actionaid

Climate Resilient Sustainable Agriculture

Handbook

Harvest of Rice, Myanmar
PHOTO: Celso Marcatto/ActionAid

Sustainable agriculture can be defined as:

"A whole-systems approach to food, feed, and fibre production that sustains the health of soils, ecosystems and people. It relies on ecological processes, biodiversity and cycles adapted to local conditions, rather than the use of inputs with adverse effects. It combines tradition, innovation and science to benefit the shared environment and promote fair relationships and a good quality of life for all involved. Inherent in this definition is the idea that sustainability must be extended not only globally but indefinitely in time and to all living organisms including humans" [i]

Soil cover - mulching, Mozambique
PHOTO: Celso Marcatto/ActionAid

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Climate Resilient Sustainable Agriculture Handbook

1. Introduction

This handbook has been developed in response to a large demand within the organisation, and is to serve as a guide for country programme (CP) staff in designing and implementing sustainable agriculture programmes on the ground. It will also help advance Objective 1 of the international strategy, which is focused on promoting sustainable agriculture and control over natural resources for people living in poverty.

With this handbook, we aim to enhance the understanding of ActionAid staff and partners on the issues concerning sustainable agriculture, and to facilitate the process of strengthening the work that ActionAid has been carrying out in this area. This handbook is not a comprehensive guide to climate resilient sustainable agriculture, as that would be an impossible task. Instead, it points readers to the key components and topical issues on sustainable agriculture, thereby helping them draw insights in designing local sustainable agriculture programmes. We hope that our staff and partners will be inspired and encouraged to share their own unique experiences and contribute to making this handbook a living document.

ActionAid considers sustainable agriculture as an approach derived from the recognition of people's right to food. It is a way of life based on self-reliant and agro-ecological systems which encompass all forms of livelihoods for smallholder farmers, farm workers, landless people, pastoralists, livestock farmers, fisheries and hunter-gatherer societies.

Sustainable agriculture should not merely be seen as a set of practices and technologies that do not harm the environment. It represents a resistance of smallholder farmers' movements to the current development model that increases their dependency on external inputs and reduces their autonomy from the agribusiness sector. It represents an opportunity for more equitable and just distribution of income, power, and responsibility. To be a real alternative for farmers' autonomy, it also needs to promote women farmers empowerment.

ActionAid, through its Human Rights Based Approach (HRBA) to development, has included sustainable agriculture as one of the integral components of its goal to ensure that poor people have sovereignty over their food and production systems.

As an international organisation present in more than 40 countries in Africa, Asia, America and Europe, ActionAid has been developing various activities on sustainable agriculture with its partners – all of which have been influenced by several schools of thought from **organic agriculture**, **agro-ecology**, **conservation agriculture**, **permaculture** and **conventional agriculture** (see Glossary for these terms).

2. Climate Resilient Sustainable Agriculture

Climate Resilient Sustainable Agriculture is an initiative that ActionAid has been developing, based on the concepts and practices of sustainable agriculture. It represents an effort to incorporate in our work on sustainable agriculture and food security the new challenges posed by climate change and its impacts on poor people's lives. Indeed, various research findings and farmers' lived experiences have demonstrated the importance of sustainable agriculture within the context of climate change (See Box 1).

Almost all recent climate models are indicating that even if we manage to drastically reduce the emission of greenhouse gases, the amount of gases already present in the atmosphere is enough to increase the average temperature of the planet[ii]. As a consequence, we can expect an increase of the occurrence and the severity of extreme climatic events like storms, droughts, hurricanes and so on. The tendency is that problems like serious floods, land slice, crop failures and food insecurity will became even more common and grave than today.

Smallholder farmers around the world are already suffering from the growing unpredictability of the climate. Farmers have been struggling with climate variability for centuries; they have developed diverse adaptation strategies and coping mechanisms and have incorporated them into their day-to-day workings. Climate change, however, is likely to cause detrimental impacts on agriculture in general and smallholder farmers in particular, in a way that is far more serious and dangerous than anything we had seen before.

BOX 1: Importance of sustainable agriculture within the context of climate change

- A study undertaken after the passage of Hurricane Mitch in Central America in 1998 – based on observations and field interviews among 360 rural communities in Guatemala, Honduras and Nicaragua – show that farmers who practiced agricultural diversification such as agro-forestry, as well as soil coverage (mulch) and multi-cropping suffered less crop damage and economic losses and recovered more easily than their neighbours who depended on mono-cropping systems.
- Recent research from the Federal University of Viçosa (UFV) in Brazil demonstrates that the average temperature inside a coffee agro-forestry system is 4°C less compared to open sun systems. This difference in temperature can allow smallholder farmers to continue producing high quality coffee even in the context of rising temperatures.
- Farmers from the semi-arid region of Brazil refer to multi-cropping as an "insurance against bad weather". Even when hit by severe drought or flood, they will always have some food available, and they will always have something to harvest.

ActionAid is proposing Climate Resilient Sustainable Agriculture as a tool to enhance food security and increase the preparedness of women and men smallholder farmers to face the impacts of climate change. Climate Resilient Sustainable Agriculture is based on the identification of major risks that the local communities face, and/or are likely to face in the near future, and on the design and implementation of site-specific adaptation strategies aimed at reducing vulnerabilities, enhance food security, and increasing the resistance and resilience of the smallholder production systems.

The starting point of our proposal to design local alternatives to cope with climate change is the knowledge and practices of the community themselves. Most agricultural practices are site-specific; they depend on the environmental, social, cultural, and economic conditions of the place where they originate, and therefore are more in tune with local contexts and needs.

This, by no means, is equal to saying that smallholder farmers' communities alone have the answer to present and future challenges, or that the smallholder practices are the panacea to all problems. To the contrary, there is not a single response or solution to the complex challenges posed by climate change. We believe, however, that exploring local alternatives is a good place to start. They contain key insights that - combined with the scientific knowledge and modern technology - can help us to design and implement food production systems that are more adapted to the present and future needs.

3. The transition process to sustainable agriculture

Every farmer, from conventional farmers that are heavily dependent on external inputs to traditional smallholder farmers or marginal farmers that rely mostly on internal inputs and on natural fertility of the soils, can begin a process of transition to more sustainable production systems.

This transition process does not and must not happen overnight; complex farming systems cannot be transformed suddenly. The redesigning of production systems requires a series of small, very well planned and realistic steps. It requires that farmers take time to experiment, to test and to validate whether the small changes that they are adopting are bringing about positive results from social, cultural, economic, and environmental perspectives.

There are several factors that can influence the speed and the extent of the transition process. This process can be influenced by, for example, the capacity of investment within households, the availability of natural and productive resources, the level of degradation of the production system, climatic conditions and so on. Systems that have been submitted to huge stress for prolonged periods of time (through overexploitation, overgrazing, soil and vegetation depletion, soil compaction, desertification), will probably demand the investment of more time and resources in the transition process than systems in a healthier condition.

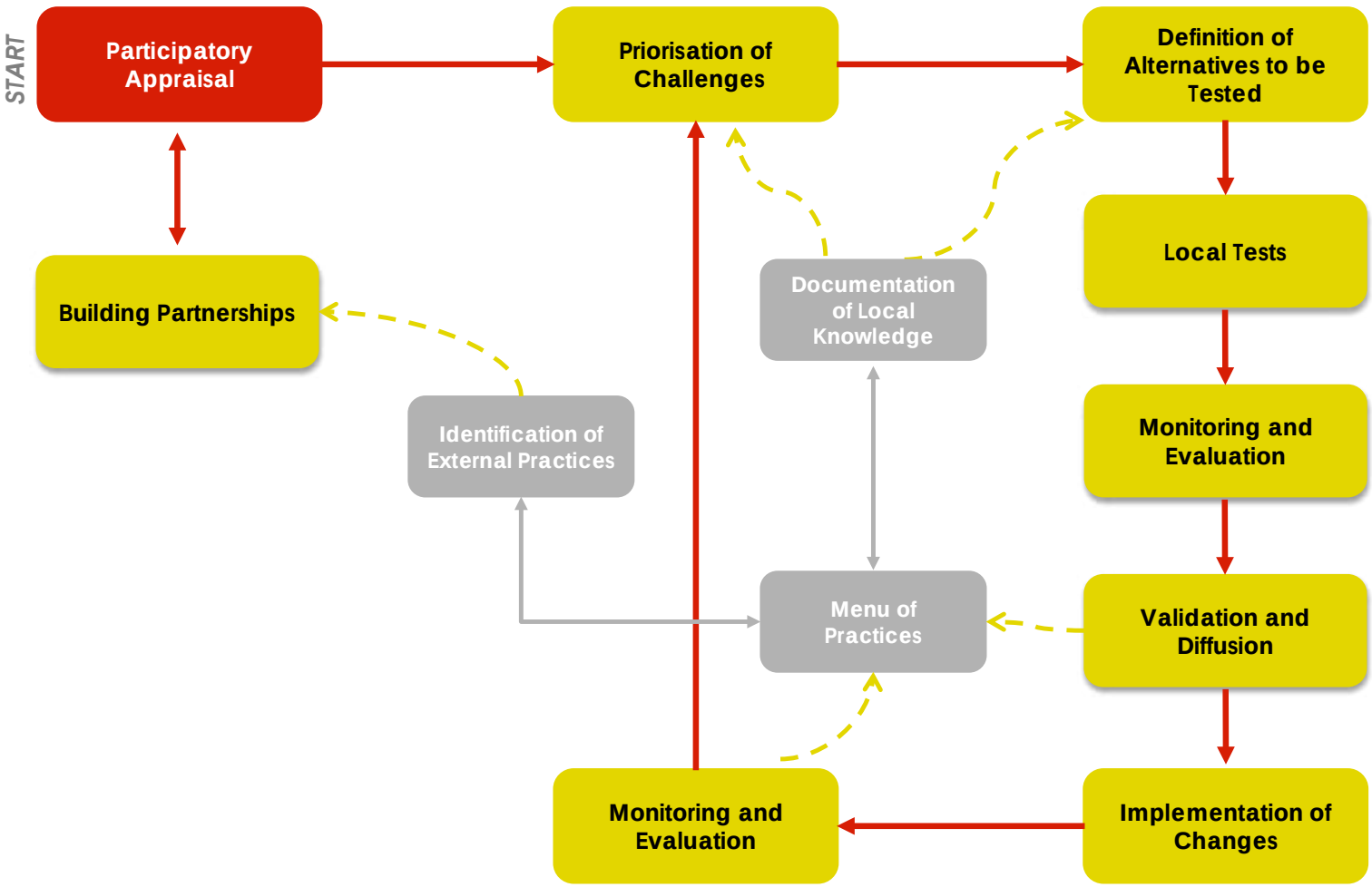
The transition to sustainable agriculture is a continuous/ never-ending process.

