Has ecosystem management based on techno-scientific practices twisted sustainability?

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Objective

To write a book on how the increasing use of new techno-scientific practices and distinct agricultural systems have affected the sustainability of two Brazilian ecosystems.

Short description

Brazil has six different terrestrial biomes: Amazon, Atlantic Forest, Cerrado, Caatinga, Pampa and Pantanal. Prior to the arrival of European immigrants, native indigenous people were already inhabiting all of them. Our work will focus on the Atlantic Rainforest biome, one of the hotspots of biodiversity, and the Pampa biome. *Mata Atlântica* (Atlantic Forest) is a rich mosaic of tropical and subtropical forests whose previous area stretched from the northeast to the south of Brazil, northeast Argentina and eastern Paraguay. Today, the Atlantic Forest biome of southeastern Brazil is one of the most threatened and diverse ecosystems in the world. The Pampa is a biome that occupies a single state in Brazil, Rio Grande do Sul, covering only 2% of the country. It includes a large diversity of landscapes, ranging from plains, mountains and rocky outcrops, but the most typical are grass fields with hills and isolated trees with watercourses nearby.

The endangered condition of these biomes is to a large degree the result of the early colonization model adopted in the states of Rio Grande do Sul, Santa Catarina, and Paraná, followed by techno-scientific based management practices and agricultural inputs. As a result of this, only 10% and 36% of the original extent of the Atlantic Forest and Pampa remain, respectively, due to anthropogenic intervention, and only less than 2% and 3%, respectively, of the biomes are under protected status**.** The two selected biomes had harbored indigenous peoples for centuries, providing them with shelter and food, both native (e.g. Brazilian pine fruits) and that domesticated elsewhere, such as maize, beans, and cassava. In addition to indigenous peoples, this area has also harbored a social group called *caboclo*, formed by the contact between Indians and European settlers, especially the Portuguese, since the 17th century. The different fate of these two biomes reveals a lot about the geography of Brazilian environmental history. The arrival of immigrants undermined the traditional way of life of these two groups. As they possessed no ownership documents, they were removed by the state or colonization companies from their lands in favor of settlers. The change from indigenous and *caboclo* occupation to European settlements throughout the nineteenth and twentieth centuries generated drastic alterations in nature.

The presence of human groups for extended periods in the same environment causes them to develop complex strategies of interaction with the environment, selecting genetic resources for their use and domesticating landscapes and plants. With the settlement of European immigrants, the management of the ecosystem increased. Since the middle of the last century, high-input agricultural systems, including pesticides and other agrochemicals, have largely replaced traditional ones. More recently, farmers have also adopted new technologies such as

genetically modified organisms (GMO). Now, Brazil ranks first in pesticide use and second in GMO cultivated area. However, GMOs and pesticides are having unpredicted and unintentional effects on biodiversity, environment, and agriculture. The quality of foods also is affected by these technologies. Currently, we are studying the GMO soybean proteome at the request of the German Federal Agency for Nature Conservation (Bundesamt für Naturschutz, BfN).

The large transformations caused by anthropogenic activities in the managed ecosystems had several consequences. The larger part of these ecosystems became adapted for agricultural purposes. Thus, it is possible to associate these ecosystems transformations with (i) the great difference that exists in biodiversity uses between indigenous and immigrants; (ii) the adverse impacts of certain types of agro-ecosystem management and (iii) the unprecedented negative effects of new technologies on socioeconomic and environmental sustainability. On the other hand, the agro-ecological management of the ecosystems can increase the rate of evolution of native species. Some species, if favored by humans, can be domesticated in a sustainable managed ecosystem. For instance, plants with notable attributes, such as food and medicinal properties, are often promoted. Further, sustainable agricultural systems (agro-ecology, organic) also carry positive consequences to the environment and human health quality.

We have been researching and writing about the main themes we propose here for almost 30 years. But we have never been able to undertake this kind of evaluation of the two biomes in an interdisciplinary analysis in the way we have envisioned in this proposal. Our goal is to discuss how the increasing intensification of ecosystem management practices, based on techno-scientific advancements, has affected the environment, food production and life quality in the two biomes in southern Brazil. This kind of analysis should rely on the biophysical, geographical, and economic dimensions of history. It is also important that it will consider the historical changes in the different cultural perceptions about nature and the use of different landscapes (forests and pastures).

The focus of our analysis will be on six main aspects: (1) previous and current main features of the Mata Atlântica and Pampa biomes; (2) the evolution of deforestation and ecosystem management types and their consequences (mainly adverse effects); (3) the expansion of industrial agriculture systems based on the advancement of techno-science (mainly GMO and pesticides) and its consequences and the role of public policies in agriculture; (4) agro-ecology principles and processes as the basis of a sustainable agricultural system and their relationship with social movements and consumers; (5) how certain ecosystem management practices can enhance domestication of native species (e.g.; feijoa (*Acca sellowiana*) by traditional people and small farmers and (6) a final balance of the management practices in the ecosystem of southern Brazil, with conclusions.

The expected output is a book that could be used by undergraduate and graduate students in agronomy, history, environmental studies, and interdisciplinary studies. Considering their expertise and experience, it is our intention to invite our partners at RCC/LMU as authors as well, depending on their interest and available time.