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From Vulnerability to Resilience: Agroecology for Sustainable Dryland Management[1]

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Abstract – This paper explores the main institutional and political factors contributing to the gap between evidence and mainstream policies/funding priorities in dryland management.It explores two agricultural paradigms: firstly, it explores the dominant paradigm that favours modernization, economies of scale and specialisation. Secondly, it explores the agroecological paradigm with resilience of farming communities and their ecosystems as its central concept. It then discusses a number of practical experiences, each illustrating that agroecological approaches can lead to triple wins: increased productivity, increased natural resource sustainability and increased food security. But sharing good practices alone is not enough to bridge the gap. The role of research-based evidence is one among the many variables that influence policy making and implementation. Other variables include values, political affiliation, experiences, expertise, stakeholder organisation, the role of the media and pressure. Building agro-ecological resilience is a challenging concept for policymakers as it requires a fundamental change in agricultural investment patterns, towards enabling small-scale family farmers to develop their skills, expertise and voice, and towards full-fledged support for the up scaling of agroecological practices.

Keywords –*Resilience, agroecology, family farming, paradigm shift, knowledge building*

1. Introduction

The theme 'Desertification, Sustainable Land Management and Resilience', which was also the title of the conference organised by the UNCCD is highly relevant in the context of the multiple interlocked crises the world is facing today. As per UN estimates, 1.5 billion people around the world are directly affected by land degradation, while every year 12 million hectares of land become unproductive through desertification. The effects are worsened by climate change. Pastures are scorched, and crops, trees and livestock do not survive.

The impact can be devastating. For example, impoverished dryland communities in the Sahel and the Horn of Africa are experiencing high levels of chronic malnutrition, hunger, child mortality and migration, in an environment that is at risk of degradation beyond repair. Humanitarian aid to cope with these crises is costing millions of dollars each time and leaves many new projects in its wake.

Desertification and land degradation are not just natural phenomena. They are the outcomes of long-term overexploitation and mismanagement of fragile ecosystems. To address these problems, we cannot resort to the same ways of thinking that have led to this situation. We need to take a different perspective, which is already presenting itself.

Evidence built by an increasing number of scientific reports and by innovative farmers around the world, all show that a new paradigm for agricultural development is unfolding that has a strong basis in local innovation and resources. The interesting thing is that this paradigm is emerging out of practical experiences on the ground (Altieri and Toledo, 2011; Gliessman, 1998).

The UNCCD observes the collective failure to convince policymakers of effective Sustainable Land Management (SLM) approaches as a key factor limiting the dissemination and application of good practice. This paper will explore the main institutional and political factors contributing to the frequent gap between evidence (from

[1]This article is based on a presentation given during the UNCCD 2nd Scientific Conference on "Economic assessment of desertification, sustainable land management and resilience of arid, semi-arid and dry sub-humid areas", held 9-12 April 2013 in Bonn, Germany (http://2sc.unccd.int).

practice) and mainstream policies/funding priorities. The paper draws practical lessons and experiences from different parts of the world.

2. The dominant Paradigm

Over the past few decades the neo-liberal modernization paradigm has asserted a position of dominance (Long 2001, Blakie 2000, Bauman 2003, Slater 2004, Escobar 2010). It has transformed agriculture and other domains of society into a state that has been characterised in terms of 'risk' (Beck 1992), 'vulnerability' (Marsden 2009), and 'fragility' (Scheffer 2009).

Under neoliberal modernisation people and resources became part of global networks and flows (Urry 2000, Davis 2004, Marsden 2009). National governments and institutes such as the World Bank, the IMF and the world trade organization embarked upon a mission of privatization, commoditization, financial deregulation, decentralisation and trade liberalization. While this has provided opportunities to some it has also led to the creation of new powers, particularly large multinational organizations that thrived in these new circumstances with more access to resources, markets and labour. At the same time modern global ways of producing and consuming were pushed forward to replace local ones. Governments, research institutes and extension services pushed for monocropping, specialization, and the use of chemical fertilizers, improved seeds and agro-toxins. This also led to the further integration of agriculture in, and subsequent subjection to the workings of, the global market.

