# FOOD SECURITY, POVERTY REDUCTION, CLIMATE CHANGE:

## PLACING TRÓCAIRE'S LIVELIHOODS WORK IN CONTEXT

DISCUSSION PAPER, JUNE 2012

TRÓCAIRE
Working for a Just World

**Cover photo:** Women carrying their seed pots to the seed fair in Chandanguda Village, Malkangiri District, Orissa State, India.

**Photo:** Joanna McClatchie.

# Contents

# Introduction

In 2011, the Sustainable Livelihoods and Environmental Justice team in Maynooth, with the support of a Steering Group[1] commissioned a background paper from Practical Action UK to provide an overview of different approaches/models of '*sustainable*' agriculture. This work coincides with a renewed interest amongst governments, international agencies and various other stakeholders in developing more resilient and sustainable farming systems. Following the global food price crisis of 2007-08 the headline figure of more than a billion people living in hunger served as a belated wake up call of the need to address the inadequacies of our global food system. Confidence in the ability of the market system to feed the world's population has been eroded underlining the veracity of IAASTD's (International Assessment of Agricultural Knowledge, Science and Technology for Development) key finding, namely, food security, sustainable agriculture, poverty reduction and healthy diets are not possible under business as usual scenarios[2].

Food, agriculture and trade policies continue to favour the socially and environmentally compromised chemically dependent industrialised production systems. However, the emergence and mainstreaming of a policy discourse on alternatives is in itself an implicit acknowledgement of that system's weaknesses. Food and agriculture is at a crossroads. The opportunity for promoting a transition to a more sustainable and productive agriculture versus the greenwashing of capitalism, through the rhetoric of the 'green economy', represents the current tug of war.

At our 2011 global Livelihoods meeting in Kigali, the session on the nexus between food security, climate change and poverty reduction drew on the Practical Action background paper. This session helped develop a common understanding of this policy debate. It was agreed that a Trócaire version of the Practical Action paper representing the continuum of agricultural systems from the small scale food producers[3] perspective would be a useful next step. Such a paper would be a catalyst for reflecting our approaches, capture shifts in practices and provide evidence of transitioning along the continuum. The Trócaire Transitioning Assessment tool section of this paper sets out the methodology for how this mapping will be conducted at programme level.

The diverse agricultural practices within our livelihoods programmes, exist within the continuum of broad policy responses, from the high external input industrial systems to agro-ecological approaches. By critiquing both of these systems and the increasingly discussed midway solution, represented by sustainable intensification, this paper begins by presenting the breadth of the continuum and the opportunities/challenges each approach presents for small scale food producers.

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1 The steering group initially comprised: Sorcha Fennell, Larry Paul Fuentes, Emmanuel Karulinda, Cliff Onega and Alex McClean. Since late 2011, Laura Lalor has replaced Alex and Herve Bund has replaced Emmanuel on the group.

2 See www.agassessment.org for IAASTD report

3 The Civil Society Mechanism responding to the draft of the Committee on Food Security's Global Strategic Framework recommend the use of this term as an overarching concept which is understood to include smallholder farmers, peasants, fisherfolks, pastoralists, forest dwellers and agricultural workers.

# 1. The Farming Transitions Continuum

The **business as usual** approach to farming represents one end of the continuum. This approach is strongly identified with chemicalisation and industrialisation of agricultural production. The Green Revolution , structural adjustment programmes that institutionalised privatisation, liberalisation and deregulation, together with free trade agreements, which give primacy to corporate profits over local and national needs, have been significant facilitators of this approach. Concentration of land holdings and food and agricultural systems has been further incentivised by innovations which make the rapid adoption of costly new technologies and high speed logistics key. Under this business as usual scenario, agricultural greenhouse gas emissions are predicted to rise by almost 40% till 2030.

A trawl of the literature over the past five years reflects a growing consensus on the limitations of the business as usual approach. This emerging consensus does not in itself mean a paradigm shift is underway. The challenges to transitioning from such an approach are significant. There are very powerful vested interests, multi-national corporations that dominate the agricultural input markets, large farmers, many of whom are dependent on energy, input and product price subsidies who exert a disproportionate influence on policy. Established consumer cultures and infrastructure built around industrial production further increase the challenge. Perhaps the greatest challenge though is presented by the proposed transition that is embodied in the term sustainable intensification.

Interpretations of **sustainable intensification** range from those who mean little more than a tweaking of the business as usual approach to those who mean a paradigm shift away from agribusiness and towards small scale food producers. Though an emerging discourse, without a policy blueprint, sustainable intensification is attempting to chart a middle way between the business as usual and food sovereignty approaches. It can be moulded to respond to the heterogeneity of agro-ecological conditions and endorses the prevailing view in recent literature which rejects adoption of a one size fits all approach.

At the opposite end of the continuum to business as usual are proponents of a transition to defined **transformative systems** which recognise agricultural functions neglected by the business as usual or sustainable intensification approaches. Examples of some of the varied strategies which fit with this end of the continuum include, LEISA (low external input sustainable agriculture), agro-ecology, permaculture and ecological agriculture.

Each point along the farming transitions continuum has implications for small scale food producers. There is widely varying participation by this constituency along the continuum. Moving in any direction will create both opportunities and threats for different stakeholders. By focussing on three points along the continuum, represented by business as usual, sustainable intensification and transformative approaches, the next section of this paper considers what each may mean for small scale food producers.

**TABLE 1** The Farming Transitions Continuum

**The Farming Transitions Continuum**

| Approach | 'Business as usual' | Sustainable Intensification | Transformative |
|---|---|---|---|
| **Description** | Agribusiness<br>• Monocultural agricultural practices<br>• High external inputs<br>• Capital intensive<br>• Machine dependent | Current popular policy discourse of green revolution technologies with sustainable agricultural practices<br>• Knowledge intensive<br>• Technological solutions<br>• Extension services, scientists highly valued | Approaches based on environmental health, economic profitability and social equity e.g. permaculture<br>• Low external inputs<br>• Maximises use of local knowledge and innovation systems |
| **Environmental** | Biodiversity and ecological resilience diminished | Seeks co-existence between industrial production and an ecosystem approach | Sustains and develops a wide range of agricultural biodiversity. Strengthens ecological resilience |
| **Social** | Low labour demand. Small-scale producers engage through contract farming type schemes | 'Business minded' farmers/entrepreneurs | Labour intensive (often family farms) |
| **Economic** | External markets | External markets with greater targeting of fair trade/organic markets | Emphasis on local community as markets |

| | | |
|---|---|---|
| Low | **DIVERSITY/RESILIENCE** | High |
| High | **CARBON COST** | Low |
| Low | **PEOPLE/LOCAL KNOWLEDGE** | High |
| High | **CORPORATE CONTROL** | Low |
| Low | **FOOD SOVEREIGNTY** | High |

# Business as Usual

***What it is***

The business as usual approach represents the dominant food system. Examples of some of the strategies which fit with this approach include, HEI (high external input) agribusiness, industrial farming and Green Revolution proponents. Arguments presented in its favour include high levels of automation thereby overcoming labour supply constraints and facilitating production on a very large scale; intensive use of land, without having to leave fallow, due to usage of external chemical inputs and greater participation in export markets, generating higher incomes for producers. Other defining characteristics include:

- A focus on maximising production and productivity of individual commodities and products
- Monocultural agricultural practices
- Externalisation of environmental, social and other costs
- Concentration on national and international markets and their control

Agriculture is seen as a business like any other, in which enhanced growth, profitability and labour productivity are sought through the application of technology and economies of scale. Success is measured against returns and market control. Evidence of market concentration is reflected by the transformation in the seed industry over the past two decades. Today just ten corporations control half of the global market for commercial seeds. Most are pesticide producers focussing on the development of genetically modified crops that support a chemically intensive agriculture. With the rise of transnational seed corporations, the public plant breeding systems, which were so significant have been reduced to contractors for the private sector. More recently the privatisation and concentrated ownership of natural resources through commercial contracts, laws, intellectual property rights have become more widespread. Loss of ecological resilience is one of the costs associated with same.

