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To cite this version:
D Sheeren, S Ladet, O Ribière, B Raynaud, Martin Paegelow, et al.. Assessing land cover changes in the French Pyrenees since the 1940s A semi-automatic GEOBIA approach using aerial photographs. AGILE 2012: International conference on geographic information science, Apr 2012, Avignon, France. <hal-01197132>

HAL Id: hal-01197132
https://hal-univ-tlse2.archives-ouvertes.fr/hal-01197132
 Submitted on 11 Sep 2015

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Assessing land cover changes in the French Pyrenees since the 1940s
A semi-automatic GEOBIA approach using aerial photographs

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Introduction

As in many mountain areas in Europe, agro-pastoral landscapes of the Pyrenees are subject to fast spontaneous reforestation. Encroachment is mainly related to the abandonment of farmland in combination with rural depopulation and agriculture modernization.

Observed changes of land abandonment or land-use extensification can be similar at the regional scale but the dynamics at the local scale do not occur homogeneously, as it is determined by specific conditions (environmental, climatic, socio-economic, anthropogenic).

The objective of this work (part of the MODE-RESPYR project) is to assess the spatial patterns of land cover changes during the last 70 years in three study sites of the Pyrenees, and to compare the local dynamics in order to observe and to explain similarities and disparities.

Material and Method

Data
Historical panchromatic aerial photographs with recent true color digital images

- 1. Davayntz (76 km²)
  - Number of photographs: 67
  - 6 dates: from 1948 to 2001
  - Scale: 1:15000–1:30000
  - Spatial resolution: 0.5m
  - TIFF (8 or 24 bits)

- 2. Haut-Vicdessos (244 km²)
  - Number of photographs: 286
  - 7 dates: from 1942 to 2003
  - Scale: 1:25000–1:30000
  - Spatial resolution: 0.5m
  - TIFF (8 or 24 bits)

- 3. Garrottes (85 km²)
  - Number of photographs: 104
  - 5 dates: from 1942 to 2000
  - Scale: 1:25000–1:30000
  - Spatial resolution: 0.5m
  - TIFF (8 or 24 bits)

Methodological approach

Depending on the land cover maps from a GeoBIA Object-Based Image Analysis

- Time 1–3 Classified Map
- Time 1 Aerial photographs
- Image pre-processing
- Orthorectification
- Registration
- Mosaicking
- Use of 1–3 classified map to constrain segmentation and avoid silver polygons
- Region-based segmentation
- Semi-automatic classification
- Update 1–3 classified map by rule-based classification and visual interpretation of changes
- Classification-based fusion
- Merge all adjacent objects of identical class

Results

1. Davayntz

- Woody area ↗ (+15%)
- Urban area ↗ (+1%)
- Scrub/Grass in valley upper slopes ↘ (-9.5%)
- Pasture and hayfields in valley upper slopes ↘ (-4%)
- Cropland and grassland in valley bottom ↘ (-2.5%)

2. Haut-Vicdessos

- Woody area ↗ (+16%)
- Urban area ↗ (+0.25%)
- Scrub/Grass in valley upper slopes ↘ (-7.6%)
- Pasture and hayfields in valley upper slopes ↘ (-6.3%)
- Cropland and grassland in valley bottom ↘ (-1.7%)

3. Garrottes

- Woody area ↗ (+20.1%)
- Urban area ↗ (+0.2%)
- Scrub/Grass ↘ (-38%)
- Pasture and hayfields ↗ (+1%)
- Cropland (valley bottom) ↘ (-3.3%)

Conclusions

- A similar spatial pattern of land cover changes for the 3 study sites (encroachment at low and medium altitudes) but with different rates and extents, and occurring at different periods.
- A spatial pattern highly related to pattern of farmland abandonment and depopulation.
- A generic method usable for various mountain areas.
- Perspectives: developing an automatic classification procedure using very high resolution remotely sensed images for monitoring annual land use and cover changes.