

Monitoring Landscape Dynamics of the Adret of Central Valais in Switzerland using Remote Sensing: The Case of the Commune of Ayent

Fairouz Megdiche-Kharrat¹, Mathieu Gravey², Emmanuel Reynard³

¹ Assistant professor in Architecture and Urbanism, Higher Institute of Agronomy of Chott-Mériem ISACM-IRESA, University of Sousse, Tunisia; Researcher at the Laboratory Governance, Ambiances and Development of Cities GADEV/UMRAN, ENAU-EDSIA, University of Carthage, Tunisia; Former post doc researcher at the Institute of Geography and Sustainability (IGD), University of Lausanne.

² Junior Group Leader at the Institute for Interdisciplinary Mountain Research, Austrian Academy of Sciences in Innsbruck, Austria; Former PhD candidate at the Institute of Earth Surface Dynamics (IDYST), University of Lausanne.

³ Full Professor in Geography, Institute of Geography and Sustainability (IGD) and Interdisciplinary Centre for Mountain Research (CIRM), University of Lausanne, Switzerland

*Corresponding author, e-mail: feirouzmekdish@gmail.com

Abstract

The landscape of Central Valais in Switzerland owes its specificity, firstly, to the geographical characteristics that mark the region: a large 110 km long valley, spreading spatially between two mountain ranges with peaks of 3 to 4 thousand metres in altitude; and, secondly, to human activities over several centuries, arising from the need for territorial integration and adaptation to particular climatic conditions, and guided by the evolving socio-economic trends, at that time. Local communities still use artificial irrigation by bringing water from where it is available at high elevations, rivers fed by the melting of the upper glaciers being the main source, towards dry cultivated areas through a network of channels, locally called *bisses*. It resulted in a specific territorial occupation marked by a periodic migration of families with their livestock according to seasons between the Rhône Valley, at an altitude of around 500 m, the villages, a little higher, the *mayens* (1 500 m alt.) and the alpine meadows named *alpagnes* (at lower, middle and upper levels, from 2 000 m of altitude). Other than the natural dynamics, such as climatic changes, the study shows interest above all to recent anthropic dynamics which impact is clearly visible on the landscape. To explore the dynamic aspect of the studied area, we adopted a method based on remote sensing. We used as tool the cloud-based platform Google Earth Engine for planetary-scale environmental data analysis. This platform enables the access to data from the different sensors Landsat and Sentinel, embedding field product such as AlphaEarth and their treatment, processing and information extraction. We elaborated a model script to process and operate data about Earth surface reflectance within the fixed timeframe (yearly spring to summer irrigation period), from the 1980s to the year 2025. We aggregated data over data structures (space, time, bands and cloud cover) and we reduced filtered data (the images in the collection) into a composite, yearly one. We trained the model using supervised classification based on a 2009 orthophoto, ten (10) various land use classes

were identified based on-site investigation and literature review, such as Dense and sparse forest, pasturelands, irrigated meadows, Vineyard, Urban areas, etc. Results show five different dynamics of change: High and frequent; high and slow; Low and frequent; Low and slow, and classes with almost no variation in surfaces. Besides, since the second half of the 19th century, some types of land uses have been abandoned, such as cereal crop growing, and others have been intensified, such as viticulture and bovine stock breeding. On the local landscape level, this resulted in specific agrarian forms, irrigation channels and water storing lakes, deforestation, etc. Besides, the economic development, mainly due to seasonal touristic activity, and population growth resulted into a progressive development in infrastructure, such as road network, housing, mountain lodges and chalets, reforestation, etc. The recent construction of new buildings, far from the urban groupings and spread in agricultural domains are provoking a progressive urban sprawl of the territory.

Keywords: Landscape Assets; Dynamics; Remote Sensing; Ayent; Central Valais.