While initially driven by (inter)national public institutions, this model of agricultural development is increasingly pushed by large multinational agribusiness corporations. The IAASTD (2009) found that the adoption of agrochemicals and mono-cropping has benefitted transnational corporations with "near-total control" of food production (http://www.groundswellinternational.org/sustainable-development/burkina-faso/women-farmers-feed-the-world/). These corporations are moreover exerting increasing influence on the course of science, policy and regulation. Agribusiness companies have aggressively promoted their products through PR activities, industry lobby groups, funding academic research and directly influencing government policy (Holt-Giménez and Shattuck, 2011). Watchdogs estimate that in 2012 alone, Monsanto has spent $4,730,000 on lobbying the US government (OpenSecrets.org, 2002). The patent laws that Monsanto has lobbied for have diminished farmer breeding rights (Kloppenburg, 2010). Legal assaults of Monsanto against farmers violating their property rights have been reported (CFS, 2004).

These developments have created two types of vulnerabilities. First, it has created a superfluous group of urban and rural dwellers, coined by Breeman (1996) as footloose labour and by Bauman (2003) as outcasts of modernity. People and local communities have been displaced, excluded or marginalised because they were not modern or had to make way for modern development projects or agribusiness. Rural-urban migration was the result and as not all could be absorbed by the cities, slums were created and a new class of transnational refugees emerged (Davis 2004). During the 1980s, structural adjustment policies promoted by the World Bank and others pushed African and other governments to privatise land and focus on industrial farming. In addition, large scale 'development' projects such as dams, mines and pipelines, also often supported by financial institutions, pushed farming communities off their land, increasing rather than alleviating poverty. The World Bank is now playing a key role in the global rush for land by providing capital and guarantees to big multinational investors. Oxfam found that more than 60 per cent of investments in agricultural land by foreign investors between 2000 and 2010 were in developing countries with serious hunger problems, while two thirds of those investors plan to export everything they produce on the land (Oxfam, 2012). Many small-scale farmers and pastoralist communities living in such areas were forced to leave and work in towns and cities or on large scale commercial plantations or farms. Food aid is dispensed during periodic droughts and shocks while this perceived 'inevitable' transition goes on. Sometimes, as is the case for many dryland areas, entire regions were excluded. Investment in ecologically fragile and drought prone areas were not seen as being economically feasible.

Second, these developments have led to the institutionalisation of unsustainable modes of production. The Green Revolution, beginning in the 1940′s, pushed for the widespread use of chemical fertilizers, pesticides, and machinery. The Green Revolution did result in increased agricultural productivity. However, such increases were not without environmental and social consequences and some areas (particularly in Africa) were excluded from productivity gains altogether (Matson et al., 1997; Pimental et al., 1973). For tens of millions of small-scale farmers who live in fragile drought prone areas, industrial inputs like hybrid or genetically engineered seeds, chemical fertilizer, pesticides, or irrigation are unsuitable or unaffordable. Similarly, this type of agriculture has resulted in the degradation and depletion of natural resources, for example, years of water-intensive farming has depleted water tables, while increased use of chemicals has severely damaged soils. Although the failure of the Green revolution, especially in Africa, is increasingly recognised, a New Green Revolution is gaining momentum. The New Green Revolution is still driven by the belief that yield increases require intensive use of chemical fertilizers and pesticides, but also promotes high-yielding varieties and emphasises the creation of input and output markets. Environmental concerns are also being acknowledged and presently the concept of 'sustainable intensification' – broadly defined as a means to increase productivity while reducing environmental impacts such as pollution and resource degradation – has gained widespread acceptance (Fish et al., 2014; Garnett et al., 2013). Both the New Green Revolution and sustainable intensification represent a reformed version of the dominant paradigm. Proponents of this paradigm focus on measurable efficiencies. For example yield per hectare or per other inputs such as nitrogen and

water. While this is a valuable concept in itself, it is limited in that it favours analysis of individual cropping systems, livestock systems or value chains. When approaching whole farming systems, everything cannot be reduced to a measurable input or output such that by default certain modes of production are favoured (Malezieux, 2012). Further, neither sustainable intensification nor the New Green Revolution acknowledges the sociopolitical drivers of sustainability (Darnhofer et al., 2010). As a result, policies tend to prioritise export oriented, commercial production in areas that have access to reliable rainfall, inputs, roads and markets and perpetuate social exclusion.

3. Agroecology

3.1. A sustainable alternative?

In response to the vulnerabilities and shortfalls of the 'Green Revolution' type of farming many farmers have sought alternative farming practices. In areas untouched by modernisation farmers have continued to innovate using the resources they had at hand and according to local needs and possibilities. Over the past decades, farmers, and the NGOs and scientists working with them distilled a set of principles from a variety of these experiences which was coined agroecology. Agroecology is one of the central recommendations of the IAASTD (2009) and is often referred to as a practice, a science and a movement. (Wezel et al, 2009). Agroecology is now increasingly being adopted and articulated by peasant movements worldwide.

