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Assessment of macrophyte *Typha spp* invasion in the Hadejia Valley Irrigation Scheme using WorldView-2 satellite image analysis

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The uncontrolled growth of *Typha* weed (*Typha spp, Typha domingensis*) in the Hadejia Valley Irrigation Scheme (HVIS), located in North-Eastern Nigeria, has been of great concern during the last decades. The Federal Government has implemented several solutions with different degrees of success trying to control its invasion in rivers, channels and agricultural lands. However, this problem is not solved yet and *Typha spp* has become a real agricultural and environmental challenge with important social implications for the local communities depending on agriculture and livestock.

Recently, under a sustainable and circular economy point of view, it has been proposed to unite the control of this plant with a sustainable use of it. *Typha spp* biomass can be used in the production of biogas, which is an important social and economic benefit for local communities. This would help to alleviate the serious environmental consequences of desertification. A first step, and our aim in this work, was to estimate and locate the *Typha* biomass in this area to study its long-term sustainability.

WorldView-2 satellite images were used to map *Typha* grass in HVIS. The WorldView-2 satellite is a high-resolution, multispectral sensor, owned by Digital Globe. Its images present a spatial resolution of 0.5 m in panchromatic and 2.0 m for 8-band spectral resolution (coastal, blue, green, yellow, red, red-edge, near infrared 1 and near infrared 2).

In order to achieve our goal, a segmentation of the image is necessary to classify the pixels based in land use and presence or absent of *Typha* spp. A supervised classification was implemented using the free SNAP software v. 6.0.4. Random Forest (RF) algorithm was employed in the classification (Breiman, 2001; Breiman et al., 2006).

The results provide relevant information on patterns and drivers of invasive *Typha* in HVIS. An estimation of *Typha* biomass is obtained globally and per irrigation sector. Finally, a discussion in the context of development a *Typha* baseline scenario is presented.

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