Large-Scale Wetland Mapping and Monitoring

Sentinel imagery is used to develop methodology for high-resolution mapping of vegetated wetlands.

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The challenge

More than 1 billion people rely entirely on the provisional services provided by wetland ecosystems, and healthy and functional natural wetlands are intrinsically linked with human livelihoods, well-being and sustainable development. However, despite their value, wetlands are facing major threats due to several reasons: conversion for commercial development, overfishing, tourism, pollution and climate change, to name a few.

Thus, there is an urgent need to strengthen, and reinforce, national policies and legal frameworks to help countries protect and restore critical wetland ecosystems. Efforts to preserve and restore wetlands, however, have been hampered by lacking data on the locations, types and sizes of wetland resources.

This data and information are crucial to measure the effectiveness of policy, legal and regulatory mechanisms and essential for tracking progress against the Sustainable Development Goals.

The space-based solution

Accurate mapping of wetland extent is essential for monitoring habitat distribution, abundance, and connectivity, all of which are critical parameters for developing targets, plans and priorities for future restoration, protection and enhancement.

The dynamics and large diversity of wetlands are a challenge for global-scale mapping, and as of today, only coarse resolution data exists on a global level.

Traditional work on wetland mapping has relied on standard image processing techniques (map interpretation, digitizing, collation of ancillary data and image analysis) to compile spatial information about wetland extent. This process is both resource- and labor-intensive, inconsistent and difficult to scale.

> **The use of satellite-based Earth Observation data for monitoring water-related ecosystems is accepted as a viable source of information for decision-makers.**
>
> *Gareth James Lloyd, UNEP-DHI Center*

However, the Sentinel satellites now provide global imagery at the required temporal and spatial resolutions to accurately derive information on wetland extent in high resolution. Recent mapping efforts by GlobWetland Africa (http://globwetland-africa.org/) have demonstrated the multipurpose capacity of the Sentinel missions to support wetland assessment, inventory and monitoring across wetland sites and regions in Africa.

Wetland monitoring in Chad. The wetland extents can be input to UN national reporting on SDG 6.6.1.

AI technology is perfectly positioned to automate the analysis and interpretation of satellite images to detect and delineate wetlands at global level and with minimal human input.

Together with United Nations Environment - DHI GRAS has developed an artificial intelligence – machine-learning algorithm as a globally applicable method for mapping of vegetated wetland extents in response to the Sustainable Development Goals monitoring requirements (https://www.sdg661.app/). In a nutshell, supervised machine-learning algorithms are trained by example to build a general model for wetland extent prediction beyond the learning examples.

Benefits to citizens

Wetland monitoring is crucial for conservation and restoration of wetland ecosystems and is explicitly mentioned in many national conservation plans. Hence, monitoring and reporting is not only important for reporting on the Sustainable Development Goal indicators but should be anchored within and used by the national agencies to avoid further degradation of wetlands.

Outlook to the future

It is expected that the methodology in development could pave the way for a state-of-the-art scalable wetland monitoring methodology that can improve the management and preservation of global wetlands.

The findings could have global-level impact as the data and the algorithms developed within the scope of this project will be freely available to all countries in the world as a critical resource for tracking the status and extent of national and regional wetland ecosystems.

This will effectively bridge the information gap in many countries, regions and cities, allowing them to act and react to water-related issues and stresses through informed decision-making.

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