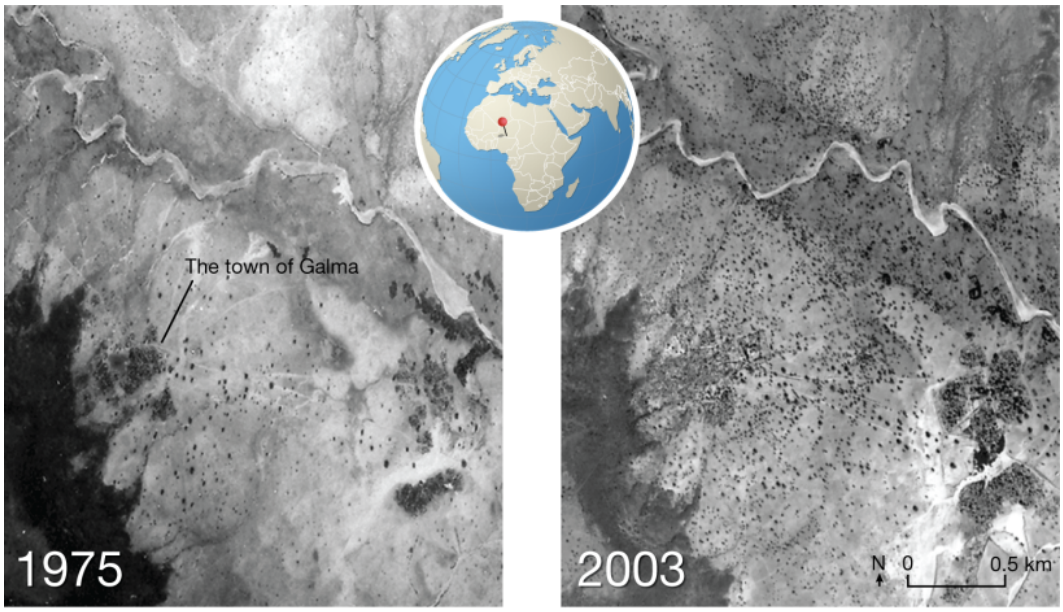
Agroecology sees the farm as a system. A healthy and active soil forms the basis. The core principles of agroecology include recycling nutrients and energy on the farm, rather than introducing external chemical inputs; integrating crops and livestock; diversifying species and genetic resources in agroecosystems over time and space; and focusing on interactions and productivity across the agricultural system, rather than on individual species (Altieri and Toledo; de Schutter, 2011). In contrast to neoliberal modernisation, agroecology is based on techniques that are not delivered top-down but developed on the basis of farmers' knowledge and experimentation. Therefore, agroecology is highly knowledge-intensive, for example, local knowledge systems, including knowledge about agrobiodiversity are indispensable. Furthermore, agroecology takes strength from existing socio-cultural structures such as local institutions governing natural resources.

Benefits of agroecology include increased productivity and incomes for farmers, enhanced food security, improved adaptive capacity for the changing climate, regeneration of natural resource bases and greater autonomy for farmers. These benefits are the building blocks of a more resilient agriculture, defined by the United States Agency for International Development (USAID, 2012) as the ability of people, households, communities and systems to adapt and recover from shocks and stresses in a manner that reduces chronic poverty and facilitates inclusive growth. The two types of vulnerabilities outlined in Section 2.1 – namely marginalisation of farmers and farming communities and institutionalisation of unsustainable farming practices – can be considered the polar opposites of a resilient agriculture. Benefits from agroecological approaches remain contested. For example, it is often claimed that necessary agricultural productivity (measured in efficiency terms) can only be reached with technology such as fertilizer and improved seeds (Tilman et al., 2011). However, tangible links between agro-ecological approaches and resilience are increasingly recognised and for this reason, agroecological approaches in many forms emerge as promising alternatives to neoliberal modernisation. For example, agrobiodiverse farming underpinned by traditional crop and livestock varieties (created by farmers) out-perform hybrids in terms of suitability to local conditions, resistance to pests and disease outbreaks and capacity to adapt to extreme weather events (Jarvis et al., 2011; Ratnadass et al, 2011). Furthermore, reduction of external inputs into farming systems (e.g. seeds, nutrients and fossil fuels) not only mitigate greenhouse gas emissions and better align farming practices with ecological cycles supporting productivity, but also break the cycle of dependence on expensive, often unaffordable technologies and reduces farmers' risks caused by fluctuating commodity prices and energy markets (Altieri, 1999). Finally, the ultimate value, that agroecology places on farmers' knowledge and increased autonomy, serves to redistribute power towards farmers and farming communities (Gliessman, 2013; Van der Ploeg; 2008).

