Preserving the Web of Life

ITDG
PRACTICAL ANSWERS TO POVERTY

"We are called to help preserve the diversity handed down to us. The manner in which we meet this challenge will largely determine how – or whether – future generations will live on this planet."

Cary Fowler and Pat Mooney **(The Threatened Gene, Lutterworth Press)**

Agricultural biodiversity, the vast number of locally-adapted seed varieties and animal breeds, underpins the food security of our planet. This interdependent life-support system helps sustain local eco-systems that provide, not just food to eat, but also clean water, healthy top-soils, living landscapes, clean air, and even a sink for excess carbon dioxide.

Agricultural biodiversity is disappearing rapidly, a loss that is contributing to poverty and environmental degradation. The effects of industrialised agricultural production threaten in particular, agricultural biodiversity. Mono-cropping, genetic modification and increasing restrictions on access to genetic diversity diminish agricultural biodiversity.

The ten international agreements to preserve agricultural biodiversity since the first Earth Summit held in Rio de Janeiro ten years ago have not delivered reductions in losses of agricultural biodiversity, because their provisions have not been implemented effectively. The World Summit on Sustainable Development (WSSD) in Johannesburg presents an opportunity for governments to commit to their implementation.

It is also an opportunity to agree further action in key areas. Governments must:

- Take immediate action to ratify the Biosafety Protocol and the International Treaty on Plant Genetic Resources for Food and Agriculture, and implement these and other existing agreements that concern the conservation, sustainable use and equitable sharing of the benefits arising from the use of agricultural biodiversity.

Tharaka, Kenya: Jane Kiriamba, a farmer from Maragwa, with her sorghum crop. She grows up to 10 varieties each of sorghum, millet and maize, to ensure a harvest whatever the season's rainfall.

- Ensure the 'free flow' of agricultural biodiversity without threats of privatisation through patents, and other intellectual property rights that restrict access to plant, animal and aquatic genetic resources.
- Prioritise agro ecological approaches in agricultural research, development and extension policies.
- Ensure that existing environmental and agricultural agreements which preserve agricultural biodiversity have precedence over trade agreements, where these conflict.
- Agree a global moratorium on the release of GM crops, livestock, fish and other aquatic organisms in the form of grain, food, food aid, animal feed, seeds, embryos, live animals or living organisms, in accordance with the Precautionary Principle. In particular, implement an immediate ban on the release into the environment of GM crops in centres of origin and diversity of those crops, and prohibit the development and use of Genetic Use Restriction Technologies

What is agricultural biodiversity?

The taste, texture and diversity of the food we eat, as well as its nutritional qualities, depend on the genes of the plants and animals from which it comes. These plants and animals grow, thrive, resist pest and diseases and live in symbiosis with surrounding species. Collectively they comprise what we call agricultural biodiversity and are a vital part of what is termed 'biodiversity' – the variability among living organisms on the Earth. This agricultural biodiversity is the product of the application of the knowledge and skills used by women and men to develop agriculture, livestock production and aquaculture. Agricultural biodiversity is thus both a product of agriculture and an essential component of ecosystems and their sustainability.

Although some 7,000 species of plants and many hundreds of animal species and thousands of aquatic plants are edible, human societies have focused on a few to feed themselves. Only about 100 crops, a handful of grasses and a dozen animal species are considered by some to be essential for feeding the world. Just four crops provide more than half the dietary energy for the whole world's population – maize, potatoes, rice and wheat.

Such dependence on a few species is a potentially perilous strategy, at risk from pest or disease epidemics and climate change. Fortunately for mankind, resourceful indigenous peoples, women and men farmers, forest dwellers, pastoralists and fisher-folk have developed a myriad of varieties of every crop, breeds of livestock and sub-species of fish and other aquatic organisms. These provide for every possible social, cultural and economic need and are suited to a kaleidoscope of different ecosystems, climates and pest and

Threats to agricultural biodiversity

For the majority of the 2.7 billion people who live on less than two dollars a day, survival depends on consuming locally-grown food, a fact that highlights the importance of agriculture to poverty reduction. Threats to the agricultural biodiversity which underpins food security for these people are threats to sustainable development and poverty reduction. These threats are very real.

Changes in production systems

In the 1990s, the adoption of modern varieties of wheat, rice, and maize in developing countries reached around 90, 70, and 60 per cent respectively. In Latin America the take up of modern rice varieties leapt from 4 to 58 per cent in two decades, in Asia from 12 to 67 per cent. Access to, and use of, a wide range of agricultural biodiversity is threatened by this simplification of production systems.

