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USING EARTH OBSERVATION DATA TO INFORM COMMUNITY MANAGEMENT OF INVASIVE PLANTS AND TRADITIONAL FISHING PRACTICES ON LAKE NOKOUE IN BENIN

Abstract

This paper explores an Earth Observation application with the enterprise Green Keeper Africa (GKA) based in Cotonou, Benin, that addresses the management of an invasive plant species that threatens economic activities such as fishing and transportation. GKA pays local community members to harvest the water hyacinth and transform it into a product that absorbs oil-based waste. The EO application is an online observatory and decision support tool that utilizes satellite, aerial and ground data to map the location of the water hyacinth and a fish farming practice known as "acadja" over time, providing valuable information for government, private and public users. The acadja analysis is relevant due to the adverse effects on water quality that the practice results in. This paper is a follow up on the work presented in the 2019 contribution to IAC session B1.5 by the authors. New research in this paper includes (i) improved and validated remote sensing algorithms for monitoring water hyacinth extent, (ii) trend analysis and forecasting of water hyacinth growth with other environmental data sets, (iii) improved and validated remote sensing algorithms for identifying and quantifying acadja and (iv) analysis of water quality parameters describing the coastal ecosystem. The technique Normalized Difference Vegetation Index (NDVI), combined with a Change Detection scheme is applied to the Landsat series to identify water hyacinth in the target region of Lake Nokoue from 1999 - Present. The water hyacinth classification is cross-validated with data from Sentinel-2, Planet, and high resolution drone imagery. Trend analysis and forecasting of water hyacinth growth is assessed by incorporating hydrological data and regression modelling. The acadja classification is performed through backscatter analysis and supervised machine learning on Synthetic Aperture Radar images from Sentinel-1 from 2014 - Present. The estimates and impacts of hyacinth and acadja are improved by measuring characteristics of the lake - including conductivity, temperature and dissolved oxygen - informed by past work by scientists at the University of Abomey-Calavi in Benin. This paper presents an example of integrating in-situ data into the observatory for water hyacinth growth suitability modelling and acadja impact assessment. Thus far, several rounds of co-design of the observatory have commenced in Benin, most recently in March 2020. This work aims to enable data-informed decision making by GKA and local community members, improve sustainable management of the Lake Nokoue ecosystem, and increase accessibility to value-adding EO tools through the design of a new low-cost data stream.