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The Impact of Sea Level Rise and Socioeconomic Growth on Ecosystem Services in the Atlantic Coastal Region

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Introduction

The future of coastal ecosystem services and values will depend on how much sea level rise (SLR) there will be in the future and how much socioeconomic development there will be. The combined effects of socioeconomic growth and floods on environmental services and values in the Atlantic coastal zone by 2100 are examined in this study. In order to achieve this, flood probability maps (using the Uncertainty Bathtub Model; uBTM) and local ecosystem service value (ESV) estimates (using meta-analytic-based global ecosystem service value functions for Provisioning, Regulating & maintenance, and Cultural ecosystem services across 12 biomes) are derived for a wide range of Representative Concentration Pathway (RCP) and Shared Socioeconomic Pathways (SSP) scenarios (ES). Examining their estimated values and paying attention to how they change (decrease/increase) over time is a crucial step in determining vulnerability and human dependence on coastal ES. In addition to informing policymakers, estimating their worth offers insight into the factors (such as site and context features) driving their high and low values. Additionally, evaluating future scenarios that involve socioeconomic development and climatic change offers insight into potential losses in ES values through time and countermeasures [1].

Coastal ecosystems are diversified, extremely prolific, crucial to global ecology, and highly valuable due to the variety of services they provide to people. These include provisioning services like the provision of food through the production of fisheries, fuel wood, energy sources, and natural products; regulating & maintenance services like shoreline stabilisation, nutrient regulation, carbon sequestration, detoxification of polluted waters, and waste disposal; and cultural services like tourism, recreation, aesthetics, spiritual experience, and religious and traditional knowledge. These ecosystem services (ES) and the values they represent are of immeasurable significance to human life and wellbeing, as well as to coastal communities, national economies, and international trade [2].

Description

Therefore, the goal of this study is to examine how future ecosystem services and values in the Atlantic coastal zone by 2100 will be impacted by flooding caused by sea level rise and socioeconomic growth. To this purpose, we combine the Uncertainty Bathtub Model (uBTM; to assess areas at risk of flooding) with combined socioeconomic (SSP1-SSP5), climate (RCP 4.5 and 8.5), and global value function transfer scenario. (For estimating local Provisioning, Regulating & maintenance and Cultural ecosystem service values). About 60 countries along the Atlantic coast are included in the study, which spans 5 continents. These assumptions were converted into quantitative projections for future energy and land use through Integrated Assessment Models (IAM) representing the global coupled energy-land-economy-climate system and its development over the 21st century in order to understand what these SSP narratives mean for future greenhouse gas emissions and climate change. IAM forecast the consequent emissions of greenhouse gases and air pollutants to the end of the century using consistent pathways for macroeconomic, energy system, and land use variables that are based on socioeconomic scenarios [3].

Over the coming decades and centuries, a wide range of societal elements will contribute to climate change. This prompts queries like "What will happen?" and makes predictions about their effects. Although uncertain, the future is not completely unknown. Given that we have control over the future, scenarios can be utilised to explore "What can happen?" and even "What should happen?". By constructing credible and coherent descriptions of potential climate change futures, scenarios for climate change arise in this way. These scenarios are projections of what might happen rather than predictions of the future. They may also serve as comprehensive descriptions of the means to achieve particular objectives. Even though the area at risk is only 2.4% of the overall area of the Atlantic coastal zone, the impacts vary depending on the type of coastal biome. According to the RCP 4.5 and RCP 8.5, Table 5 shows the Atlantic coastal zone's area at risk of flooding by biome. Fresh Waters and Coastal Wetlands are the biomes most at risk under RCP 8.5, with 36.4% and 16.6% of the area at risk, respectively. As a result of their frequent low altitude locations and concomitant direct ocean contact, these biomes are frequently disrupted by the ooding process. If the RCP 8.5 is not followed, the damages brought on by the flooding process will be irreversible [4].

The future danger of SLR by scenario for the year 2100 could be estimated as a result of the joint analysis of the RCP and SSP. In this analysis, the continental values for the reference year and for the ESV at risk based on the scenarios are distinguished by ecosystem service. The general comparison between the values in the reference year and those in the future scenarios is a problem worth bringing out. Based on data for the year 2100, the values in the risk of "ood" scenarios show a relative increase for the socioeconomic variables used in the meta-analytic value functions, particularly population and income. We give an analysis broken down by kind of ecosystem function to show the risk of ood caused by the SLR process. The change in ESV for each continent is for each RCP and SSP scenario, with the greatest value SSP scenario underlined above each value bar. Be aware that there is variation in the values, primarily as a result of changes in socioeconomic statistics (such GNI and PDen), which have been translated into various values at risk for ood [5].

Conclusion

Generally speaking, the Atlantic coastal zone is where the majority of the world's potential flood losses due to SLR are concentrated. The least affected continent is Central America, which does not have any countries included among the most affected nations, meaning they do not rank among the "Top 3" losses of each service considered. Another thing to keep in mind is that northern European nations, particularly the Netherlands, Denmark, and Sweden, are among the hardest hit. In these nations, the risk of flooding is higher, and as a result, the ESV losses are greater. The largest losses are seen for cultural services of the ESV examined. This is mostly due to the relationship between cultural ESV and coastal habitats, particularly coral reefs and wetlands (coastal and inland). The CCI-LC, a global database with a 300 m resolution and frequently too low to capture significant elements of the coastal zones, was the land cover used in this study. Furthermore, CCI-LC was not specifically created to take into account the features of any nation or

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biome; rather, it was created to be applied throughout geographic regions. In order to approximate the biomes used in the global ecosystem service value functions, it was essential to reclassify the land cover between the various classes. Alternatives, however, are few, and CCI-LC is now among the most complete databases of its kind to be found elsewhere in the world.

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