

## A Meta-population Approach to Farmer Seed Systems

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This work is being developed in order to provide methodology and empirical approaches for understanding farmer seed systems in developing countries. A meta-population is composed of a number of nodes of smaller populations inhabiting ecological niches connected by migration and colonization. The starting point is to improve the understanding of farmer seed systems by utilizing information on farmer management of seeds to the level of a local population composed of a region of farmers interacting through seed exchange. The empirical application explores social, economic, and institutional factors that can influence the outcomes of the seed system. This presentation has two components, first an outline of key points in integrating population modeling with farm level information, and second, econometric analysis of household survey data from Mexico.

There are three areas where the development of this new methodology and generation of empirical case studies is currently needed. This approach is first motivated by a need to evolve our approach to in situ conservation of agricultural biodiversity, also called Crop Genetic Resources. The previous approaches used a household based approach to look at the social and market context of households choosing to conserve traditional varieties, merging tools of ethnobotany with household-farm modeling. There is a need for in situ studies to move to a community or regional level and to be able to look at the dynamic evolution of a crop population across a set of farmers. The second key area is in the realm of agricultural biosafety in the face of the field release of genetically modified crops. While there is some research on the biological and ecological modeling of the effects of the release (or escape) of genetically modified crops into areas of related biological diversity, there is a concurrent need to investigate the human aspects of the crop management that will impact the spread or control of foreign genes in a farmer environment. The third area is to contribute to the dissemination of the products of crop breeding to locations where the formal seed supply systems of the green revolution and CGIAR model have failed, where farmers could gain from improved germplasm but solely source seed through informal networks. Previous Green Revolution studies focused on why farmers either failed to adopt new seed technologies, or how governments and seed companies failed to provide

access. A better understanding of the informal networks, and their economic and institutional contexts, is necessary to extend the benefits of access to crop genetic resources.

The idea of a meta-population comes from conservation biology, and the current work of a group of theoretical ecologists. While it is hard to apply to the crop case in the detail and complexity used in the ecological literature, it is a useful framework for the complexity of farmer-based seed systems. The ecological modeling derives from studies of Island Biogeography, where different species inhabit different ecological niches across a fragmented landscape, and there are movements of colonization and migration between niches and local trends of growth or extinctions within niches. The idea of a meta-population is to model the entire population as composed of the populations in each niche, or patch, and to using the quantification of rates of migration, to derive mathematically results for the minimum number of patches to support a population or the minimum number of individuals within each patch. In the crop case, the implication would be to move from each farmer having a distinct population to the population being composed of a community or set of farmers in an ecologic or agronomic region. In an informal seed system, the rates of colonization are the exchanges and sources of seeds of farmers within the set of farmers, and colonization and extinction are the turnover rate and adoption of new seed types by farmers. As the processes of seed exchange and varietal adoption have social and economic components, and are mediated by local institutions in farm communities, there is an opportunity to empirically look for the social and economic factors influencing the linkages between the patches in the seed meta-population.