B01 Agricultural biodiversity and associated services across rural-urban landscapes: field & modelling studies

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Introduction

Crop yield is affected by :

- Agricultural biodiversity providing services and disservices: plants (including weeds), herbivores and their natural enemies (insects and birds), and pollinators (mainly bees).
- Spillover of organisms from surrounding urban *vs.* rural landscapes, driven by "graying vs. greening".

Work plan

On-farm vegetation surveys, city and landscape maps.

Pollination and biocontrol experiments.

Models and scenarios balancing socio-economic and ecological needs.

Multi-species model of long-term bee dynamics.

Synthesis of social-economic-ecological functions.

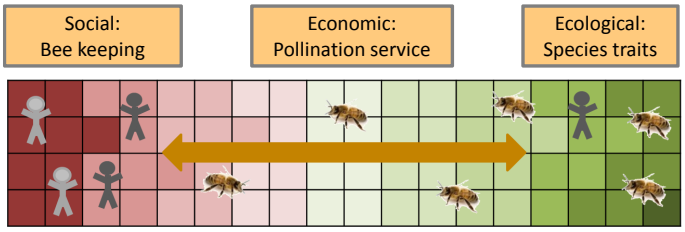

Fig. 2: Virtual rural-urban landscape with pollination.

Collaborations

Within FOR2432:

A01, A02, B02, C01, C02, C03, C04, C05.

Indian partner projects:

Plant and insect diversity in agro-ecosystems along the urban-rural interface *(K.N. Ganeshaiah).*

Mapping of bee species distribution in agriculture systems under transition *(S. Devy).*

Hypotheses

- Croplands near to urban areas experience reduced agro-biodiversity and ecosystem services and higher variability.
- High crop diversity and low pesticide input sustain pollination and biocontrol services, stabilizing production.
- Spatial configuration of the city affects local pollination.
- High resource unit mobilization (pollination) decreases self-organization in Social-Ecological-Systems.

Methodology

WP1 - Baseline assessment (field & model)

- Diverse versus simple vegetable production systems.
- All 36 on-farm sites, and surveys in 200 vegetable systems.
- Landscape context: matrix at different spatial scales .
- Diversity and density of the crop species, associated plants and experimental weedy strips.

WP2 - Pollination services (field; Fig. 1)

- Pollination success, experiments and phytometer plants.
- Plant-pollinator interaction webs.
- Cavity-nesting bees and bee-parasitoid interaction webs.

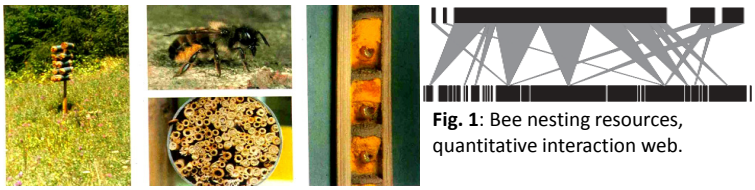

Fig. 1: Bee nesting resources, quantitative interaction web.

WP3 - Biological pest control (field)

- Surveys of major pest insects and their natural enemies.
- Experimental exclusion of invertebrate enemies.
- Functional bird diversity.

WP4 - Dynamic spatial model of multi-species bee dynamics and pollination services (model; Fig. 2)

- Spatial multi-species model (short-term bee dynamics).
- Simulation model of urban sprawl (greying vs. greening).
- Combined dynamic model (long-term bee dynamics).

WP5 - Social-ecological viability of vegetable production system (integration)

- Monetary value of pollination services, ecological-socioeconomic synergies and trade-offs.
- Spatio-temporal connector in Social-Ecological Systems.

Expected results and contribution to the framework

- Spatially explicit quantitative data on ecosystem services such as crop pollination and pest control.
- Ecological-socio-economic model of pollination dynamics and services in rural-urban landscapes.
- Changing scenarios across changing urban-rural landscapes.
- Integrative assessment of pollination as a spatio-temporal connector in Social-Ecological Systems.
- Integrative understanding of agroecosystem transitions, balancing socio-economic and ecological needs.