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Agricultural Biodiversity, Ecological Food Provision and Food Sovereignty: vital interdependencies

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ABSTRACT

Agricultural biodiversity comprises more than 'seeds'. It is the basis of all food, fibre and other products of ecosystems used by people, their livestock and other farmed, fished and harvested species. It is one of the last 'resources' developed and used by small-scale food providers, in their biodiverse, ecological food production systems, that has not been completely removed from the 'commons' and local control through privatisation, commodification, financialisation and commerce. Although varieties of some, mainly industrial, commodity crops have been enclosed through plant variety rights and patents, most agricultural biodiversity of both the 'target' species – more than 30,000 edible plant species and thousands of other useful species – and also the innumerable 'associated' species – including pollinators, aquatic and soil micro-organisms – has not, yet, been removed from the 'commons', though there are increasing numbers of legal and other instruments that will hasten its enclosure. As yet, not all agricultural biodiversity has been captured by those who control industrial production and harvesting, through financial, legal, corporate, market and governance systems and structures, which privilege power, and are supported by scientific and technological developments that manipulate and modify the resources in ways that improve benefits for the powerful. These systems and structures develop potent instruments which can undermine and enclose agricultural biodiversity and 'criminalise' biodiverse and ecological peasant production processes and their components, which depend on and sustain agricultural biodiversity. Confronting these onslaughts on agricultural biodiversity, and defending biodiverse, ecological food provision are arguably among the most significant challenges for those who wish to realise food sovereignty. This biodiverse, ecological model of food provision, developed in the framework of food sovereignty, is more resilient and can consistently produce more food over time per unit area, or per volume of water, than industrial monocultures. This model of 'peasant' production is dependent on, and also regenerates, and develops, agricultural biodiversity above and below ground, on-farm, on the range and in productive waters. This paper examines the interdependencies of agricultural biodiversity with ecological food provision, developed in the framework of food sovereignty, and the centrality of these to providing healthy, local food for a growing population, whilst sustaining the environment. It argues that the food sovereignty movement needs to give as high a priority to defending access to and control over all agricultural biodiversity's conservation, sustainable use and development as it does currently to defending peasant seeds.

> *"If agricultural development policies and conservation priorities are guided by the mistaken assumption that humanity depends on a handful of commodity crops, then we run the risk of undermining food security…"*
>
> Hope Shand, Human Nature, (FAO, 1997)

> *"What are we fighting for? A world where… we are able to conserve and rehabilitate rural environments, fish populations, landscapes and food traditions based on ecologically sustainable management of land, soils, water, seas, seeds, livestock and all other[agricultural] biodiversity."*
>
> Declaration of Nyéléni, Nyéléni 2007: forum for food sovereignty, Sélingué, Mali, 2007. (Nyeleni, 2007a).

> *"Agricultural biodiversity provides much more than our daily bread – it is the basis for fuel, medicine, fibre, tools, shelter, transportation, and a vital component of cultural and religious traditions."*
>
> SeedMap.org (USC Canada and ETC Group, 2013)

1 Introduction

Agricultural biodiversity is the basis of all food, fibre and other products of ecosystems used by people, their livestock and other farmed, fished and harvested species (PAR and FAO 2011) and it has critical, but often under-recognised, linkages with culture, spirituality and livelihoods (Pimbert, 2006). It is a creation of humankind whose food and livelihood security and food sovereignty depend on the sustained management of the biodiversity that is important for food and agriculture: the origins of agricultural biodiversity are through the careful selection and inventive developments of women and men small-scale food providers over more than 10 millennia, since the dawn of civilisation. (Mulvany, 2001; ITDG, 1996).

Agricultural biodiversity is one of the last 'resources' developed and utilised by small-scale food providers, in their biodiverse, ecological food production systems, that have not been completely removed from the 'commons' and local control through privatisation, commodification, financialisation and commerce (Shiva, Bhar and Jafri, 2002).

Although varieties of some, mainly industrial, commodity crops have been enclosed through plant variety rights and patents, most agricultural biodiversity – of the more than 30,000 'target' edible plant species (FAO, 1997a), other useful plant, animal, insect, fungal and microbial species, and innumerable 'associated' species that perform essential ecosystem functions – is not yet privatised, though there are increasing numbers of legal and other instruments that could hasten their enclosure, 'criminalising' biodiverse and ecological peasant production processes and their components, which depend on and sustain agricultural biodiversity (Halewood, Noriega and Louafi, 2013; Tansey and Rajotte, 2008; Via Campesina, 2013b).

This dynamic sub-set of biodiversity is developed and maintained in ecological production systems by, mainly small-scale, food providers to secure livelihoods, food and a resilient production environment. Yet, along with much of biodiversity, it is being lost at alarming rates due the ravages of industrial food and fibre production and related changes in consumption patterns. Its loss threatens global food supplies.

Food sovereignty, with its clarity about building upon local knowledge and skills, eschewing the privatisation of the commons and working with nature, is arguably the best framework within which agricultural biodiversity, and the systems of ecological food provision with which it has mutual interdependence, can be sustained (etcGroup, GRAIN and ITDG, 2002; Windfuhr and Jonsén, 2005; Nyéléni, 2007b).

