

## Chapter 7

# Impact Analysis of Amendment Application Under Diversified Agro–Ecological System: Sustainable Environment

**Amit Kumar**

*Independent Researcher, India*

### **ABSTRACT**

*In alternative agricultural systems such as organic or low-input farming, farmers can build particular forms of relationships that help sustain ecosystem services and social infrastructure more effectively. The authors discuss many of these relationships, including direct marketing, fair trade certification, and food justice movements. An agroecological approach to improve tropical small farming systems must ensure that promoted systems and technologies are suited to the specific environmental and socio-economic conditions of small farmers, without increasing risk or dependence on external inputs. Here in this chapter, the authors have focused on diversified agro-ecological systems.*

### **BACKGROUND**

One of the major challenges of this millennium is ensuring food security in times of climate change, increasing population, environmental needs, economic and energy crisis. Agro-ecology as a science, is a set of principles and practices, and a social movement. Small scale diversified systems which rely mostly on local resources and complex crop arrangements are reasonably productive and stable, exhibiting a high return per unit of labor and energy. In many ways complex polycultures and agroforestry systems used by small tropical farmers mimic the structure and function of natural communities therefore acquiring many features typical of such communities, such as tight nutrient cycling, resistance to pest invasion, vertical structure, and high levels of biodiversity. An agro-ecological approach to improve tropical small farming systems must ensure that promoted systems and technologies are suited to the specific environmental

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and socio-economic conditions of small farmers, without increasing risk or dependence on external inputs. Rather, agro-ecological development projects should incorporate elements of traditional agricultural knowledge and modern agricultural science, featuring resource-conserving yet highly productive systems such as poly-cultures, agroforestry, and the integration of crops and livestock. It is ecologically futile to promote mechanized monocultures in areas of overwhelming biotic intricacy where pests flourish year-round and nutrient leaching is a major constraint. Here, it pays to imitate natural cycles rather than struggle to impose simplistic ecosystems that are not inherently complex. For this reason, many researchers think that successional ecosystems can be particularly appropriate templates for the design of sustainable tropical agro-ecosystems.

The industrialized agricultural techniques are exacting a huge toll on surrounding environments, polluting waterways, creating dead zones in the oceans, destroying bio diverse habitats, releasing toxins into food chains, endangering public health via disease outbreaks and pesticide exposures, and contributing to climate warming (Horrihan et al., 2002, Tilman et al., 2002; Diaz & Rosenberg 2008; Marks et al., 2010; Foley et al., 2011). Moreover, industrial agricultural methods are inherently unsustainable in mining soils (Montgomery, 2007) and aquifers far more quickly than they can be replenished, and in their high use of fossil fuels (Lynch et al., 2011). These numerous environmental and social externalities create a huge economic cost that industrialized food producers seldom pay. For instance, pesticide use alone causes up to \$10 billion in damage to humans and ecosystems in the United States every year (Pimentel, 2005). Finally, although the agricultural sector currently produces more than enough calories to feed humanity, one billion people remain hungry and an additional one billion have micronutrient deficiencies. This paradoxical situation occurs because many people still lack access to sufficiently diverse and healthy food, or the means to produce it, which is primarily a problem of distribution rather than production. As further evidence of this paradox, global obesity rates have more than doubled since 1980 (WHO, 2012), reflecting an overproduction of food in industrialized countries that creates strong incentives for agri-food companies to absorb excess food production into processed foods and to market and distribute them to customers in supersized portions (Nestle, 2003).

Components of the agro-biodiversity within diversified agro-ecological system interact with one another and/or the physical environment to supply critical ecosystem services to the farming process, such as soil building, nitrogen fixation, nutrient cycling, water infiltration, pest or disease suppression, and pollination, thereby achieving a more sustainable form of agriculture that relies primarily upon inputs generated and regenerated within the agro-ecosystem, rather than primarily on external, often nonrenewable, inputs (Shennan, 2008). Spatial considerations are important, since different components of the system must be in sufficient proximity, at each relevant scale, to create needed interactions and synergies. For example, the utility of intercropping for reducing belowground soil disease depends on spacing the different crops such that their root systems interact (Hiddink et al., 2010). Similarly, wild bee communities can only provide complete crop pollination services when a sufficient proportion of their natural habitat occurs within a given distance of crop fields. The diversified agro-ecological system is not only spatially heterogeneous, but is variable across time, due both to human actions (e.g., harvest, crop rotations, fallows, and other management practices or land use changes), and natural successional processes.

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