

Changing Climates, Changing Deltas

The International Association of Dredging Companies (IADC) explains how climate change influences the river deltas and what has been done to mitigate the risk.

Asia has many major, important river deltas, including the Ganges-Brahmaputra delta in India/Bangladesh, which is considered to be the largest in the world; Mekong, Vietnam; Chao Phraya, Thailand; Godavari, India; Krishna, India; Mahakam, Indonesia; and Yangtze-Kiang, China. These deltas often have large ports and harbours and thus become hubs of industry and trade. However, with land hardly above sea level or most often below it, deltas are quite vulnerable to natural disasters. Land subsidence can also be threatening.

Studies indicate that subsidence or sinking is worsened by the impacts of human activity, such as upstream sediment collection caused by reservoirs, dams, accelerated sediment compaction and control of river channels. Under these circumstances deltas are often subject to flooding and require frequent attention to their sea defences, and this is without considering the consequences of climate change.

As a result of climate change and rising sea levels, this vulnerability is already becoming more acute and causing severe impacts on the natural processes in deltas. The lives of the millions of people living there have been and will be affected dramatically. Today about 500 million people live in or near river deltas and the prognosis for the future is that people will continue to gravitate to these fertile areas.

Flood risk and erosion

According to the Intergovernmental Panel on Climate Change (IPCC), climate-related changes in the past century are continuing in the 21st century and include an acceleration in sea level rise, further rise in sea surface temperature, more extreme weather events and storm surges, altered precipitation and ocean acidification. This could lead to a 50 percent increase in delta surface areas that are vulnerable to flooding. At coastal zones and deltas these climate-related changes are already having a range of physical, economic and social impacts.

On the border between India and Bangladesh at the Sundarbans islands, which are amongst the world's largest collection of river delta islands, woven through by an elaborate network of streams and tributaries, the sea level rise has already proved



The Mekong river delta in Vietnam.

devastating. Nearly 31 square miles of the Sundarbans have vanished entirely and more than 600 families have been displaced, according to local government authorities. Four million people on the Indian side alone, as well as the royal Bengal tigers that make their habitat there, are threatened by flooding related to climate change.

And in a worse-case projection, a Vietnamese government report said that more than one-third of the Mekong delta, where 17 million people live and nearly half the country's rice is grown, could be submerged if sea levels rise by three feet in the coming decades.

Rising sea levels are increasing the flood risk and erosion along the coast, but they may also impact freshwater availability. They are already resulting in an accelerated loss of coastal ecosystems like wetlands and mangroves. Climate experts emphasise the importance of adapting to these effects by developing and implementing coastal protection and adaptation strategies for each deltaic region, be it a delta where water is rising rapidly or other areas where a water shortage is resulting.

Are soft solutions a better approach?

Many solutions of the past – the hard technical defence solutions that completely block the natural processes – need to be reconsidered.

What once were accepted solutions are often not sustainable anymore because of the increased dangers brought on by global warming. New approaches are therefore being sought.

In the current search for sustainability, a more flexible approach, the so-called 'building with nature' strategy, is being developed by major international dredging companies. These 'soft' or system-based measures present strategies in which the natural, dynamic forces in a delta are re-instated. Research indicates that these system-based methods may be a better way of coping with climate change. Many research organisations as well are exploring, developing and implementing new softer approaches, which create a dynamic equilibrium between land and water.

Soft solutions include employing physical measures aimed at the management of sediment and/or at the management of water; adapting human behaviour; and in some cases, taking no action at all.

Physical measures for managing sediment and water can entail full or partial recovery of a water system such as removing dikes, seawalls and dams as well as steering natural processes by creating flood areas and using sand replenishment along the coastline. Dredging is an important tool for addressing these problems.

Western Europe has a long tradition of beach nourishment, using trailing suction hopper dredgers that rainbow sand onto the shore. In recent years, given the looming crisis of global warming, dredging contractors have sought new cost-effective, environmentally sound, long-term solutions. One of these, known as the Sand Motor, uses large quantities of foreshore placement and then allows currents to gradually transport sand to shore. Other pilot projects for the restoration and/or relocation of dunes are being conducted, as well as measures for managing salt marshes, mangroves and re-creating wetlands.

Adapting human behaviour may be more difficult, but spatial planning of deltas, which includes the evacuation or even relocation of people to less risky higher elevations, can be effective in reducing the harm to life and livelihood caused by flooding. By identifying flood hazard and buffer zones, damage can be controlled. Taking no action at all is probably only feasible in less populated coastal areas where swift evacuation in times of flooding can be easily realised.

These soft system-based strategies may be less expensive than hard technical solutions and more sustainable in the long term. The key is an integrated approach, combining technical, ecological (or natural) and social measures. A storm-surge barrier at the mouth of a river, which can be closed and opened so that protection is provided and natural processes remain active, is one such remedy that has been successfully used in the UK and the Netherlands.