Every production system will always have some components that can be changed and improved to become more sustainable. It is important to understand that each small decision made and every little step taken will promote changes that can contribute to the long-term sustainability and equilibrium of the entire farming system.

Each case has its differences and specificities but the transition process may begin with very simple but fundamental changes. Halting burning practices, for instance, is an essential step into this journey to sustainable agriculture. The next step could be the introduction of trees (fruit trees, leguminous trees) to the production system, and the implementation of contour strip cropping, crop rotation, composting, use of green manure, mulch, etc.

Based on the results of these initial steps, it will be possible to advance to more complex stages – ones that may need a bit more investment, such as building terraces, water harvesting structures, small irrigation facilities, silage structures etc.

Transition Process to Sustainable Agriculture



1. The starting point of a collective transition process to sustainable agriculture can be a participatory appraisal, to identify the challenges that the community is facing, the alternatives they have been building, and potentialities (some possible initiatives / alternatives that they are not exploring yet or alternatives that they have been exploring but could be enhanced). This participatory appraisal process is a useful way to build partnerships with other organisations working on this area.

2. After the identification of challenges and potentialities, the community will need to decide which challenge or challenges they want to prioritise.

3. The community then need to define which alternatives they would like to test. In many cases, the alternatives to be tested (or some elements of the alternatives) are already there, within the community. Sometimes the alternatives to be tested will need to come from outside the community.

4. At this point in the process, it is very important to start a process of documentation of local knowledge around sustainable practices / alternatives, as a way to ensure that this knowledge is incorporated into the process of transition. These documented alternatives can be also very useful to the community and to other groups, communities and countries.

5. This knowledge can be incorporated in a menu of CRSA practices. Within this process, it is important identify external practices as well as those used within your community.

6. Local tests should then be carried out to test these sustainable practices / alternatives. Every alternative, even the ones that are already present in the community, needs to be collectively tested, in small fields or on a small scale, to allow farmers' groups to monitor and evaluate their usefulness.

7. It is important that monitoring and evaluation of these tests takes place.

8. If the local groups validate the alternative, they can start the diffusion of it, and start the implementation of the changes at community level.

9. This implementation should be followed by a further process of monitoring and evaluation.

10. The process of transition to sustainable agriculture is a continuous one. Communities will always have new challenges to work with, and the whole circle of transition to sustainable agriculture may start again, with new challenges and new alternatives to be tested.

Sustainable alternatives:

Sustainable alternatives mean different things to different groups. It may mean, for example, the introduction of some practices of soil conservation, or a rain water catchment system, or a seed bank that the community may build. It can also mean the creation of a self-help group, a cooperative that can process and access markets collectively, or a group that can be formed to discuss the issues related to access and control over natural and productive resources.

Challenges:

One of the main challenges that ActionAid and partners have been facing to implement transition processes to sustainable agriculture involves the relationship with agricultural research institutes, universities and public extension services. Most of these institutions are very focused on conventional agriculture - a model of agriculture that is highly demanding on capital and on external inputs. Most of them are used to working based on top-down approaches. They create solutions inside research centres and universities, and the extension services will teach farmers about how to implement these solutions. In using such an approach, they view farmers as clients, as consumers of their research, not as partners in a process of building collective locally sustainable alternatives.

The examples that ActionAid has from some countries, however, demonstrates that it is possible to build a relationship with these public institutes and extension services based on different principles, on different technologies and ways of working. Some public universities, research centres and extension services have been working with ActionAid and partners in a participatory process of building sustainable alternatives tailor-made to the local economic, cultural and environmental situation.

One of the key tasks throughout the transition process is finding ways to reduce the dependency on external inputs.

Usually, smallholder farmers do not face much difficulty in reducing the dependence on pesticides. The introduction of crop rotation, together with many other alternatives (e.g. using different plant varieties, local natural pesticides, multi-cropping) can significantly reduce the use or eliminate completely the necessity of pesticides.

The dependency on seeds can be surpassed by investing in traditional varieties of crops. It will probably involve the identification of local seeds varieties, organisation of local tests, exchange of seeds, seeds improvement and seeds production at community level and, in some cases, the re-introduction of traditional varieties.

The dependency on chemical fertilizer, however, is more difficult to graduate from. Generally, it requires a long-term investment process[iii] that can start with the enhancement of soil condition by increasing the dynamics of organic matter, reducing soil erosion, building better integrated crop-livestock production systems and so on.

Another important step in the transition process is to break farmers' isolation by forming groups and networks and building solidarity.

The organisation of the farmer and the involvement of neighbours within the

community is the key to making the transition a success. This is not only because what a farmer does on her/his farm can influence neighbours' farms. In fact, smallholder farmers depend on their neighbours[iv] to exchange seeds, labour, knowledge, and views. It is also important because collective activities, such as managing cooperatives, organising collective purchase of inputs, implementing communal processing units and collective access to local and regional markets are central to enhancing the economic viability of smallholder farms.

4. Climate Resilient Sustainable Agriculture initiative: key approaches

Climate resilient sustainable agriculture cannot be a model or a technological package that can be replicated anywhere at any time. There are very few practices that can be applied in a great number of situations. Real alternatives are rather site-specific; they are highly dependent on the cultural, social, economic and environmental context in which they are generated.

What ActionAid is proposing has more to do with introducing new ways of thinking, rather than distributing ready-made solutions.

The Climate Resilient Sustainable Agriculture Initiative of ActionAid is based in four main approaches and seven pillars. Figure 1 (page 15) visually summarises the main components of our initiative.

The four main approaches are:

1. Conducting participatory appraisals to identify local potentials and political and technical challenges

Participatory appraisal is a broad empowerment approach that builds community awareness and knowledge and encourages collective grassroots action. The term itself refers to a family of approaches (See the Climate Resilient Sustainable Agriculture online platform on Hive) that enable local people to identify the issues and challenges that affect their lives, as well as their own priorities, to make autonomous decisions about their future.

For any human rights-based programmes, particularly those on climate resilient sustainable agriculture and food security, it is essential to conduct participatory appraisals to understand the heterogeneous contexts in which people make out their livelihoods. A well-conducted participatory appraisal will inform us of the present and future challenges faced by communities as well as the existing local knowledge and alternative practices on climate change adaptation.

Several methodologies can be used to facilitate this process. The well-known ones are:

- **Participatory Rural Appraisal (PRA)**. This is a set of participatory techniques, based on Paulo Freire´s adult education methods that can be applied to provide basic information and incorporate the knowledge and views of local people in the planning and management of development projects and programmes.

- **Participatory Vulnerability Analysis (PVA)**. Based on PRA and on REFLECT,PVA is a very important tool in identifying the main risks and causes of vulnerability faced by local communities.

- **Sustainable Livelihoods Approach (SLA)**. This is a participatory methodology that provides a comprehensive understanding of livelihood strategies. It is based on the identification of the main factors that affect poor people's livelihoods and the relationships between these factors.

Building a rain and activities calendar, CRSA Training, Ghana
PHOTO: Celso Marcatto/ActionAid

Building a map of the community, Ghana
PHOTO: Celso Marcatto/ActionAid

Building a map of the community, CRSA Training, Ghana
PHOTO: Celso Marcatto/ActionAid

Special attention should be given to the equilibrium of gender and women participation on the local appraisals. Men and women have very different knowledge and views on issues relating to production processes, sustainability, access to market and food security. Despite the vast differentiations among continents, countries and communities, men are generally more involved with cash crops, livestock production and marketing. Women, on the contrary, tend to be engaged in staple food production. They are also usually responsible for backyard gardens for growing fruits, vegetables and taking care of small animals around the house. Women are also responsible for fetching water, maintaining the quality of drinking water, as well as preserving traditional seeds and medicinal plants. All these activities, as well as the knowledge behind them, are vital to ensure household food security and the sustainability of whole smallholder farmers' production systems and must be incorporated in our analyses of local potentialities and challenges.

More background information and resources on how to use these methodologies can be found at the Climate Resilient Sustainable Agriculture Toolkit online platform on HIVE.

2. Identifying, documenting, testing and diffusion of local knowledge and alternative practices and encouraging local innovation

Once an analysis of the local context has been completed, the next step is to identify, strengthen and promote local innovations and alternative practices.

