7. WATER QUALITY FOR SUSTAINABLE DEVELOPMENT

Living DELTAS
RESEARCH HUB

The Living Deltas Hub is running the longest continuous water quality monitoring programme in any Asian mega-delta setting, the outcomes of which are shaping policy and water management in Vietnam, especially the Red River Delta. This work is serving as a blueprint for monitoring programmes across the Mekong and Ganges-Brahmaputra-Meghna Deltas.

Foreign, Commonwealth & Development Office

Climate change & biodiversity

Science, research, technology

SUSTAINABLE DEVELOPMENT GOALS

6 CLEAN WATER AND SANITATION

12 RESPONSIBLE CONSUMPTION AND PRODUCTION

13 CLIMATE ACTION

14 LIFE BELOW WATER

15 LIFE ON LAND

17 PARTNERSHIPS FOR THE GOALS

Achievements

Living Deltas has co-designed and implemented a water quality monitoring programme for the Red River Delta in Vietnam, which is being used to deliver national policy and progress towards SDG targets and aligns with FCDO priorities. This work is highlighting water pollution of the river is being caused by multiple stressors including untreated sewage and agricultural runoff, saline intrusion through over extraction of ground water and sea level rise, untreated industrial discharges, water shortage/competition for water resources, excessive sediment loads in the river, transboundary water dependency and aquatic biodiversity loss. These issues are common across tropical delta regions.

High quality water quality monitoring programmes underpin the delivery and assessment of progress towards safely managed drinking water, as well as delivering clean water for industry, agriculture, and aquaculture, while facilitating climate action plans. Therefore, Living Deltas will not only to help meet SDG 6, but contribute to:

- Responsible consumption and production (SDG12) by providing the information needed to minimise waste and pollutant production;

- Climate action (SDG13) by monitoring the impact of sea level rise, droughts, floods and cyclones on water quality;

- Life below water (SDG14) by monitoring pollution from the wider river basin in to coastal ecosystems that are essential for human livelihoods and socio-economic development;

- Life on land (SDG15) by establishing tools to protect, restore and promote the sustainable use of terrestrial ecosystems, especially the impact of agriculture and aquaculture in an Asian mega delta setting.

The Living Deltas water quality programme in the Red River Delta is defining 'best practice' and is being applied to the Mekong and Ganges-Brahmaputra-Meghna Deltas to establish water quality monitoring programmes that currently don't exist in these tropical

delta regions. Water networks in these regions are complex and existing monitoring is piecemeal, and often focused on few parameters, potentially missing vital contaminants of concern. In addition to the water quality indicators that are routinely monitored by government agencies in the Global North (e.g., nutrients, suspended sediments), the Hub is trialling the application of more novel parameters[1,2,3] (stable isotopes, elemental analyses of suspended sediments, calculations of carbon dioxide in river waters and aquatic biological communities) to identify how they can be used to deliver more efficient and effective assessments of water quality[4].

Importantly, the continuous long-term monitoring of water quality has produced an open-access dataset, available to government bodies, which documents the impact of major urban expansion and development in Hanoi, and across the wider delta to benchmark environmental change, which highlights:

- The creation of reservoirs upstream of Hanoi has reduced the Red River sediment load, essential to maintain the delta environment.

- Severe nutrient and organic pollution of the river from urban and agriculture/aquaculture runoff.

- Large changes in water quality are a result of seasonally variable river discharge.

- Reduction in oxygen in river water (essential for biological life) is driven by untreated sewage effluent release.

- Identification of how urbanization and seasonal variability propagates harmful algae blooms (HABs).

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[1] Luu et al. (2019) Stable isotopes as an effective tool for N nutrient source identification in a heavily urbanized and agriculturally intensive tropical lowland basin. Biogeochemistry 149: 17-35.
[2] Duong et al. (2019). Transitions in diatom assemblages and pigments through dry and wet season conditions in the Red River, Hanoi (Vietnam). Plant ecology and evolution, 152:163-77.
[3] Anh et al., (2020) Using stable isotopes to estimate young water fractions in a heavily regulated, tropical lowland river basin. Hydrological Processes 34: 4239-4250
[4] McGowan S (2020) Water quality monitoring in the Red River Delta (Vietnam): how to improve water resource management in the region, University of Nottingham, Policy brief. https://www.nottingham.ac.uk/asiaresearch/documents/policy-briefs/sustainable-development-goals/policy-brief-suzanne-mcgowan.pdf

Who benefits?

