

Towards a biodiversity–based productivity framework

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According to the dominant paradigm of production, diversity goes against productivity, which creates an imperative for uniformity and monocultures. This has generated the paradoxical situation in which modern plant improvement has been based on the destruction of the biodiversity which it uses as raw material. The irony of plant and animal breeding is that it destroys the very building blocks on which the technology depends. Forestry development schemes introduce monocultures of industrial species such as eucalyptus, and push into extinction the diversity of local species which fulfils local needs.

Agricultural modernisation schemes introduce new and uniform crops into the farmer's field and destroy the diversity of local varieties. Modernisation of animal husbandry destroys diverse breeds and introduces factory farming. This strategy of basing productivity increase on the destruction of diversity is dangerous and unnecessary. Monocultures are ecologically and socially non–sustainable because they destroy both nature's economy and people's economy.

Wanted: diversity

In agriculture and forestry, in fisheries and animal husbandry, production is being incessantly pushed in the direction of diversity destruction. Production based on uniformity thus becomes the primary threat to biodiversity conservation and to sustainability, both in its natural resource and its socio–economic dimensions. Not till diversity is made the logic of production can diversity be conserved. If production continues to be based on the logic of uniformity and homogenisation, uniformity will continue to displace diversity.

"Improvement" from the corporate viewpoint, or from the viewpoint of western agricultural or forestry research, is often a loss for the Third World, especially for the poor in the Third World. There is therefore no inevitability that production should act against diversity. Uniformity as a pattern of production becomes inevitable only in a context of control and profitability.

Plant improvement in agriculture has been based on the "enhancement" of the yield of desired product at the expense of unwanted plant parts. The "desired" product is however not the same for agribusiness and Third World peasants. Which parts of a farming system will be treated as "unwanted" depends on what class and what gender one belongs to. What is unwanted for agribusiness may be wanted by the poor, and by squeezing out those aspects of biodiversity, agriculture "development" fosters poverty and ecological decline.

Framework for assessment

Given the rapid changes in agriculture taking place because of liberalisation, there is an urgent need to monitor the ecological costs of globalisation of agriculture using a biodiversity based productivity framework to reflect the health of nature's economy and people's economy. We have developed such a framework over the past decade. The framework

- provides documentation of the biodiversity status of a farm including crop, tree and animal biodiversity;
- indicates the contribution of biodiversity to provisioning of internal inputs and to the building and maintenance of "nature's economy" through the conservation of soil, water and biodiversity;
- indicates the contribution of biodiversity to the self-provisioning of food needs by agricultural families and communities and to the building and maintenance of "people's economy";
- reflects the market economy of the farm in terms of incomes from sale of agricultural produce, and of additional costs for purchase of external inputs and food items, when benefits from biodiversity are foregone.

The biodiversity-based productivity framework has been kept simple to allow participatory research by farmers in evaluating agricultural change on the basis of the needs of the land and the needs of farming communities, and to allow for comparisons across diverse ecosystems and farming systems. It can be adapted to reflect the complexity of the socio-economic context of farming. We welcome you to join us in developing this biodiversity-based productivity to realistically and honestly reflect the status of nature's economy and people's economy, which are the economies on which life depends.

Experiences with the framework

The framework has been applied to farming systems in different regions. While this is still work in progress even the early results show that when diversity is taken in account, the "return" to farmers is higher from mixed systems than from monocultures. On the one hand, diverse systems produce more nutrition per acre when all crops and all crop parts are included. On the other hand farmers save money by substituting purchased external inputs such as chemicals and fertilisers with internal inputs provided by biodiversity.

For example, in the Central Himalaya, in the rainfed areas a particular traditional cropping pattern takes place called "baranaja" – which means, literally twelve seeds (Shiva et al 1995). The seeds of twelve different crops (often more than twelve) are mixed and then randomly sown in a field which is fertilised by cow dung and farm yard manure. Relationship between different plants leads to symbiosis, which contributes to increased productivity of the crops.