3.2. Successful agroecological experiences in dryland regions

In dryland areas unaffected by modernisation local knowledge systems have been better preserved in most cases, as well as their (knowledge about) agrobiodiversity and their local institutions governing natural resources. These systems are well adapted as they have evolved under local climatic and bio-physical conditions and in accordance with local values. They hold within them promises to move towards a more resilient agriculture. A diverse array of practices in dryland areas have shown to increase resilience in several ways. First, they build resilience to drought and climate change. This includes the conservation and improvement of indigenous seeds and breeds that require less water and are adapted to harsh conditions, the restoration of traditional water storage structures and the use intercropping in pest management.

Many civil society organisations have worked closely with local communities and interested scientists, to develop and document holistic approaches to dryland management. These approaches are powerful because the technical, social and governance dimensions are closely integrated (Burger, 2012). Day by day, successful agroecological experiences are increasing (de Schutter, op.cit.).Though a key feature of agroecology is that it is locally specific and diverse, some initiatives have scaled up massively, as can be seen in the Sahel.



Source: USGS EROS

Figure 1: Increase in Tree cover

3.2.1. Soil restoration in the Sahel

In southern Niger, there is considerable evidence that sustainable intensification of small farming systems, which integrate food production, trees and livestock, using low external inputs, agro-ecological methods, and crop diversification, can "re-green" denuded landscapes, reduce risks and improve food security for small-scale farmers. The best documented techniques include "zaï" planting pits, rock bunds on the contour and half moons water catchments. Also very crucial is farmer managed natural regeneration (FMNR) of trees: farmers protecting and growing trees on their own land.

Through FMNR, small-scale farmers in Niger are producing an estimated additional 500,000 tons of cereals a year which helps feed about 2.5 million people (Rinaudo, 2007). The World Bank estimates the annual production value of the new trees is at least $US 260 million, which flows directly back to farm families, either as cash or as produce (World Bank, 2010) . In the region of Maradi in Niger alone, in 2008, a very conservative estimate is that 62,000 farm families practicing a full version of FMNR have generated an additional gross income of US$17 - 23 million per year, contributing 900,000 to 1,000,000 new trees to the local environment (Haglund, et al. 2009).

The "re-greening" of about 5 million hectares in southern Niger has been described by an informed writer on the environment, Mark Hertsgaard as "one of the great success stories in the field of climate change and agriculture" and "the single largest environmental transformation in Africa" (Rinaudo and Yao, 2009).

Regreening Africa is a farmer led innovation movement. In Niger, desertification and soil degradation, low soil fertility, unreliable and erratic rainfall patterns combined with high levels of pest attacks make agricultural activities very risky. In some zones of Niger, up to 50% of the landmass is totally unproductive because land degradation and erosion have resulted in hardpan formation (Rinaud and Yaou, 2009). This means that when it rains, water cannot infiltrate the hard soil. Extensive water runoff and flooding occur, destroying crops and increasing erosion even further. Few farmer families have sufficient organic matter to maintain soil fertility. As a consequence, in many parts of Niger, even in good years, many poorer farm families do not produce enough food to meet their family's nutritional needs for more than three to six months (Rinaud and Yaou, 2009).

Determined to break this cycle of permanent food and nutrition insecurity, the new government of Niger recently outlined the "3N Initiative" (Nigeriens Nourishing Nigeriens"). There is still considerable controversy, however, about the model to follow to increase aid and investment in agricultural development. Despite repeated commitments by key donors and the government to support small-scale farmers (Rinaud and Yaou, 2009), agricultural policies and practices often remain biased to farming in more favourable areas, and to large irrigation schemes.

However, as noted above, there is considerable evidence that agroecological methods can transform the landscape, and rehabilitate degraded land. Where farmer managed natural regeneration and complementary soil and water conservation techniques have been practiced in Niger, degraded land was restored to production, crop yields have increased, water tables have risen and resilience to shocks has strengthened (Rinaud and Yaou, 2009), financial benefits through sale of tree products and increased grain and livestock production are estimated to be up to $250 per hectare (Rinaud and Yaou, 2009). FMNR adoption appears to increase household gross income by about 46 and 56 USD) per capita, or by between 18 and 24 percent (Haglund et. al, op.cit.) .

