Weed infestation control through landscape dynamics modelling

Résumé :

Weeds are a great nuisance in agriculture: Farmers spend an enormous amount of money on their control. They mostly lean on pesticides to try and curb their numbers. Nevertheless, because of new EU regulations and farmer's health issues, other weed control means should be considered. The ecosystem services provided by certain carabid species as weed seed predators have been studied by several authors. Honek et al. (2003) examined several carabid species seed preferences and daily consumption in laboratory and real life conditions. Their results hinted at the potential use carabids may have as a way to control seed density numbers. A larger scale study was carried out in more than 200 British farms by Bohan et al. (2011). Their work also suggests that carabids have a strong regulatory effect on weed seedbank density. Carabids are very diverse insect group (over 40000 species), and most of them are carnivores. Some species however are omnivores such as *Pœcilus Cupreus*. Two studies, one carried out in 2010 and the other on 2011 in France's Brittany region, showed that one of the most abundant carabid species is *Pœcilus Cupreus*. This species is not the biggest weed seed predator but its bountiful population numbers along with its substantial seed consumption make it an interesting species to base our study on.

Our goal in this study goal is to use a mechanistic framework to explore how carabid, and more specifically *Pœcilus Cupreus*, activity may bear on weed seed numbers in agricultural landscapes. In order to estimate this impact, a coupled weed-seed carabid model is proposed. This model will be solved on different landscapes, obtained by a stochastic procedure, with several distinctive geometrical configurations and land use, to try and establish whether there are certain landscape types which could maximize ecosystem services provided by carabids. To probe this question we'll use a global sensitivity analysis procedure, the Morris method. Using this strategy, we'll generate a matrix comprising of geometric and land use parameters. This matrix will later be employed to create the landscapes on which the model will be solved. We'll then use some simple metrics like total carabid and weed seed population to determine if there is a relationship between them and the entry parameters.