

### **New agricultural models, some old problems.**

José Paruelo<sup>1,2</sup>.

<sup>1</sup>LART and Departamento de Métodos Cuantitativos y Sistemas de Información.  
IFEVA and Facultad de Agronomía. UBA and CONICET. Argentina.

<sup>2</sup> IECA. Facultad de Ciencias. Universidad de la República. Uruguay.

Advances in agriculture, both related to intensification and cultivated area, contributed to reduce the undernourished population around the world from over a 23% in 1990 to less than 15% in the latest years. Agriculture, however, is a key determinant of several of the environmental and social problems that humankind face today. Land use and land cover changes are in the core of many conflicts around the world. Improvements in food security mentioned above were associated to a erosion of food sovereignty in most of the developing world.

The expansion of agriculture and cattle ranching determined in many areas profound changes in land tenure, social and production relationships. Agricultural expansion and intensification has been related to a process of land concentration and displacement of peasant and aboriginal communities, on one hand, and to an increase of an industrialized type of agriculture, on the other. Some of changes are associated to "land grabbing". This terms described the processes of buying or leasing large pieces of land in developing countries, by domestic and transnational companies, governments, and individuals. Though no new, the land grabbing increased its importance during the last decade.

Land grabbing is taking place all over the world. In South America the phenomenon is concentrated in four countries: Argentina, Brazil, Paraguay and Uruguay. The xerophitic woodlands of the Gran Chaco Region are one of the biomes more affected by land grabbing in the continent, showing one of the highest rates of deforestation in the world and an increasing number of territorial and environmental conflicts. Land grabbing is operating as a dominant force in organizing the spatial distribution of land cover and land uses on the territory. Such transformations are taking place without the participation of local stakeholders and without cumulative impact assessments. Industrial agriculture or the agri-business represent a major change in scale, organization, technology and financial resources from peasant or small farmers agriculture. This would impact, given the same area devoted to agricultural, on the type and level of ecosystem services and economic goods provided and on their distribution among different stakeholders.

Humankind developed historically different land uses patterns in a more or less spontaneous way. In some cases the socio-ecological systems (SES) resulting were successful and last for centuries, i.e the Chinampas in México or the highlands agriculture of New Guinea. Others failed, given place to the collapse of the SES. The analysis of several cases of SES collapses in very different geographic, environmental and historic contexts, from Easter Island to the Norwich colonization of Greenland, allowed anthropologists and ecologists to identify some common features. Several of these factors seems to operate nowadays in the Gran Chaco. Are we repeating history with agri-business expansion? Are we tripping over the same stone? These common features include:

1. *The model used for decision making is based on an extrapolation of knowledge acquired in different systems with some similarities but critical differences.* Agriculture in the Argentine Chaco is based on the same technological packages than in the pampas. A subtropical region with summer precipitations is cultivated using a model developed in a temperate area with even distributed precipitation.

2. *The information available is scarce, problems are over-generalized and the description of the temporal and spatial heterogeneity of the structural and functional characteristics of the SSE is insufficient.* The regular distribution of the deforested patches in the territory suggests that the edaphic and geomorphological heterogeneity was not taken into account. The expansion of agriculture to areas with historical records of mean annual precipitation under 600 mm during wet periods ignores the temporal variability of rainfalls and/or cyclic behaviors. The regular shape and the increasing size of deforested patches ignores the effects of landscape configuration on vertical and horizontal flows of energy and matter.

3. *The observation period is short and the dynamics of the system is poorly characterized and/or trends are not evident. Lagged feedbacks are not perceived.* Rain fed agriculture expands in semi-arid zones during wet periods and collapsed during dry cycles promoting desertification processes. The slow but sustained raise of groundwater in areas where croplands replace forests and the salinization problems that may occur are an example of lagged feedbacks in the SEE.

4. *Those who take long term, strategic decisions are not those who actually operate on the agroecosystems.* Land grabbing located decision makers even in a different continent. As a consequence decision making is disconnected from an eventual degradation dynamics and the responses are lagged. Land grabbing and industrial agriculture connect systems with a very different dynamics: financial markets and agroecosystems. Response times, internal and external controls and feedbacks differ markedly between them.

5. *Decision makers may acknowledge the problems but they do not feel responsible for them.* Not only global environmental problems (biodiversity losses or climatic change) but also more local issues such as contamination, flood regulation, etc., are considered as government or international institutions responsibility. The lack of territorial bounds of the actual decision makers would exacerbate this behavior.

6. *The "model of nature" used (explicit or implicitly) as decision framework is not correct.* A typical case is to assume an equilibrium dynamics to plan and to evaluate impacts. A number of exogenous (from climatic change to biological invasions) and endogenous (the succession dynamics of a forest, the disturbance regime, the land surface-atmosphere interaction) factors are continually changing and modifying the response of the system.

Are we able to understand and anticipate these problems? Are we able to communicate properly the consequences of the problems and to propose alternative? How do we play as scientists in an arena full of interests and conflicting values?

There are many ideological, ethical, political, economic and social concerns related to the land grabbing phenomenon and the expansion of industrial agriculture. Aside from them, understanding the coupled dynamics of the land - atmosphere systems requires a proper characterization of the particular consequences of industrial agriculture on landscape structure, configuration and functioning. The idea of *Ecosystem Functional Types* provides a basis to characterize in an integrative way functional differences among landscapes.