What is significant about these practices in Niger is that it is largely a farmer led movement. This "re-greening" began in 1985, supported by a few NGOs that

built on farmers' knowledge, and farmer to farmer approaches to learning and innovation. Supportive policies on decentralised, community based natural resource management, particularly over trees on farmers own land, and were another factor for success. This combination of learning from farmers, using low cost appropriate technologies, supportive policies, and eventually catalytic support by NGOs, contributed to eventually achieving a "critical mass" of practice within villages, and spontaneous widespread adoption. The massive increase in tree cover is so widespread, that the effects can be seen in satellite pictures comparing landscapes from 1975 to 2003.

However, even with this evidence, the new 3N Initiative in Niger is still largely influenced by the dominant Green Revolution thinking, investing in expensive seeds, external inputs, and large scale irrigation. This is limiting the much needed investment to further spread agroecological techniques such as farmer managed natural regeneration which, in addition to increasing production, also contributes to resilience to drought, re-greening of the environment, inclusive growth and farmer autonomy.

3.2.2. Biomass and water retention in Ethiopia

Land degradation is one of the most serious problems facing Ethiopia today. Yield reduction is high as a result of loss of topsoil to support farming. In order to improve crop yield in the region, the Ethiopian Government adopted the Sasakawa Global (SG) 2000 package, which is based on the use of high input demanding varieties and chemical fertilisers. The Institute for Sustainable Development, an Ethiopian NGO implemented a project using agroecological principles and compared its performance with that of the SG package in neighbouring villages.

Experiments were carried out in pairs of the following villages: Abomsas, Adi Nifas, Guimse and Ziban Sas. The use of chemicals and high-input demanding seeds on the one hand and use of technologies such as biomass and water retention techniques were used in other villages. After five years of the project, impressive results in soil management; productivity increase in crop yield; rehabilitation of grazing lands (that was left wasted) and water conservation were observed. Farmers obtained yields equal to those of the high external input farmers while their straw yields were higher. This provided them more fodder and composting material.

The key to the success of this project laid in the systematic involvement of almost all of the stakeholders. The project offered a range of choices and farmers adopted those that suited their ecological and social setting. As the project's results were convincing, it has been upscaled in a large UNDP-supported Programme (Edwards and Belay, 2003).

3.2.3. Seeds and local varieties in Brazil

Practices that use and conserve agrobiodiversity in the Brazilian semi-arid region of Paraíba form an important livelihood strategy for family farmers. However there are not recognised by governments as such. AS-PTA and ASA-PB, two non-governmental organisations, sought to have successfully managed to strengthen, upscale them and ground farmer seed systems in public seed policies and programmes (Petersen et. al., forthcoming, Curado et. al., 2013).

Identifying and enhancing the visibility of these practices was a crucial first step. ASA-PB started this process in 1996. In collaboration with the local farmers' union, they carried out a participatory appraisal to identify local bean varieties in the municipalities of Solânea and Remígio. They found 67 varieties of beans with different characteristic traits including resistance to droughts and pests, taste and acceptance in the market. They also identified mechanisms that enhance diversity and seed security. Farmers store their seeds and exchange them with other families, allowing for the free circulation of genetic material and of the knowledge associated with each variety in the communities. Local church based organisations had established seed banks in the drylands of Praíba in the 1970's. These proved highly effective in times of drought, when crops fail and farmers' own seed stocks are depleted. The bank lends seeds to the farmers which the farmers return, with a small percentual increase, after the harvest.

The local seed banks formed an important entry point to establish a seed security system. ASA-PB organisations established the Seeds Network, a platform for knowledge exchange on seed practices and the conservation of agrobiodiversity. This network links 230 seed banks in 61 municipalities, covering 6500 family farms in Paraíba. The seeds network formed a space for critical analysing and proposing policies. A drought in 1993 triggered a protest where ASA-PB and other social movements challenged the state's measures that were based on the notion of tackling the effects of drought. Alternatives were proposed based instead on living with the semi-arid.