2 The development of understanding about agricultural biodiversity

While "biological diversity" or "biodiversity" is a well-defined term in scientific literature (Wilson, 1988) and in law[1] (CBD, 1992), the term "agricultural biodiversity" is relatively new; science and policy are catching up with practice and the generational knowledge of small-scale food providers. The understanding in scientific and institutional circles about agricultural biodiversity has developed during the last four decades from the recognition of the importance of genetic diversity, particularly of commercial crops, and an emphasis on the

[1] "Biological diversity" means the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems.
Article 2, Convention on Biological Diversity (CBD, 1992). Biodiversity is fully described in Wilson, 1988.

ex situ approach of conserving seeds away from their production environment in the 1970s, to the adoption of the *in situ* approach to the conservation and sustainable use of agricultural biodiversity on-farm, on the range and in productive waters, in the 1990s, and the subsequent development of the agro-ecosystem approach that integrates the conservation and sustainable use of agricultural biodiversity in all its dimensions (adapted from FAO, 1999).

Agricultural biodiversity (sometimes known as agrobiodiversity[2]) comprises more than 'seeds'. It includes all the 'target' species, varieties and breeds and ecosystems needed, *inter alia*: to provide food, fibre and other products for people; to provide feed for their livestock and other farmed, fished and harvested species; and all the 'associated' species, which support production – pollinators, pest predators, aquatic and soil micro-organisms, 'wild' relatives etc. – required to maintain the structure of, and sustain key functions and processes in, productive terrestrial agricultural, pastoral, forest ecosystems above and below ground and in marine and inland aquatic ecosystems. (See Box "What is Agricultural Biodiversity?")

Agricultural biodiversity also supports and is the source of the biological resources for producing industrial agricultural, livestock, forestry, aquaculture and fisheries commodities, especially when the resources have been extracted, manipulated, commoditised and often privatised.

Understanding of this broad scope of agricultural biodiversity, that is comprehensive and inclusive of all the changes in biodiversity and ecosystems resulting from the application of the knowledge and skills of small-scale food providers over millennia, now informs the discourse in FAO and its Commission on Genetic Resources for Food and Agriculture, which now considers all biodiversity for food and agriculture (FAO, 2008; PAR and FAO, 2011).

[2] The term Agricultural Biodiversity is, in the English language, the accepted term in the United Nations FAO and CBD and by many authors that come from a public interest perspective. It is also a useful term in that it highlights the 'cultural' dimension. The reductionist term 'agrobiodiversity', though common in translation in other languages (and translation from those languages), is sometimes used by institutions and individuals who consider agricultural biodiversity mainly as an exploitable resource.

Box1: What is Agricultural Biodiversity

Agricultural biodiversity provides, and supports the production of food, feed, fibre, fuel and pharmaceuticals, as well as products used for many other things , for example, tools, shelter and transport. It also provides a vital component of cultural, culinary and religious traditions. It includes all genetic resources for food and agriculture, the diversity of 'target' species used by people and 'associated' species that support production and provide vital ecosystem functions, and also the diversity of the productive ecosystems managed by people.

Agricultural biodiversity encompasses the variety and variability of animals, plants and micro-organisms which are necessary to sustain key functions of the agro-ecosystem, its structure and processes for, and in support of, food production and food security. (FAO, 1999)

Agricultural biodiversity comprises the selected and enhanced sub-set of biodiversity of 'target' and 'associated' species, resulting from human interaction with other species in (agro)ecosystems. It is an outcome of the innovation, knowledge, skills and practices of, or has co-evolved with, countless generations of women and men who are smallholder and peasant farmers, urban gardeners, livestock keepers, pastoralists, artisanal fishers, forest dwellers, Indigenous Peoples, and other small-scale food providers, who produce food for most people in the world from their more biodiverse and ecological forms of production and harvesting. They have developed and sustained agricultural biodiversity above and below ground, in farms and gardens, in grazing lands and in productive waters.

Agricultural biodiversity can be described at genetic, species and ecosystem levels - variation in agricultural biodiversity is apparent and can be described at local, community and landscape / watershed / coastal-marine levels. It is also described spatially, at all scales, within and between production systems, and temporally.

Agricultural biodiversity is part of the 'commons', developed initially in 'centres of origin and diversity' and spread and further developed through exchanges of 'target' species, varieties and breeds, between communities, countries and continents.

Agricultural biodiversity includes the variety and variability of:

- Crop varieties, fodder and tree species, livestock breeds, diverse aquatic and marine species and non-domesticated ('wild') species used by people. It includes what are often called 'neglected and underutilised species[1]'. These 'target' species may also be manifest as 'populations', rather than distinct 'varieties'. There are between 30,000 and 50,000 edible plant species of which about 7,000 have been cultivated and for which millions of varieties have been bred by farmers. Between 35 and 40 animal species have been domesticated and around 7,600 distinct breeds of livestock, developed by livestock keepers, are raised. The world's capture fisheries harvested an estimated 1,938 aquatic species or species groups in 2011. Forests contain thousands of tree and other woody species, for some of which sub-specific varieties have been selected or developed. There are many species of edible fungi, insects, and other invertebrates that are harvested and a few are cultivated for human consumption (FAO, 2013).
- Non-harvested 'associated' species and populations within ecosystems that support production and provide essential ecosystem functions e.g. soil micro-organisms, pollinators, plant and animal pest predators, crop wild relatives, aquatic organisms. There are probably many millions of these species that directly, or indirectly through the ecosystem functions they perform, support the production of 'target' species.
- Ecosystems (including agricultural, pastoral, forest and aquatic/marine ecosystems) at all scales.