This business as usual approach is a top-down, capital intensive strategy, substituting human and animal labour with machinery and purchased inputs. It values agricultural research and development which focuses on commercial hybrids and biotechnology, including technologies that undermine, threaten or contaminate local production systems. It may usurp local knowledge and has the reputation of being the principal emitter of greenhouse gases globally. Ironically, most non governmental organisations follow this approach in donor funded food security projects by procuring conventional input packages from national or international companies for distribution to small scale food producers.

***Relevance to Small – Scale Food Producers***

*Opportunities*

In a policy environment where the emphasis remains largely focussed on increasing production rather than changing supply and demand trends, the case for promoting business as usual, especially where labour supply constrains small scale food producer expansion appears compelling. Through lower prices arising from higher production, food security can be advanced and employment generated, reducing poverty. Indirect employment may also be created as a result of the growing importance of *contract farming*. Small scale food producers may achieve higher productivity (made possible by discounted inputs and technical support) and a stable assured market with guaranteed prices that often exceed the market going rate. So, while small scale food producers remain largely excluded from global value chains, there can be opportunities to them and poor people working in other links in the chains related to agribusiness production models. [4]

*Challenges*

On the downside, the bulk of the expansion in monoculture production has not been about producing more food for people. The expanded agricultural area growing soya, maize and sugar for example is mainly used for industrial purposes, especially biofuels and animal feed. In terms of social costs, vertical integration allows global retail companies demand adherence to specific standards. Contract producers are not employed directly by these companies and there is no imperative for compliance with labour laws.

# Sustainable Intensification

***What it is***

This approach represents the current popular policy discourse. Institutional endorsements from major international institutions dealing with agriculture include the Food and Agriculture Organisation (FAO), the Consultative Group on International Agricultural Research (CGIAR), the International Fund for Agricultural Development (IFAD) and the European Union (EU). This emerging discourse attempts to find a middle way between the business as usual and transformative approaches. It is the discourse which is dominating global policy discussions on agriculture in general and related themes such as agriculture and climate change.

[4] See '*Linking African Small Producers to Large Distribution Networks: Enhancing Capacity of Mozambican Producers to Supply the South African Market*' (UNCTAD, 2008)

Sustainable intensification seeks a synthesis of paradigms in order to increase resilience and promote environmental sustainability, while increasing productivity. It recognises the negative environmental impacts of the Green Revolution whilst ignoring its social consequences. It supports small scale production and agro-ecological approaches whilst continuing to stress the importance of current investment strategies in agricultural science and technology.[5]

The defining characteristics are not fully developed at this point, but the 2011 Rural Development Report identified some basic common features in the ongoing dialogue. These include:

- Linking farmers own and scientific knowledge
- Context adaptation and
- Pursuing a systemic approach

In the promotion of farmers own knowledge there can be common cause between sustainable intensification and food sovereignty advocates. However, this policy discourse defends input dependent production using seeds with elite genes and the treatment of agro-ecology is narrowly biological, missing the social, political and cultural aspects of food production. The central appeal of sustainable intensification is its ability to respond to the heterogeneity of agro-ecological conditions within and across countries. The 2011 Rural Poverty Report argues that integrating sustainability-oriented practices into conventional approaches to intensification in many local contexts in Sub-Saharan Africa may involve increased use of fertiliser as a necessary adjunct to organic based plant nutrient management while in Asia, better integration of crop and livestock systems and improved organic based plant nutrient management may lead to reduced fertiliser use. Everywhere, the authors contend, improved varieties may eliminate the need for pesticides, fix biological nitrogen, improve resilience to pests or drought- and thereby reduce the need for supplementary irrigation.

As it seeks co-existence between business as usual and transformative approaches, sustainable intensification focuses on increasing productivity within the existing framework of power relations. It accepts that meeting the food production challenge is knowledge intensive, requiring greater inclusion and scaling up of local and traditional knowledge while at the same time supporting dominant intellectual property rights and use restriction technologies. The role of external actors, including extension workers, scientists from both formal and private sectors is highly valued. It also encourages the sequestration of carbon dioxide in soils.

***Relevance to Small – Scale Food Producers***

*Opportunities*

Proponents of sustainable intensification believe this approach has alot to offer small scale food producers. Realising this potential requires developing a conducive policy environment which creates synergies among the various stakeholders including the private sector and food producers. It has the potential to enhance small scale producers productivity, strengthen their capacity to manage risk, including climatic variability, delivering environmental services with possible income streams for producers. In summary , sustainable intensification should be taken as an approach through which women and men small scale food producers in different contexts can broaden their options to better capture market opportunities while reducing risks or strengthening their capacity to manage them.

[5] The FAO has published a resource pack on sustainable intensification, www.fao.org/ag/save-and-grow/

*Challenges*

While sustainable intensification is advocated by a range of stakeholders from international public crop research bodies, major donor agencies, multilateral development banks, large philanthropic foundations, the enthusiasm of stakeholders such as Syngenta and Pioneer is food for thought. Sustainable intensification is being used as a vehicle to promote an intensive use of chemical fertilisers and pesticides, in conjunction with patented improved seed varieties raising familiar questions round environmental sustainability, economic affordability and social inequality. Packaged as a 'new' green revolution sustainable intensification represents a false solution leaving us with the question: how can agriculture develop in a way which promotes development for the majority of producers, small scale food producers, in a sustainable manner?

# Transformative Approaches

***What it is***

Whereas the emphasis in the two previous approaches is on increased productivity, proponents of transformative approaches focus less on the supply imperative and more on addressing the different forms of inefficiency, misuse of resources and waste within the current food system. Associated more with the food sovereignty movement, academic and institutional actors have produced a significant body of work in support of strategies such as agro-ecology. [6] Examples include papers produced on the topic by the Centre for Agroecology and Food Security at Coventry University, the UN Special Rapporteur on the Right to Food, the United Nations Conference on Trade and Development (UNCTAD) and initiatives such as the development of Voluntary Guidelines on Land Tenure at the Committee on Food Security (CFS).

