Technology Fact Sheet for Adaptation

Coastal wetland protection and restoration [i]

Technology: Coastal Wetland Protection and Restoration	
Sector : Coastal Zone	
Subsector :	
Technology characteristics	
Introduction	Wetland habitats are important because they perform essential functions in terms of coastal flood and erosion management. They induce wave and tidal energy dissipation (Brampton, 1992) and act as a sediment trap for materials, thus helping to build land seawards. The dense root mats of wetland plants also help to stabilise shore sediments, thus reducing erosion (USACE, 1989). Wetland restoration re-establishes these advantageous functions for the benefits of coastal flood and erosion protection. Techniques have been developed to reintroduce coastal wetlands to areas where they previously existed and to areas where they did not, but conditions will allow. The diversity of wetland types means there are numerous methods for restoring wetlands. The method adopted will depend on the habitat which is being restored.
Technology characteristics/highlights	The most commonly restored wetland ecosystems for coastal protection are salt marshes and mangroves. Sea grass may also be employed as a coastal defense, to dampen waves but on their own are seldom considered an adequate shore protection alternative. Salt marshes are widely re-established: • through managed realignment schemes. • whilst maintaining the present coastline position through vegetative transplants from healthy marshes, and • may require the site's elevation to be raised using appropriate fill material. Mangrove restoration includes: • collecting plant propgules from a sustainable source, • preparation of the restoration site for planting at regular intervals at an appropriate time of year • Establishment of nurseries to stockpile seedlings for future planting • Planting dune grasses. These grasses provide a stable, protective substrate for mangroves to establish their root systems in.
Institutional and organizational requirements	At a local level, proactive measures can be implemented to ensure wetland habitats are maintained and used in a sustainable manner. This will preserve habitats into the future, reduce or even avoid the cost of restoration and planting schemes and avoid the many potential problems encountered in the course of wetland restoration efforts. It is important that the multiple agencies involved in shoreline management avoid providing conflicting guidance (e.g.

	clear mangroves because these areas are a breeding ground for malaria-transmitting mosquitoes v. Valuing the ecosystem services provided by mangroves, including their coastal protection function). At a larger scale, it is useful for governments to adopt proactive coastal management plans to protect, enhance, restore and create marine habitats. Without such a framework, action to restore wetlands is likely to be fragmented and uncoordinated.
Operation and maintenance	In contrast to hard defenses, wetlands are capable of undergoing 'autonomous' adaptation to SLR, through increased accumulation of sediments to allow the elevation of the wetland to keep pace with changes in sea level. Provided wetlands are not subjected to coastal squeeze, and the rate of SLR is not too rapid to keep pace, wetlands are capable of adapting to SLR without further investments.
Endorsement by experts	The restoration and recreation of wetlands can also reduce or even reverse wetland loss as a result of coastal development. This is important in terms of maintaining the global area of wetlands and in sustaining wetlands in the face of climate change. Wetland creation may also fulfill legal obligations for the compensation of habitats lost through development, treatment of wastewater and reduction on non-point pollution. Evidence from the 12 Indian Ocean countries affected by the 2004 tsunami disaster suggested that coastal areas with dense and healthy mangrove forests suffered fewer losses and less damage to property than those areas in which mangroves had been degraded or converted to other land use (Kathiresan & Rajendran, 2005).
Adequacy for current climate	Fits well, both for present and expected climate.
Scale/Size of beneficiaries group	Wetland creation can bring about various economic, social, and environmental benefits to local communities (see direct and indirect benefits section below).
Disadvantages	The disadvantages of wetland restoration are minimal. One possible disadvantage is the space requirement in locations which are often of high development potential (but also increasingly high flooding potential). Wetland restoration is also likely to require a degree of expertise, especially in locations where wetland re-colonisation has to be encouraged by transplanting wetland plants and wetland habitats are difficult to recreate.
Capital costs	
Cost to implement adaptation technology	Different types of wetland will require different restorative measures with varying costs and labour requirements. A number of factors which are likely to contribute toward variations in costs are given below (Tri et al. 1998): • Type of wetland to be restored, expertise availability, and consequent chances of success • Degree of wetland degradation and consequent restoration requirements