As food production becomes increasingly industrialised, with fewer niches available for species other than those targeted for production, we are witnessing a rapid decline in the diversity of varieties used. The UN's Food and Agriculture Organisation (FAO) estimate that more than 90 per cent of crop varieties have disappeared from farmers' fields in the past 100 years. Agricultural plant varieties are continuing to disappear at 2 per cent a year. Livestock breeds are being lost at 5 per cent annually. The current extinction rate of species range from approximately 1,000 to 10,000 times higher than natural extinction rates.

These major changes in production lead to simplified and less resilient agro-ecosystems, reducing not only the number of niches but also the range of products and their distribution over time and space. Single crops are more vulnerable to the rapid spread of disease – this greatly heightens the vulnerability of resource-poor farmers. Through reduction of field margins, elimination of intercropping, destruction of soil biodiversity, pollution of water courses and so on, the essential niches for the species which support production – e.g. predators, pollinators, soil biota (fungi, bacteria, insects, worms) etc. – are removed. In the USA, for example, over 50 pollinator species are listed as threatened or endangered, and wild honeybee populations have dropped 25 per cent since 1990.

Sustainable agro ecology, the option that sustains agricultural biodiversity and food production, has been shown to be successful in restoring yields. Surveys of this type of production, in more than 10 million hectares in 51 countries, reveal that yields can increase by 200 – 300 per cent in the more degraded production systems. Even in modern smallholder production systems, yields increased by about 10 per cent, despite the sharp reduction in use of pesticides and added chemical fertilisers.

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A smallholding in Malaysia; a variety of fruit trees and annual crops contribute to household food security while contributing to a diverse ecosystem

Genetic Engineering

While FAO records show that governments' most cited reason for biodiversity loss is variety and breed replacement on the farm, a further threat is presented by the adoption of genetic engineering in industrialised agricultural systems. During the six-year period 1996 to 2001, the global area under GM crops increased more than thirty-fold, from 1.7 million hectares in 1996 to 52.6 million hectares in 2001. The seven principal GM crops grown in 1998 were (in descending order of area) soybean, maize, cotton, canola (rapeseed), potato, squash, and papaya. GM crops have reached the field trial or commercial scale in over 40 countries, including those with high proportions of their populations dependent upon agricultural biodiversity, such as Nicaragua, Honduras, Swaziland and Vietnam.

Genetic modification is a threat to both the genetic integrity of agricultural biodiversity and its ownership. The resultant location of an inserted gene, the impact of modification on the structure of the genome and the impact and location of promoters is unknown in most cases and could have long-term deleterious effects. It is not just that the new genetically modified organisms (GMOs) may produce unexpected proteins that could cause allergies in humans, nor that they may behave in an erratic and unexpected way, it is also that the impacts they may have on other living organisms and the environment are unpredictable.

A concern is that the process of modification so alters the arrangement of genetic material in the nucleus – it "scrambles the genome" – that the GMO will behave very differently from other species that have been developed through normal sexual

disease threats. By developing, selecting and improving local varieties and livestock breeds, swapping seeds and animals amongst themselves and sharing these with neighbours, agricultural biodiversity has been maintained.

The exchange of seeds and breeds across the world has resulted in a vast number of locally adapted varieties and breeds. Maize, which originated in what is now Oaxaca, Mexico, is a staple crop in Africa and Asia, as well as all of the Americas and much of Europe. Apples originated in the Himalayas but now there are varieties suited to every community in all temperate regions of the world. Rice came from S E Asia, wheat from the Fertile Crescent, potatoes from Peru, and the humble lettuce has its origin in Slovenia.