Before thinking of introducing new techniques from outside the community, it is important to identify the practices that local farmers have been developing. Local alternatives are in fact being developed constantly. Farmers are very knowledgeable in their selection of new ideas that can be tailored to suit to their local environments, and they are always on the lookout for alternatives that can be used to improve their systems. Even when they are presented with a package of technologies that are far from their reality, they are able to distinguish the pros and cons of each choice and usually take home the fragments of it that will be of use for them.

However, farmers' local knowledge may be difficult to detect as a lot of this knowledge may not not be very visible. Some farmers may also be ashamed to openly talk about it, particularly to conventional extension agents, for the fear of being considered outdated and primitive.

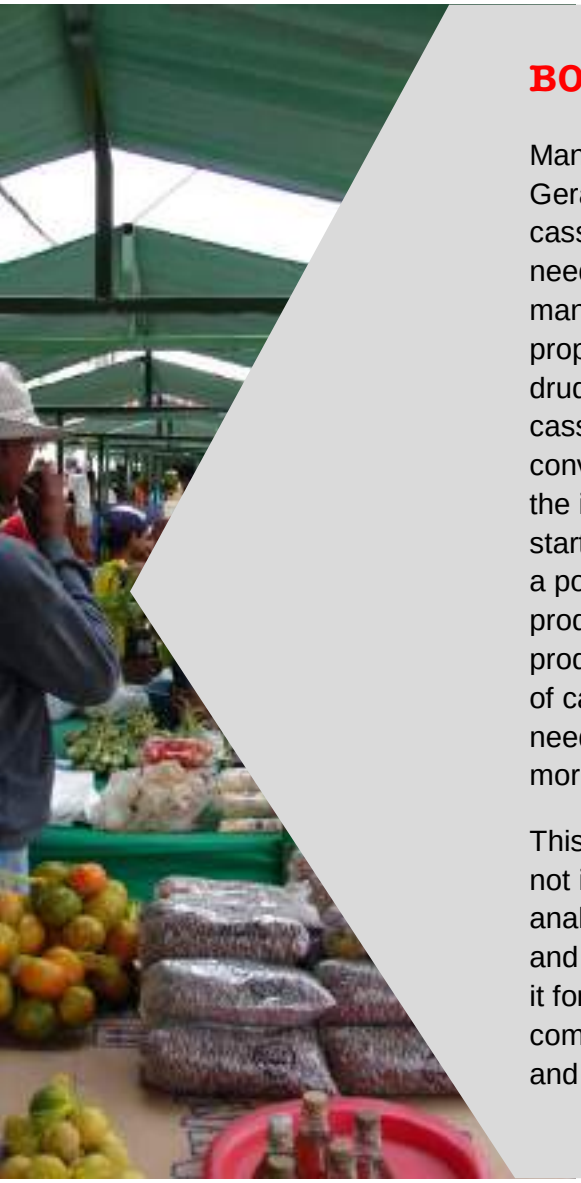
Hence, it is crucial for facilitators to encourage communities to organise themselves in dialogues about how best to use farmers' knowledge and experiences (both womens and mens) towards the designing and implementation of sustainable production systems. They should be encouraged to identify and test out their alternative solutions and measure their impacts on food production, food security and sustainability through participatory appraisal, planning, monitoring and evaluation. Once validated, these alternatives should be formally documented and systematised so as to preserve the knowledge and to spread it more widely through mechanisms such as farmer-to-farmer exchanges[v].

It is important to note here that in many places, women's groups are still in their first stages and that women may find it difficult to organise themselves to talk about their experiences due to social constraints. Moreover, women are often invisible to policymakers and not considered farmers in their own right. ActionAid's experience on the ground shows that farmer-to-farmer exchange programmes designed specifically for women can be very effective in empowering women and encouraging their participation on the identification and documentation of local knowledge.

Energy saving clay stove, Rwanda
PHOTO: Celso Marcatto/ActionAid

Sack garden, RUCID, Uganda
PHOTO: Celso Marcatto/ActionAid

Sometimes we will be confronted with the necessity to search for solutions outside communities, and be forced to introduce technologies that are really not known by smallholder farmers' local groups. Decisions to introduce external technology should always be complemented by participatory analyses of local priorities and needs as well as risk and impact assessment. Smallholder farmers' productions systems are characterised by a very complex process of interaction and interdependency of many sub-systems. Even a small change can affect the whole system. Therefore, introducing external technology requires careful planning, local tests and close evaluation before widespread diffusion. Indeed, there are many examples of very promising interventions that have brought about unsuccessful results at local level (See Box 2).



BOX 2. Case of Brazil

Many communities of smallholder farmers in the semi-arid region of Minas Gerais State, Brazil, grow cassava as a cash crop. They usually produce cassava flour and sell it at the local market to be able to provide for the family's needs. The production of cassava flour is labour intensive, as all stages involve manual work. In the 1980s, one non-governmental organisation (NGO) proposed to mechanise the cassava flour production system to reduce the drudgery of farmers. They started distributing machines to grate (to rasp) the cassava – the most menial part of cassava flour production. The NGO was so convinced about its proposal that did not even assess the possible impacts of the intervention on the local communities. Stimulated by the machines, farmers started to produce more cassava flour. In fact, some communities viewed it as a possibility to make more money and consumed the cassava they have to produce flour for the whole year in only a few months. As a result, they produced more cassava flour than the demand of local markets and the prices of cassava flour at the local market plummeted. Many smallholder farmers needed to sell animals and parts of their land to survive; they had to spend more than two years to recover from this negative intervention.

This example shows how initiatives with good intentions can result in disaster if not implemented carefully. Every intervention should be based on in-depth analysis of possible impacts and benefits of it. Local communities need the time and opportunity to experiment with new technology before they decide to adopt it for widespread use. Such pilot tests should always be designed by local communities themselves, so that they can collectively monitor and evaluate, and make the decision on whether to adopt or reject the technology.

FIGURE 1:

Climate Resilient Sustainable Agriculture

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Four main approaches:

1. Conducting participatory appraisals to identify local potentials and political and technical challenges
2. Identifying, documenting, testing and diffusion of local knowledge/alternative practices and encouraging local innovation
3. Promoting sustainability through appropriate agricultural research and extension services based on technologies that reduce dependence on external inputs and agro-chemicals, help adapt to climate change, build on and reinforce local knowledge
4. Empowering farming communities to promote sustainable agriculture through local, national and global campaigning actions for policy and budgetary changes in favour of smallholders

With a particular focus on the following seven pillars:

Gender Equity and Women's Rights

Soil Conservation

Sustainable Water Management

Agro-biodiversity Preservation

Livelihood Diversification

Processing and Market Access

Supporting Farmers' Organisations

3. Promoting sustainability through appropriate agricultural research and extension services based on technologies that reduce dependence on external inputs and agro-chemicals, help adapt to climate change, build on and reinforce local knowledge

Building bridges between local knowledge and scientific knowledge:

"It is only when we move away from the sterile dichotomy between indigenous and western…and when we seek out bridges across the constructed chasm between the traditional and the scientific, that we will initiate a productive dialogue to safeguard the interests of those who are disadvantaged."

Agrawal, 1995[vi]

One may think that the site-specific nature of sustainable agriculture clashes with the universality of scientific knowledge. However, such black-and-white thinking should be avoided. Generating alternative solutions that adequately address the challenges of food security and climate change adaptation requires combining scientific knowledge and modern technology with local, traditional knowledge that has been passed down through generations.

Although most agricultural research centres and agrarian universities focus on conventional agriculture, there are many examples of engagement of scientists (whether at the individual research or at the institutional level) in partnerships with social movements and the civil society working on sustainable agriculture. Such partnerships can not only impart critical knowledge and insight on developing sustainable alternatives, but also build credibility of our work, which is vital for our policy advocacy.

4. Empowering farming communities to promote sustainable agriculture through local, national and global campaigning actions for policy and budgetary changes in favour of smallholders

The field-level sustainable practices and the processes of transition to CRSA need to be supported with institutional, policy and budgetary changes by the states for a lasting and wider adaptation of CRSA. Such changes are an uphill task in poor countries where smallholder farmers still face huge challenges to organise themselves and the state machinery and government representatives are hardly receptive to their issues and demands. The 'food sovereignty' approach demands that farming communities and people are a crucial part of the processes of developing food, agriculture and related policies (such as agriculture policy, trade policy, land policy, rural development policy). The UN Human Right to Food holds all states to 'respect, protect and fulfil' the right to food of its citizens and overcome hunger and malnutrition and realise food security for all.

ActionAid's Human Rights Based Approach (HRBA) stresses that people and communities who face any injustice can be the best advocates to highlight their own issues along with options to address them. They need to be at the centre of advocacy and related work. Therefore, the CRSA framework includes "**Empowering farming communities to promote sustainable**

agriculture through local, national and global campaigning actions for policy and budgetary changes in favour of smallholders" as one of the main approaches for all the components. This approach means to develop programme policy and micro-macro linkages by connecting field level experiences with policy challenges and changes at local and national level. The three components of ActionAis's HRBA can be applied to CRSA and food security work in the following ways:

Empowerment

Empowerment of people to seek their rights and entitlements can include:

- Building capacity on CRSA, awareness and critical consciousness on CRSA and its linkages with food security, livelihoods, land, natural resources etc. Besides technical trainings on CRSA, reflection-action approaches are also a central part of the process.
- Organising and mobilising based on the above areas.
- Understanding and monitoring public policies such as agriculture in general, CRSA, land, water, rural development, trade, etc. and the associated budgets.
- Harnessing the power of communications by strengthening people's capacity to communicate; from accessing information in new ways, building confidence to speak out in public spaces or understanding audiences they are trying to reach, to accessing and using new media or strengthening people's use of official languages (the languages of power). This may also mean helping people to become citizen journalists or bloggers, to learn new skills (like digital photography or participatory video) or to access new forms of communication (community radio, for example).
- Responding to needs through rights-based approaches to service delivery elements such as irrigation, extension etc.