Sustainability within transformative approaches aims to ensure environmental health, economic profitability and social equity. Central common characteristics of this approach include:

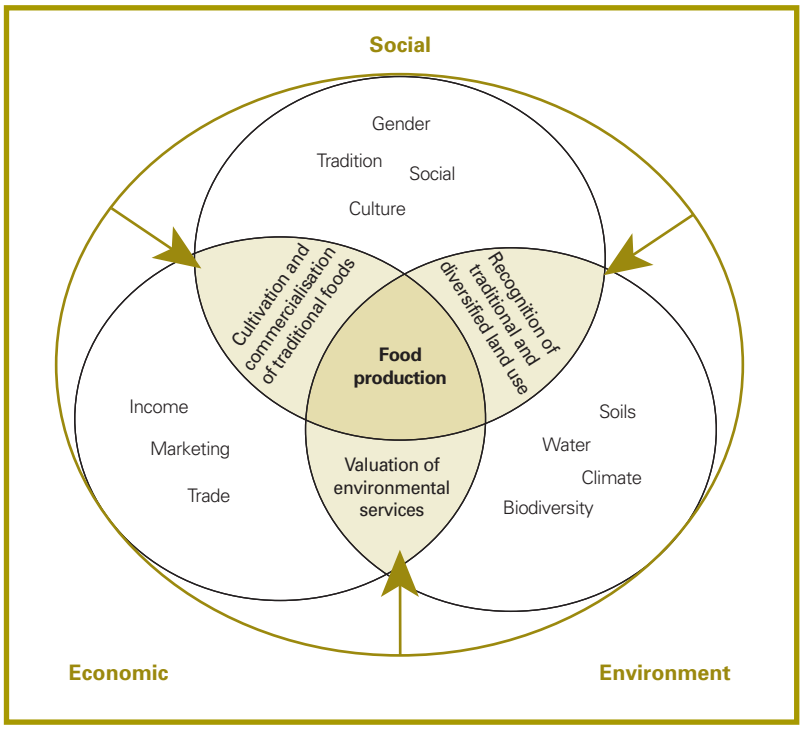
- Functional integration (figure 1)
- Diversification of crops (including livestock)
- Temporal and spatial crop diversity i.e. selection of species and varieties that are well suited to the site and to conditions on the farm
- Maintenance of soil fertility and pest/weed control by natural processes
- Consideration of small scale food producers goals and lifestyle choices

Food is the priority output of transformative approaches, placing the right to adequate, nutritious and culturally appropriate food to the fore. It is a system with high labour requirements but minimises use of other external inputs while maximising the use of local knowledge and innovation systems.

Transformative approaches place a high value on both producers and consumers. They are designed to bring producers and consumers closer together in ensuring that good quality food is locally accessible. Small scale food producers, peasant farmers, pastoralists, indigenous peoples, labourers who cultivate, grow, harvest, process and consume are at the heart of decision making. Accordingly transformative approaches respect traditional users rights over land, water, forests while encouraging appropriate research and innovation. By sustaining and developing a wide range of agricultural biodiversity, adaptive capacities are enhanced, while carbon use is minimised and carbon dioxide may be sequestered in soil organic matter. Such approaches reject involvement in carbon markets and emissions trading.

[6] There is a debate over definitions and terms for agriculture that are more in harmony with nature. Agro-ecology is being referenced in this paper to illustrate a number of strategies which share main goals and general principles. Others include LEISA, permaculture and ecological agriculture.

**FIGURE 1** Multi-functionality of agriculture




**Source:** IAASTD (2008)

***Relevance to Small – Scale Food Producers***

*Opportunities*

Transformative approaches are rooted in traditional, small scale and subsistence agricultural systems. Many of the practices are adapted for production at smaller scale and for available labour resources and may have a cultural or traditional significance associated with them. Making these practices viable in different economies represents an opportunity for a significant scaling up of agricultural research for development funding to encourage more context specific, low input, diversified, sustainable agricultural systems. For those already engaging in transformative systems, the potential benefits of coalescing through farmers groups in order to maximise potential benefits in food value chains can be advanced through organisational capacity building and the expansion of business services.

*Challenges*

The challenges at policy and implementation levels are significant. Involving small scale food producers in the governance of research and development initiatives, the development of institutions that place science as a driver toward multi-functionality and resilience, developing markets and trade that reward sustainable practices and supportive intellectual property regimes are amongst the policy issues. The risks for small scale food producers to change practices is an obvious obstacle to transitioning towards transformative systems.

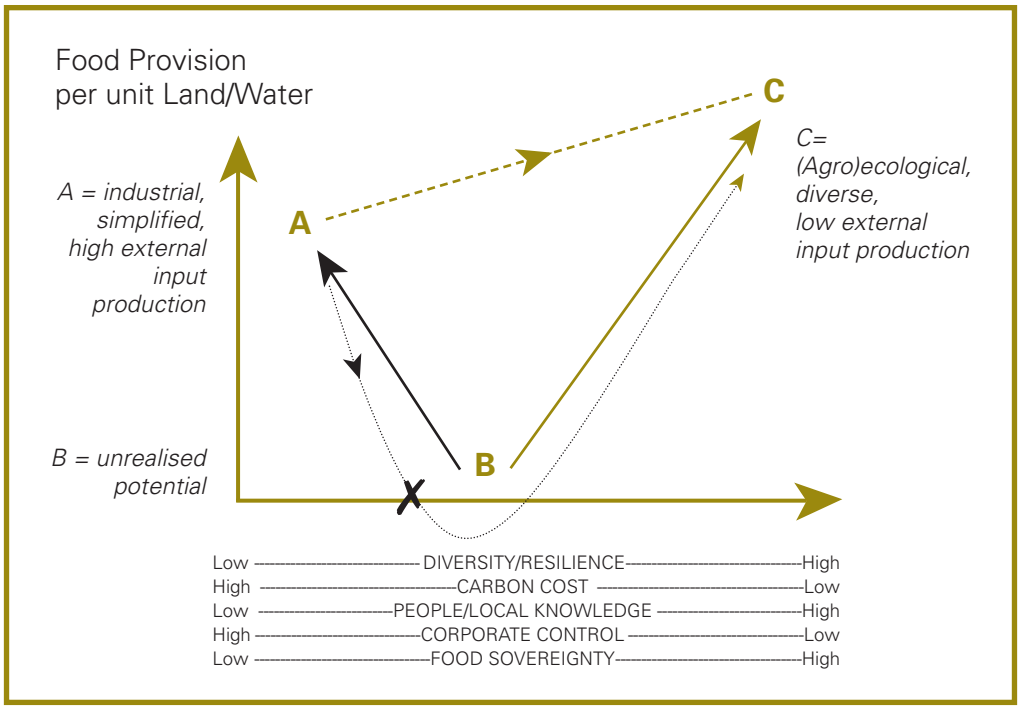
The next section of the paper focuses on what transitioning looks like. Emphasis is placed on transitioning towards a transformative approach represented by agro-ecological agriculture. The specific merits and challenges of agro-ecology in terms of building resilience and adapting to climate change are named, with consideration given to how to minimise the costs and maximise the transition benefits.

