Impact of the location of agricultural production on ecosystem services - Conference summary

The topic of the conference being too vast for a single day, the objective of the day was to present recent research results on three specific topics:

- Session 1 focused on the impact of the location of agricultural production on one particular ecosystem service, namely the provision of water in sufficient quality and quantity;
- Session 2 focused on the drivers of the location of one particular type of agricultural production – organic farming – which produces multiple ecosystem services;
- Session 3 focused on the simulation of fine-scale crop location by partial equilibrium models.

A one-paragraph summary is provided below for each presentation. More details can be obtain from downloading the presentations at http://www2.dijon.inra.fr/cesaer/animation-scientifique/journees-detude/

1. Cropping / land-use choices and water management

1.1. Determinants of cropping decisions and water management

One of the key objective of the work presented by Arnaud Reynaud (INRA/TSE, Toulouse) was to quantify two distinct components of the elasticity of water use in the Midi-Pyrénées regions: the direct input reduction for a given crop and the indirect reduction through changes in cropping choices. To that end, two econometric models are combined: (1) a cropping choice model, where water price is one of the drivers of crop shares at farm scale, and (2) a production cost model, where water price is one of the drivers of the farm production costs, once crop shares have been fixed. Among other preliminary results, the indirect component of water use elasticity – -15% for a 10% water price increase – is estimated to be twice the direct component – -7% for a 10% water price increase.

1.2. Land use impact on water quality

Serge Garcia (INRA/LEF, Nancy) presented two studies quantifying the impact of land use on water price. The rationale is that land use influences water quality – nitrates and pesticides – which forces water supply services to either invest in water treatment plants or in pipes to fetch a more distant source of clean water. These two strategies are integrated into water price. The first study covers the entire French territory without spatial interactions and the second is focused on the Vosges department but accounts for a spatial-lag effect of land use. Both demonstrate that the local abundance of forests and grasslands decreases water price. The "water purification value" of one hectare of forest is estimated between 29 and 138 euros per hectare.

1.3. Agricultural compensations versus land purchase to protect water from pesticide pollution

In order to foster the production of ecosystem services, a regulator can promote land sharing – low cost, low environmental impact – and/or land sparing – high cost, high environmental impact. Elsa Martin (Agrosup/CESAER, Dijon) presented a theoretical framework to assess the environmental impact and the monetary costs of these strategies. The framework refines the existing literature along two main avenues: the regulator can mix the two strategies, and he can even do so at an intra-field resolution (eg. subsidize land sharing on one third of a field and purchase the two remaining thirds for conservation). An empirical application of this framework to protect water from pesticide pollution in Northern Côte d'Or (France) shows that using a regulator using mixed sharing/sparing strategy can be 20 % more cost-effective in water protection than if he focuses on one or the other of the two strategies.

2. Determinants of the location of organic farming

2.1. Spatial distribution of organic farming in Germany: does neighbourhood matter?

A last-minute event prevented Eva Schmidtner (Universitat Hohenheim) from attending the conference. In her work on the location of organic farming in Germany, she shows that agglomeration effects are important: more organic farming close to a given administrative delimitation increase the share of organic farming within the administrative delimitation of interest. These agglomeration effect are not dependent on the scale of the delimitation: the same effect is found at county scale and at community association scale.

2.2. Spatial diffusion of organic farming

After a review of the driver of conversion to organic farming, Ghislain Geniaux (INRA/Ecodev, Avignon) discussed the methodological difficulties associated with an empirical analysis of organic farming location. In particular, he highlighted the difficulty to interpret spatial autocorrelation when the overall fit is low: it may as well come from missing covariates, non-linearity in covariates, spatially varying coefficients or spatial diffusion processes. He also insisted on separating agricultural sub-sectors (arable crops, fruits, dairy, …) when studying the drivers of organic farming. To mitigate these difficulties, econometric analysis at farm scale is promising and possible through the combination of agricultural census, MSA and Agence Bio data.

3. Location of agricultural production in large-scale crop supply models

3.1. Determinants of cropping choices and their use in CAPRI model

The effect of agricultural activities on the environment depends on fine resolution characteristics such as climate, soil, etc. The historical regional resolution of policy-oriented partial equilibrium models such as CAPRI is therefore limiting when assessing environmental impacts. Markus Kempen (Bonn University) presented the downscaling procedure used to overcome this limitation in CAPRI. It consists in two steps: (1) estimating a discrete crop choice model on fine scale data – LUCAS, and (2) ensuring the consistency of predicted land use with the regional totals from EU statistics or CAPRI by a revision of the estimates of the first step which maximizes posterior density (highest posterior density method). Downscaled data is consistent with NUTS 3 (sub-regional) data for northern France and the UK, but significant inconsistencies occur in southern Europe and Denmark.

3.2. Projected location of energy crops in the UK using an agent-based model

Peter Alexander (Scotland Rural College, Edimburgh) presented an agent-based model aimed at studying the adoption of energy crops in the UK under various policies. One of the advantages of such an approach is to simulate the transition between two market-driven equilibria through the inertia of technology adoption processes and supply/demand adjustment at local scale. This inertia – validated against the diffusion of oilseed rape between 1966 and 1996 – results in substantially lower acreage of energy crops in 2020 and 2030 than predicted by existing studies. It also results in a counter-intuitive U-shaped marginal abatement cost curve. This curve starts with a downward trend typical of increasing return to adoption and ends with a neo-classical upward trend.

3.3. The role of supply chains in today's agricultural production: how relevant is proximity?

Several studies show agglomeration economies and economies of scope are roughly balanced at farm level. At territorial level however, agricultural production displays a clear tendency for agglomeration which is often neglected in economic models, be they theoretical or policy oriented. Valentin Bellassen (INRA/CESAER, Dijon) presented an empirical approach to quantify the agglomeration impact of economic and institutional factors on a selection of arable crops in Burgundy. Preliminary results show that proximity to key transformation plant types and/or collectors explain a larger share of the variability in crop location than classical pedo-climatic variables.