

Title: Internship

Topic: Space-Time Modelling of Crop Rotation in Luxembourg applied to the LUCAS project

Duration: 6 months

Remuneration: 625 € net/month (to be confirmed)

Company: CRP Henri Tudor/CRTE, Luxembourg

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Background and objectives

Within the project LUCAS (Indirect land use change effects in consequential Life Cycle Assessment of bioenergy) there is the need to determine the changes in the spatial patterns of land use induced by an additional production of maize for biogas production.

The Luxembourgish agricultural and farming model being set up by CRTE and the external contractor ORDECSYS will determine the new production patterns coming from an economic equilibrium (opportunity cost determination, revenue maximisation) at the farm level.

The goal is to add a spatial component to the optimization model developed in LUCAS, to determine impacts of the induced land use changes and to show the importance of accounting for spatial patterns of land use change in crop production optimisation, i.e. where these changes in land use patterns occur.

The objective of the internship is to analyse and model spatial patterns and of crop rotation for Luxembourg. This includes the production of a consistent space-time data set on crop rotation of the Grand-Duchy of Luxembourg using the agriculture reference parcel data set of Luxembourg (FLIK) from the Agricultural Service of Luxembourg, [ASTA](#) as well as the development of a simple spatial model to simulate crop rotation accounting for crop specific environmental parameters.

Description of the internship

The trainee will follow a stepwise approach based on the following tasks:

1. Develop an automated algorithm to clean geometries and duplicates of existing agricultural plots and harmonise land register and FLIK numbers in space and time.
2. Develop an algorithm to estimate missing crops accounting for neighbouring parcels. Generate typical crop rotations for Luxembourg. Generate mixed crop plantation distributed on the same plot for the same year.
3. Build a spatial allocation model accounting for crop specific information, such as soil properties, nutrients, fertiliser usage, meteorological information and typical crop rotations, etc.

Depending on the skills of the trainee steps 1 and 2 should be accomplished within the traineeship project. Step 3 can be added if the trainee shows sufficient skills.

Various spatial methods will need to be considered to achieve the outcomes of the project:

- **Cleaning of geometries, removing of duplicates** will be achieved by standard GIS operations available in R, GRASS GIS and/or PostGIS;
- **For harmonisation of land register and FLIK numbers** matching algorithms will need to be developed in R. The cleaned and harmonised data set will be stored in a PostGIS data base;
- **To estimate missing crop data** on a per FLIK number basis, nearest neighbour based algorithms could be used and/or developed, such as simple neighbour statistics or more advanced methods such as Moran's methods with the help of the spdep package;
- **For the space-time** analysis of typical crop rotation data and most occurrences of specific crops in space and their evolution in time standard statistical procedures such as cross-tables and principle component analysis can be used to develop transition matrices for crop rotation using R;
- **To optimally allocate crops in space and time** a spatial-temporal algorithm will be built by using simplified probabilistic approaches based on Markov chains relying on transition probabilities or more advanced geostatistical methods.

The candidate is expected to start as soon as possible. The interview process will continue until a suitable candidate will be found.

Profile and expected skills

The trainee will have a background in Geography, Geoinformatics, Geomathematics, GIS or Spatial Statistics. He/she will work in an interdisciplinary and multi-lingual/-cultural work environment and therefore team spirit is expected.

Fluent knowledge of English is required. The successful candidate will have some experience in:

- ✓ Programming in R;
- ✓ Spatial statistics and GIS;
- ✓ Knowledge on agricultural engineering and SLQ are an asset.

The candidate is also expected to learn by doing.

Information

For further information about this internship, please contact:

- Ulrich Leopold, Phone: +352-425991-4618; Email: Ulrich.Leopold@tudor.lu
- Antonino Marvuglia, Phone: +352-425991-4652; Email: Antonino.Marvuglia@tudor.lu

To apply for the internship position, please send your motivation letter and CV to Mrs. Paula Couto at jobs@tudor.lu citing the title of the advert.