(Derived from FAO, CBD and other sources[1])

3 Resilient, Biodiverse and Ecological food provision

> *"Humankind is going to have to utilize sustainably every type of agricultural biodiversity at all levels, genetic, species and agro-ecosystem, if, as is required for universal food security, sustainable food production is to be achieved across the whole range of production environments."* (FAO, 1997b)

This exhortation in the report of a workshop in 1997 on Farming Systems Approaches for the Sustainable Use and Conservation of Agricultural Biodiversity and Agro-Ecosystems heralded a change in official views on the efficacy of biodiverse food provision and the interdependence of agricultural biodiversity with (agro)ecosystems and, by implication, ecological food provision. This reflection was subsequently translated into policies in the FAO and CBD and informed programmes and projects supported by many CSOs.

This change in approach gave official legitimacy to the methods used over millennia by the world's majority food providers who know that their biodiverse, ecological food provision is more sustainable, resilient and nutritious. In the report Biodiverse Agriculture for a Changing Climate, Ensor notes: "Biodiverse agroecological approaches bring multiple benefits, simultaneously building resilience in ecosystems and farming communities, while reducing greenhouse gas emissions from food production and drawing carbon from the atmosphere" (Ensor, 2009). He further elaborates on the "productivity-enhancing, purifying, regulating and recycling functions provided to agroecosystems by their embedded agricultural biodiversity… [which] improve ecosystem functioning, photosynthesis and nutrient capture". This is achieved by having a sufficient (and large) number of 'target' and 'associated' species in a productive ecosystem that can collectively make optimal use of available energy and nutrients from light, air, soil and water (Finke and Snyder, 2008). Sustainability is enhanced through homeostasis[3] that improves ecosystem resilience and, as numbers of species in the ecosystem increase so does, productivity (Egziabher, 2002).

Ecological food production can also sustain and improve livelihoods through improved productivity per unit area and unit of water. The International Assessment of Agricultural Knowledge, Science, and Technology for Development (IAASTD) found "an increase and strengthening of agricultural knowledge, science and technology [AKST] towards agro-ecological sciences will contribute to addressing environmental issues while maintaining and increasing productivity.[4]" (IAASTD, 2008; summarised by Mulvany, 2008). The productivity of biodiverse agroecology, in terms of food and other outputs from the whole production system, not just the yield of a commodity from a monoculture, can be as high if not greater than from a 'conventional' industrial crop[5].

In addition to ecosystem and livelihoods benefits the nutritional benefits of biodiverse food systems are significant and seriously under-emphasised in policy and practice. As Denis Lairon, the President, Federation of European Nutrition Societies, said, it is "very urgent to profoundly change our food strategy and to promote fair, culturally-appropriated, biodiversity-based, sustainable diets" (Lairon, 2010). The benefits of biodiverse, agroecological approaches, in terms of realising the Right to Food, have been highlighted by the UN Special Rapporteur on the Right to Food in his communications on seeds and agroecology to the UN (De

[3] *Homeostasis is achieved when an ecosystem* maintains a biological equilibrium between its different components.
[4] IAASTD, Finding #7 (IAASTD, 2008)
[5] This is examined in Ensor, 2009 and summarised in UKFG, 2010, building on the findings of Pimentel et al, 2005.

Schutter, 2009; 2011).

It is arguably, now, conventional wisdom, backed by extensive research, that the more biodiverse, ecological approaches to production practiced by small-scale food providers, are more productive, resilient, better for people and the environment, and can feed the world. (Altieri, 1995; FAO, 2012; Elfstrand, 2011; UNCTAD, 2013; europAfrica, 2013). It is their biodiverse and complex food webs that provide food to more than 70% of the world's peoples (ETC Group, 2013).

4 Enclosure of Agricultural Biodiversity

Agricultural biodiversity is threatened by the spread of 'uniform' industrial production systems in monocultures, livestock factories and aquaculture and by legal instruments which allow enclosure of the commons including agricultural biodiversity. In the landmark publication "The Threatened Gene", Cary Fowler and Pat Mooney chart the politics surrounding the loss of genetic diversity (Fowler and Mooney, 1990). This seminal work awakened people across the globe to the threats and laid the basis for collective action to resist enclosure.

While peasant, pastoral and artisanal production and harvesting uses and develops varieties and breeds of many thousands of species, this diversity is being replaced by the industrial production system's focus on relatively few crop, livestock, tree and aquatic species. Fewer than 150 plant species are commercially produced, with just four – rice, wheat maize/corn and potatoes – dominating the industrial commodity chain, which has also focused livestock production on only five livestock species – bovines, chickens, pigs, sheep and goats. Relatively few tree species are used in plantations for e.g. producing oils, cellulose / fibre / wood products. Most global consumption of fish (the industrial catch) comes from only five groups of species: finfish – Salmonidae, Cyprinidae and Cichlidae – marine crustaceans and the bivalve mollusks (mussels, clams, scallops and oysters), which are over exploited and endangered. Farmed fish and aquaculture are similarly dominated by limited groups of species (ETC Group, 2009).

Using financial, legal, corporate, market and governance systems and structures, which privilege power, those who control industrial production, harvesting, processing, distribution and retail are concentrating resources under their control, including the agricultural biodiversity commons. (Tansey and Rajotte, 2008)

Seed laws, originally designed to protect farmers and gardeners, are now designed, with the help of Plant Variety Protection measures and IPRs, to benefit the seed industry.[6] (Mulvany, 2005)

Acquisitions and mergers also allow concentration of businesses into larger conglomerates and trans-national corporations. For example, the seed industry is dominated by just three companies, which are also in among the leading manufacturers of agrochemicals (EcoNexus and Berne Declaration , 2013; ETC Group, 2011).