# 2. Transitioning

## Diagram 1 below conceptualises both business as usual and transformative transitions.

There are two starting points represented in the figure as points A and B. Many small-scale, food producers are at Point B, with relatively low levels of food produced per unit land and/or water and the potential to produce more. Others are at Point A, and are already using external input technology packages. For those at Point A, increases in production have come at the cost of more carbon and high levels of inputs, and have resulted in the simplification of production systems, reduced diversity and lower resilience. These systems depend on commercial and proprietary industrial technologies (including genetically modified seeds and livestock, pesticides and fertilisers) that are patentable and are controlled by agribusiness corporations.

**DIAGRAM 1** *The Transitioning Model*




Point C represents the potential for increasing production and productivity per unit area and/or per unit of water by implementing transformative approaches. Resource conserving, low external input techniques have a proven potential to significantly improve yields. Jules Pretty et al. compared the impacts of 286 recent sustainable agriculture projects in 57 poor countries covering 37 million hectares.[7] UNCTAD reanalysed the findings of this study to produce a summary of the impacts in Africa.[8] It was found that the average crop yield increase was even higher for these projects than the global average. Evidence which was recently cited at the second African Organic Conference by the Deputy Secretary-General of UNCTAD.[9]

[7] Jules Pretty et al., 'Resource-conserving agriculture increases yields in developing countries', Environmental Science and Technology

[8] UNEP-UNCTAD Capacity Building Task Force on Trade, Environment and Development, 'Organic Agriculture and Food Security in Africa' (2008)

[9] See papers from May 2012 conference at http://www.africanorganicconference.com/

The technologies used to achieve Point C incorporate more diversity in more complex and resilient agro-ecological systems. They can have lower, zero or negative carbon costs, and they use non-appropriable technologies that cannot be privatised and which provide maximum benefit to local food producers. In this approach it is local food producers who develop and use the technologies, supporting the realisation of food sovereignty. These technologies require more people for their implementation – although this should not be an insurmountable problem in the medium term in a world with a significantly increasing population. The approaches at Point C– especially at smaller scales – can bring higher productivity than that achieved by the high input, carbon intensive practices most closely associated with the business as usual approach represented by point A.

However, most international and national efforts in the formal sector are in moving towards or sustaining production at Point A – simplified, industrial, high-input production. There is increasing research and funding for these production systems.

*How to reach Point C ?*

There is a need to invest more in implementing known agricultural knowledge, science and technology, from both informal and formal sectors, and the necessary institutional arrangements that will assist with the move from Point B to Point C. There is a further urgent challenge to prevent the commodification and corporate control over people's collective rights to the commons that are needed for the realisation of productivity at Point C.

While the methods for moving from Point B to Point C are well known, a significant scientific challenge is how to move from point A to point C: the conversion of degraded, simplified production systems to diverse, agro-ecological, resilient, low carbon systems. And to achieve this without losing productivity in the process, as represented by the dotted line marked with an X in Diagram 1. This shows how productivity could even fall to levels below the production system represented by Point B, if external inputs are suddenly removed, and it will take time before beginning to recover and build productivity again.

One challenge for those working with small scale food producers is to redirect research and development funding towards building open access agro-ecological research (needed to reach point C). This is particularly the case in countries where governments are moving to reform their agricultural sectors in the opposite direction and are being supported to do so by global institutional forces. Another, addressed in the remainder of this paper, is for small scale food producers to access the support they need at a local level to make the transition to the sustainable, equitable, resilient food system represented by Point C.

# Agroecology and Climate Change

Climate change provides a particular challenge: we know that change is happening, but our ability to foresee that change depends on a number of factors. How far into the future we look, what region we are in, whether a local or national prediction is needed, whether we are concerned with temperature, precipitation or extreme events all have an impact on the degree of confidence with which predictions can be made. A meaningful approach to adaptation must address this challenge by ensuring that altered livelihood strategies do not only bring benefit if climate change plays out as predicted. Optimising agricultural, aquacultural or livestock strategies to a particular climate future risks mal-adaptation and will always be a mistake as long as uncertainty remains in climate projections. Rather, adaptation needs to take account of uncertainty by ensuring that livelihoods - and therefore also agro-ecosystems retain and enhance the ability to ride out or respond to unexpected events.

*Building resilience*

A risk reduction approach to our livelihoods programming includes an emphasis on ensuring climate related risks to agricultural production systems are reduced and that livelihood strategies which encourage context specific innovations and approaches to reducing risk are pursued. Building resilience to climate change is a core element of risk reduction. Resilience to climate change in agricultural systems comprises overlapping elements: agro-ecosystem resilience (persistence and sustainability of yield from the land or water in face of a changing climate) and livelihood resilience (achieved through livelihood strategy diversification, such as by introducing fish into rice paddies, or planting a wider variety of crop species). Resilience is also improved through removing dependence on external inputs and retaining on-farm assets.

Diverse practices reduce risks, enrich natural resources and build resilience through synergies between different farm species and activities. Common practices include

- Complex systems: complex and diversified systems allow crops to reach acceptable productivity levels in environmentally stressful conditions and are less vulnerable to catastrophic loss because they grow a wide range of crops in different spatial arrangements.
- Use and maintenance of local genetic diversity: diversity provides insurance against diseases and emerging pathogens and future environmental change. Mixed crop varieties reduce the spread of disease-carrying spores and modify environmental conditions so that they are less favourable to the spread of certain pathogens.
- Selecting and breeding: developing locally-adapted crop varieties, animal breeds and fish species for resistance to disease, pests or adverse weather conditions.
- Soil organic matter enhancement: crop rotation, composting, green manures and cover crops all build active organic matter, sustaining the productivity of agricultural systems, in particular in the face of droughts and intense rainfall events by regulating the absorption and supply of water.
- Multiple cropping or polyculture systems: diverse plant communities are more resistant to disturbance and more resilient to environmental perturbations. Intercropping, which breaks down the monoculture structure, can provide pest control benefits, weed control advantages, reduced wind erosion, and improved water infiltration.[10]

The improvement and protection of soils in particular is crucial in enabling agricultural ecosystems to remain productive in the face of variable and extreme weather (and also brings carbon sequestration benefits). Evidence which can be cited includes the lower economic losses of ecological farmers following the landfall of Hurricane Mitch.[11] Their land was found to have 20 - 40 per cent more topsoil, greater levels of moisture and less erosion. The soils in Nicaragua, Honduras and Guatemala with high levels of organic matter had the capacity to retain larger quantities of moisture. Linked to locally appropriate land management practices such as terracing, a resilient agro-ecosystem resulted that was better able to withstand extreme weather events, absorbing heavy rains and high winds.