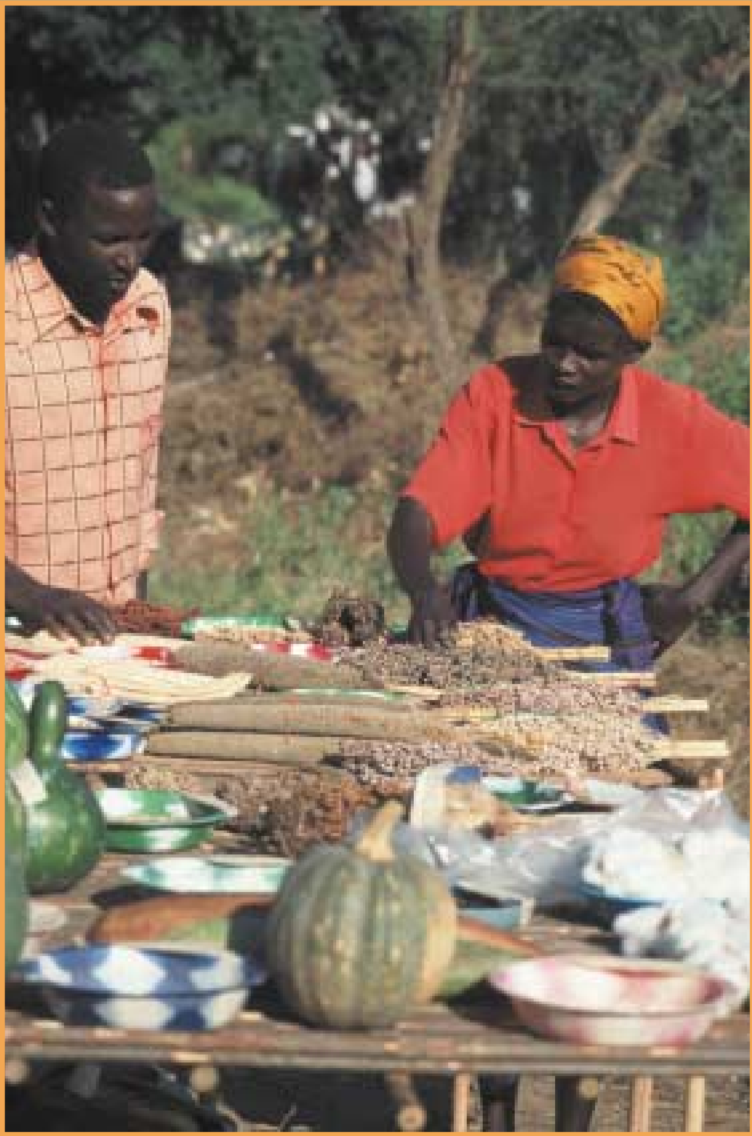
The biosphere – the Earth's surface environment and atmosphere – is dependent on agricultural biodiversity. For every crop variety, livestock breed or aquatic organism growing or being raised on a farm or on common pasture or in ponds, there are thousands of other species on which it depends – other plants, animals, insects, pollinators, predators and soil biota (fungi, bacteria, soil insects, worms). In one teaspoon of healthy soil there are estimated to be more than 100 million soil organisms of some 50,000 different species, each with its specific functions and niches within the soil structure. Pollinators, including bees, provide free services that have been valued as being worth more than $50 billion annually. All of these are interdependent life-support systems and sustain local ecosystems. In turn these ecosystems provide not just a productive environment but also clean water, healthy top-soils, living landscapes, clean air, even a sink for excess carbon dioxide.

Case study

Conserving and promoting agricultural diversity

Seed Fairs in Zimbabwe and Kenya

Seed fairs are increasingly popular events for promoting diversity. African interest in these was rekindled by exchange visits in the 1990s between Zimbabwe and Peru, where Seed Fairs are a traditional, spiritual and cultural mechanism for keeping seed diversity alive.



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Maragwa Seed Show, Kenya 1998: a woman farmer exhibiting her many different seed varieties and uses. The seed show enables farmers to exchange knowledge on seed types, as well as exchange seeds.

Zimbabwean Seed Fairs are now annual events in many villages and the word spread to many countries throughout the continent. This has been achieved by informal information exchange, publications and through some formal NGO networks, such as PELUM. In Tharaka, Kenya, for example, they are called Seed Shows and have been held annually since 1996, when they were initiated by ITDG.

In 1998, 29 women and 47 men, as well as some community groups mounted displays. A panel of judges evaluates the displays and the most diverse are awarded prizes. The total number of crop varieties displayed increased in 1998 to 149 from 134 in 1997. In 2001, 46 farmers displayed 206 varieties.

Participants like seed shows for many reasons: farmers can obtain rare crop varieties; they identify seed sources; it is a good forum for exchange of ideas on farming and exchange of seeds; farmers are exposed to national agricultural research work; the spirit of competition boosts farmers' morale and motivates farmers to diversify their crops, indirectly enhancing food security; and it is a venue for interaction between farmers, students, researchers, extension staff and other development agents.

reproduction. The resultant gene constructs could then spread through the biosphere by way of horizontal gene transfer, through seeds, pollen, soil micro-organisms and so on, with unknown consequences. The focus on genetic engineering in agricultural research and development skews resource allocations away from the more sustainable option of agro ecology.