Since the landmark Chakrabarty case in the United States of America in 1980, it has been increasingly permissible to patent living beings and genes, conferring ownership of whole organisms and their products

[6] For an account of this process of exclusion in the USA, see Chapter 6 "Traditional knowledge and intellectual property: seeking alternatives" in Debora Halbert's book "Resisting Intellectual Property" (Halbert, 2005)

that contain proprietary genes. This encourages science and technology development mainly to serve the interests of capital. Scientists and corporations or 'legal persons' are rewarded by monopoly privileges (patents and other restrictive intellectual property rights) on their products and processes. These manipulate and modify the living organisms and genetic resources in ways that improve benefits for the powerful (Tansey and Rajotte, 2008).

Of particular interest to capital are varieties and breeds that contain proprietary modified genes; genetically-modified varieties containing patented genes allow control of markets and production by the patent holder. This control can spread to include crops grown in adjacent fields that have been contaminated by the GM genes, further extending the reach of the patent holder, usually a biotech corporation or client scientist.[7]

Land and water 'grabs' reduce the territories available for biodiverse peasant, pastoral and artisanal fisheries production and harvesting (GRAIN, 2012). Food chains lock in producers to serve industrial retail interests using production processes that grow few, often protected, non-reproducible, hybrid or genetically-modified, varieties of crops, industrial breeds of livestock or harvest or cultivate limited species of fish and aquatic organisms (ETC Group, 2013).

Further enclosures are imminent or planned. From Terminator to NanoBio to SynBio, life (not as we know it!) will be privatised and in the hands of patent holders; the basis of the production of food, other 'natural' goods and many materials will be in corporate hands. The Economics of Ecosystems and Biodiversity (TEEB) will provide the data that will hasten the commodification of nature. Soil carbon trading will facilitate enclosure of territories. Water, already privatised in many parts of the world, will become an increasingly important portfolio in hedge, offshore and sovereign funds, managed far from those who need and use it. Indeed, as Pat Mooney of the ETC group has said: in 2012 at the Earth Summit Rio+20, the world gave itself permission to privatise everything.[8]

In summary, trade and intellectual property agreements, commercial contracts, seed laws, restrictive technologies are developed, by the systems and structures which serve the powerful, into potent instruments. These can undermine and enclose the agricultural biodiversity 'commons' and 'criminalise' biodiverse and ecological peasant production processes and their components, which depend on and sustain agricultural biodiversity.

5 The Erosion of Agricultural Biodiversity

Beyond the impacts of 'variety displacement' resulting from the spread of 'uniform' production systems, such as monocultures and livestock factories, aided by the structures and processes outlined above, agricultural biodiversity is further threatened by changes in climate, patterns of land and water use and consumption patterns, which are accelerated by industrialised societies.

These pressures have led to losses of crop varieties on-farm, estimated to be as high as 90%, and even a significant proportion of seeds of unique varieties stored in genebanks are dying. One livestock breed is lost

[7] For more on the history of GM technologies see "The GMO Emperor Has No Clothes" a Global Citizens' Report on the State of GMOs – False Promises, Failed Technologies (Shiva, Barker, and Lockhart 2011)
[8] More on the privatisation of nature in who will control the Green Economy (ETC Group, 2011)

every month. Most commercial fishing grounds are overfished, with threats to the viability of sub-species. And the loss of their territories from locally-controlled food provision to industrial production and harvesting, and the impacts of climate change, will inevitably result in losses of agricultural biodiversity.

There are few data recorded about these losses – and much of it is anecdotal information from local people. The fate of the diversity of the many thousands of species, cultivated, farmed or fished, which are important in the diets of many people but are not commercially exploited is under-recorded. And there are even fewer data about all the 'associated' species that support production and harvesting, most of which, perhaps with the exception of pollinators, are not even surveyed.

This 'hidden' agricultural biodiversity is still mainly in the control of peasant farmers, pastoralists, forest dwellers and artisanal fishers. This is the agricultural biodiversity developed by small=scale food providers, which is still a part of the 'commons'. It currently provides food for the majority of people in the world using a wide range of species.

The 'headline' losses of seed diversity are, however, mainly focused on the losses of varieties of a limited number of commercial crop species, especially cereals – rice, maize, wheat.

It can be argued, that by accepting the dominant narrative in industrialised societies, which focuses issues concerning food provision on the few species and varieties and breeds used in industrial commodity production, it may conveniently obscure the existence of the vast majority of agricultural biodiversity that still remains in, the potentially more important, biodiverse and ecological food production systems, which use and are supported by many thousands of species.

Even though agricultural biodiversity is the bulwark against failures of the large-scale commercial, industrial system, there is a systemic dysfunctionality in the industrial food regime. On the one hand it vigorously exploits market niches for diversely packaged processed foods, made from a limited range of uniform ingredients, yet on the other hand, it causes reduced diversity and complexity in production systems, undermining its own sustainability.