[10] Altieri, M.A. (2002) 'Agroecology: the science of natural resource management for poor farmers in marginal environments' Agriculture, Ecosystems and Environment 1971 and Altieri, M.A. (2008) and P. Koohafkan, Enduring farms:Climate change, smallholders and traditional farming communities, Third World Network

[11] Altieri, M.A. (2002)

**Resilience through Organic Farming**

A side by side comparison of organic and conventional farms that has run continuously since 1948 also demonstrates the impact of farming practice. It found that organic methods, in which crop rotations, manuring, organic fertilisers and biological pest controls are employed in place of chemical inputs, reduce soil erosion and maintain productivity over the long term. The study found that moisture contents were 'significantly higher' in the organically farmed soils, while 'the amount of productive topsoil was dramatically less on the conventionally farmed soil'.[12] A similar study, based on a 22 year continuous field scale trial, found that 'high levels of soil organic matter helped conserve soil and water resources and proved beneficial during drought years'.[13]

Recent research in China illustrates the significance of above ground biodiversity, finding that farmers who grew four different varieties of rice 'suffered 44 per cent less blast incidence and exhibited 89 per cent greater yield than homogeneous fields without the need to use fungicides.'[14] This researcher's review of literature also suggests that agro-ecological practices that improve soils reduce the incidence of plant diseases (whereas applications of nitrogen fertiliser can create nutritional imbalances, and render crops susceptible to diseases) and control weeds. Indigenous breeds of livestock are known for their ability to withstand particular diseases and environments - for example, the Red Masai sheep is resistant or less prone to intestinal worms while the Kuri cattle, found on the shores of Lake Chad, are resistant to insect bites. As environments in some regions become harsher, the loss of breeds that are able to exploit poor quality vegetation may also damage the ability of societies to persist. These and many other traits found in indigenous breeds will become increasingly important as climate change alters the environment and the pattern of pathogen spread between and within countries. Their protection, along with the local knowledge that is critical to their management and breeding, is therefore ever more important.

### *Supporting adaptive capacity*

Agricultural biodiversity provides the raw materials for meeting the challenges of climate change. As a recent report into agro-ecological practices in Ethiopia notes, diversity is:

> *the foundation for plant and animal breeding and an insurance for the future. We know that climate and the environment will in all probability change at an increasing pace and it is therefore important to maintain a diversity of plants and animals with different environmental requirements that can perform the same functions under new conditions.*[15]

Utilising diversity also requires harnessing *adaptive capacity*. Adaptive capacity encompasses the ability of individuals or communities to make changes to their livelihoods or livelihood strategies in response to changing conditions. This creative and innovative component of adaptation is a central feature of agro-ecological practice. It encourages and requires small scale food producers including fishers and herders to be responsive to their environment, engendering flexibility and experimentation in breeding and management practices. Methods for coping with harsh environments exist within different communities, and tend to be 'knowledge-intensive rather than input-intensive',[16] creatively applying agro-ecological principles to a particular context:

[12] Reganold, J.P. (1987) , Elliott and Unger, Long terms effects of conventional and organic farming on soil erosion, *Nature* 330

[13] Pimentel,D. Et al (2005), Environmental, Energetic, and Economic Comparisons of Organic and Conventional Farming Systems, *Bioscience,* 55

[14] Altieri, M.A. 2002

[15] Swedish Society for Nature Conservation 2008

[16] Altieri, M.A. 2002

*Thousands of examples of the application of agro-ecology are at work throughout the developing world, where yields for crops that the poor rely on most—rice, beans, maize, cassava, potatoes, barley—have been increased several-fold, relying on local biodiversity, family labour and new and traditional agro-ecological knowledge.* [17]

The combination of responsive management strategies and technologies with agricultural biodiversity is witnessed in 'millions of hectares under traditional agriculture in the form of raised fields, terraces, polycultures, agro-forestry systems'. *'[t]hese microcosms of traditional agriculture offer promising models for other areas as they promote biodiversity, thrive without agrochemicals, and sustain year-round yields.'*[18] Maintaining indigenous knowledge is as significant to adaptive capacity as the biodiversity that it works with.

# Managing the Costs and Maximising the Benefits of Transition

Transition is not a costless process for small scale food producers. They cannot simply move from business as usual, from existing use of fertiliser or pesticides and hope to maintain outputs, so making operations more profitable. They also cannot simply introduce a new productive element into their farming systems, and hope it succeeds. These transition costs arise for several reasons. Small scale food producers must be encouraged to invest in learning. During the transition period, small scale food producers ability to experiment more may be influenced by safety nets, such as insurance schemes, so the costs of making mistakes are absorbable and secondary to the acquiring of new knowledge and information.

The on-farm biological processes that make sustainable agro-ecosystems productive also take time to become established. These include the rebuilding of depleted natural buffers of predator stocks and wild host plants; increasing the levels of nutrients; developing and exploiting micro-environments and positive interactions between them; and the establishment and growth of trees. These higher variable and capital investment costs must be incurred before returns increase. Examples include for labour in construction of soil and water conservation measures; for planting of trees and hedgerows; for pest and predator monitoring and management; for fencing of paddocks; for the establishment of zero-grazing units; and for purchase of new technologies, such as manure storage equipment.

Like all major changes, transitions towards transformative approaches can also provoke secondary problems such as:

- Building a road near a forest can help farmers reach food markets, but also aid illegal timber extraction.
- If land has to be closed off to grazing for rehabilitation, then people with no other source of feed may have to sell their livestock;
- If cropping intensity increases or new lands are taken into cultivation, then the burden of increased workloads may fall particularly on women.
- Additional incomes arising from sales of produce may go directly to men in households, who may be less likely than women to invest in children and the household as a whole.
- Projects may be making considerable progress on reducing soil erosion and increasing water conservation through adoption of zero-tillage, but still continue to rely on applications of herbicides.

[17] Holt-Gimenez, E. (2006), Altieri and Rosset Ten Reasons why the Rockefeller and the Bill and Melinda Gates Foundations Alliance for Another Green Revolution will not solve the problems of poverty and hunger in Sub-Saharan Africa, Food First Policy Brief no. 12

[18] Altieri, M.A. 2002

*and Transition Benefits*

Intercropping is a superbly useful strategy with high benefit to cost ratios of 2.5 to 1. Compared with mono-cropping strategies push pull strategies and intercropping both imply an increased use of labour. But demonstrated returns are more than 200 per cent.

Strategies such as nitrogen-fixing fodder or green manure mainly involve additional labour costs: additional labour is required to distribute fodder over land and for sowing and growing green manure plants. Nevertheless, crop yield increases uo to 40 per cent are capable of making the investments profitable for small scale food producers.

Diversification strategies are not just useful to ensure diminished vulnerability but also to increase profitability and yields of existing farming systems. Diversifying across crops has demonstrated increased yields in India and Bangladesh and shows potential for recovering research and extension costs. In both Africa and Asia, diversifying into animal husbandry has meant increased profits. The main on farm costs for all these strategies is usually the cost of increased labour, but also the cost of training and learning new practices.

Specific, targeted schemes must ensure that women are empowered and encouraged to participate in this construction of knowledge. Culturally-sensitive participatory initiatives with female project staff and all-female working groups, and an increase in locally-recruited female agricultural extension staff and village motivators facing fewer cultural and language barriers helps counterbalance the greater access that men have to formal sources of agricultural knowledge. Finally, diversification into animal husbandries may involve important capital costs in farm equipment. In countries where employment opportunities are few, diversification represents a potent poverty alleviation strategy for both the small scale food producer and the labourer.

**Gender Implications are Context Specific**

Each farming approach has social implications. Depending on context the implications can be positive or negative, or a mixture of both. Different approaches can work to reinforce or diminish inequalities in power relations at a national, community and household level. For example, transformative approaches applied in contexts where a high value is placed on women's traditional and indigenous knowledge could raise their status, access to resources and livelihoods options. Depending on how labour tasks are divided, transformative systems could also result in adding to women's work burdens while having a positive impact on households nutrition and food sufficiency.