Current efforts

Several systems have been and are being developed to help scientists and engineers study river deltas and devise new soft engineering solutions. The World Delta Database (WDD) website (www.geol.lsu.edu/wdd) contains data about vulnerability and physical characterisations of specific deltas. It offers a means to determine indicators of the physical vulnerability of the coastal area as well as the risks to society at those areas. The goal is to discover soft, ecosystem-oriented engineering solutions that permit adaptation or mitigation responses from these coastal communities.



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In addition, EcoShape (www.ecoshape.nl), a consortium of Dutch specialists with a rich history of solving coastal infrastructural challenges in the Netherlands and abroad, is working on systems for the benefit of sustainable coastal development and protection such as land reclamation, sea and river defences, dike building, dredging to protect nature, and developing state-of-

the-art models for ecodynamic design.

Deltas are diverse and complicated ecosystems and no one-size-fits-all solution is suitable. Continued research efforts are a necessity. Investments in the further study of ecological, morphological, economic and social factors must be made and cooperation amongst a variety of international and national agencies and the private sector is imperative. Finding the best solutions in terms of quality of life, safety and affordability will present government authorities with decision-making challenges.

The private sector, including engineers and dredging companies, also has a role to play in pursuing innovative, system-based delta management. ■

IN THE CURRENT SEARCH FOR SUSTAINABILITY, A MORE FLEXIBLE APPROACH, THE SO-CALLED 'BUILDING WITH NATURE' STRATEGY, IS BEING DEVELOPED BY MAJOR INTERNATIONAL DREDGING COMPANIES. THESE 'SOFT' OR SYSTEM-BASED MEASURES PRESENT STRATEGIES IN WHICH THE NATURAL, DYNAMIC FORCES IN A DELTA ARE RE-INSTATED. RESEARCH INDICATES THAT THESE SYSTEM-BASED METHODS MAY BE A BETTER WAY OF COPING WITH CLIMATE CHANGE.

Seminar on dredging and reclamation in Singapore

The international seminar on dredging and reclamation in Singapore, organised by IADC, was recently held from 27 to 31 October 2014 at the Grand Park City Hall hotel. This five-day intensive course aims to provide an understanding of dredging through lectures by experts in the field and by interactive workshops. At the end of the seminar, each participant receives a certificate of achievement in recognition of the completion of the coursework.

This year's lecturers included experts from three major dredging contractors - Frans Uelman, expert in dredging and environment, Hydronic engineering department, Royal Boskalis Westminster NV; Philip De Nys, chief operations superintendent of dredging activities, Jan De Nul NV; and Luk Verstraelen, senior engineering manager, RMPE department, DEME NV. There were also two guest speakers from DHI Singapore and the Korea Institute of Ocean Science and Technology.

Participants came from not only Singapore, but also all over the world, including Malaysia, Brunei, Vietnam, Indonesia, the Philippines, Hong Kong, Korea, UAE, Maldives, the UK, Russia and even as far away as Nigeria and Argentina.

A highlight of the seminar was the boat trip to see some reclamation projects and dredging equipment in action around the western part of the country.

The IADC seminar is targeted at both existing and future decision makers and their advisors in governments, port and harbour authorities, offshore companies and other organisations that have to execute dredging projects. The programme is continually updated to meet the dynamism of the industry.

IADC is the global umbrella organisation for contractors in the private dredging industry. It is dedicated to not only promoting the skills, integrity and reliability of its members, but also the dredging industry in general.

Next year, the IADC seminar will take place in Jakarta, Indonesia.



Above and left: The IADC seminar included both lecturers and workshops.

Below: A certificate of achievement was given to each student at the end of the seminar.



Above and left: A highlight of this year's seminar was the boat trip to see some reclamation projects and dredging equipment in action around the western part of the country.

Dredging for the future

Speaking to Southeast Asia Construction during the seminar, Mr Uelman explained how the dredging industry will become more important in the future due to urbanisation and climate change. "By 2050, more than 65 percent of the world's population are expected to live in urban areas and many of them would reside near the coast. With such huge transition, there is a greater need to reclaim lands for these people to live on, and at the same time protect them against floods caused by the rise in sea level," he said. Other drivers of dredging include increased tourism, expanding world trade and the surge in demand for energy consumption.

Mr Uelman also said that the dredging industry has experienced dynamic changes over the past decade. "Not only does the scale of the projects get bigger, dredging techniques and surveying methods are now much more advanced, and safety at sea has improved."

However, Mr Uelman noted that safety is still considered a challenge to the industry. "Safety has to be a mindset, not a rule. Safety programmes that are enforced by regulations have been proven ineffective at a certain level," he said. "People must be committed to embrace safety as a personal value, on their own will." ■

Website: www.iadc-dredging.com