In Biodiverse Agriculture for a Changing Climate, Jonathon Ensor says:

> "Diversity is the enemy of these large scale processes: diversity creates a complex landscape that prevents the homogenisation of methods and the uniformity of product demanded by the commodity supply chain. This simplification and the associated deterioration of the agroecosystems is compensated for through the introduction of chemical inputs - fertilisers, pesticides and herbicides and the increasing using of antibiotics in livestock. Thus, fossil fuel dependent industrial processes are required to provide agricultural inputs and sustain productivity. Yet while yields may be supported in the short term, these highly simplified agroecosystems cannot achieve homeostasis and remain in long term decline. …though intensive inputs may make agricultural production in a given season high, sustained high productivity over years is not possible." (Ensor, 2009)

It may be convenient to minimise discussion about the wide range of agricultural biodiversity used in the majority food system. This enables proponents of the minority industrial food regime to assert that as there is an accepted 'huge erosion of agricultural biodiversity', there is no alternative but to consume their industrial

foods, made from their limited range of proprietary seeds, if a growing world population is to be fed. It could become a self-fulfilling assertion.

6 Sustaining Agricultural Biodiversity

Confronting these onslaughts on agricultural biodiversity, and defending biodiverse, ecological food provision are arguably among the most significant challenges for those who wish to realise food sovereignty. As explained above, not all agricultural biodiversity has been enclosed and there are many opportunities to sustain it, if peasant production systems, pastoralism and artisanal fisheries are protected. A summary of the challenges can be found in the paper "Sustaining Agricultural Biodiversity" prepared for the Forum on Food Sovereignty (ETC Group, GRAIN and ITDG, 2002).

During the Leipzig process in 1990s[9], though it dealt exclusively with crop plant diversity, *in situ* conservation, development and sustainable use of genetic resources for food and agriculture (and, by implication all agricultural biodiversity) became mainstream. It moved to being a recognised activity worthy of official scientific support from being simply something that good food producers did as a routine. *In situ* conservation, development and sustainable use is practiced on-farm, on the range and in productive waters by farmers, gardeners, herders and fisherfolk. It includes activities such as multi-variety cropping (Rahmanian, 2013), seed saving (Stickland, 2001), community seed banks (Lewis and Mulvany, 1997), community seed systems (Jarvis et al., 2003), participatory plant breeding (PPB) (Ceccarelli et al., 2009), maintaining breeds of livestock (Gura et al., 2002), selective fishing (ICSF, 2005), as well as protecting pollinators (Gemmill-Herren, 2013), maintaining productive landscapes (GIAHS, 2013) and restoring mangroves, the breeding grounds for many aquatic organisms (Bosire et al., 2008).

Ecological food provision[10], especially when practiced in the framework of Food Sovereignty, depends on and develops agricultural biodiversity (UKFG, 2010). Agroecology (Altieri, 1995) is the most well known term for this but it is not always recognised by pastoralists and fishers as descriptive of their production and harvesting systems. Where local, biodiverse and ecological food provision is practiced, agricultural biodiversity is sustained. Protection of these production systems, the commons upon which they depend and the communities of peasants, pastoralists, forest dwellers and fishers is a *sine qua non* for conservation and development of agricultural biodiversity.

There are many institutions that govern agricultural biodiversity or components of it. Internationally FAO, especially its Commission on Genetic Resources for Food and Agriculture (CGRFA), and the Convention on Biological Diversity (CBD) have overall governance of agricultural biodiversity.[11]

There are others that cover aspects of agricultural biodiversity. The International Seed Treaty (IT PGRFA) focuses on 35 genera of seeds and 29 species of forages and has legally-binding clauses on Farmers' Rights,

[9] The FAO 'Leipzig' conference on plant genetic resources for food and agriculture in 1996 was a landmark event for all who had an interest in conserving agricultural biodiversity. For an introduction to this and the other events that surrounded this process, and what was achieved, see 'The Year of Agricultural Biodiversity Revisited' (GRAIN, 1997).

[10] Ecological food provision can include many types of food production when these are practiced ecologically e.g. peasant production, pastoralism, artisanal fishing, agroecology, organic agriculture and gardening, permaculture, Low-External Input Agriculture, natural farming, ecoagriculture.

[11] Much of this section is derived from discussions held by the IPC for Food Sovereignty in 2012 and 2013.

sustainable use and conservation of PGRFA; the Cartagena Protocol on Biosafety (CBP) governs the transboundary movement of genetically engineered species/living modified organsims (GMOs/LMOs); the World Trade Organisation (WTO) has an agreement on intellectual property rights that deals with plant varieties and microbial processes (TRIPs); the World Intellectual Property Organisation (WIPO) has agreements on the use of genetic resources and traditional knowledge and it also houses the Union for the protection of new varieties of plant (UPOV) now with some 71 members, mostly signed up to UPOV 91.

At regional levels in most parts of the world there are similar institutions that control and govern aspects of agricultural biodiversity and have charge of making and enforcing laws e.g. in the European Union (EU) there are regulations that govern intellectual property, GMOs, seed licensing, cloning etc. Governance bodies are most often dominated by lawyers, corporate interests and those seeking to preserve genetic resources *ex situ* i.e. away from the place where they were developed e.g. in gene banks. There is a thin legal line that distinguishes between *ex situ* preservation and BioPiracy.

Women and men peasant farmers and gardeners, herders, fishers, forest dwellers, Indigenous Peoples and other small-scale food providers, who sustain biodiversity, need to be central in governance and decision making about the conservation, development and sustainable use of agricultural biodiversity and its governance, at local national, regional and international levels. However, there are many legal, commercial and technological measures, agreed by those with power, that exclude these developers and custodians of agricultural biodiversity from any meaningful participation. Participation is too often relegated to belated, and usually ignored, contributions to government and secretariat-led governance processes.