# 3. Transition Mapping

Table 2 below looks at two distinct scenarios for the transition which we will be dealing with in the coming decades.


One is the transition from business as usual type approaches, represented by A to transformative systems represented by C. This is a transition from a high input agriculture to '*agro-ecological*' systems. Because high external input type agriculture requires constant input application, any abrupt interruption in availability of inputs will cause a decline in production. The actions required to make a successful shift away from high input agriculture are broken down in Table 2 into a series of categories: inputs, labour, knowledge and markets. It is notable that these are commonly invoked as barriers to the transition. Good practice options for overcoming these issues, as well as key challenges, are suggested. In the right hand column of Table 2, the B->C transition is considered. The emphasis we have placed on situation B is of ecosystems which are often still resilient and need to be supported to meet their potential, but also defended from actors in the business as usual coalition who are pursing the expansion of industrial agriculture into the spaces occupied by poor and marginalised producers.

Cross-cutting issues that emerge from this analysis of inputs, labour, knowledge and markets include research, agricultural biodiversity, incentives and costs. Costs are a central issue making the necessary transition towards equitable and ecological food provision – but the challenge can be one of perception, as benefits can rapidly accrue, particularly to those who receive adequate support.

**TABLE 2:** Approaches, Barriers and Challenges to Transition

| | **Transition from 'High External Input' to 'Agro-Ecological Agriculture in the Framework of Food Sovereignty'** Point **A** —> Point **C** | **Transition from 'Unrealised Potential' to 'Agro-Ecological Agriculture in the Framework of Food Sovereignty'** Point **B** —> Point **C** |
|---|---|---|
| **Seeds and Breeds** | • Diversify locally available genetic resources<br>- Seed fairs, exchange visits, programme of mass selection through participatory plant breeding, etc.<br>- Reintroduction of locally resilient seeds and breeds.<br>• Overcoming existing institutional and market pressures to adopt green revolution seeds and breeds. | • Improved selection from existing genetic material<br>- Same approaches as A->C<br>• Defending against incoming proprietary genes and genetic contamination.<br>- Supporting collective rights to seeds and breeds, Farmers' Rights and Rights of Livestock Keepers |
| **Soils** | • Building soil fertility<br>- Use of nitrogen fixing plants (including fodder), composting and vermiculture, mixed farming systems, ally cropping, agroforestry etc.<br>- Adoption of soil conservation practices.<br>• Overcoming short term reduction in yields through well designed long term transition plans (e.g. System of Rice Intensification, long term yield increases).<br>• Overcoming land tenure constraints (long and stable tenure for investment in soils). | • Maintaining or restoring soil fertility<br>- Same approaches as A—>C, including the replacement of slash and burn fertility building with these approaches.<br>• Defending land tenure and common property resources, particularly in the context of land grabbing and the monetisation of soil carbon. |
| **Water** | • Adopting sustainable water management approaches<br>- Applying contouring, rain water harvesting, intercropping, mulching, community management etc.<br>• Rehabilitation of water systems through adoption of ecological production.<br>• Overcoming subsidised irrigation (water or electricity subsidy), equipment costs and capture of water resources by those with capital (e.g. using deep tube wells or control of upstream resources). | • Adopting sustainable water management approaches<br>- Same approaches as A—>C plus: learning from existing water management practices.<br>• Defending community management of water resources. |
| **Land Tenure** | • Land reform including redistribution and expropriation<br>• Investments and concessions regulation<br>• Recognition of customary tenure rights<br>• Strengthening women's land rights | • Support for smallholder investment and application of the principle of Free Prior Informed Consent (FPIC)<br>• Implementation of the Voluntary Guidelines on Land Tenure (VGLT)<br>• Same approaches as A—>C |
| **Plant and Animal Health Management** | • Moving away from pesticide usage and vet drugs (particularly for chronic conditions)<br>- Integrated pest management (IPM) and push-pull training for local government, extension workers and communities, supporting paravets as local medicine providers, intercropping, ally cropping, multi variety diverse use of agricultural land, polycultures, healthy soils, etc.<br>• Overcoming short term convenience/ familiarity of chemical inputs through training, awareness (of long term cost reduction, human health benefits) and local regulation. | • Maintaining or building ecological approaches<br>- Same approaches as A—>C plus: recording, improving and raising awareness of indigenous approaches.<br>• Defending against the introduction of external technology packages through awareness raising of ecological approaches and local regulation. |

**TABLE 2:** Approaches, Barriers and Challenges to Transition

| | **Transition from 'High External Input' to 'Agro-Ecological Agriculture in the Framework of Food Sovereignty'** Point **A** —> Point **C** | **Transition from 'Unrealised Potential' to 'Agro-Ecological Agriculture in the Framework of Food Sovereignty'** Point **B** —> Point **C** |
|---|---|---|
| **Labour** | • Mobilisation of increased labour (in particular, the youth) onto land to substitute for capital or green revolution inputs.<br>- Training for transformation and community based planning to address local mindset, positive media images (radio and TV), incentives from project resources or local budgets.<br>• Overcoming input subsidy that devalues labour, initial labour costs of agro-ecological approaches (gradually offset by greater yields) and media and education-led images of rural/urban lifestyles. | • Recognising and valuing family, and especially women's, labour.<br>- Inclusive decision making processes and consensus building.<br>- Opportunity-based rather than distress-based migration.<br>• Defending family farming and reducing out-migration.<br>- Training for transformation, community based planning, positive media and incentives as for A->C. |
| **Knowledge and Skills** | • Reskilling.<br>- Valuing, recognising, collecting and recording local knowledge and bio-cultural heritage with elders etc.<br>- Community based extension, farmer field schools, agro-ecological training packages and exchanges for extension workers and community.<br>• Overcoming prejudice, ignorance and suppression of local knowledge; co-option of extension services by agri-business. | • Maintaining and building knowledge and skills<br>- Community based extension, farmer field schools, agro-ecological training packages and exchanges for extension workers and community.<br>• Defending local knowledge systems.<br>- Collecting and recording local knowledge and bio-cultural heritage.<br>- Working with service providers (NGOs, local government, extension) to raise awareness of resilience of existing ecological approaches. |
| **Markets** | • Developing resilient markets for diversified produce.<br>- Building consumer-supplier relationships, particularly to buyers in urban areas.<br>- Raising consumer awareness.<br>- Enabling rural producers to understand and better satisfy the product, process or delivery standards required by buyers in urban markets<br>- Localised supply management to achieve economies of scale e.g. through collective planning.<br>- Opening channels of information (e.g. about product specifications, market prices).<br>- Avoiding engagement with monoculture-based market development.<br>• Development of post-harvest processing capacity and small scale organic input markets<br>• Overcoming market demands for monoculture, niche and/or uniform products. | • Developing resilient markets for diversified produce.<br>- Same approaches as A—>C<br>• Defending local/ farmer's markets. |

# Trócaire Transitioning Assessment Tool

This final section seeks to set out the questions which will enable us to build up our understanding of the approaches Trócaire programmes support.