Solidarity

Solidarity can be built:

- Where people facing different rights violations (food rights, land rights, access to state responsibilities like extension, research, access to information on budget etc) come together to support each other in the form of farmers' networks, peasant alliances etc.
- Where people who are not themselves living in poverty stand side-by-side with those who are, like NGOs networks and alliances.

Campaigning

Campaign tools and tactics could involve any mix of:

- Research for evidence-building based on the field experiences of CRSA and food security programmes.
- Advocating for rights with duty bearers and lobbying for change on policies, practices and budgets in favour of CRSA.
- Public engagement, mobilisation of supporters, mobilisation and action.
- Using communications for change; for example, the media, digital marketing, advertising and publicity.
- Building alliances and coalitions with farmer organisations and like-minded CSOs .

Connecting national to regional and international:

These days many national policies are linked to processes - beyond national government policies – at regional and international level. Some of the examples of such linkages are; at continental level in Africa, The Comprehensive Africal Agriculture Development Programme (CAADP) in West Africa, Economic Community of West African States (ECOWAS) agricultural policy (ECOWAP) and a regional investment programme for agriculture with a focus on access for vulnerable people. In East and Southern Africa, examples would be the East Africa Food Security Plan and the 15 SADC countries efforts in developing a common Regional Agricultural Policy.

In Asia, South Asia Association of Regional Cooperation (SAARC) and the Association of South East Asian Nations (ASEAN) are the major sub-regional economic integration bodies for the South Asian and East Asian sub-regions. Examples of regional policies and plans for agriculture and food are; ASEAN Integrated Food Security Network, SAARC Food Bank and SAARC Seed Bank.

Internationally, processes like the Committee on World Food Security (CFS), Global Agriculture and Food Security Programs (GAFPS), International Year of Family Farmers - 2014 etc. are crucial to put forward the case for promotion of CRSA related policies and practices. It is important that while developing local and national level linkages these regional and international avenues are also explored to achieve widespread and lasting impact of our work.

5. Seven pillars of CRSA

These four approaches should cut across the environmental, economic and social components of Climate Resilient Sustainable Agriculture, with a special focus on seven pillars:

Gender equity and women's rights

- Improving women's access to and control over productive resources
- Promoting group dynamics and collective action among women farmers
- Increasing women's contributions to household income through training in financial literacy and marketing skills
- Enhance women farmers' productivity and reduce the energy and time spent in food and non-food production by the use of sustainable agriculture techniques
- Optimising women's time spent on unpaid care and reproductive work

Meeting of women smallholder farmers' group, India
PHOTO: Celso Marcatto/ActionAid

Women's collective vegetable garden, Senegal
PHOTO: Celso Marcatto/ActionAid

Soil conservation

- Soil coverage to preserve moisture, to prevent soil erosion, to enhance the dynamic of organic matter and to hold essential nutrients
- Building terraces and using contour strip cropping, alley cropping, trees and many other techniques to prevent soil erosion
- Reducing dependence on agro-chemicals through composts, green manure, mixed cropping, multi-cropping, mulching, crop rotation, introduction of multipurpose trees, and natural control of pests and diseases
- Control the presence of animals on the crop fields by the introduction of fences and other mechanisms as a way to allow farmers to design and implement more complex and sustainable multi-cropping systems without the interference of animals
- Avoiding over-stocking of grazing animals which can lead to erosion and desertification

Soil cover-mulching, Mozambique
PHOTO: Celso Marcatto/ActionAid

Fencing to prevent the entrance of animals, Ethiopia
PHOTO: Celso Marcatto/ActionAid

Soil erosion, Ethiopia
PHOTO: Celso Marcatto/ActionAid

Training girls on how to build terraces, Myanmar
PHOTO: ActionAid Myanmar

Sustainable water management

- Water catchment systems and rainwater harvesting at the community level (e.g. small dams, wells, boreholes, brick tanks, rock cisterns and other types of reservoirs)
- On-farm water preservation systems (e.g. roof catchment/guttering, water wells, boreholes and underground dams)
- Small, low-cost irrigation systems (e.g. drip/micro irrigation)
- Design and implementation of participatory sustainable community (watershed) water management systems that ensure soil, water and natural resources preservation and guarantee access to quality water for all

Dam in semiarid region, Kenya
PHOTO: Celso Marcatto/ActionAid

Construction of a dam, Myanmar
PHOTO: ActionAid Myanmar

Building a cistern to collect rain water, Brazil
PHOTO: AS-PTA

Small dam, Kenya
PHOTO: Celso Marcatto/ActionAid

Agrobidiversity preservation

- Supporting poor people's control over their local knowledge and heritage and reducing the dependency on external inputs
- Conservation of local crop varieties, livestock and fish species
- Organisation of community and micro regional seed banks and gene banks
- Participatory breeding of plants and animals
- Collective multiplication of seeds to ensure access to quality seeds at the right time, when farmers need it

Community seed bank, Senegal
PHOTO: Celso Marcatto/ActionAid

Women smallholder farmers group, Senegal
PHOTO: Celso Marcatto/ActionAid

Community seed bank, India
PHOTO: Celso Marcatto/ActionAid

Smallholder farmer seeds stock, Brazil
PHOTO: CTA-ZM

Livelihood diversification

- Mixed/multi cropping to reduce the risk of crop failure, to improve yields, to gain extra household income and to improve dietary balance and nutrition
- Agroforestry: introduction of multipurpose trees, integrating trees with crops, grass and vegetables to reduce erosion, improve soil fertility, to increase and diversify household income and the amount of food available
- Reduce the stress and enhance the wellbeing of livestock by ensuring that their behavioural needs (e.g. free, natural movement), are met, that appropriate shelter is provided, and that the length of journeys for slaughter animals are reduced
- Increase animal health by secure access to nutritious food, vaccination and control of animal diseases, as a way to ensure good living conditions for the animals and a stable source of food and income from animal husbandry
- Explore alternatives to integrated crops with livestock farming to increase food production and enhance the production of animal fodder as a way to ensure the accessibility to animal manure and to increase the availability of organic materials to feed the soil

Beekeeping as livelihood diversification, Bangladesh
PHOTO: Celso Marcatto/ActionAid

Multi-cropping, Brazil
PHOTO: Celso Marcatto/ActionAid

Livelihood diversification, Nepal
PHOTO: Celso Marcatto/ActionAid

Processing, marketing and market access

- Building and strengthening decentralised processing units to increase and diversify farmers' income, to increase quality and enhance the time that smallholder farmers' products can be preserved
- Facilitating value addition and marketing of both food and non-food products from smallholder farmers
- Investing in trainings and capacity building of women and men smallholder farmers' groups as a way to increase their knowledge and skills on processing, marketing and market access
- Reduce the distance among producers and consumers by investing in access to local and regional markets, as a way to increase farmers' incomes and to ensure that they are not exploited in the value chain
- Explore other possible markets like public procurement and institutional markets

Smallholder farmers open market for agro-ecological products, Brazil
PHOTO: Celso Marcatto/ActionAid

Organic products of RUCID, Uganda
PHOTO: Celso Marcatto/ActionAid

Collective sari factory, Bangladesh
PHOTO: Celso Marcatto/ActionAid

Support farmers'organisations (women and men)

- Establish or strengthen women farmers' associations, farmers' cooperatives, unions, and landless movements
- Work in partnership with local farmers' organisations, producer cooperatives, national farmers' associations and regional and international farmers' networks
- Strengthen farmers' organisations participation on the process of building public policies to support adaptation to climate change and scale up sustainable agriculture practices
- Support farming communities, regional, national and international farmers' organisations to promote sustainable agriculture through local, national and global campaigning actions for policy and budgetary changes in favour of smallholders

Women's Land Rights (WOLAR) sensitisation campaign, Malawi
PHOTO: ActionAid

Collective production of shea butter, Ghana
PHOTO: Celso Marcatto/ActionAid

6. Frequently asked questions (FAQ) on key topics

What role do women have in sustainable agriculture?

Although women are central in food production, they continue to remain invisible to community leaders, policy makers and men in general. In many places around the world, they lack access to land, water, credit and loans, seeds, markets and so on. Despite these constraints, women smallholders have been spearheading various agricultural alternatives. They have devised their own strategies for fetching and preserving water, for rearing and feeding animals and maintaining home vegetable and fruit gardens. These home gardens, which are maintained usually in their backyards, are important sources of household food security and diversified nutrients. Because they are generating many useful alternatives, it becomes crucial to help them organise themselves and build their confidence, so that they can identify, systemise and disseminate their knowledge beyond the community level. In addition, it is extremely important for women to improve their access to processing units, which will help add value to their products and to link them to markets.

Why do some smallholder systems seem to become less productive every year?

Farmers are facing a new reality today; they cannot continue on with the production systems used in the past. There isn't "free land" to be occupied anymore. Smallholder farmers cannot rely only on the natural fertility of their systems by using traditional methods like shifting cultivation and slash and burning. Moreover, as access to and control over land becomes more and more precarious, farmers cannot afford to leave the land to fallow.

