

## Restoring Nature's Benefits provided by the Gulf of Mexico

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For the past several years, I have had the privilege of serving on a National Research Council Committee analyzing the Effects of the *Deepwater Horizon* Mississippi Canyon-252 Oil Spill on Ecosystem Services in the Gulf of Mexico. My views on restoration in the Gulf have been shaped by the rich dialog that has occurred in Committee deliberations. The views expressed in this testimony, however, are my own and do not represent the official views of the Committee.

The Gulf of Mexico is an asset of tremendous value to the 22 million residents of Gulf Coast and to the American public at large. The Gulf of Mexico supplies numerous benefits including a large fraction of the total value of fisheries in the US, beaches and other recreational opportunities that support a multi-billion dollar tourism and recreation industry, and approximately 30% of the oil and 20% of the natural gas produced in the US. Intact coastal ecosystems, such as mangroves and coastal marshes, also provide vital protection for coastal communities and infrastructure from storm surge generated by hurricanes and tropical storms in the Gulf.

The benefits generated by the Gulf of Mexico are currently at risk. Like careless investors who have failed to maintain vital plant and equipment and see a subsequent decline in productivity of their assets, societal actions have degraded the natural capital of the Gulf with negative impacts on the benefits it provides. Some of the degradation is the result of chronic long-term abuse. Human actions have vastly increased the flow of nutrients carried by the Mississippi River to the Gulf. This increase in nutrients has led to massive algae blooms. When the algae die, their decomposition consumes oxygen in the water leading to a large hypoxic zone with too little oxygen to support fish and other marine life. In previous times the Mississippi River periodically flooded sending silt and sediment laden waters through coastal wetlands. But navigation and flood control projects have fixed the Mississippi River in its current path to the sea and channeled the large sediment load of the river out through the Mississippi River Delta into relatively deep waters of the Gulf. Deprived of the inflow of sediments, the coastal wetlands of Louisiana have receded. It is estimated that there has been a net loss of approximately 1,850 square miles of wetlands. To put this loss in context, there are currently less than 10,000 square miles of coastal wetlands remaining so this represents a relatively large percentage loss of wetlands.

The Deepwater Horizon oil spill in April 2010, the largest oil spill in US history, occurred on top of these chronic long-term impacts. The oil spill led to fishery closures, the oiling of 1100 linear miles of coastal marshes, and a major decline in tourism. The oil spill caused severe stress both on the environment and on Gulf Coast communities reliant on fisheries and tourism. The oil spill showed in dramatic fashion the degree to

which the health of the region's economy and community vitality are dependent on a healthy environment.

The worst impacts of the oil spill proved to be relatively short-lived. After a very tough year in 2010, by 2011 fisheries had reopened and tourists had returned. The ecosystems of the Gulf of Mexico, like its people, have proven to be resilient. But the long-term toll from both the acute damage of the oil spill and the chronic damages of other environmental changes is not yet fully known.

For all of the damage and stress caused by the Deepwater Horizon oil spill, the oil spill has also led to an opportunity to reverse decades of decline in the Gulf of Mexico. The Resources and Ecosystems Sustainability, Tourist Opportunities, and Revived Economies of the Gulf Coast States Act (RESTORE Act) passed by Congress in 2012 provides a once-in-a-lifetime opportunity to reinvest in the natural capital of the Gulf of Mexico. If we are good investors of the funds available under the RESTORE Act we can ensure recovery of the Gulf of Mexico so that it continues to provide benefits to current and future generations. It is important to emphasize that restoration efforts are good not only for environment but for lives of people who depend on a healthy Gulf of Mexico. Done well, these investments in restoring the natural capital of the Gulf will offer a high rate of return with benefits that far exceed the cost of investment.

