BETWEEN SEA AND EARTH — PROTECTING AN ESSENTIAL BUFFER

Neither ocean nor land, coastal zones are ecologically and economically important. Making up a fifth of the earth's surface, coastlines are experiencing the swiftest population growth on earth. Livelihoods in tourism, industry, fishing and trade, as well as revenues worth hundreds of billions of dollars are generated on and in these coastal waters.

Food for Growing Populations

Wild fish caught in coastal zones serve as an essential source of feed for aquaculture, the world's fastest growing food production system that depends heavily on marine fisheries. The OECD–FAO Agricultural Outlook 2013–2022 projects that aquaculture will surpass 'capture' fishing as the main source of fish for human consumption by 2015. The total world production of farmed fish production now exceeds beef production[1].

Irreplaceable Protection

Since healthy coastal zones are powerful contributors to sustainable ecosystems and economies, they need to be preserved. They serve as natural coastal protection in the form of mangrove forests, sand banks, corals and salt marshes, moderating the full impact of floods and ever more powerful storm surges, which are expected to be more frequent with warming waters and rising sea levels. Coral reefs, for instance, break surf and prevent damage to coastlines and their natural defences. But these natural protections are themselves under threat, making coasts even more vulnerable. Coral, for example, is sensitive to rising ocean temperatures and higher acidity and is increasingly threatened. According to the UNEP, as much as 7% of mangroves, salt marsh plants and seagrasses are lost every year.

Carbon Sink

These weakening, natural protective barriers play a dual role in moderating climate disruptions. 'Blue' carbon sinks, like mangroves, saltmarsh plants and seagrasses, capture more than half of the naturally captured carbon emissions. The UNEP estimates that the earth's 'blue' carbon capture capacity is equal to half the annual emissions from the global transport sector.

Coastal zones serve as natural coastal protection in the form of mangrove forests, sand banks, corals and salt marshes, moderating the full impact of floods and ever more powerful storm surges, which are expected to be more frequent with warming waters and rising sea levels. (Photo: iStockphoto)

Threats

Beyond threats to coasts' natural protection, there are several other reversible threats burdening these ecological treasures.

Run-off

Agricultural run-off triggers algal blooms in coastal zones, which can lead to toxic seafood contamination and later to oxygen-depleted dead zones (see 'Pollution Effects on Oceans and Marine Life', pages 24-25). Herbicides in run-off can kill mangroves, reducing biodiversity since the mangroves serve as fish nurseries.

Dredging and dumping

Deeper harbour channels are needed to handle ever deeper draught cargo ships, but the dredged sediment carries pollutants that are then dumped in concentrated form in an otherwise undisturbed area. Life forms that cannot escape are buried and the pollutants contaminate that ecosystem. Annually, hundreds of millions of cubic metres of sediments are dumped worldwide.

Industrial effluent can be treated using radiation without adding any other chemical substances or generating radioactivity. This technique can be used to clean wastewater and reclaim water for use in industry and agriculture.

Wastewater

Municipal sewage increases the 'turbidity', or cloudiness, of water, which cuts the amount of light reaching organisms like seaweed, seagrasses and corals. Solids bury marine life that lives on the seabed. Pathogens are also transported by untreated sewage that can cause diseases like typhoid, hepatitis and cholera. Nitrogen in sewage is difficult and expensive to remove and when released in the sea can trigger or extend dead zones and increase turbidity. In developing countries, the UNEP estimates that up to 90% of municipal wastewater entering rivers, lakes and coastal zones is untreated.

Weakening Resilience

These combined threats push coastal marine environments' resilience to a tipping point, beyond which these environments may no longer recover. According to the UNEP's Blue Carbon report, the carbon sinks and fisheries in coastal zones can be reinvigorated, if measures are taken to regulate the activities that cause damage, such as coastal reclamation, mangrove removal, fertilizer overuse, silting caused by deforestation, overfishing and unsustainable coastal development.

Solutions

Radioactive isotopes, or 'radiotracers', are used to precisely measure the purification efficiency of wastewater facilities and drinkable water production facilities, aiding their design and improving their performance. Minute quantities of radiotracers can be reliably detected in large-scale processing, such as treatment plants handling millions of litres of effluent daily. (Learn more about radiotracers on page 7)

Sewage sludge, which normally would be released into waterways, can be irradiated to produce both fertilizer and sterile water for agriculture, improving crop yields, food safety and reducing the demand for fresh water. Isotopic techniques are used to map how sediment moves, ensuring that dredged material can be released in an area where it cannot migrate into ecologically sensitive regions or return to the dredged harbour.

Industrial effluent can be treated using radiation without adding any other chemical substances or generating radioactivity. This technique can be used to clean wastewater and reclaim water for use in industry and agriculture. Irradiation removes persistent organic pesticides and toxic compounds. An electron beam can irradiate wastewater containing chemicals that resist being broken down with heat, such as those used in manufacturing textile dyes. After irradiation these chemicals are either rendered harmless or converted to substances that are easily removed by using conventional treatment techniques.

Peter Kaiser, IAEA Division of Public Information

[1]Earth Policy Institute, Plan B Updates; June 12, 2013; Farmed Fish Production Overtakes Beef; Janet Larsen and J. Matthew Roney.