Smallholder farmers frequently have a very small amount of land, surrounded by other farms, large or small. The necessity to produce an important part of their living from these small plots of land, usually marginal land, forces farmers to exploit intensively - very often overexploit - their natural and productive resources. This necessity also compels many farmers to cut trees, to use it as timber, firewood or charcoal. All these things combined leads to deforestation, soil depletion, desertification and a reduction in production and productivity. Heavy machinery and intensive use of chemical fertilizers only exacerbates this situation.

Does low input agriculture mean low production and low productivity?

The level of production and the productivity of an area are not related only to the amount and type of inputs. There are many other factors that interfere on the level of production of a system. Agroecological systems - production systems that explore, in a sustainable way, the local potential, systems based on multi-cropping, traditional seeds and on the integration of animal and crop systems, can have very high and stable levels of production.

As the International Assessment of Agricultural Knowledge, Science and Technology for Development (IAASTD) report points out: "The common assumption that "alternative" or agro-ecological methods are necessarily less productive than high-input conventional systems is incorrect; farmers adopting agro-ecological methods have produced equal and sometimes substantially increased yields per unit area compared to those using conventional methods".[vii]

Why is soil and soil organic matter so important?

Soil is one of the most important components of sustainable agriculture. We consider it a *living* organism and, as a living organism, it demands care. It requires air, water and needs to be fed. Feeding the soil means providing it with organic materials so that it can offer the right kinds of nutrients to the plants—i.e. feed the soil to feed the plants.

Soils in developing countries usually are very old (in geological terms). This means that the clay of the soils is not very reactive, meaning that it cannot hold lots of nutrients. In such conditions, soil organic matter plays an important role in "keeping" nutrients as it can prevent them from being washed away by water. It also plays an important role in maintaining the soil moisture, soil structure and protecting the soil against erosion.

Organic matter is central even in conventional production systems. Soil that has little organic matter cannot hold chemical (and highly soluble) fertilizers. Indeed, part of the expensive chemical fertilizers can be washed away by the first rain. This is not only a waste of money, but it also demonstrates the inefficacy of conventional farming in the absence of proper soil management and environmental problems, since the use of fertilizers can cause eutrophication of water sources around the production area.

Most smallholder farmers have access to very poor soil (with low organic matter content), due to the natural low fertility of marginal land or overexploitation. Burning of organic materials, the use of heavy equipment, drought, overgrazing and uncovered soil can make the conditions even worse.

Since the soils are already depleted, many smallholder farmers depend on very expensive chemical fertilizers as the only alternative to ensure food production. Farmers can no longer count on the natural fertility of their soil to produce more food. However, increasing the use of external inputs cannot solve the problem either. ActionAid is not proposing to abruptly abandon all chemical fertilizer use and encourage farmers to only depend on the soil's natural fertility. This is clearly not an option as we know that it would only make smallholder farmers even more vulnerable. Rather, we are proposing a committed investment to improving soil quality and enhancing the dynamics of soil organic matter whenever and wherever possible. After several years of intensive investment in soil quality, smallholder farmers can become less dependent of chemical fertilizers.

How important are soil covers?

One of the main problems with soil in dry land areas is that the soil is often left uncovered for a prolonged period of time, increasing the chances of degradation. Uncovered soil is negatively affected by high temperatures which harm soil organisms and cause soil organic matters to

burn. It also increases the rate of evaporation, rendering the soil hard and dry, making it more difficult for water to infiltrate. Erosion and fertility reduction are the main results of this process.

On the other hand, covered soil can protect organic matter from intense sunlight, preserve moisture, provide a viable living condition for microorganisms and protect the soil from erosion. A good way to protect the soil is to cover it with a layer of any organic matter (mulch), usually of 7 to 10 centimetres or more. Anything can be used; grass, hay, leaves, parts from previous harvests and other types of mulches. These organic materials will eventually be digested by soil organisms, thereby increasing the level of organic matter in the soil and liberating the nutrients to the plants.

It is relatively simple to have materials to cover some meters of soil of a vegetable garden, for example. A critical question, however, is how to ensure enough organic materials to cover a huge amount of land. This could be an even bigger challenge in dry land areas, where there is huge competition for organic materials, as animals usually eat almost all materials available, leaving little or nothing to be used as soil covers. So it is important that livestock numbers be controlled, so that they contribute to soil fertility rather than harming it.

To ameliorate the problem, farmers from the semi-arid area of Brazil usually concentrate the few materials they have to cover (in whole or in parts) the most important food crop. This strategy can ensure that even in a context of drought, they will have something to harvest. Another strategy involves increasing fodder production. The introduction of leguminous trees, pigeon pies, Napier grass, Elephant grass, palm, sugar cane and many others can help to increase both the availability of fodder and the amount of materials to be used as mulch.

What techniques can be used, apart from soil cover (mulch), to prevent soil erosion?

Covering the soil is a good start, but is usually not enough to prevent soil erosion. In dry land areas, it rains very heavily for a short period of time, making it difficult for the soil to absorb all water. It can be worse in poor and compacted soils. Even in flat areas, heavy downpours can cause surface run-off, washing away much of the topsoil and the organic matter and nutrients with it. Therefore, farmers in dry land areas need to use many other techniques alongside soil covers to prevent soil erosion. These techniques include: building terraces, introduction of contour strip cropping and other physical barriers to keep in the water and prevent run-off from gaining speed, building dams and cisterns to retain water for future use during dry spells.

Trees, in particular, are extremely instrumental for sustaining the dynamic of organic matter in soils. Trees have deep and complex root systems that work like a pump, absorbing water and nutrients from the soil and bringing them to the surface. Trees can prevent soil erosion, and they can provide shadows, fruits and natural protection against heavy rain. Leguminous plants in general (trees and shrubs inclusive), such as *leucaena*, pigeon pie, beans, soy beans, cow peas, groundnuts and many others can also help to increase the amount of nitrogen in the soil as nodules in their roots contain bacteria that are able to “fix” the nitrogen content from the atmosphere into the soil and to the plants themselves. As nitrogen is an important element for plant development, using such nitrogen-fixing legumes could prevent nitrogen deficiency in soils, reducing the necessity to add external chemical fertilisers.

How is climate change affecting soil management in dry land areas?

It is clear now that climate change is negatively affecting agriculture, and that farmers are suffering the consequences. In many places around the world, regardless of different ecosystems in which they live, farmers are expressing common concerns on how the weather is becoming more and more unpredictable with more intense and frequent droughts and floods; how their traditional knowledge on ecological farming is affected by the vagaries of extreme weather conditions; and how short but strong rains are negatively impacting crop yields.

In this context, it becomes even more necessary to protect the soil against increasing heat and heavy rains. The same type of soil protection techniques discussed above (e.g. building terraces, planting trees, building dams) can be used in both dry and wet seasons. Although no one is prepared for a prolonged drought of two or more years, farmers' capacity to deal with and to recover from such shocks needs to be enhanced.

How is climate change affecting water management in dry land areas?

Access to water and water management is also a challenge in dry land. This is true especially for women and girls who usually walk long hours and distances (sometimes over 10 km) fetching and transporting water from far away water sources. This situation is likely to exacerbate as climate change accelerates. Therefore, it is important to develop water catchment systems at the household and community level, building structures that enable water to be preserved on farms.

In many dry land areas, farmers have been using traditional techniques and mechanisms to deal with erratic changes in the rainfall. For example, they have built indigenous systems to catch rainwater not only for domestic consumption, but also for livestock-rearing and crop production. These systems include building roof-catchment systems (guttering), small dams including those underground, brick tanks, rock cisterns and other types of reservoirs. Such methods will not only help to conserve water for domestic consumption, but also to control erosion and flood, and to make use of preserved water for agriculture during dry seasons.

Mono-cropping and mixed cropping in smallholder farmers context

In the climate change context, mono-cropping could be a risky way of farming, especially in rain fed agriculture in dry lands. In case of a crop failure – due to problems related with lack of, or too much, rainwater, pest infestation or diseases – farmers with single crops on their field are left with nothing to harvest. It is a risk for both smallholder and larger farmers.

Sustainable agriculture embraces mixed cropping, also known as multi-cropping, as opposed to mono-cropping. It refers to the type of agriculture that involves planting of two or more plants simultaneously in the same field. In fact, some crops can grow very well together. Smallholder farmers from several places have been developing complex systems that integrate many crops in the same area. Some successful examples of mixed copping practices include maize and beans, wheat and chickpea, groundnut and sunflower, sorghum and pigeon pea, and so on.

Mixed croppingis not only effective for building farmers' resilience to climate extremes; mixing crops appropriately could generate many other positive effects, such as balancing soil nutrients,

preventing weeds and pests, suppressing plant diseases and increasing the overall efficiency and productivity of land. Furthermore, mixed cropping practices from North-eastern Brazil show how farmers benefit from the availability of a wide variety of crops; as each crop is planted and harvested at different times of the year, they always have something to consume and sell. As farmers in North-eastern Brazil say: "*Mixed cropping is an insurance against bad weather"*.

Why do we need crop rotation?

While it is important to mix crops, it is equally important to rotate them. The principle of crop rotation is to grow specific groups of plants on different parts of the field each year to help reduce a build-up of pests and diseases. As different crops have different nutrient and water requirements, they explore the soil in unique ways. Therefore, rotating crops annually helps to reduce soil degradation arising from nutrient imbalance. If the rotation includes leguminous plants, it can also reduce the dependency on chemical fertilizers.