Specifically we aim to have a clear understanding of :

- current practice
- evidence of transitioning and the
- push and pull factors influencing decisions made

This mapping has two components. The first is a '**lite'** mapping which all Livelihoods programme officers will complete. This mapping should be based on the following two questions:

A. *Using the **Farming Transitions Continuum** indicate where national policy makers are focussed. Has this focus changed over the last five years? If so, explain why.*

B. *Using the same **Farming Transitions Continuum** indicate where Trócaire's programme work fits.Has this focus changed over the last three to five years? Is there significant variation within the programme? Please explain and provide examples.*

The second is a voluntary '**comprehensive** ' mapping. An accompanying powerpoint presentation with facilitation notes has been prepared to resource programme officers who are interested in conducting this more detailed mapping. Such a mapping could be done in a workshop with partners.

For powerpoint presentation and further information on mapping contact **mobrien@trocaire.ie**

# 4. Annex

## Case Studies

This section provides four case studies that illustrate responses to the challenge of making the transition towards more ecological and equitable food provision, both from high input dependence and situations of underutilised potential.

**1. Malawi–Agro-Forestry**

This case study was selected as an example of an important first step that is possible in a challenging context for agro-ecological transition. Virtually all of Malawi will need to go through a B to C transition. In this context the driver of change is the World Forestry Centre with support from donor governments searching for a sustainable response to the soil organic matter gap. Some question marks around the process are the need for further localisation of the forestry genetic resources and the political buy-in for alternatives to the Green Revolution package is still very much a work in progress within the Malawi government and more broadly at the level of the Africa Union's Comprehensive Africa Agriculture Development Programme process, where export-orientated farm commercialisation is the currently favoured model.

Malawi successfully launched a fertiliser subsidy programme in 2005-2006, following the dramatic food crisis due to drought in 2004-2005. However, it is now implementing agro-forestry systems, using nitrogen-fixing trees, to ensure sustained growth in maize production in preparation for the medium-term situation when fertiliser subsidies may have to be scaled back or withdrawn.

By mid-2009, over 120,000 Malawian farmers had received training and tree materials from the programme, and support from Ireland has now enabled extension of the programme to 40 per cent of Malawi's districts, benefiting 1.3 million of the poorest people. Research shows that this results in increased yields from 1 t/ha to 2–3 t/ha, even if farmers cannot afford commercial nitrogen fertilisers. With an application of a quarter-dose of mineral fertiliser, maize yields may surpass 4 t/ha. However, this shows that, while investment in organic fertilising techniques should be a priority, this should not exclude the use of other fertilisers. An optimal solution that could be an exit strategy from fertiliser subsidy schemes would be to link fertiliser subsidies directly to agro-forestry investments on the farm in order to provide for long-term sustainability in nutrient supply, and to build up soil health as the basis for sustained yields and improved efficiency of fertiliser response. Malawi is reportedly exploring this "subsidy to sustainability" approach.
(De Schutter, 2011)

Research by the World Agro-forestry Centre and its partners has established that the use of fertiliser trees can significantly boost crop yields and improve soil quality. There are several agro-forestry systems that improve soil fertility.

One of the most commonly used involves intercropping. Farmers plant nitrogen-fixing trees – the most popular is *Gliricidia sepium* – throughout their fields. The trees are periodically pruned back, and their leaves and other biomass are incorporated into the soil. "Using this system, farmers can double their yield of maize, or even triple it if they use a small quantity of mineral fertiliser – about a quarter of the recommended dose – at the same time."

A ten-year experiment involving continuous cultivation of maize with *Gliricidia* yielded more than 5 tonnes per hectare in good years, and averaged 3.7 tonnes per hectare. This was without using any mineral fertilisers. Compare this with an average yield of 1 tonne or less in control plots without *Gliricidia* or mineral fertiliser.

Another system that is proving popular in areas where landholdings are larger involves a fallow rotation using short-lived, non-coppicing species. Over a two-year period, the use of nitrogen-fixing shrubs such as *Sesbania sesban* and *Tephrosia vogelii* can provide 100–250 kilograms of nitrogen per hectare. As a result maize yields can be more than doubled. The advantage of using *Gliricidia* intercropping is that the trees live for up to 20 years, whereas those used for non-coppicing fallows must be replaced after two or three cropping seasons, and the rotational fallow involves seasons where no food crop is grown.

A survey of over 10,000 farmers, 31 key informants and 55 extension staff by the Extension Department of the Ministry of Agriculture provided insights into existing knowledge about agro-forestry. Among extension staff, the knowledge about fodder trees, fruit orchards and agribusiness was weak. As for farmers, only 10 per cent of those canvassed in three of the target districts had grown fertiliser trees in the past, while none had used them in the other five districts. Just two per cent of farmers had grown fodder trees, and over 60 per cent lack the knowledge or skills needed to raise seedlings in nurseries and transplant them into fields.

Addressing these knowledge gaps lies at the heart of the programme, and training has involved a range of approaches tailored to meet the needs of farmers, government extension officers, non-governmental organizations and community-based organisations. During the first year, the programme established 344 on-farm demonstration plots, 123 roadside plots and eight Farmer Field Schools to showcase the different agro-forestry technologies available in the eight target districts. There has been a strong emphasis on training the trainers. "Farmers are extremely important for up-scaling," explains World Agro-forestry Centre's France Gondwe. "We've found that other farmers are far more likely to listen to their testimony about the benefits of agro-forestry, than to that of outsiders." (Pye-Smith 2008).

**2. Ethiopia/Tigray- Agro-Ecological Transition**

The Tigray Sustainable Agriculture Development Project is the largest-scale experience to date of a systematic process of agro-ecological transition at the landscape level. A success factor was the presence of Tewolde, an internationally renowned scientist and very senior policy maker, who was able to mobilise the effort of government staff in a new direction. Despite the success indicators and barriers overcome the experience has not been adopted more widely in Ethiopia as the aid system is focussed on high external inputs. The control of agricultural inputs has become a central feature of internal power struggles, and co-option and manipulation of communities, making the context unfavourable for low or zero cost alternatives.

'Is there sufficient biomass to make adequate quantities of compost?' This is the question most often raised whenever there is any suggestion that Ethiopia could use an organic system to increase crop yield. In 1995, Dr Tewolde Berhan Gebre Egziabher, then in charge of developing a conservation strategy for Ethiopia, was asked by some government officials to design a project that could be promoted with farmers of poor and marginal areas in order to improve the productivity of their land and rehabilitate their environments

Farmers, development agents and experts, local administration and ISD staff have identified the following as the positive effects of the Sustainable Agriculture/Development Project:

- Yields are as good as and often better than those obtained using chemical fertiliser.
- Agricultural biodiversity is maintained and improved — for example, the farmers of Ziban Sas were growing only a durum wheat / barley mixture called 'Karka'eta' and a little teff, but now other crops such as maize and faba bean are also grown.
- Weeds are reduced in composted fields – weed seeds, pathogens and insect pests are killed by the high temperature in the compost pits, but earthworms and other useful soil organisms establish well. Weeds that do well on poor soils, such as wild oats (*Avena vaviloviana*), are much reduced in composted soil.
- Increased moisture retention capacity of a soil — if rain stops early, crops grown on composted soil resist wilting for about two weeks longer compared to fields treated with chemical fertiliser. This is crucial during times of drought, which remains a problem in many parts of Ethiopia.
- Plants grown with compost are more resistant to pests and diseases than crops treated with chemical fertiliser.
- Residual effect of compost — the positive effects of compost can remain for up to four years. The farmers have realised that, in contrast to chemical fertilisers, they do not need to apply compost each year and those who have used adequate amounts of compost for two can obtain high yields from their crops the next year without applying compost afresh.
- Farmers have been able to get out of debt from buying chemical fertiliser — the economic returns are positive as farmers have been able to stop buying chemical fertiliser, but they get even higher yields.
- Foods made from composted grain are said to have a better flavour than foods made from crops treated with chemical fertiliser.
- Production greatly improved, tree and grass cover returned and ground cover increased.