Genetic Patents

The insertion of patented genes into plants and animals, using genetic engineering technologies, transfers ownership of those plants and animals to the gene's patent holders. As these genes spread through the agro-ecosystem, so ownership of agricultural genetic resources will be further concentrated.

Agricultural biodiversity and its component genetic resources for food and agriculture are therefore under threat from privatisation through patents and other intellectual property rights. This results in moving knowledge and genetic resources from the informal sector into the formal sector, and from public domain to private ownership, reducing benefits for the originators of that knowledge. These are usually people and communities in the informal sector. Agricultural biodiversity was developed through the free exchange of seeds and other genetic resources and is better conserved and utilised through common access arrangements and the realisation of community, farmers' and traditional rights.

Terminator Technologies

Threats also arise from the development of one particular type of restriction of access. This is through the use of genetic modification to produce a GMO including Genetic Use Restriction Technologies (GURTs). They include a range of use restriction technologies that limit a plant's ability to produce certain traits. The most dramatic of these is the variant that prevents

Case study

Conserving local breeds

Conserving Aseel poultry

The Aseel is a chicken breed in India. For centuries, Adivasi communities living in the East Godavari District have reared and selectively shaped this breed especially for its meat. Today, infectious diseases, high production losses and government policies promoting non-local breeds threaten its existence.

In 1996, a group of organisations studied the local production system in 24 villages. A number of improvements were initiated: promotion of local fodder crops to improve feeding; training of village animal health workers and introduction of basic healthcare practices such as vaccinations and regular deworming; and education of women – who are responsible for the poultry – in improved animal husbandry.

A follow-up survey conducted a year later revealed that overall mortality had fallen from 70% to 17%. The following year (1998-99) the mortality was down to 6% and the number of Aseel poultry had trebled. A further mechanism to enlarge the population was the revival of 'vaata', a traditional system of sharing and asset building. Initially, 196 women in 20 villages received 200 hens and 67 cocks.

Within one year, the birds had produced 1,414 chicks and the initial investment of Rs 60,000 could be recovered. The main problems faced by the project were the difficulty to obtain vaccines in small quantities, difficult access to markets and policies that favour crossbreeding.

Anthra, Yakshi, Girijana Deepika, and Womens Gottis of East Godavari Adivasi Areas, Andra Pradesh.

germination of seeds produced by a plant. These technologies have been dubbed "Terminator Technologies".

The widespread use of GURTs will result, by definition, in reduced access to genetic resources. Farmers prefer a wide range of genetic materials available for local crop development. Increased use of GURTs may result in greater reliance on formal seed markets that are less efficient and accessible to cash-poor farmers. Finally the economic power of the corporations developing and marketing GURTs could induce a shift away from local germplasm sources and further erode local and traditional seed systems that lie at the heart of crop genetic diversity.

Action plan for WSSD

Ten years ago, at Rio, there was recognition that agricultural biodiversity is fast disappearing and that this was contributing to poverty and environmental degradation.

International action to arrest this decline and restore agricultural biodiversity has resulted in a Treaty, a Protocol, a Code of Conduct, and action plans and programmes. In all, ten international agreements to preserve agricultural biodiversity have been negotiated since 1992, an indication of the importance attached by the UN to this issue. Together these agreements could go some way to arrest the decline in agricultural biodiversity. However, none of their measures have yet been effectively implemented and they have, so far, failed to deliver reductions in losses of agricultural biodiversity.

The WSSD Plan of Implementation should call for immediate implementation of all these agricultural biodiversity instruments and programmes. Their combined impact could go some way to restoring the agricultural biodiversity that preserves the web of life on earth. It should specifically cite them in both the 'Agriculture' and 'Biodiversity' sections of the Plan of Implementation.

Case study

Restoring marine diversity

Construction of artificial reefs

In Kerala, SW India, local civil society organisations, supported by ITDG, have worked with fishing communities to restore aquatic biodiversity in their fishing grounds. The solution was the construction of simple artificial reefs by village fishermen in response to loss of fishing grounds through destructive effects of trawling.

India is the world's seventh largest producer of fish products and one quarter of India's catch is from the fishermen of Kerala who use very simple craft and gear. Norwegian fishery advisers advocated the introduction of trawlers. The village fishermen survive at subsistence levels and did not have the capital to invest in this technology. They saw the market price of their catch collapsed, fall in catches through overfishing and destruction of natural reefs. Militant actions were taken to keep trawlers away. Kerala fishing policy was changed, introducing a closed season for trawlers. But the fisherfolk took long-term actions themselves.