Clean water is essential for life – a third of people globally do not have access to clean drinking water and half of the world's population does not have safe sanitation. One of the key indicators for Sustainable Development Goal 6 (SDG6: clean water and sanitation) is access to safely managed drinking water services, which is defined as improved sources of drinking water (piped water, protected groundwater sources, rainwater collection, packaged or delivered water) that are accessible on premises, available when needed and free from contamination. The achievement of this target is hampered by limited monitoring efforts to detect polluted waters, which is particularly acute in regions who stand to gain the most from clean water and sanitation. Of the 2 billion people who lack safely managed drinking water, 768 million are in Central and South Asia and in the Red River, Mekong River and Ganges-Brahmaputra-Meghna Deltas this is being exacerbated by threats from climate change and sea level rise leading to increased salinisation of surface and ground water sources used to support local livelihoods.

Our ambition is for our water quality monitoring networks to address the issue of clean water in the Asian Mega-Deltas by working with a range of stakeholders, in particular policy makers to ensure the datasets and analysis feed into decision making around infrastructure, environment and resource planning.

A gap analysis has been used to identify the areas where water quality monitoring can contribute to delivering policy within the Red River Delta in the first instance, with the plan to carry out similar initiatives in the Mekong River Delta and GBM. Relevant ministries in Vietnam include Ministry of Natural Resources and Environment (MONRE), Ministry of Agriculture and Rural Development, Ministry of Industry and Trade (MOIT), Ministry of Construction (MOC), Ministry of Transport (MOT) and Ministry of Health (MOH).

One key gap identified was that government departments have difficulties in accessing relevant data. For

example, MONRE's Centre for Water Resources Inventory and Planning collects data on groundwater; MONRE's Department of Hydro-metrology collects data of surface water and river basins; while MARD's Department of Water Resources manages data on irrigation system/works. Living Deltas is able to provide a solution to this scattered approach and make available a single complete open access dataset with all the required information.

Living Deltas is also looking to improve the technical capacity at local levels, as this is where a large majority of operational decisions are made. Through our community science approach, we have begun training across delta regions, sharing knowledge and experience between early career researchers. Through technical training, villagers gained a deep understanding of the importance of water management and became experts in using water quality monitoring toolkits.

Summary of development impact of this work

Instituional & policy gap	Living Deltas contribution	Pathways to impact
No integrated water resource management plans at river basin level.	Regular and comprehensive water monitoring programme providing all essential data to support future water resource management planning at local national levels.	Using this data to disseminate of scenarios to ministries via workshops and publications. Working with relevant ministries to feed into water resources planning for 2020-2035 in provinces and cities nationwide that are being developed.
Overlap and inconsistency in water resource management functions and responsibilities at the central government in Vietnam.	Supporting the consistency of data available through monthly monitoring and analysis including tracing sources of pollution and calculating pollution load from agriculture, domestic, industry	Living Deltas has made its datasets open access for MONRE, with workshops and meetings with ministries (MONRE and MARD) to discuss water quality monitoring and how Living Deltas can support the more streamlined management of water resources are planned.
Prioritization of economic growth and underestimate environmental protection, particularly at the provincial level.	Providing interdisciplinary generated datasets to support the economic importance of environmental protection. Working across the Hub to demonstrate this through the SDG indicatory monitoring and benchmarking.	Living Deltas is working to ensure long term storage and accessibility of datasets across ministries. We are looking to bring together provincial and national level decisions makers to emphasize the links to water management, environmental protection and prosperity, in particular in relation to the SDGs.

People involved in this work

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Virginia Panizzo	F	Water quality monitoringt	Delta Baselines	Nottingham University	UK
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Lucy Roberts	F	Water pollution & community science	Delta Baselines	Nottingham University	UK
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