The Tigray experience has been reviewed and validated by conference of the African Union which reached inter alia the following conclusions: (FAO, 2010)

- Ecological agriculture holds significant promise for increasing the productivity of Africa's smallholder farmers, with consequent positive impacts on food security and food self-reliance. This is demonstrated by efforts such as the Tigray Project, now working with over 20 000 farming families in Ethiopia, where crop yields of major cereals and pulses have almost doubled using ecological agricultural practices such as composting, water and soil conservation activities, agro-forestry and crop diversification. Although Tigray was previously known as one of the most degraded regions of Ethiopia, over the 12 years of the introduction and expansion of ecological agriculture, the use of chemical fertilisers has steadily decreased while total grain production has steadily increased.
- The implementation and scaling up of ecological agriculture face several constraints, including the lack of policy support at local, national, regional and international levels, resource and capacity constraints, and a lack of awareness and inadequate information, training and research on ecological agriculture at all levels.

**3. Zimbabwe – Labour Mobilisation**

The context for this experience is the collapse over the last decade of agricultural extension services in semi-arid regions of Zimbabwe; food insecurity resulting from low rainfall and soil loss and reduced workforce due to HIV/AIDS. It shows that with the right social development methodologies the labour constraint for agro-ecological transition can be surmounted, even in situations of apparent labour scarcity.

Practical Action implemented practical projects in Chivi, Nyanga and Gwanda (Ward 17) which successfully demonstrated that infield water harvesting and soil conservation practices coupled with field interactive approaches can enhance and sustain the productivity of arable soils and grazing areas in semi-arid areas. The projects have led to increased demand for low cost rainwater harvesting technologies by other communities in Matebeleland South Province. This creates an opportunity to use trained farmer groups in Gwanda Ward 17 to impart their knowledge and skills on other community groups. Practical Action has demonstrated capacity making grassroots knowledge networks work for the poor through training for transformation and transformational leadership training programmes.

The approaches are farmer driven and vision focused. They tend to create in-built learning mechanisms that allow a process of learning by all actors through doing. Partnerships and fair returns for all participating stakeholders are key guiding principles. The Gwanda experience is a good example of the release of "democratic energies" by a grassroots project.

Mass meetings covering three villages at a time have taken place over the last year for discussion and debate. These were attended by a district level officials responsible for agriculture and natural resource management as well as political leaders. They became a major reference point for district development as a locus of development energies in the district. The Matabeleland South Poverty Reduction Strategy contains a chapter specifically directing resources towards rainwater harvesting as a result of the Gwanda experience. Larger NGOs, have taken up the principles of farmer-to-farmer learning developed , and demand is such that the Gwanda work groups' capacity is being stretched.

Account of field visit to Humbane village, Ward 17, Gwanda District, 2005.

*The first strategy was rainwater harvesting instead of allowing the water to run off. So farmers began digging contours. But how to dig? There were only two resident extension workers. So we got training in pegging contours (using the A frame.) It is an affordable technology. We organised ourselves into groups of ten, each with a leader. Each group had a target field. The group included a wide range of people. We set an individual target of digging 7m a day. At first that seemed hard, but was quite achievable. Some people now have 2 or 3 contours in a field.*

*We realised if we just dug a contour, the water would overwhelm it, so we dug infiltration pits, to slow it down. There were other challenges too; there was a lack of suitable tools for digging, we only had very small ones. It was a dry season, and food was scarce, so the work was very hard. (Now we have picks and shovels, which were given by well-wishers)*

*Then we ploughed and sowed. But we have had other challenges: pests – the maize stalk borer, and crickets wrecked sorghum and millet. We didn't sit back and despair, but tried to find how to control. One way is to put sand into the funnels of the shoots, which prevents eggs attaching and hatching. The crickets we collected and crushed, and spread the material around, to discourage the others.*

*Tilling the land was hard, because of a lack of donkeys and ploughs. In the dry season, donkeys don't have enough grass to eat and are weak. So 3 farmers would come together with their donkeys to work. We approached DDF (District Development fund) to ask to hire tractors. The cost is too high for most villages. We were able to pay enough to cover half hectare for each farmer. Because DDF is in Gwanda town, 72km away, so a condition was, that many farmers would use the tractors.*

**4. Peru – Community Based Extension**

This case study shows how it is possible to change mind-sets around the perceived technical superiority and short term benefits of agro-chemical products over locally generated technological solutions, and the local market potential for diversified production systems that exists even in remote rural areas

Since 1990, Practical Action has been working with farming communities in the Cusco region and exploring approaches to extension service provision that community members can afford. The defining characteristic of the extension initiatives is the training of local farmer-to-farmer extension agents, both men and women, known as *Kamayoq*. To date over 240 *Kamayoq* have been trained of whom one third are women.

The training initially focused on improving the social organisation of irrigation. *Kamayoq* now have their own organisation and seek training so that they are able to address a wider range of local farmers' animal health and agricultural needs including: identification and treatment of pests and diseases of agricultural crops and livestock; storage and provision of seeds and seed potatoes; and improved livestock breeding of, for example, guinea pigs.

Practical Action takes great care to ensure that the *Kamayoq* do not become the promoters of off-the-shelf technologies. On the contrary, the objective is to ensure, that by promoting alternative and appropriate technologies, the *Kamayoq* are able to work subsequently with farmers to generate creative solutions to real local agricultural and veterinary problems.

Active farmer participation is widely recognized as one of the critical components of rural development. The confidence that comes from participation increases farmers' ability to learn and experiment. This ability to innovate is vital because biophysical, social and economic conditions change and farmers need to be able to adapt to these changing circumstances. This is particularly so in the Peruvian Andes where farming conditions are so complex and diverse that it would be difficult to find a ready-to-use technology that needs no further adaptation. In addition, suitably empowered, farmers are better able to influence formal research and extension systems to their own benefit and to gain access to potentially useful skills, information and research products.

Farmers pay the *Kamayoq* for their services in cash or in kind. They are able and willing to do so because the advice and technical assistance they receive can lead to an increase in family income of 10 - 40 per cent. This can come about through increased production and sales of animals, vegetables, crops and milk. For example, the technical advice that farmers have received on the organisation of irrigation management and improved pasture has led to increases in milk production of up to 50 per cent.

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