Artificial reefs were constructed using any available materials, rocks, coconut palm stumps, tyres, concrete well rings and later triangular ferro-concrete units cast on the beach. These have restored aquatic ecology and fish breeding sites, provided inshore fishing locations, made the fishery more reliable and created a sense of ownership and stewardship for the resource. The unmarked reefs also protect the fishing grounds by erecting on the sea floor a significant disincentive to trawlers whose nets snag on the underwater obstructions.

International Collective in Support of Fishworkers (ICSF)

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A monoculture of oilseed rape, treated with herbicides and pesticides, coupled with clearance of other habitats to maximise the area under production, leads to loss of agricultural biodiversity, including the soil biota.

A considerable contribution to sustaining agricultural biodiversity can be made through continued support for work through civil society organisations and producer organisations with local small-scale producer groups to conserve, develop and use sustainably all genetic resources for food and agriculture including plant, animal and aquatic genetic resources.

Action is also required nationally and internationally. The draft Plan of Implementation for WSSD includes many agreed actions concerning the conservation, sustainable use, intellectual property, benefit sharing and biosafety of agricultural biodiversity. Actions for strengthening sustainable agriculture and food security, the protection of local natural resource management, soils, and the use of environmentally sound pest management practices have been agreed. The draft plan also calls for the involvement of local communities and especially women and the recognition of their resource rights. It 'invites' countries to ratify the International Seed Treaty (ITPGRFA) and the Biosafety Protocol.

About ITDG

ITDG – the Intermediate Technology Development Group – helps people to use technology in the fight against poverty. We work in partnership with communities to develop practical answers to their problems, based on local knowledge and skills and putting people's needs first.

ITDG is a charity registered in the United Kingdom which works directly in four regions of the developing world – Latin America, East Africa, Southern Africa and South Asia, with particular concentration on Peru, Kenya, Sudan, Zimbabwe, Sri Lanka, Bangladesh and Nepal.

ITDG has a unique approach to development – we don't start with technology, but with people.

The tools may be simple or sophisticated – but to provide long-term, appropriate and practical answers, they must be firmly in the hands of local people: people who shape technology and control it for themselves.

Further actions governments must take are:

- The immediate ratification of the Biosafety Protocol and the International Treaty on Plant Genetic Resources for Food and Agriculture and implement these and other existing agreements that concern the conservation, sustainable use and equitable sharing of the benefits arising from the use of agricultural biodiversity.
- Prohibit patent on genetic resources for food and agriculture, to ensure the 'free flow' of agricultural biodiversity without threats of privatisation through patents, and other intellectual property rights that restrict access to plant, animal and aquatic genetic resources.
- Give priority to agro ecological approaches in agricultural research, development and extension policies. Changing the focus of agricultural, livestock, forestry and fisheries research away from industrial production systems and genetic engineering towards small-scale agro ecological approaches, in collaboration with producers, would sustain and develop agricultural biodiversity.
- Agree a global moratorium on the release of GM crops, livestock, fish and other aquatic organisms in the form of grain, food, food aid, animal feed, seeds, embryos, live animals or living organisms, in accordance with the Precautionary Principle. In particular, implement an immediate ban on the release into the environment of GM crops in centres of origin and diversity of those crops, and prohibit the development and use of Genetic Use Restriction Technologies (GURTs).
- Ensure that environmental and agricultural agreements that preserve agricultural biodiversity have precedence over trade agreements, where these conflict.

The fast-disappearing varieties of crops, livestock breeds and aquatic organisms threaten the planet's web of life. Urgent action is needed to restore this vital component of biodiversity so essential to food security and ecosystem integrity. WSSD must rise to the challenge of sustaining the agricultural biodiversity of the food crops, livestock breeds and aquatic organisms that feed us and sustain the biosphere.

Contact:

Patrick Mulvany,
Policy Advisor
Mobile: +44 (0)7949 575711
Email: patrickm@itdg.org.uk

Intermediate Technology Development Group
The Schumacher Centre for Technology and Development
Bourton Hall, Bourton-on-Dunsmore
Rugby, Warwickshire, CV23 9QZ, UK

Tel: +44 (0)1926 634400
Fax: +44 (0)1926 634401
Website: www.itdg.org

Media contact:

Lucja Wisniewska,
Media Relations Officer
Tel: +44 (0)1926 634510 (direct)
Mobile: +44 (0)7780 997489
Email: lucjaw@itdg.org.uk

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