce this flood risk. Preserving healthy sandy beaches is an effective coastal protection measure, which in addition has minimum environmental effects.

More information: Michalis I. Vousdoukas et al. Economic motivation for raising coastal flood defenses in Europe, *Nature Communications* (2020). [DOI: 10.1038/s41467-020-15665-3](https://doi.org/10.1038/s41467-020-15665-3)

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