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Spatial and temporal evaluation of perennial vegetation distribution in the arid areas surrounding North Horr city

Velia Bigi [a, *], Ingrid Vigna [a], Elena Comino [b]

[a] *Interuniversity Department of Regional and Urban Studies and Planning (DIST), Politecnico di Torino & Università di Torino, 10125 Torino, Italy, velia.bigi@polito.it, ingrid.vigna@polito.it*

[b] *University Department of Environmental, Land and Infrastructure Engineering (DIATI), Politecnico di Torino, 10125 Torino, Italy, elena.comino@polito.it*

* Corresponding author

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Abstract:

According to the Intergovernmental Panel on Climate Change (IPCC), the Horn of Africa is getting drier. However strong differences exist at local level and generally the encroachment of invasive plant species, such as *Prosopis juliflora*, is responsible for the greening.

Gichenje and Godinho (2018) using satellite-based remote sensing have proved that in Kenya 8.9% of the country, mainly belonging to the northern counties, experienced a greening between 1992 and 2015. In Kenyan Arid and Semi-Arid Lands (ASALs), the dry climate only supports shrub vegetation and seasonal grassland. Growing population trends and uncontrolled grazing practices created strong pressure on natural resources. Since the late 80's, therefore, non-indigenous vegetation species were introduced in Kenya to increase the vegetation cover, with different and uncertain results.

This research aims at assessing browning and/or greening trends in a semiarid pilot area of North Horr Sub-County, in northern Kenya, between 2016-2020. The area is mainly characterized by shrub vegetation, which has two relatively short vegetative periods during the wet seasons. *Prosopis juliflora*, whose presence has been attested in the sub-county since the 1980s, is now the main species found in the most densely vegetated zones.

The vegetation trend assessment is based on a remote sensing approach through the analysis of Sentinel-2 images. The method implies the calculation of four vegetation indices (NDVI, NDRE, CCCI and NDVI-NDRE-CCCI). To distinguish the perennial vegetation, which appears to be vigorous also during the dry seasons, from the herbaceous vegetation, whose spectral signature greatly varies from wet to dry periods, a phenological approach is used. The indices bands created are combined, in order to obtain one multitemporal image for each index for each year. Seven Region of Interests (ROIs), referring to the year 2019 and covering only the densely vegetated areas in all the historical images are created. Tests on different supervised classification methods indicate that the Minimum Distance (MD) method is suitable for the NDVI, the NDRE and CCCI indices, while the Spectral Angle Mapper (SAM) method is suitable for the images derived from the combination of the three. Based on the selected ROISs, the two different supervised classification methods are then applied. Results will be analysed combining a statistical approach and a visual comparison with the geographical characteristics of the area, such as distance from watercourses and settlements.

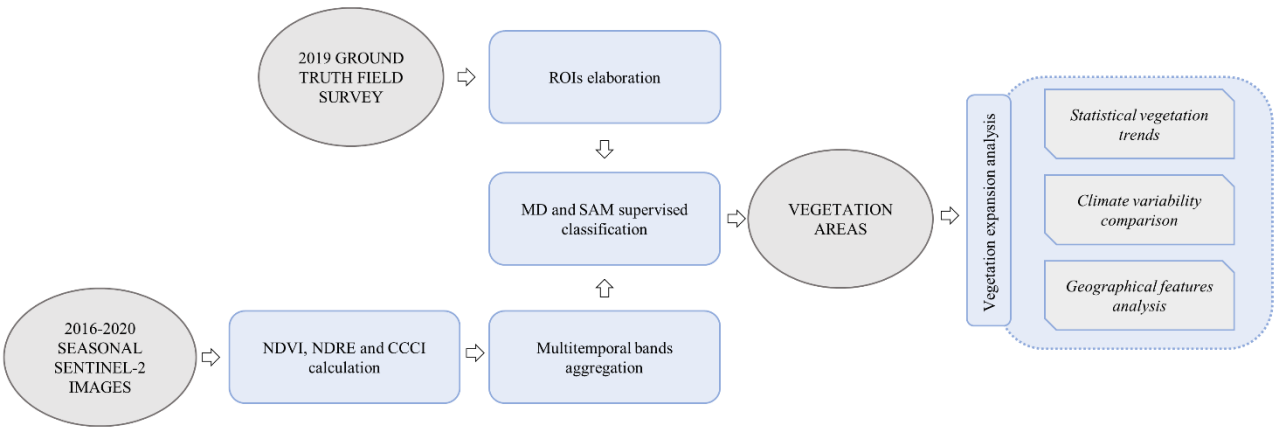

Figure 1. Synthetic schema of the methodology applied.

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Preliminary results show some uncertainties, detected for the last two years of the analysis, related to unusual precipitation patterns. However, a general greening of the area is found to have occurred on average. This trend is characterized by the expansion of the most densely vegetated surfaces. The role played by water availability and soil salinity will be discussed in reference to the existing literature.

This work will help understanding the land cover changes taking place in an already depressed and prone to climate change related risk area for supporting local decision-making processes. Although the area is not affected by desertification, the expansion of *Prosopis juliflora* is stealing space from species edible by humans and animals and therefore needs to be sustainably managed. This issue should occupy a prominent place in the local land management strategies not with the intention to eradicate the plant but with the aim of finding alternative economical exploitation methods.

Gichenje, H.; Godinho, S. Establishing a land degradation neutrality national baseline through trend analysis of GIMMS NDVI Time-series. *L. Degrad. Dev.* **2018**, *29*, 2985–2997, doi:10.1002/ldr.3067.

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