What is agro-forestry?

Agro-forestry is another important element of sustainable agriculture. It is the growing of trees, crops, grass and/or vegetables on the same piece of land. It differs from conventional forestry as it focuses on the interaction among various trees, plants and their biological components. In fact, many farmers around the world are increasing the number of trees in their farming systems.

Many coffee growers, for example, plant trees in their farms as coffee grows better in the shade and this in turn improves the quality of coffee beans. Again, trees can help the dynamic flow of organic matter within soils, retain soil moisture, and offer nitrogen, in the case of leguminous trees.

Other than coffee farmers, there are a great many farmers who are building complex agro-forestry systems – integrating trees with crops and animal fodder in the same area. In this way, they can have many different products in small plots of lands. Farmers can also cut and use parts of the trees to cover and protect the soil against erosion, use timber for fuel wood, and consume fruits and berries. In many dry lands, trees have been integrated with crops – such as banana trees with mango trees, cassava, maize, beans, even rice and animal fodder all together in the same field.

Farmers could produce more bananas if they followed mono-cropping methods, but the benefits of planting multiple trees and crops (e.g. crop diversification, soil protection, improved food security and nutrient intake, increased total output) outweigh high production in single crops. There are many studies showing that although the amount of production of a single crop in a mono-cropping system is larger than that of a mixed system, the total production within the latter is higher than in the former.

What do we mean by seed banks?

One of the most common complaints from women and men smallholder farmers that ActionAid works with are related to the difficulties of accessing and preserving seeds. A Seed Bank is one

of the possible collective strategies to minimise farmers difficulties related to seeds. Community Seed Banks, or Community Seeds Storage Facilities, are collective spaces where smallholder farmers store, preserve and manage their own seeds and other planting materials.

Seed banks may be used to store and preserve traditional varieties of crops, or to multiply and store some ready-to-use improved varieties, meaning that farmers do not need to buy seeds every year. Seed banks can be a central element of smallholder farmer communities' strategies to increase food security and food sovereignty, preserve the local varieties, facilitate the access of farmers to quality seeds, and reduce the risks of local seeds and local plants losses in the context of climate change.

The practice of seed exchange is based on a loan-and-return system; a family borrows a certain quantity of seeds, and returns the same amount of seeds plus some contribution (an additional percentage of seeds) after harvesting. At the outset, participating community members collectively define how the seed bank will operate – e.g. deciding the amount of seeds each farmer must put in, and the percentage of seeds that should be returned. This system allows farmers to produce their own seeds that can be used, shared, and preserved under the collective management of the community.

Examples of existing seed banks, guidelines on how to organise a seed bank, and more useful information related to seeds can be found in the Community Seed Banks Guidance Note – part of the Climate Resilient Sustainable Agriculture Programme Guidance Briefing Series. This document is also available on the KCP2 Hive space.

7. Where does ActionAid stand in the debate and practice on sustainable agriculture?

For	Against
Local control over natural resources, seeds, land, water, forest, knowledge and technology	Corporate control and concentration over natural resources, seeds, land, water, knowledge, technology
Appropriate technology that works with nature and combines food production with environment preservation	Technology that works against nature
Acknowledgement of the need to work with local knowledge, environments, soils, and work on solutions that are context-specific – both from an agro-ecological, institutional and social	One size fits all solutions that don't take account of local agro-ecological zones, or different social and cultural realities

perspective	
Centrality of women's role in food production, seed preservation, water quality and environment protection	Agriculture that ignores the needs and role of women
Greater role of the state in providing public goods like agricultural research, rural infrastructure, access to institutional market, access to local markets and social protection	Withdrawal of the state as a duty bearer from agriculture and from supporting the most marginalised rural communities
Looking at local context-specific solutions that work for the poorest and most marginalised communities, for smallholder farmers and their groups	One size fits all solutions that don't understand and appreciate the diversity amongst the rural farming community
Building the political voice and identity of smallholder farmers aiming to enhance the space and participation of farmers' movements and groups on the process of construction of public policies to attend to their specific demands	Marginalisation of smallholder farmers
We support multiple solutions to preserve local biodiversity, facilitate the access to high quality seeds adapted to the local conditions; including household seed banks, community seed banks, regional gene banks, community seeds selection and improvement, multiplication and distribution of seeds by smallholder farmers groups, government extension and private traders	Corporate control over seeds and loss of biodiversity at local farm level
Availability of affordable credit specific for smallholder farmers and grants (social transfers) for marginal farmers	Credit at high interest rates for smallholder farmers
Use of locally adapted seeds and vegetal and animal species and races that are under the control of local communities and smallholder farmers social movements	Hybrids and high yielding varieties that do not take account of local realities (economic, social, climatic)
Smallholder farmer – scientist partnerships that build solutions for the local communities demands, based on local tests designed, monitored and evaluated by smallholder farmers'	Top-down agricultural research that does not take into account farmers realities, does not involve farmers on the design and implementation and is often not

local groups	disseminated well
Supporting transition processes to sustainable agriculture, based on local reality, aiming to reduce the dependency on external inputs and to improve the sustainability, food security and resilience of smallholder production systems	High input intensive agriculture that does not build resilience and that promotes a uniform solution
Diversified farming systems that help improve food security, livelihoods and build resilience	Mono-cropping that often does not build on resilience

8. Glossary

Agro-ecology: The application of ecological concepts and principles in the design and management of sustainable agricultural systems. A whole-systems approach to agriculture and food systems development based on traditional knowledge, alternative agriculture, and local food system experiences. (Griessman ,2001).
Source: http://www.agroecology.org - Glossary of Terms Used in Agroecology

Agroecosystem: "A biological and natural resource system managed by humans for the primary purpose of producing food as well as other socially valuable nonfood goods and environmental services".
Source: (Wood et al., 2000)

Agroforestry: Is the deliberate incorporation of trees and other woody species of plants into other types of agricultural activities. By definition the use of woody species must result in the enhancement of either the biological productivity or the economic return of the system, or both. There are many types of agroforestry, which are usually defined by what type of agricultural activity is involved, but this can be a very broad definition and includes what we normally think of as agriculture (agroforestry), but also other combinations such as livestock production (sylvo-pastoral agroforestry) and even aquaculture (sylvo-aqua agroforestry). Even more complicated versions are possible such as agricultural systems that incorporate livestock, trees and aquaculture (sylvo-pastoral-aqua agroforestry).
Source: The Encyclopedia of Earth - http://www.eoearth.org

Antagonisn: A biological structure or chemical agent that interferes with the physiological action of another
Source: Biology on Line http://www.biology-online.org
In phytopathology, **antagonism** refers to the action of any organism that suppress or interfere the normal growth and activity of a plant pathogen, such as the main parts ofbacteria or fungi. This organisms can be used for pest control and are referred to as ``Biological Control Agents´´. They may be predators, parasites, parasitoides or pathogens which attacks harmful insect, weed or plant disease.
Source: http://en.wikipedia.org

Allelopathy: Is a biological phenomenon by which an organism produces one or more biochemicals that influence the growth, survival, and reproduction of other organisms. These biochemicals are known as

allelochemicals and can have beneficial (positive allelopathy) or detrimental (negative allelopathy) effects on the target organisms.
Source: http://dbpedia.org

Biotechnology: is the utilisation of organisms and biological processes to create products. In the broad sense, biotechnology can be seen as an umbrella term. It embraces not only new technologies like recombinant DNA(rDNA) and protoplast fusion, but also very traditional technologies such fermentation of beer and wine, bread and cheese production.
Source: Marcatto,C., 1997, Trends of biotechnological development and risks for small-scale farmers. Master of Science degree thesis in Ecological Agriculture, Wageningen Agricultural University, The Netherlands, 62 pages

Composts: Composting is a natural process that breaks down organic material like leaves, grass clippings, food scraps and paper into a nutrient-rich, soil-like material which is great for the garden! When properly maintained, compost has no unpleasant odours. Composting is best suited to homes that have a garden, as you need to have soil under the compost bin or enclosure. Using a composting bin or making a composting enclosure are options depending on the garden space available. Ready made composting bins are available at garden centres or hardware stores.
Source: http://www.sustainability.govt.nz

Conservation agriculture: A concept for resource-saving agricultural crop production that strives to achieve acceptable profits together with high and sustained production levels while concurrently conserving the environment.
Source: FAO, Marketing research and information systems, Marketing and Agribusiness Texts, http://www.fao.org

Contour Strip Cropping: It is a practice of growing different crops in a systematic arrangement of bands or strips along the contours of sloping land. Crops are arranged so that a strip of grass or close-growing crop is alternated with a strip of clean-tilled crop or fallow, or a strip of grass is alternated with a close-growing crop (Czapar et al., 2006). Contour Strip Cropping helps to protect soil from wind or water erosion. This practice is applied to cropland subject to erosion or soil movement which would contribute pollutants to the water (MDA, 2008).
Source: Czapar G.F. et al. (2006), *Effects of Erosion Control Practices on Nutrient Loss*, University of Illinois, available at *www.epa.gov*
For more information see also: Maryland Department of Agriculture (2008), *Strip-Cropping Contour*, 585-1, 586-1, available at www.mda.state.md.us

Conventional agriculture: an industrialised agricultural system characterised by mechanisation, monocultures, and the use of synthetic inputs such as chemical fertilizers and pesticides, with an emphasis on maximising productivity and profitability. Industrialised agriculture has become "conventional" only within the last 60 or so years (since World War II).
Source: Annie Eicher, Organic Farming Program Coordinator, University of California Cooperative Extension -aleicher@ucdavis.edu

