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Mapping land use and dynamics of vegetation cover in Southeastern Arabia using remote sensing: the study case of Wilayat Nizwa (Oman) from 1987 to 2016

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Abstract

The region of Wilayat Nizwa, in Northern Oman, is characterized by very high temperature and rare irregular rainfall. Local farmers relay on irrigation to maintain their lands productive. They get water by means of ancestral water acquisition systems called *aflaj* (plural of *falaj*). This study focalizes on the physical space of Wilayat Nizwa. Its main goal is to read and analyze the landscape of this area using a method based on multispectral electromagnetic spatial remote sensing. The processing of data from satellites Landsat 5 TM, Landsat 7 ETM+, and Landsat 8 OLI and TIRS relative to January 1987, October 2000, February 2009, and January 2016 allowed us to extract information on the landscape components of Nizwa and its surroundings, to generate a land use map, and to monitor the dynamics of the vegetation cover in Wilayat Niwza from 1987 to 2016. The study zone is mainly a mountainous region, rugged with many gullies and characterized by an important geological diversity and large sedimentary valleys and riverbeds. The non-supervised classification reveals six different classes of which the clay/sandy sedimentary soils and the very clayey rocky/gypsum blocs are the most important ones. The information extracted from the Perpendicular Vegetation Index 1 (PVI1) show that the area of irrigated vegetation remained relatively stable, with a minor increase, which equals to 805.91 ha, in 2009, compared with the spontaneous one in which the rise is 17,588.85 ha. Combined with socioeconomical and climatic parameters, these results would be good indicators to assess the functioning of *aflaj* and to anticipate the evolution of the local landscape.

Keywords Landscape · Land use · Vegetation cover · Irrigation · Remote sensing · Nizwa

Introduction

Most of the Arabian Peninsula has arid climate. About one third of this area is covered by a large sandy desert Al-Rub Al-Khali (Besler, 1982, cited in Bray and Stokes 2004). Al-Rub Al-Khali is for most a large sedimentary basin that extends over an area of 600,000 km^2 (Anton, 1983, cited in Bray and Stokes 2004) and is bounded by Oman's mountains Al-Hajar in its east. Oman is situated in the southeast of the Arabian Peninsula. It has a total area of 309,500 km^2; it opens onto the Gulf of Oman and the Arabian Sea with a coastline of 1700 km (Hawley 2005). Oman shares borders with the United Arab Emirates, the Kingdom of Saudi Arabia, and the Republic of Yemen. Oman presents large landscape sets that can be classified into four families: plains of gravel or loess (silt clay and limestone), the deserts of sand, sebkha, and mountain ranges (El-Baz 2002). Oman can be divided into four distinct geologic areas: the chain of Al-Hajar Mountains in the north which forms a belt characterized by

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