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Further Reading: Hynes, S., Burger, R., Tudella, J., Norton, D. and Chen, W. (2022). Estimating the costs and benefits of protecting a coastal amenity from climate change-related hazards: Nature based solutions via oyster reef restoration versus grey infrastructure. Ecological Economics, 194, 107349. https://doi.org/10.1016/j.ecolecon.2022.107349

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The costs and benefits of protecting a coastal amenity from climate change-related hazards

This research examines the recreational use values associated with a coastal walking trail under threat from increased episodes of storm surges and coastal erosion, and the cost of alternative grey and nature based infrastructure options that could protect it. These options involve restoring an oyster reef bar that would act as a natural breakwater versus a hard engineering solution such as an impermeable revetment. This comparison also facilitates the demonstration of the cost effectiveness of nature based solutions (NBS) for climate adaptation versus the grey alterative – information that is needed for climate adaptation and flood management planning. Research in which the monetary costs and benefits of NBS versus grey alternatives are compared are still limited and this study provides additional information to help fill that gap. The study was carried out at a coastal walking trail, on Galway Bay on the west coast of Ireland. In order to obtain information relating to the demand for recreational walking along the coastal path, an on-site survey of users was conducted while relevant cost information was compiled for the two protection alternatives.

Research Findings

The results of the on-site survey of users of the amenity and a negative binomial travel cost model demonstrated that the coastal trail has considerable recreational use value to local communities. In terms of a cost benefit analysis (CBA) it was found that both protection options resulted in a positive net benefit over a 20 year time horizon but the nature based solution had a benefit cost ratio multiple times larger than the grey infrastructure alternative. A sensitivity analysis was carried out to evaluate how robust the findings of the CBA were under a number of alternative assumptions. These included employing a higher discount rate, applying lower estimates of the benefits and capital costs used for the hard engineered solution, the addition of maintenance costs or the costs of some rock armour in a hybrid solution as part of the oyster reef restoration alternative and examininig the situation where not all the recreational use value is lost following path damage. The conclusions of the analysis remained valid under the sensitivity analysis. While only the the amenity use value was considered in the CBA the native oyster also has substantial cultural value to Galway city and county not captured in the study. Nor did the CBA take into account the possible negative impacts of the grey infrastructure alternative on marine ecosystems which would further increase the costs associated with it in a complete social CBA. However, even without the inclusion of these additional non-use and other ecosystem service values, the benefit cost ratio is greater than unity for the oyster reef protection option in all cases.

Policy Implications

The results suggest a compelling case for embedding nature based solutions in climate adaption and flood management planning for low lying coastal areas where recreational resources are under threat as it can be not only more cost effective but may also offer other ecosystem benefits to coastal communities. The fact that oyster reefs can also adapt to sea level rise with vertical growth rates that are faster than the expected rate of sea level rise also makes them a good NBS to consider for dealing with climate change-related natural hazards in low lying coastal areas.