Climate change and ecosystem services: Can non-inversion tillage and field margins improve water storage in arable landscapes through stimulation of earthworm diversity?

Summary
The project relates to the management of agrobiodiversity for the provision of soil ecosystem services in agricultural landscapes. Although non-productive landscape elements on farms, such as field margins, are principally managed for biological disease control, above-ground biodiversity conservation and/or landscape aesthetics, they can also stimulate below-ground biodiversity with a positive impact on soil characteristics in neighboring productive fields. Especially so, if the soil management of the productive landscape elements is also supportive to a higher soil biodiversity. Earthworms are an important component of the soil biodiversity in Dutch polder soils and their positive effects on soil structure are well-known. Farmers are increasingly concerned about severe soil compaction and water stagnation on their fields, a problem that is expected to aggravate due to the predicted impacts of climate change. Earthworm diversity is typically low in conventionally tilled arable fields, but different functional groups of earthworms can be restored when soil disturbance is decreased and crop residues are maintained in the upper centimeters of the soil. In this research project we investigate to what extent soil structure and water infiltration and retention in arable land can be improved through a higher earthworm diversity resulting from non-inversion tillage in combination with controlled traffic and field margin management. The study involves a replicated field trial at PPO Lelystad, complemented with on-farm studies in the Flevopolder and Hoeksche Waard, and laboratory experiments with different earthworm populations. Remote sensing, GIS and ecohydrological modeling will be used for scaling up to the landscape level.

Keywords
Science, Applied Research, Arable land, Earthworms, Soil structure, Soil moisture, Field margins, Tillage, Controlled Traffic

Objectives
1. To understand and quantify the combined effects of field margins, soil tillage and field traffic management on:
   - The abundance, species composition and spatial distribution of earthworm populations in arable fields and field margins
   - Soil structure, water infiltration and water retention in arable fields
2. Quantifying the effects of agrobiodiversity management on water storage at the landscape scale.

Time frame
The project runs for 5 years (2009 – 2013).
Partners
Partners involved in the project are:

- Wageningen University, Department of Soil Quality
- Wageningen University, Centre for Geo-Information
- Alterra, Soil Physics and Land Use, Wageningen UR
- Plant Research International, Wageningen UR
- Applied Plant Research, locations Lelystad and Westmaas
- Participating farmers in the Hoeksche Waard and the Flevopolder

The project is co-funded by Wageningen UR and the Netherlands Ministries of Housing, Spatial Planning and the Environment (VROM) and Agriculture, Nature and Food Quality (LNV, via Knowledge Base KB-01).

Outputs
Expected outputs are:

- A PhD thesis (2013) and at least four scientific articles describing the results of the project
- Results and new insights will also be communicated through documents targeted at policy makers
- Results will also be presented to different stakeholder groups (e.g. farmers, water boards, policy makers) through the websites of Spade (http://www.spade.nl) and the European Learning Network for Functional Agrobiodiversity (http://www.eln-fab.eu/).

Stakeholders
Relevant stakeholders include farmers, policy makers, water boards, and researchers

Links
For a description of the project in Dutch see: Projectbeschrijving Nederlands Spade.pdf
http://www.spade.nl/projecten-detail.asp?ProjectID=91
http://www.biokennis.nl/Nieuws/22062009Niekerkendegrondbewerkingvraagtoamaanp
assingmechanisatie.htm

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