agropolis fondation

SEEDBANK

Hydrological flows explaining seedbank biodiversity in agroecoABSYSs

ABSTRACT

To limit adverse effects of intensive agriculture on soil, water, and biodiversity, it is now necessary to completely rethink our view of natural capital and the way we manage agroecosystems. By considering interstitial elements of the agroecosystems (e.g. field borders and ditches) into agroecological approaches, we will be able to implement Nature-Based solutions that take advantage of the specific properties of these elements. Focusing on topological properties of ditches for example, we know that they are organized in a network that increase landscape connectivities, by concentrating and channeling abiotic and biotic flows. Ditches also host spontaneous vegetation that provides many ecosystem services : regulation of solid and liquid flows, hot-spot of biodiversity, resources for crop auxiliaries, amongst others. It also provides some disservices, such as spreading invasive species and limitating hydraulic abilities of the hydrographic network.The interrelations between water, plants and soil are at the core of ditch functioning. Vegetation exhibits a permeability to water flows, limiting hydraulic transport, but also to plant material fluxes, such as seeds by hydrochory, limiting species spread in the network. Soil of ditches contained a large amount of seeds, constituting the natural capital of plant biodiversity of these elements. Empirical knowledge is still lacking on the interrelations between all the components, despite recent advances in ecohydrological research. For this purpose, it is important to better assess the factors and mechanisms explaining the soil seedbank of ditches, in order to evaluate their potential for ecological rehabilitation of spontaneous vegetation of ditches.

The proposed project consists in setting experimental studies to better characterize the seedbank of the ditches and their surroundings, according to the exogeneous properties of the ditches and the main processes explaining the seed deposition (hydrochory in our case). We will examine what will be the fluxes of seeds displaced by hydrochory, and how runoff regime, geomorphology and standing vegetation will affect these fluxes ?To that end, we will set up experiments in small sections of a ditch network to (i) characterize finely the properties of the section (morphology and standing vegetation), (ii) track released seeds at different position inside and outside the ditch section. In the same time, we will realize seedbank samplings and seed identification using the seed germination method to estimate the composition and abundance of each spontaneous species in the soil.A spatially explicit model will be built to integrate the observed dispersal kernels and their explaining factors and calibrated using the empirical dataset. The proposed model will aim at testing different Nature-Based solutions, applied either at local or lanscape scale, and favoring seed circulation for maintaining plant biodiversity.

Keywords : Agricultural practices, Seeds, Process-based model, Biodiversity, Ditches

Year : 2020
Project number : 2002-214
Type of funding : AAP ICL
Project type : AAP
Research units in the network : LISAH G-EAU ABSYS
Start date : 2021-09-01
End date : 2024-10-31
Flagship project : no

Project leader : Fabrice Vinatier
Project leader's institution : INRAE
Project leader's RU : LISAH

Budget allocated : 67176 €
Total budget allocated (including co-financing) : 67176 €

Funding : Labex

GOAL

In this context, our main objective is to assess which factors will affect the spatial distribution of seeds by focusing on runoff transport of seeds in linear features of different origin, size and shape. Three scientific questions will be answered in the project:
• What will be the fluxes of seeds displaced by hydrochory in linear features such as ditches?
• How runoff regime, geomorphology of the linear features (microhabitats) and standing vegetation will affect these fluxes?
• How the soil seedbank diversity (alpha and beta) will differ according to the properties of ditches in agroecosystems and their surroundings?
The answers to these questions should help implementing a process-based model linking seed-vegetation-water to implement Nature-Based Solutions focused on ditches natural rehabilitation.