Yet, the most important developments in governance that have contributed to some extent in sustaining agricultural biodiversity in all environments, and restraining the biotech and corporate engine, have mostly originated through civil society pressure.

There are many programmes of work, guided by governance structures and based on analyses of 'States of the World' of particular types of species – plants, livestock, fisheries, forests etc – which outline programmes that could help sustain agricultural biodiversity. These depend, ultimately, on the contribution of work by the originators and custodians of agricultural biodiversity. The most challenging, and potentially interesting assessment is underway, organised by the CGRFA. It is the State of the World's Biodiversity for Food and Agriculture (See Box 2).

Box2: State of the World's Biodiversity for Food and Agriculture (SoW-BFA)*

This cross-sectoral assessment, using the ecosystem approach, covers plants, animals, aquatic and soil organisms, pollinators as well as other associated species and the ecosystem functions they provide. It also includes social, legal, institutional issues. Data are being collected in 2014; analysis will be carried out in 2015; draft will be published in 2016 with the final version presented in 2017 as a landmark contribution to the International Decade on Biodiversity.

The assessment could help to :

- contribute to changes in policy and practice that will enhance agricultural biodiversity and related ecosystem functions in all production systems and at all scales.
- identify ways in which the developers and conservers of agricultural biodiversity and its related ecosystem functions – the (especially small-scale) food providers – farmers, gardeners, livestock keepers, fishers, forest dwellers, indigenous peoples etc. – can be protected and supported so that they can continue producing food as well as other multiple benefits in their biodiverse, resilient and ecological systems, thereby contributing to food provision, wellbeing and the conservation, development and sustainable use of agricultural biodiversity and its related ecosystem functions.
- increase recognition of the overriding contribution of the knowledge, skills, innovations and practices of the (especially small-scale) food providers to the conservation, development and sustainable use of agricultural biodiversity and its related ecosystem functions.
- increase recognition of the contribution of the food sovereignty framework, developed by the social movements of (especially small-scale) food providers, to improving the policy environment for the conservation, development and sustainable use of agricultural biodiversity and its related ecosystem functions.
- identify the principal drivers causing the loss of agricultural biodiversity, its related ecosystem functions and biodiverse food production systems and suggest mitigation measures (e.g. ref IAASTD)
- provide a framework for the analysis of policy, production systems, research and practice which helps policy makers, academics, change agents and others to assess impacts on the conservation, development and sustainable use of agricultural biodiversity and its related ecosystem functions.
- identify the key enablers/stressors, policies and actors which impact positively and negatively on the conservation, development and sustainable use of agricultural biodiversity and its related ecosystem functions and suggest governance structures at all levels which best contribute to an improved environment and better outcomes.
- provide stimuli for the inter and intra community and intergenerational transfer of knowledge and skills that enable continued conservation, development and sustainable use of agricultural biodiversity and its related ecosystem functions.
- mitigate the negative impacts of externally controlled markets (inputs and outputs) on the conservation, development and sustainable use of agricultural biodiversity and its related ecosystem functions.

*For more on SoW-BFA, see www.fao.org/nr/cgrfa/biodiversity/sowbfa/en/

7 Resistance is Fertile

Even though enclosures of agricultural biodiversity and related knowledge are increasing, most people in most countries are unbowed. They are resisting through actions and activities and even contesting monopoly power of corporations in the courts. (Mullin, 2013)

Though the threat is to all agricultural biodiversity the most iconic campaigns focus on seeds. For more than

30 years there have been campaigns to protect seeds and reverse decisions that undermine seed diversity on-farm. In the past few years, campaigns have re-energised as populations are faced with increasingly bad policies and actions by states, intergovernmental bodies and corporations restricting access to seeds, contaminating the environment with GMOs and passing laws and agreements that favour industry.

As Via Campesina declare:

> "Peasant and farmers' seeds are under threat of extinction. If we do not change the course history is taking, our children will not be able to produce their own food. If the know-how of farmers and peasants in selecting and conserving seeds disappears as older people pass away, our children will be left at the mercy of multinationals. If small-scale practitioners do not, starting today, go and retrieve from still accessible refrigerated banks the seeds of their parents which are required for new selections, then these seeds will no longer be available tomorrow. This is why La Via Campesina is developing its seed campaign along two axes:
>
> 1) by exchanging know-how from farmer to farmer, and organizing collectively to produce and conserve locally our own seeds intended for small-scale farming and organic farming;
>
> 2) by fighting against the 'Monsanto' Laws, and enshrining in the laws of each country and at the global level the recognition of the inalienable rights of peasants and family farmers to conserve, use, exchange, sell and protect their seeds." (Via Campesina 2013a)

In all regions, there are strong civil society campaigns against GM seeds, foods and feed and draconian seed laws. Industry-funded lobbies and promotions of the same products and processes are also increasing.

A way of contesting the industry-led attack on seeds campaigns is to present the impacts of their technologies and processes on all agricultural biodiversity, at genetic, species and ecosystem levels, and on the food system. Presenting biodiverse, ecological food provision as the norm in most parts of the world, and the most efficient system of providing wholesome, healthy, nutritious food, can unsettle their worldview.

In industrialised societies, the growing resistance is fertile: guerrilla gardening, community supported agriculture schemes, food collectives, local farmers' markets, seed fairs, permaculture/organic/low input food production, and many other actions by civil society are operating despite and outwith any laws or other biodiversity-destroying measures.