Investing in restoring nature capital is not exactly the same as other more common forms of investment but there are many similarities. As with other forms of investment, the rate of return on investment depends on both the increase in the value of benefits generated by the investment and the cost of the investment. So, for example, the rate of return on investing in restoring coastal marsh can be found by calculating the increase in value from fishery productivity, coastal protection, and other benefits attributable to marsh restoration, divided by restoration cost. Restoring a healthy functioning ecosystem, such as a coastal marsh, makes it possible to improve performance in multiple dimensions (e.g., fishery productivity, coastal protection, recreation). Investing in nature often most closely resembles investing in infrastructure in that it provides the basic conditions under which it is possible to derive multiple benefits, much like the building of roads or ports allows many businesses to thrive. In the case of investments in natural capital, however, it can, be difficult to link particular actions to particular results because of the complexity of large interconnected systems like the Gulf of Mexico. For example, the restoration of coastal marshes may have a positive influence on fishery productivity but this affect may be difficult to detect given changes in ocean conditions or freshwater inflow and nutrients caused by rainfall patterns hundreds of miles inland.

Attempting to estimate rates of return on investments in natural capital requires knowledge about how people benefit from nature and the likely impacts of any investment on the performance of natural systems. To better understand what is involved in calculating a rate of return for investing in natural capital, consider the example of investing in oyster reef restoration. Oyster reefs have been in significant decline in the Gulf and around the world. Oyster reefs are estimated to have declined globally by 85%. The Nature Conservancy recently led an effort to restore oyster reefs along portions of

the Gulf Coast including a major effort in Mobile Bay. Oyster reef restoration provides a number of benefits including increased harvest of fish and shellfish that rely on oyster reefs for food or shelter, improvements in water quality from removal of nitrogen in water that leads to algal blooms and hypoxia, coastline protection from erosion and flooding from storms, as well as providing a harvestable supply of oysters and larvae that can be used to seed others areas. The majority of the value of the benefits of oyster reef restoration in Mobile Bay is due to increased coastal protection. The value of increased coastal protection provided by oyster reefs can be estimated either by calculating what it would cost to build bulkheads or other infrastructure that would provide the same degree of protection (called “replacement cost”) or by calculating the degree to which oyster reefs would lead to diminished erosion and flooding and the reduction in damage to coastal properties that would result (called “avoided damage”). The contribution of the oyster reef in terms of fish and shellfish production requires estimating the increased productivity of various fish and shellfish fisheries along the net revenue from harvest. While there are sometimes data gaps and other technical issues, ballpark estimates of value for all of these benefits can be generated. Other benefits, however, such as the value of improved water quality, which are no doubt of great value to Gulf Coast communities, present more difficult challenges for estimating benefits in monetary terms.

In general, it is difficult to get a complete accurate accounting of all of the benefits of restoring natural capital. But often a complete accounting is not necessary to know that investing in natural capital is a good idea. Even a partial accounting can show that the benefits of investing in nature far outweigh the costs.

There are two other issues regarding restoring the natural capital in the Gulf region: a) the distribution of benefits from restoring natural capital, and b) restoring resiliency. First, while everyone is for restoring the Gulf in general, there are likely to be disagreements about specific investment plans (“the devil is in the details”). Restoration at particular locations along the Gulf Coast will generate benefits to specific groups and not others. For example, restoring oyster reefs in Mobile Bay will generate benefits for communities in and around Mobile Bay but may do little to help communities elsewhere. There is a danger that the whole restoration process could get bogged down in disputes over distribution of benefits. It is important for the restoration process to get agreement up front, before restoration activities begin in earnest, on rules for ranking high priority investments as well as transparent guidelines for carrying out investments.

Second, the Gulf of Mexico is subject to natural disturbances, such hurricanes, as well as human-caused disturbances, such as oil spills. Hurricanes, oil spills and other disturbances often result in the disruption of the flow of benefits (e.g., loss of fishery productivity). Resilient systems are able to absorb disturbances and recover. Loss of resilience may lead to collapse of important system processes and make the system more susceptible to future losses of important benefits. Investing in restoration of natural capital will likely increase resilience and reduce the probability of sudden declines in benefits, like loss of oyster beds or fish stocks, with future disturbances.

The RESTORE Act provides a rare opportunity to invest in nature and revitalize the Gulf Coast, reversing decades of neglect and the impacts of the oil spill. Investing wisely will bring numerous valuable benefits to people living along the Gulf and the American public more generally. Making wise investments requires clear thinking, good science and evidence on what works, clear rules to guide investment, and strong leadership. Investing in nature is not simply about making the environment whole. It is about making the American public whole. Wise investments in nature will result in repayment many times over for current and future generations. We need to do everything we can to insure that we make wise investments on behalf of the American people.