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Estimating taxonomic diversity and functional types of perennial forage grasses in mountain meadows
Potentialities of Pléiades imagery

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Introduction

Meadows play a major role in agro-pastoral systems. They are used as a fodder resource for animals. They are also among the most species rich plant communities depending on the nature and the intensity of management practices.

Remote sensing has shown considerable potential to estimate the spatial patterns of biodiversity. In particular, NDVI-based variables have been found to be useful predictors of plant species richness since it responds to variation in primary productivity and habitats (e.g. Levin et al. 2007).

The objective of this study is to investigate the potential of Pléiades imagery to explain (1) the richness patterns in plant and (2) the functional types of forage grasses in mountain meadows.

Pléiades image data

- Acquisition date: August 10th, 2012
- Spatial resolution: 2 meters
- Spectral resolution: 4 bands (NIR, R, G, B)
- Product level: ortho-imagery (level 2)

Indicators of spectral responses of meadows

- NDVI-based variables
- mean, max, range, std dev per meadow

Pléiades Days – BP 32607, 31326 Castanet Tolosan Cedex, France

Study area

Villelongue municipality, in the peripheral area of the National Park of the Pyrenees, France (00°03’W & 42°53’N). This municipality is located in a small valley of medium altitudinal range (460 – 1800m a.s.l.).

Field sampling of plants

Selection of 30 meadows:
- Derived from the same production system
- Chosen according to an altitudinal gradient
- Distinguished by their land use (grazing alone or grazing and mowing)

Recording botanical composition:
- Period: between May and June 2012 (time of peak vegetation in each elevation)
- Point quadrat analysis method
- 50 punctual observations along a 20 m long transect (one observation every 40 cm)
- Recording of each plant species when the foliage contacts a steel needle stuck vertically

Statistical analyses

Generalized Linear Models (GLM):

Predicted vs Observed (Type A)

Predicted vs Observed (Type B)

Predicted vs Observed (Type C)

Predicted vs Observed (Type D)

Results

Productivity Models (GLM):

Response variable | %D² | Sgn. | RMSE |
--- | --- | --- | --- |
1. Species Richness | 16.98 | n.s. | 3.05 |
2. % grasses of Type A | 10.79 | n.s. | 12.19 |
3. % grasses of Type B | 35.44 | n.s. | 5.70 |
4. % grasses of Type C | 15.38 | n.s. | 12.09 |
5. % grasses of Type D | 2.60 | n.s. | 2.37 |

Heterogeneity Models (GLM):

Response variable | %D² | Sgn. | RMSE |
--- | --- | --- | --- |
6. Species Richness | 13.69 | n.s. | 3.15 |
7. % grasses of Type A | 37.16 | n.s. | 11.85 |
8. % grasses of Type B | 9.46 | n.s. | 6.88 |
9. % grasses of Type C | 23.78 | n.s. | 11.25 |
10. % grasses of Type D | 0.5 | n.s. | 2.38 |

Hybrid Models (GLM):

Response variable | %D² | Sgn. | RMSE |
--- | --- | --- | --- |
11. Species Richness | 17.28 | n.s. | 3.04 |
12. % grasses of Type A | 15.26 | n.s. | 13.53 |
13. % grasses of Type B | 20.49 | n.s. | 6.49 |
14. % grasses of Type C | 16.36 | n.s. | 11.88 |
15. % grasses of Type D | 1.61 | n.s. | 2.37 |

Conclusions

- No significant relationships between plant species response variables and remote sensing predictors
- Results are contradictory to similar studies (e.g. Levin et al. 2007, Pauvainen et al. 2010)
- The acquisition date of the Pléiades image (August 10th, 2012) could explain the non-conclusive results: time delay with the plant survey, mowing of meadows
- In the next step, the study will evaluate the effect of the date of the image by using reflectance spectra obtained during the vegetation surveys. Relationships with other vegetation indices will also be explored.

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