Agricultural Biodiversity and Food Sovereignty

The inter-dependence of agricultural biodiversity and ecological food provision as well as with environmental and social (health) sustainability is clear. But benefits to people and planet can only be properly realised if its development and the resultant food provision is in the framework of food sovereignty.

The contested discussion about 'sustainable agriculture' is examined in a paper prepared for the Irish aid agency Trócaire – Food security, poverty reduction, climate change: placing Trócaire's livelihoods work in context. (Coupe et al., 2011) In this paper a comparative table is presented (annexed to this paper) which, under three domains of 'sustainable agriculture': Ecological Small-scale Food Production (in framework of Food Sovereignty); Sustainable Intensification; 'Slightly Green' High External Input Industrialised Commodity Production; compares their performance based on criteria derived from the six pillars of food sovereignty (Nyeleni, 2007b). The analysis shows clear benefits to people and the planet from approaches that are within the framework of food sovereignty.

Conclusion

Despite the accumulated evidence of the failures of industrialised approaches and the contrasting positive practices of small-scale food providers supported by the findings of IAASTD that chart a different, sustainable and equitable way forward, institutions and governments continue to invest in and roll out industrialised approaches, at all scales, promoting the proprietary technologies they depend on. The scientific challenge now is to move away from this reductionist approach and towards ecological food provision, one that embraces complexity and diversity, sustainably using technologies that are freely available for the majority of food providers. The political challenge is for governments to regulate and reduce the negative impacts of industrial food systems and defend, support and promote ecological food provision, using natural wealth that may not be commodified though there are increasing attempts to privatise it, and adopting policies within the food sovereignty framework in order to safeguard the world's food supply. Such an approach depends on and favours agricultural biodiversity and the biodiverse, ecological model of food provision. (UKFG, 2010)

This biodiverse, ecological model of food provision, developed in the framework of food sovereignty, is more resilient and can consistently produce more food over time per unit area, or per volume of water, than industrial monocultures. This model of 'peasant' production is dependent on, and also regenerates, and develops, agricultural biodiversity above and below ground, on-farm, on the range and in productive waters.

Given the interdependencies described above of agricultural biodiversity and ecological food provision developed in the framework of food sovereignty, it is argued that the food sovereignty movement needs to give as high a priority to defending access to and control over all agricultural biodiversity's conservation, sustainable use and development as it does currently to defending peasant seeds.

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Annex: Comparison of Ecological, Sustainable Intensification and Industrialised Production Models (Coupe, Ensor and Mulvany, 2011)

		Ecological Small-scale Food Provision (in framework of Food Sovereignty)	Sustainable Intensification	'Slightly Green' High External Input Industrialised Commodity Production
	Main Characteristics (based on the 6 Pillars of food sovereignty summarised in Nyéléni Synthesis Report (Nyeleni, 2007b)	Locally-controlled, ecologically and socially sustainable and resilient food system that fulfils the right to food and right of access to productive resources. It has high (often family) labour requirements but minimises use of other external inputs (irrigation water, chemicals) and maximises: the use of local knowledge and innovation systems; the diversity of locally adapted seeds and breeds used for food; and ecosystem functions, which support plants and animals and provide environmental services, within biocultural landscapes.	Seeks to increase productivity within existing framework of power relations. It uses the ecosystem approach in which "inputs such as land, water, seed and fertilizer complement the natural processes that support plant growth, including pollination, natural predation for pest control, and the action of soil biota that allows plants to access nutrients.".	Designed to maximize profit through increased production of monocultures and trade to supply industrial processors and transnational retailers. Dependent on fertilisers, agrochemicals (fertilizers, insecticides, fungicides, herbicides), high response, chemically-compliant varieties of commodity crops (cereals, legumes, roots, oil crops etc)). Use of heavy mechanization and irrigation, prevalent. Potential overuse of irrigation water Monocultures
1.	What is the priority output for the system?	Food. It puts the right to sufficient, healthy and culturally appropriate food for all individuals, peoples and communities, (including those who are hungry, under occupation, in conflict zones and marginalised), at the centre of food, agriculture, livestock and fisheries policies and practices.	Commodity production for market chains	Commodity production primarily for, and prices set by, external (national/regional) markets and international agri-business linked through market chains
2.	Which actors are valued?	Women and men, peasants and small scale family farmers, pastoralists, artisanal fisherfolk, forest dwellers, indigenous peoples and agricultural and fisheries workers, including migrants, who cultivate, grow, harvest and process food for (especially local) consumption	External actors – extension workers, scientists from formal public and private institutions and companies	Very capital intensive Low labour requirement Machine dependent local livelihoods only from labour or contract farming
3.	Is the food system delivering locally?	Yes. Designed to bring small-scale food providers and consumers closer together in ensuring that good quality food is locally accessible.	Not a priority other than to ensure production ultimately provides for food security	No – based on demands and prices determined by unsustainable and inequitable international trade, often subsidised Encourages 'dumping' of products in others' markets Depends on governance, agreements and practices that are determined remotely. Power ultimately in the hands of remote and unaccountable corporations.
4.	Who controls the food system?	Ensures local small-scale food providers and consumers and their organisations are at the	Defends dominant IPR systems and use-restriction technologies	Facilitates the privatisation of natural resources (land, water, soil, biodiversity) and agricultural

