



### Post-doctoral position

## MULTISCALE MAPPING OF ECOSYSTEM SERVICES BY VERY HIGH SPATIAL RESOLUTION HYPERSPECTRAL AND LIDAR REMOTE SENSING IMAGERY

Université de Toulouse, INP UMR 1201 DYNAFOR, Chemin de Borde Rouge, BP 52627,  
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## 1 Context - Project MUESLI

The objective of the project MUESLI is to monitor ecosystem services using high spatial resolution hyperspectral and LiDAR images. Regulating services, such as pollination and biological control, will be considered on a Long Term Ecological Research site. Unlike conventional approaches that use a crisp description of the landscape, i.e., by defining spatial objects from pre-defined classes (forest, agricultural field, river, meadow, ...), it is proposed to adopt a finer representation that considers the continuous nature of landscape. Indeed, an object for a given spatial resolution is usually not made of only one material. A more realistic representation is to consider that an object can be a mixture of several materials. Using such a representation of the landscape, it is expected to identify new spatial patterns that provide significant regulating services. Furthermore, the object representation will allow to perform a multiscale analysis that better preserves the original landscape configuration.

Hyperspectral images provides a rich spectral information, which is necessary to assess correctly the heterogeneity of the landscape while LiDAR data provides topographic information, which is complementary to the spectral information. However, this multi-source data is challenging to process accurately and specific developments will be done during the project. In particular, the definition a mixture model on objects (rather than on pixels) will be addressed.

Three major steps are planned during the project for a total duration of 36 months. The first step concerns the data acquisition (remote sensing images and field data). The second step concerns the performances assessment of the state-of-art method and the data base construction. The last step concerns the definition and the implementation of the proposed representation of the landscape. The new developments will be compared to conventional approaches.

The scientific contribution of the project will be threefold. First, publications in journals and conferences about the different steps will done during the three years. Second, maps of regulating services will be produced on the study site. Third, a software will be made available to the scientific community.

## 2 Objectives

The objectives of this post-doctoral position are

1. The first objective is the acquisition of field data and images. The best period for these acquisitions is during spring. This step will require a lot of field work, in order to get sufficient information on the area of interest for validation purpose. Experiment on pollination potential and pest control potential will be conducted by exposure of sentinel preys and plants across a long-term monitoring site presenting landscape heterogeneity gradients. In addition, we will record estimate production of fruits in forest and crops to match these experimental data with global pest predation and pollinisation levels
2. The second objective of the project is the analysis of the landscape with conventional methodologies, to establish a baseline in terms of results and precision. In that part, the images will

be pre-processed (atmospheric correction, calibration, ...) and they will be linked with ground measure into a GIS (geographic information system). The implementation will be done using open software such as the *Orfeo Toolbox* (C++ library from the CNES, <http://orfeo-toolbox.org/otb/>) and Python with a graphical interface in QGIS (<http://qgis.org/en/site/>). The codes will be made available to the scientific community.

3. Diffusion of the work in the scientific community.

### 3 Requirements

Candidates should have a Ph.D in applied remote sensing or geomatic with experiences in landscape ecology and field survey. Knowledge in applied statistic or machine learning, programming and image processing will be appreciated. A good knowledge of English and French is mandatory.

Candidates should demonstrate their abilities to conduct the field survey, implement the processing chain and the data base, supervise master students and to disseminate the results of the project through journal papers and communications.

### 4 Application

The candidat should send (in English) an extended CV (including formation, experiences, list of publication and scientific responsibilities), a motivation letter and reference's contacts to [mathieu.fauvel@ensat.fr](mailto:mathieu.fauvel@ensat.fr).

Review of applications begins on July, 2015, and will be closed when the position is filled.

### 5 Additional information

**Supervision:** Mathieu Fauvel and Aude Vialatte

**Location:** Université de Toulouse, INP UMR 1201 DYNAFOR, Chemin de Borde Rouge, BP 52627, F-31326 Castanet Tolosan

**Expected starting date:** January, 2016

**Duration:** 18 months

**Salary:** monthly net salary of about 2200€ (including mean annual bonus) will be adjusted according to experience and qualification.