Wetland
ecosystem services

Factsheet 1
in a series of 10

Flood control

Natural floodplain of the Morava River, Slovakia. Photo © Viera Stanová

Different types of wetlands play important flood control roles in different situations. In the upper reaches of some river basins, for example, peatlands and wet grassland can act like sponges (saturated peat is typically up to 98% water by mass), absorbing rainfall and allowing it to percolate more slowly into the soil, thereby reducing the speed and volume of runoff entering streams and rivers. This means that water levels in larger channels, further downstream, also rise more slowly and human lives and livelihoods are less likely to be affected by destructive flash flooding.

When peat becomes completely saturated and unable to absorb any more water, surface pools and peatland vegetation – including sedge meadows and some types of forest – help to slow and reduce runoff. Artificial drainage of peatlands, on the other hand, can lead to increased flood risk, since the drainage channels convey surface runoff to streams and rivers more quickly, while shrinkage and erosion of dry peat can mean that there are more numerous and wider sub-surface routes for water to flow through.

In the lower reaches of major rivers, wide floodplains typically develop, such as those of the Nile (Africa), Mississippi (USA), Yangtze (China) and Danube (Central Europe). Under natural conditions, peak river discharges – after exceptionally heavy rainfall or spring snowmelt for instance – spread out slowly across the floodplains. However, over centuries of human history, the fertile, conveniently flat floodplains have been used increasingly for agriculture and settlement.

Particularly during the last 100 years, huge areas of floodplain have been drained and cut off from their rivers by artificial embankments (termed bunds, dykes or levees in different countries). This means water that used to spread out slowly and relatively shallowly across broad floodplains is now concentrated into ever-smaller areas. As a result, floods are deeper and more likely to cause damaging – sometimes catastrophic – impacts if and when artificial flood banks are breached. In the middle reaches of the Yangtze River, for example, flooding has become more frequent and more damaging as a direct result of floodplain loss, especially when combined with the loss of vegetation cover in the river's drainage basin.

In brief...

- **Slowing the flow** – wetlands close to the headwaters of streams and rivers can slow down rainwater runoff and spring snowmelt so that it doesn't run straight off the land into water courses. This can help prevent sudden, damaging floods downstream.
- **Nature's flood storage reservoirs** – the floodplains of major rivers act as natural storage reservoirs, enabling excess water to spread out over a wide area, which reduces its depth and speed. By draining floodplains and building on them, we have effectively squeezed the floodwater into narrower and narrower corridors, which means that flood peaks are deeper and floodwater travels faster.
- **Protection from storm surges** – coastal wetlands, such as coral reefs, mangroves, tidal flats, deltas and estuaries, can limit the damaging effects of storm surges and tidal waves by acting as a physical barrier that reduces the water's height and speed. Wetland vegetation such as mangroves and saltmarshes can literally bind the shoreline together and reduce erosion from storms and freak tides.

Flood control...

Saltmarshes, such as here in Chignecto Harbour Ramsar Site in Nova Scotia, help to absorb and slow floodwaters from storm surges. Photo © Clayton Rubec

Destruction of vegetation in the upper reaches has led to soil erosion: over just 30 years forest cover has been reduced by half, and the area suffering from severe erosion has doubled. In the lower reaches, land claim and siltation has reduced the area of floodplain lakes and thus flood storage capacity, while construction of artificial embankments – such as the Great Jinjiang levee – has caused flood levels to rise due to constriction of floodplain capacity and silting up of the river channel.

In 1982, an earth dam within the US Rocky Mountain National Park collapsed, resulting in the sudden release of nearly one million cubic metres of water. A wall of water up to 10 metres in height swept downstream, entering Fall River at Horseshoe Park. Fortunately, in this area, wetlands adjacent to the river – including meadows with dense stands of reed and willow – slowed the flood wave, which spread out across the wide floodplain. The surge, reduced to a 3-metre wave, was finally contained by another dam downstream. The disaster claimed four lives and resulted in over US$30 million in damage (1982 prices). However, without the Horseshoe Park wetlands the catastrophe would have been even worse.

Coastal wetlands, such as mangroves, saltmarshes, lagoons and estuaries, play an important role in protecting human communities from storm surges. Once again, the destruction of such wetlands through land-claim and conversion for urban, industrial and agricultural development can have deadly consequences. When Hurricane Katrina struck the Mississippi Delta region of the south-eastern United States in 2005, a massive storm surge overtopped the engineered flood defences inundating 80% of the city of New Orleans, resulting in hundreds of deaths, severe long-term health and social problems and tens of billions of dollars in economic costs. The vulnerability of New Orleans has been blamed in large part on artificial constriction of the Mississippi's floodplains and on erosion of the delta's protective barrier of coastal wetlands because the river-borne sediments that maintain these wetlands have been trapped behind upstream dams.

With global climate change set to accelerate already rising sea levels and increased storminess in many parts of the world, the need for intact coastal wetlands has never been greater. Yet many wetlands remain under threat of development, while others are 'squeezed' out of existence, trapped between rising sea levels on their seaward side and land that is already drained and developed on their landward side.

There have been various attempts to estimate the economic value of natural flood control by wetlands – usually based on calculating the construction and ongoing maintenance costs of the engineered structures that would need to be built if an existing wetland were drained or filled in. For example, an assessment of the economic benefits of the 1,150-hectare Insh Marshes Ramsar Site in Scotland (UK) found that the capital costs of building replacement flood defences would be several million pounds. And the annual economic value of the remaining Danube River floodplains, including their flood mitigation function, was assessed in 1995 at EUR650 million.

Ramsar
CONVENTION ON WETLANDS

Ramsar Convention Secretariat
Rue Mauverney 28
1196 Gland
Switzerland
T +41 22 999 0170
F +41 22 999 0169
E ramsar@ramsar.org
W http://ramsar.org