		Ecological Small-scale Food Provision (in framework of Food Sovereignty)	Sustainable Intensification	'Slightly Green' High External Input Industrialised Commodity Production
		centre of decision-making on food issues. Attempts to place control over territory, land, grazing, water, seeds, livestock and fish populations in the hands of local food providers and respects their rights.	as 'stimuli for innovation'. (Such benefits only can be realised by formal sector research and development). Availability of inputs but not control over them is a priority.	biodiversity through laws, commercial contracts and intellectual property rights regimes and use-restriction technologies and processes.
5.	Whose knowledge and skills are developed?	Builds on the skills and local knowledge of small-scale food providers and their local organisations that conserve, develop and manage localised food production and harvesting systems, developing appropriate research and innovation systems to support this and passing on this wisdom to future generations.	Accepts that system is 'knowledge intensive' and will need inclusion and 'scaling up' of local and traditional knowledge. But does not call for local determination of priorities.	The actors in formal R&D and extension – mainly private sector corporations with public sector work increasingly dependent on them. Promotes technologies that undermine, threaten or contaminate local production systems, e.g. genetic engineering. Rejects local knowledge and innovations (including seeds and breeds)
6.	Does it 'work with nature?'	Uses the contributions of nature in diverse, low external input agroecological production and harvesting methods that maximise the contribution of ecosystems and improve resilience and adaptation, especially in the face of climate change.	Yes – but seeks coexistence between industrial production and an ecosystem approach	No - uses methods that harm beneficial ecosystem functions, that depend on energy intensive monocultures and livestock factories, destructive fishing practices and other industrialised production methods, which damage the environment and contribute to global warming.
	What are the impacts on: Agricultural Biodiversity	Sustains and develops a wide range of agricultural biodiversity. Develops local seeds and breeds for local ecosystems. Seeks improved animal/plant/soil interactions; improves adaptive capacity of production	Selectively builds upon existing agricultural biodiversity but can also include promotion of biodiversity-eroding 'new seeds' and cultural methods e.g. SRI	Main cause of erosion of agricultural biodiversity
	Ecosystem functions	Maximises effectiveness of ecosystem functions in the agroecosystems	Makes maximum use of ecosystem functions	Replaces, where possible, natural ecosystem functions with external inputs.

		Ecological Small-scale Food Provision (in framework of Food Sovereignty)	Sustainable Intensification	'Slightly Green' High External Input Industrialised Commodity Production
	Soils	Builds soil fertility and biodiversity and retains soils in the agroecosystems	Builds soil fertility and biodiversity and retains soils in the agroecosystems	Uses soil as a mechanical support for plants and animals and container for water (and, any pre-existing nutrients; encourages soil erosion
	Wider environment	Provides downstream environmental services e.g. water and air quality; landscape values; biocultural environments	Improves downstream environmental services	Destructive unless heavily regulated and subsidised.
	GHG emissions	Minimises carbon use contained in inputs; can sequester CO_2 in soil organic matter. Rejects involvement in carbon markets	Encourages sequestration of CO_2 in soils (also as potential for carbon credits)	Principal emitter of GHGs globally.

FOOD SOVEREIGNTY: A CRITICAL DIALOGUE INTERNATIONAL COLLOQUIUM PAPER SERIES

Food Sovereignty: A Critical Dialogue

INTERNATIONAL COLLOQUIUM
JANUARY 24, 2014

http://www.iss.nl/icas

A fundamentally contested concept, food sovereignty has – as a political project and campaign, an alternative, a social movement, and an analytical framework – barged into global agrarian discourse over the last two decades. Since then, it has inspired and mobilized diverse publics: workers, scholars and public intellectuals, farmers and peasant movements, NGOs and human rights activists in the North and global South. The term has become a challenging subject for social science research, and has been interpreted and reinterpreted in a variety of ways by various groups and individuals. Indeed, it is a concept that is broadly defined as the right of peoples to democratically control or determine the shape of their food system, and to produce sufficient and healthy food in culturally appropriate and ecologically sustainable ways in and near their territory. As such it spans issues such as food politics, agroecology, land reform, biofuels, genetically modified organisms (GMOs), urban gardening, the patenting of life forms, labor migration, the feeding of volatile cities, ecological sustainability, and subsistence rights.

Sponsored by the Program in Agrarian Studies at Yale University and the Journal of Peasant Studies, and co-organized by Food First, Initiatives in Critical Agrarian Studies (ICAS) and the International Institute of Social Studies (ISS) in The Hague, as well as the Amsterdam-based Transnational Institute (TNI), the conference "Food Sovereignty: A Critical Dialogue" was held at Yale University on September 14-15, 2013. The event brought together leading scholars and political activists who are advocates of and sympathetic to the idea of food sovereignty, as well as those who are skeptical to the concept of food sovereignty to foster a critical and productive dialogue on the issue. The purpose of the meeting was to examine what food sovereignty might mean, how it might be variously construed, and what policies (e.g. of land use, commodity policy, and food subsidies) it implies. Moreover, such a dialogue aims at exploring whether the subject of food sovereignty has an "intellectual future" in critical agrarian studies and, if so, on what terms.

The Yale conference was a huge success. It was decided by the organizers, joined by the Land Deal Politics Initiative (LDPI), to hold a European version of the Yale conference on 24 January 2014 at the ISS in The Hague, The Netherlands.

ABOUT THE AUTHOR

Patrick Mulvany focuses on policy and practice to realise food sovereignty and related issues of the governance of food, agricultural biodiversity and technology. He is adviser to Practical Action; is co-chair of the UK Food Group; works with many international CSOs, social movements and CSO lobbies of FAO and CBD; and was an NGO member of the IAASTD governing bureau.