



**CESAB**  
CENTRE FOR THE SYNTHESIS AND ANALYSIS  
OF BIODIVERSITY

# Project summary



## NETSEED

Strengthening management of agrobiodiversity through social networks: A cross-disciplinary method for analyzing how local seed systems impact the diversity of domesticated plants

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**Crop biodiversity contributes to the performance of agroecosystems. Seed circulation (SC) by farmers is key to maintaining agrobiodiversity. Understanding how SC impacts food security requires studies integrating biological and social aspects.**

## Context and objectives

Seeds of cultivated plants are both biological objects (carriers of genetic information) and social and economic objects (markers of identity and status). Seed circulation (SC) shapes the diffusion of agrobiodiversity, affecting the performance of agroecosystems. But SC is not driven by agronomic concerns alone; SC reflects social structure. No adequate framework existed for the analysis of such a 'hybrid' object. NetSeed's objective was to develop a conceptual framework and methodology for integrating biological and social aspects of SC to understand how it contributes to ensuring food security. To respond to this challenge, we assembled an interdisciplinary team: 17 researchers from fields as diverse as geography, anthropology, population genetics and modelling. Our first task, to develop a common language across disciplines, would require producing a thesaurus, a glossary, and an "application ontology" integrating concepts from different disciplines and permitting analysis of disparate types of data. We then aimed to use the new framework to produce state-of-the-art reviews, advancing synthesis of the fragmented literature and pointing to gaps; to analyze our own data for general patterns; to identify limitations of current methods; and finally, to develop new methods for producing and analyzing the data needed for rigorous, truly integrative studies of SC networks.

## Methods and approaches used for the project.

1. We developed a logical framework (thesaurus, glossary, application ontology) that permits the mediation of different datasets.
2. Modeling in the framework of network theory, we explored how different paths of SC (network topology) affect the distribution of agrobiodiversity.
3. We developed a Latent Block Model and applied it to the 43 NetSeed datasets offering "snapshot" samples of crop diversity to characterize its distribution (at species and landrace levels) at local levels (within and among villages).
4. Three individual, comprehensive datasets integrating new protocols were separately analyzed, adapting for the first time Exponential Random Graph Models to SC data.

## Principal conclusions

1. NetSeed researchers developed the capability to think 'outside the box' of their parent disciplines, and graduate students used the novel methods developed.
2. Authoritative reviews synthesized past studies, identifying open questions, challenging common misconceptions among policy-makers about the nature of farmer SC networks and their contribution to food security and agrobiodiversity conservation.
3. Modelling showed that reciprocity is of decreasing importance for the persistence of varieties as SC network size increases. These counter-intuitive results validate the use of modelling in challenging assumptions and sharpening questions.
4. High-diversity farms contain both frequent and rare taxa and low-diversity farms contain only the most frequent plants.
5. Analyses of individual datasets showed that: (1) topology of SC networks depends on the crop's biocultural status; (2) different social systems require

different sampling strategies; (3) larger volumes of seeds circulated over longer distances through different networks in “bad years”, indicating that SC networks can adapt to climate change.

### **Anticipated (or actual) impact of these results for science, society, and public and private decision making**

NetSeed has had deep and broad impact. The role of agrobiodiversity in enhancing agroecosystem performance and maximizing their resilience in the face of climate change is increasingly recognized, as is the key role of farmers’ SC networks in maintaining agrobiodiversity. The synthetic reviews, modeling and empirical studies of NetSeed have strongly influenced research priorities in this area. Reaching a broad audience through articles in fundamental and applied journals in diverse fields, NetSeed’s work has contributed key insights to further the goal of achieving sustainable agriculture in the 21st Century.

NetSeed’s legacy has outlived the project itself. NetSeed researchers soon began forming broader connections to profit from NetSeed’s impetus and create long-term synergies. NetSeed researchers formed the core of consortia in the project MADRES (Modelling and analysis of dynamics in SC networks, CNRS INEE); the program MIRES (Interdisciplinary methods for studying SC networks, INRA); and the research group (GDR) Résodiv (Networks, Society, Diversity: Methodological approaches for the study of agrobiodiversity dynamics, CNRS INEE). These daughter projects continue to produce high-impact research. NetSeed researchers make other key contributions internationally, for example, contributing three of the 17 chapters of the recent authoritative collective volume, *The Commons, Plant Breeding and Agricultural Research* (Routledge, London).

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