	• Intended degree of restoration (for example, it may not be possible to restore all the ecosystem functions of a wetland if it is located in a highly industrialised/urbanised environment and the planned restoration measures may be less ambitious) • Land costs if land purchase is required to convert to wetlands • Labour costs • Transportation distance between seedling source and planting site • Seedling mortality rate between collection and planting • Cost of raising specific species in nurseries before transplantation because they cannot be directly planted on mud flats due to strong wind and wave forces In general, restoring wetlands costs US$3,500 to $80,000 per acre (http://www.bnl.gov/erd/peconic/factsheet/wetlands.pdf). This translates into costs of the order of Rs~6,000/m to Rs~141,000/m for 25m wide restored areas. Mangrove plantation at Mon Choisy, Mauritius has been estimated at **Rs5,640/m** (Adaptation Fund project, pp54-55) Restoration of estuarine areas in Australia (Dumaresq island and Tuross) have cost between Rs750/m to Rs1,250/m. Tri et al. 1998 have studied the cost of establishing mangroves in Vietnam, and found cost of plantation to be US$41/ha (in 2009 prices). Assuming that the width of the mangrove plantation was 25m, this corresponds to a cost of **Rs31/m**. This cost includes the cost of planting and thinning 6 years onwards.
Additional cost to implement adaptation technology, compared to "business as usual"	To make the case for wetland protection, flood mapping might be a necessary pre requisite as well as educating the public about usefulness of wetlands for coastal eco-system protection and preservation. Scale of post-implementation monitoring operations might also affect the cost.
Long term cost (i.e. 10, 30, or 50 years) without adaptation	Low water quality, coast erosion and flooding.
Long term cost (i.e. 10, 30, or 50 years) with adaptation	Because the wetlands require little maintenance, long-term costs are quite low and are mainly due to monitoring program of sediment retention and its ability of dealing with contaminants.
Development impacts, direct and indirect benefits	
Direct benefits	The restoration of natural ecosystem services, including flood and erosion protection benefits. Coastal wetlands improve the productivity of coastal waters for fishing and offer recreation opportunities. Coastal Wetlands are a sustainable source of timber, fuel and fibre.
Reduction of vulnerability to climate change, indirect	Reduction in physical damage to property, source of sustainable materials and reduction in human casualties in case of large waves caused by storms.

Economic benefits, indirect Employment Growth & Investment	Given the importance of the fishing sector in many coastal communities in developing countries, coastal wetlands are highly beneficial. Improved fishing effect may increase incomes of local communities and contribute toward local sustainable development. Other goods and services provided by wetlands, such as the provision of wood and fibers could also prove highly beneficial to local communities, especially in developing countries. Wetland recreation can also create opportunities for eco-tourism and increase recreational opportunities.
Social benefits, indirect Income Education Health	 See above. Creation of wetlands, especially in or in close proximity to urban areas can even serve to increase awareness of the important functions performed by these habitats. Improved water and habitat quality with lowered risk of storm flooding
Environmental benefits, indirect	Coastal wetlands provide a number of important ecosystem services including water quality and climate regulation, they are valuable accumulation sites for sediment, contaminants, carbon and nutrients and they also provide vital breeding and nursery ground for a variety of birds, fish, shellfish and mammals.
Local context	
Opportunities and Barriers	**Opportunities:** There is an opportunity to implement wetland restoration or creation together with hard defenses such as dikes or seawalls. In such a case, the presence of wetlands on the seaward side of the defense leads to lower maintenance costs over the lifetime of the structure. **Barriers:** The establishment of wetlands which provide full coastal flood and erosion protection takes time, and the approach does not offer immediate benefits. As such, wetland recreation may not be practicable where coastal management is reactive and focused on hard defenses. A desire to improve wetland habitats also needs to exist before the strategy can go ahead. This may involve raising public awareness of the benefits of wetland restoration and (re)creation, the lack of which is itself one of the most significant barriers.
Market potential	The technology has been in use for past 20-30 years worldwide. The market for learning from successful implementation and management

	restoration and protection projects exists worldwide.
Status	Tourism Development Plan for Mauritius calls for initiatives that will maintain a pristine coastal zone. They call for wetlands protection through prohibitation on filling in wetlands and destroying mangroves. The Ministry of environment has retained consultants to assess the environmental risks in the Grand Baue area specifically with respect to the development of wetland areas and the potential impact on flooding and water quality.
Timeframe	Short term to Medium Term
Acceptability to local stakeholders	Without additional understanding, local communities might oppose the restoration of coastal wetlands, seeing it as a loss of land with development potential.

[i] **This fact sheet has been extracted from TNA Report – Technology Needs Assessment Reports For Climate Change Adaptation – Mauritius. You can access the complete report from the TNA project website http://tech-action.org/**