Crop Rotation: the practice of planting a sequence of different crops and cover crops on a specific field. Crop rotations can be used to help build soil fertility, reduce insect pest pressure, and suppress weeds.
Source: Annie Eicher, Organic Farming Program Coordinator, University of California Cooperative Extension -aleicher@ucdavis.edu

Desertification: Land degradation in arid, semi-arid and dry sub-humid areas resulting from various factors, including climatic variations and human activities; combating desertification includes activities which are part of the integrated development of land in arid, semi-arid and dry sub-humid areas for sustainable development which are aimed at: (i) prevention and/or reduction of land degradation; (ii) rehabilitation of partly degraded land; and (iii) reclamation of desertified land.
Source: United Nations Convention to Combat Desertification
http://www.unccd.int/convention/text/convention.php

Diversity (1) The number or variety of species in a location, community, ecosystem, or agroecosystem. (2) The degree of heterogeneity of the biotic components of an ecosystem or agroecosystem.
Source: http://www.agroecology.org

Ecological diversity The degree of heterogeneity of an ecosystem's or agroecosystem's species makeup, genetic potential, vertical spatial structure, horizontal spatial structure, trophic structure, ecological functioning, and change over time.
Source: http://www.agroecology.org

Eutrophication: Is the enhancement of the natural process of biological production in rivers, lakes and reservoirs, caused by natural or artificial increases in levels of nutrients, usually phosphorus and nitrogen compounds. It is widely recognised that sewage, including agricultural wastes, is the main cause of eutrophication.
Source: Lund J.G.W. (1972), *Eutrophication*, Proc. Roy. Soc. (B).180, 371-382

Fallow: Cropland left idle from harvest to planting or during the growing season.
Source: http://www.agroecology.org

Farmer-led Participatory Plant Breeding: Researchers and/or development workers interact with farmer-controlled, managed and executed PPB activities, and build on farmers' own varietal development and seed systems.
Source: http://www.agroecology.org - Glossary of Terms Used in Agroecology

Farmer to farmer exchange of knowledge: A methodology of agricultural improvement first developed in Nicaragua at the beginning of 1980´s that is the base for several processes of local developments agricultural programmes in many places of the World. The methodology, that is based on "leaning by doing" and on villager extortionists, is described in details on the book: Bunch, R., 1982. Two Ears of Corn: a guide to people-centered agricultural improvement, World Neighbors Inc. Portland, 270p.
Source: rolandbunch.com/wp-content

Genetically Modified Organism: it is an organism whose genetic material has been altered using genetic engineering techniques. The outcomes of GMO in agricultural use are still questioned. Yield gains are highly variable (10-33 per cent) in some places and actually decline in others. In addition, the use of patents for transgenes may drive up costs, restricting experimentation by the individual farmer or public researcher.
Source: Mc Intyre B.D. (2009), Reports Agriculture at a Crossroads, IAASTD, available at www.agassessment.org/.../IAASTD/.../Agriculture%20at%20a%20Crossroads_Synthesis%20Report%20(English).pdf

Global Warming: Refers to an increase in the globally-averaged surface temperature in response to the increase of well-mixed greenhouse gases, particularly CO2.
Source: http://www.agroecology.org - Glossary of Terms Used in Agroecology

Global Warming Potential An index, describing the radiative characteristics of well-mixed greenhouse gases, that represents the combined effect of the differing times these gases remain in the atmosphere and their relative effectiveness in absorbing outgoing infrared radiation. This index approximates the time-integrated warming effect of a unit mass of a given greenhouse gas in today's atmosphere, relative to that of carbon dioxide.
Source: http://www.agroecology.org - Glossary of Terms Used in Agroecology

Green Manure: a cover crop grown to help maintain soil organic matter and increase nitrogen availability. Legumes are often used because they have rhizobial bacteria living in their root nodules that are able to fix nitrogen from the air and add it to the soil. Grasses grow quickly, providing biomass good for increasing organic matter.

Source: Annie Eicher, Organic Farming Program Coordinator, University of California Cooperative Extension -aleicher@ucdavis.edu

Green Revolution An aggressive effort since 1950 in which agricultural researchers applied scientific principles of genetics and breeding to improve crops grown primarily in less-developed countries. The effort typically was accompanied by collateral investments to develop or strengthen the delivery of extension services, production inputs and markets and develop physical infrastructures such as roads and irrigation.
Source: http://www.agroecology.org - Glossary of Terms Used in Agroecology

Hunter-gatherer societies: The hunter gatherer society is the earliest form of human society. The hunter gatherer societies have an economic base that rests on the use of the naturally occurring animal and plant resources of the environment. They does not practice agriculture or raise and herd animals. Social structure is usually egalitarian with little economic and gender inequality. Private property is minimal. The hunter gatherer society is among the early societies believed to have had a matriarchal tribal system. Hunting and gathering was subsistence strategy of human societies for more than two million years. In a hunter-gatherer society the primary subsistence method involves the direct procurement of edible plants and animals from the wild, foraging and hunting without significant recourse to the domestication of either. The Hunter-gatherers obtain most from gathering rather than hunting. Originally, hunter-gatherers lived exclusively in open savanna and were generally meat scavangers than hunters. They used carcasses of large animals killed by other predators or carcasses from animals that died by natural cause.
Source: http://sociologyindex.com/hunter_gatherer_society.htm

Hybrid seed: seeds produced by cross-pollinated plants. They are planted to produce crops which are harvested for use. Saving seed from the crop and planting it is undesirable because the superior qualities of the hybrid seed will have all disappeared in the following generation. Therefore, once farmers use hybrids seeds, they are obliged to buy seeds for every cropping. Hybrid seeds were the first step whereby agribusiness corporations took control of seed from farmers.
Source: Cummings et al. (2008), *Hybrid Seed*, Institute for Science in Society available at http://www.i-sis.org.uk

Humus: Well-decomposed organic matter which is resistant to further decomposition and which may persist for hundreds of years. Humus holds on to some nutrients, storing them for slow release to plants.
Source: Annie Eicher, Organic Farming Program Coordinator, University of California Cooperative Extension -aleicher@ucdavis.edu

Integrated Pest Management The procedure of integrating and applying practical management methods to manage insect populations so as to keep pest species from reaching damaging levels while avoiding or minimising the potentially harmful effects of pest management measures on humans, non-target species, and the environment. IPM tends to incorporate assessment methods to guide management decisions.
Source: Annie Eicher, Organic Farming Program Coordinator, University of California Cooperative Extension -aleicher@ucdavis.edu

Intensive Farming: Farmers who use intensive farming methods concentrate on producing as much crop as possible on the available land. It involves either a large amount of financial or labour investment, or a high application of pesticides on a comparatively small area, or both. Intensive farming has a high potential return on investment that makes it attractive (IAASTD, 2009). Negative effects include: direct impact on global warming; fossil fuel use that is the major underlying cause of greenhouse gas production; supports much of the current food grain and concentrate production that underpins the culture of livestock and carnivorous fish species; the impact of increasing demand for concentrate feed on arable systems and the world's natural stocks of fish to support growth in intensive livestock and fish production could be reduced if integrated farming became more widespread (FAO, 2003).
Source: Mc Intyre B.D. (2009), Reports Agriculture at a Crossroads, IAASTD, available at www.agassessment.org/.../IAASTD

Intercropping: The practice of planting two or more mutually beneficial crops in close proximity, typically as alternating rows or numbers of rows. (On a small scale, this is often called companion planting). Benefits can include insect or weed suppression, structural support, or shade.
Source: Annie Eicher, Organic Farming Program Coordinator, University of California Cooperative Extension -aleicher@ucdavis.edu

Land Cover: The physical coverage of land, usually expressed in terms of vegetation cover or lack of it. Influenced by but non synonymous with land use.
Source: http://www.agroecology.org - Glossary of Terms Used in Agroecology

Land Degradation The reduction in the capability of the land to produce benefits from a particular land use under a specific form of land management.
Source: http://www.agroecology.org - Glossary of Terms Used in Agroecology

Leguminous: Cultivated or spontaneous plants in the Leguminosae (Fabaceae) family. Most species in this family has a association with a bacteria that can fix atmospheric nitrogen.
Based on Glossary of Terms Used in Agroecology - http://www.agroecology.org -

Livelihood: A livelihood comprises the capabilities, assets (including both material and social resources) and activities required for a means of living. A livelihood is sustainable when it can cope with and recover from stresses and shocks, maintain or enhance its capabilities and assets, while not undermining the natural resource base. (Chambers and Conway, 1992)
Source: www.ids.ac.uk/download.cfm?file=wp72.pdf

Marginal Farmers: It will be necessary to build this definition

Minimum Tillage The least amount possible of cultivation or soil disturbance done to prepare a suitable seedbed. The main purposes of minimum tillage are to reduce tillage energy consumption, to conserve moisture, and to retain plant cover to minimise erosion.
Source: http://www.agroecology.org - Glossary of Terms Used in Agroecology

Mono-cropping: A system of cultivation in which a single crop plant such as wheat is grown over a large area of land often for several years. Opposite mixed cropping. Monocropping involving cash crops, groundnuts, cotton, etc., exposes farmers in Africa to price fluctuations on the world market. Diversification is needed to stabilise farm incomes.
Source: AgricultureDictionary - http://www.agriculturedictionary.com

