Analysis of the Representativeness of land use in France by the French Soil Monitoring Network

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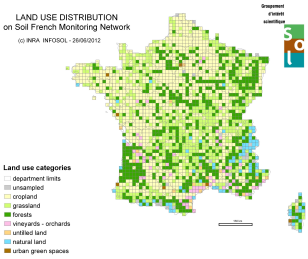
Backgrounds and objectives



Soil monitoring networks are developed at European scale for soil protection and sustainable management objectives, according diverse sampling strategies. The French Soil Monitoring Network (RMQS) is based on a systematic 16 km * 16 km grid, counting 2200 sites located in the cell centroid and covering various land uses (from arable land to natural land) and a range of soil types. To set up the network, a preliminary study established the aforementioned minimal density as required for a systematic grid-based network offering an adequate compromise for settlement costs and duration (Arrouays et al, 2001). The first sampling campaign was carried out from 2001 to 2009. In order to check the possibility to extrapolate the RMQS results at the national level, the present study investigates the representativeness of the land use distribution of monitoring sites with regards the whole French land cover. We have compared the regional and national distributions of land use for RMQS sites with land use information provided by 1) Corine Land Cover (CLC) geographical database, 2) national agricultural statistics (SAA), including detailed and annual data concerning crops, grasslands and woodlands, and 3) TERUTI LUCAS dataset.

Materials and methods

Available reference datasets

- CORINE Land Cover level 2 version 2006 for France (EEA)[4] : geographical database on European land use (exhaustive information for the territory provided by satellite and aerial photography).

A CLC code was attributed to each site. Comparison is based on proportions of classes calculated for RMQS and CLC.

- TERUTI LUCAS[3] : statistical survey of land use based on about 300 000 plots. Extrapolated to whole territory. Data used cover 2006-2009 period.

Global distribution (2006-2009) was calculated for TERUTI and compared to that of RMQS.

- Annual agricultural statistics (AGRESTE-SAA[3]) : survey of farms extrapolated to whole territory. Data used cover 2001-2009 period. Information on agricultural production.

Global distribution (2001-2009) was calculated for SAA and compared to that of RMQS.

By occurrence, comparison is made between proportion of sites for RMQS and proportion of area for the datasets.

We performed chi-square tests which are considered significant at the 0.95 confidence level.

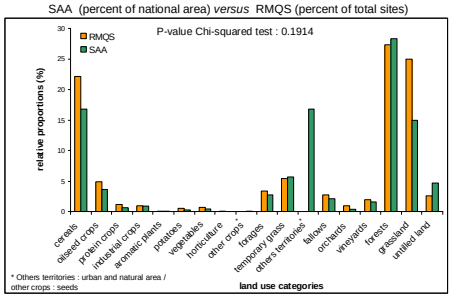
French Soil Monitoring Network available data

- Land use observation, encoded according to each reference dataset classification.
- Complete agricultural practices through survey of farmers are collected.
- For cropland, crop frequency in crop rotation was calculated.
- In case of impossibility of sampling soil, sampling point was moved to the nearest plot with the same use and soil type (excepted in case of sealing), at a maximal distance of 1 km.

Results

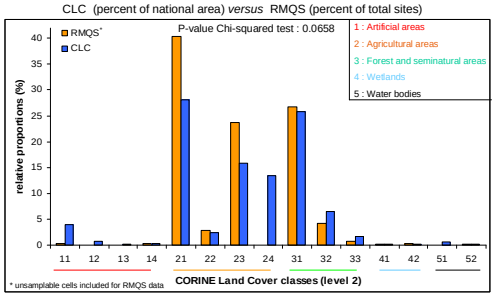
Distribution by land cover category :

SAA (percent of national area) *versus* RMQS (percent of total sites)



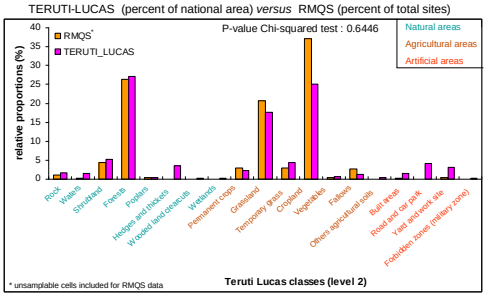
Distribution by land cover category :

CLC (percent of national area) *versus* RMQS (percent of total sites)



Distribution by land cover category :

TERUTI-LUCAS (percent of national area) *versus* RMQS (percent of total sites)



Considering the three sources of data, results of comparison are similar. For most of categories where soil exists (artificial areas excluded), land use distribution is similar between RMQS and national territory (equality of two proportions test was performed), aside for forests slightly underrepresented. When performing the comparison with whole territory (artificial areas included), arable land and grassland appear overrepresented by RMQS data.

Discussion

- The French Soil Monitoring Network avoids sampling areas without soil and artificial soils, that's the reason why representativeness study must take in account only uses with agricultural, forest or natural soils.
- We compare data at different time scale (for CLC: one collection year 2006, TERUTI-LUCAS : annual step collection from 2006 to 2009, SAA : annual step collection from 2001 to 2009, RMQS : one campaign lasting from 2001 to 2009), which can explain some small differences between proportions. In addition, reference data and RMQS concern different spatial scale (point data for RMQS and extrapolated data to areas for references).
- The methodology of comparison either with RMQS or comparing results between reference data is not easy to perform, due to different used nomenclatures. For instance, SAA groups in one category non-agricultural land and artificial areas. For RMQS, short duration temporary grass are included in crop rotation and appear in cropland. Some CLC categories cannot be represented by RMQS, like heterogeneous land use class.
- The comparison with CLC data showed regional discrepancies (particularly in regions with fragmented landscapes). The difference between some proportions can be linked to aerial photography interpretation (grass, fallows, natural land are ill-distinguished [5]). Also, CLC aggregates land use at a minimum pixel of 25 ha.

Conclusions and outlooks

French Soil Monitoring Network is representative of the land use of French territory, at national scale.

Current works are proceeded on local biases on RMQS representativeness.

Work on apparent overrepresentation of grassland and arable land by RMQS (and secondarily forests) and its origin is still in progress.

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