Assessments made at the conservation centre show that if farmers cultivate "baranaja", they get higher produce than the soyabean monoculture which is being propagated by agricultural agencies. Soyabean sells for only Rs.5/- kg., whereas "jakhia", one of the "baranaja" crops that matures earliest, is selling for Rs.60/- kg. "Phapra" is another high value crop in the "baranaja" family, which has always been cultivated as a cash crop by Garhwal farmers, which used to be traditionally exchanged for salt.

Similarly, in the Western Ghats a small farm typically has 1.5 acres of paddy, 0.5 acres arecanut, and a kitchen garden with vegetables including "brinjal", beans, cucumber, chillies, "obhea", little gourds from which a farmer can earn approximately Rs.20,000/acre in addition to saving Rs.10,000/- on purchased inputs by using the straw and farm yard manure as internal inputs. In the case of a chemical fertiliser based 3 acre paddy farm, the output brings the farmer Rs.15,300/- and he has to spend Rs.8,900/- on purchased inputs, leaving him only Rs.6,400/- or Rs.2,100/- per acre.

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The Foundation was set up in 1981 to do independent ecological research to support grassroots movements and local communities and to evolve ecological paradigms as an alternative to the dominant reductionist approach which undermines sustainability. The Foundation has also initiated "Navdanya", a programme for the conservation of biodiversity in agriculture.

This article is based on Shiva V, 1995. *Biodiversity based productivity: a framework for an alternative economic assessment for sustainable agriculture*. New Delhi, RFSTNRP, 20 p.

Reference

- Shiva et al. 1995. *The seed keepers*. New Delhi, Navdanya, RFSTNRP, 156 pp.
- *Bija: the seed. A quarterly monitor on biodiversity, biotechnology and intellectual property rights*. New Delhi, RFSTNRP.

The real meaning of sustainability

Sustainability in agriculture has two dimensions: natural resource sustainability and socio-economic sustainability. Natural resource sustainability is based on the stability of the ecology of agricultural ecosystems based on interactions between soil, water and biodiversity. This sustainability measures the wealth of "nature's economy" and the foundation of all other economies. Nature's economy includes biodiversity, soil fertility and soil and water conservation that provides the ecological capital for agriculture.

Socio-economic sustainability relates to the social ecology of agriculture, including the relationship of society to the environment, the relationship between different social groups engaged in agricultural production and the relationship between producers and consumers, which is invariably mediated by traders, government agencies and corporations. Socio-economic sustainability measures the health of "people's economy" or the economy of sustenance, in which human needs of livelihoods and nutrition are met. People's economy includes the diverse costs and benefits both material and financial, that farming communities derive from agriculture.

There are quite clearly two different meanings of "sustainability". The real meaning refers to nature's and people's sustainability. It involves a recovery of the recognition that nature supports our lives and livelihoods, it is the primary source of sustenance. Sustaining nature implies maintaining the integrity of nature's processes, cycles and rhythms.

There is a second kind of "sustainability" which refers to the market. It involves maintaining supplies of raw material for industrial production and long-distance global consumption. In this meaning, markets grow while the soils and rural communities are impoverished. This is the conventional definition of "conservation" as making available sustained yields of raw material for development. And since industrial raw materials and market commodities have substitutes, sustainability is translated into substitutability of materials, which is further translated into convertibility into profits and cash.

Real measure of productivity

Overall productivity and sustainability is much higher in mixed systems of farming and forestry which produce diverse outputs. Productivity of monocultures is low in the context of diverse outputs and needs. It is high only in the restricted context of output of "part of a part" of the forest and farm biomass, like only pulpwood, or only grain. These high partial yields do not translate into high total (including diverse) yields. Productivity is therefore different depending on whether it is measured in a

framework of diversity or uniformity.

A recent article in *Scientific American* (Bray, 1994) has developed this approach further and has shown how the economic calculations of agricultural productivity of the dominant paradigm distort the real measure of productivity by leaving out the benefits of internal inputs derived from biodiversity as well as the additional financial and ecological costs generated by purchase of external inputs to substitute for internal inputs in monoculture systems.

– Bray F. 1994. *Agriculture for developing nations*. In: *Scientific American*, July 1994. pp. 33–35.

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