Mulch: Are loose coverings or sheets of material placed on the surface of cultivated soil. Mulches can be applied to bare soil or to cover the surface of compost in containers. Depending on the type of mulch used, there are many benefits of mulching including: Help soils retain moisture in summer; Suppress weeds; Improve soil texture; Deter some pests; Protect plant roots from extreme temperatures; Encourage beneficial soil organisms; Provide a barrier for edible crops coming into contact with soil and give a decorative finish.
Mulching is generally used to improve the soil around plants, but it also gives your garden a neat, tidy appearance and can reduce the amount of time spent on tasks such as watering and weeding. Mulches help soil retain moisture in summer, prevent weeds from growing and protect the roots of plants in winter.
Source: The Royal Horticultural Society - http://apps.rhs.org.uk

Multi-cropping: The cultivation of two or more crops in succession or with some overlap in the same field within one year. Double-cropping of rice after wheat is an example. When crops overlap in time, multiple cropping is a form of polyculture.
Source: http://www.agroecology.org - Glossary of Terms Used in Agroecology

No-Till: Planting without tillage. In most systems, planter mounted coulters till a narrow seedbed assisting in the placement of fertilizer and seed. The tillage effect on weed control is replaced by herbicide use.
Source: http://www.agroecology.org - Glossary of Terms Used in Agroecology

Open pollination varieties (OPVs): it is a natural cross-pollination by insects, birds, wind or water or by self-pollination from male and female flower parts on the same plant. Open-pollinated varieties are the traditional varieties which have been grown and selected for their desirable traits for millennia. They grow well without high inputs because they have been selected under organic conditions. The recycled seed will grow and yield as well as the original plants. Compared to hybrids, OPVs are less uniform and usually lower-yielding than hybrids in optimal environments. OPVs, however, have the advantage of being more stable than hybrids in low-yielding or stress environments (FAO, 2006).
Source: Setimela et al. (2006), *Strategies for Strengthening and Scaling-up Community-Based and Seed Production*, FAO: Rome, available at ageconsearch.umn.edu/bitstream

Organic Agriculture: "A production system that sustains the health of soils, ecosystems and people. It relies on ecological processes, biodiversity and cycles adapted to local conditions, rather than the use of inputs with adverse effects. Organic agriculture combines tradition, innovation and science to benefit the shared environment and promote fair relationships and a good quality of life for all involved" (IFOAM)
Source: IFOAM - International Federation of Organic Agriculture Movements - http://www.ifoam.org

Overexploitation: Occurs when a renewable resource is exploited to the point of diminishing returns. Examples include wild plants, grazing pasture, fish stocks, forest and water aquifers. Sustained overexploitation can lead to the destruction of the resource.
Source: The Azimuth Project - http://www.azimuthproject.org/azimuth

Overgrazing: Is herbivory (animal comsumption of plants) that extracts an unsustainable yield of floral biomass from an ecosystem; however, the term is most often applied to the actions of wild or domesticated ungulates. While this relatively intensive practice may apply to livestock or native species. It is most commonly used to describe such human-tended domestic grazers as cattle, sheep and goats. Estimates of overgrazing worldwide are on the order of one third of all rangeland (Cunningham and Saigo[1]).
Manifestations of overgrazing in landscapes composed largely of native species include reduction of species richness, loss of biodiversity, desertification, loss of native topsoil and increases in surface runoff. In fact, overgrazing can be considered the major cause of desertification in arid drylands, tropical grasslands and savannas, worldwide. Overgrazing of historic human-created pastureland, especially irrigated or non-native grasslands, may lead to soil compaction, reduction in long-term grazing productivity and loss of topsoil.
Source: http://www.eoearth.org/article/Overgrazing

Permaculture: Permaculture is an ecological design system for sustainability in all aspects of human endeavor. It teaches us how build natural homes, grow our own food, restore diminished landscapes and ecosystems, catch rainwater, build communities and much more.
Source: Permaculture Institute - http://www.permaculture.org

Plant Tissue Culture: Plant Tissue Culture is the regeneration of whole plants derived from single cell taken from leaf, roots, meristems or other vegetal parts. Some possibilities of utilisation of plant tissue culture are: production of virus-free plants, mass propagation of selected plants, and germoplasm conservation
Source: Marcatto,C., 1997, Trends of biotechnological development and risks for small-scale farmers. Master of Science degree thesis in Ecological Agriculture, Wageningen Agricultural University, The Netherlands, 62 pages

Polyculture: Cropping systems in which different crop species are grown in mixtures in the same field at the same time.
Source: http://www.agroecology.org - Glossary of Terms Used in Agroecology

Resilience: Resilience is the long-term capacity of a system to deal with change and continue to develop. For an ecosystem such as a forest, this can involve dealing with storms, fires and pollution, while for a

society it involves an ability to deal with political uncertainty or natural disasters in a way that is sustainable in the long-term.
Increased knowledge of how we can strengthen resilience in society and nature is becoming increasingly important in coping with the stresses caused by climate change and other environmental impacts.
Source: Stockholm Resilience Centre - http://www.stockholmresilience.org

Soil compaction: Soil compaction is a form of physical degradation resulting in densification and distortion of the soil where biological activity, porosity and permeability are reduced, strength is increased and soil structure partly destroyed. Compaction can reduce water infiltration capacity and increase erosion risk by accelerating run-off. The compaction process can be initiated by wheels, tracks, rollers or by the passage of animals.
Some soils are naturally compacted, strongly cemented or have a thin topsoil layer on rock subsoil. Soils can vary from being sufficiently strong to resist all likely applied loads to being so weak that they are compacted by even light loads.
In arable land with annual ploughing, both topsoil and subsoil compaction is possible. A feature of compacted soils is the formation of a pan-layer, caused by the tractor tyres driving directly on the subsoil during ploughing (above). The pan-layer is less permeable for roots, water and oxygen than the soil below and is a bottleneck for the function of the subsoil. Unlike topsoil, the subsoil is not loosened annually, compaction becomes cumulative and over time, a homogeneous compacted layer is created.
Source: European Commission - Joint Research Centre
Institute for Environment and Sustainability
http://eusoils.jrc.ec.europa.eu/library/themes/compaction/

Shifting Cultivation: Found mainly in the tropics, especially in humid and sub humid regions. There are different kinds; for example, in some cases a settlement is permanent, but certain fields are fallowed and cropped alternately ('rotational agriculture'). In other cases, new land is cleared when the old is no longer productive.
Source: http://www.agroecology.org - Glossary of Terms Used in Agroecology

Slash and Burn Agriculture A pattern of agriculture in which existing vegetation is cleared and burned to provide space and nutrients for cropping.
Source: http://www.agroecology.org - Glossary of Terms Used in Agroecology

Subsistence Agriculture Agriculture carried out for the use of the individual person or their family with few or no outputs available for sale.
Source: http://www.agroecology.org - Glossary of Terms Used in Agroecology

Sustainable Development: Development that meets the needs of the present without compromising the ability of future generations to meet their own needs.
Source: http://www.agroecology.org - Glossary of Terms Used in Agroecology

Terrace: is the construction of earthen embankments that look like long stair-steps running across the slope of rolling land. A terrace consists of a channel with a ridge at its outer edge. The channel intercepts and diverts downhill runoff. Terraces help to prevent soil erosion by increasing the length of the slope, thereby reducing the speed of overland water flow to allow for greater infiltration. The channels redirect excess runoff to a controlled outlet. Terraces help prevent the formation of gullies and retain runoff water to allow sediment to settle.
Source: Soil Conservation - Barrier Approaches - Runoff, Water, Terraces, Reservoirs, Slope, and Surface - http://science.jrank.org

[i] Adapted from the Ecological Definition of Sustainable Agriculture by Professor Stephen R. Gliessman[i] and the definition of organic agriculture by the International Federation of Organic Agriculture Movements (IFOAM)[i].

[ii] IPCC Third Assessment Report - Climate Change 2001, Intergovernmental Panel on Climate Change, http://www.ipcc.ch

[iii] It is not uncommon that smallholder farmers on transition process spend several years of hard investment on improving soil structure and the dynamic of soil organic matter before manage to reduce the dependency on chemical fertiliser. It is easier to reduce the external inputs dependency of nitrogen and potassium, since there are several sources of these two nutrients that farmers can access, like animal manure and green manure in the case of nitrogen, and ash, in the case of potassium. The external dependency of phosphate, however, is very difficult to reduce. Most of the soils that our farmers have access are very poor in phosphate; this nutrient has a very restrict soil mobility. Natural sources of phosphate, like phosphate rocks, are rarely available at the places that ActionAid works.

[iv] In an interview to ActionAid, a smallholder farmer that are the only one trying to resist to the expansion of sugarcane plantation (the last one to stays in a community that had more than 40 families until 10 years ago), and that are now completely surrounded by sugarcane plantation in Rubiataba, Goias State, Brazil, said that he doesn't know for how long he is going to resist. He said that it is not possible to survive alone; he depends of his neighbours, not only on the economical, but also from social point of view. He said that the family is felling alone, they are missing the community life.

[v] Farmer to farmer exchange of knowledge is a methodology that had been developed in Nicaragua in the 1980s, as a reaction to the top-down transfer of technology ; it has been instrumental in identifying and diffusing local agricultural knowledge.

[vi] Agrawal, A. 1995. Dismantling the Divide Between Indigenous and Scientific Knowledge. *Development and Change* 26, p. 413-39.

[vii] International Assessment of Agricultural Knowledge, Science and Technology for Development – IAASTD