As a response the national government launched a seed banks policy. The state created its own seed network, which consisted of existing community seed banks, and that supported the stocking hereof. This donation of seeds also provided impetus for communities to construct new seed banks. The banks however were replenished with conventional rather than local seeds. The next protest took place in the drought of 1998/99, after which local seed banks were again refilled with conventional seeds. ASA-PB persuaded the government of Praíba to acquire local seeds from farmers for the year after. The initiative however stumbled against a legislative barrier. Local seeds were not recognised as seeds and could therefore not be distributed officially by the state through the seed bank network. The government bypassed this by acquiring the seeds as "grains", transferring them to ASA-PB who in turn distributed them through their seed bank mediators. In 2002 a law in Praíba enabled direct transfer. When local varieties became formally recognised by the national government in 2003, which was largely the result of pressure by the National Articulation for Agroecology (ANA).

Despite the successes booked by the programme in Praíba and some other states, most government seed programmes continue to be biased towards the conventional paradigm. They argue that improved seeds have been sci-

entifically proven to work under semi-arid conditions and that initiatives such as those by ASA-PB, while desirable, cannot be scaled up to reach all the farmers that are in need of seeds. Consequently, ASA-PB saw the necessity to engage with science.

To prove that local use, management and conservation practices are effective and viable, the Seed Network partnered with Embrapa, the governments most influential agricultural research agency. This was an opportunity to gain acceptance in academia and legitimacy in the eyes of the civil servants involved in seed programmes.

All Seed Network organisations were involved in the research that followed, which sought to compare the performance of local and conventional varieties. The research team used participatory methods to determine which varieties to compare, on which locations to test and how the interaction between farmers and researchers should proceed. Together with farmers, they identified performance parameters. These included grain quality, plant health, and the amount of straw on the plant and the effect of intercropping with other crops. Local varieties outperformed conventional varieties in all regions and in all the three years that the experiment lasted. Conventional varieties only yielded better in highly fertile soils with plenty of rainfall, which are exceptional conditions for family farmers in the semi-arid region. The varieties that performed best in a certain area were usually also varieties that found their origin there. Local varieties were also found to produce more biomass, highly valued as animal feed especially in the erratic climate of the region. Research also showed that the seed storage facilities constructed by farmers, often using only local materials, performed well even though no pesticides were used.

Although the research only confirmed what farmers already knew, local practices were now scientifically recognised.

4. Creating an enabling policy environment

Governments and donors still have a long way to go in mainstreaming the agroecological paradigm. This involves enabling small-scale farmers to develop their skills, expertise and voice, while supporting their use of agroecological farming practices. This requires a truly integrated perspective on dryland management, breaking down institutional barriers and improving collaboration between stakeholders. However robust the agroecological initiatives are, there are challenges preventing a more comprehensive upscaling.

In the past ten years, donors have been giving lower priority to sustainable natural resource management. They shifted their focus to farmer integration into global markets and global value chains. However, as Bill Vorley, one of the authors of a report of a three year knowledge program said: "contrary to the prevailing narrative, and what NGOs, policymakers and donors expect, interventions that aim to upgrade small-scale farmers into high-value, formal supply chains and modern markets tend to benefit only 2-10 per cent of farmers"(Vorley et. al. 2012).

Many institutions have not yet grasped that building agroecological resilience requires a fundamental change in agricultural investment patterns. For example, while the UNCCD argues that it is important to build "production systems based on the intensification of locally available and adapted biodiversity, using local knowledge", its finance mechanism emphasises encouraging private sector investments and market-based mechanisms (Rowan: 2012). Why doesn't the UNCCD encourage investments in strengthening small-scale farmers' capacities and the up scaling of local agroecological practices?

4.1. Understanding the force field

As we can see from the experiences described above, sharing good practices alone is not enough. Use of evidence is only the beginning of a political process. Equally important, even when an evidence-based policy is adopted, implementing it properly is quite another matter. The role of research-based evidence is one among the many variables that may influence a policy maker when public policies are formulated. Some other relevant variables include values, political affiliation, experiences, expertise, stakeholder organisation, the role of the media and pressure.

When designing a strategy to bring evidence for SLM in dryland regions to the attention of policy makers, it is therefore important to understand the strategic opportunities. Mapping the force field in which one operates is one way of getting there- it is fundamental to understanding power dynamics and potential windows of opportunity. Some of the key questions that require an answer when mapping the force field include:

- What are the existing policies and how do they favour or constrain SLM?
- What is the political context which shapes decision making related to SLM and what is the role of evidence in this context?
- Who are the "policy makers" that need to be convinced?
- Who are the actors, including social movements and scientists, supportive of SLM?
- What policy influencing strategies are most effective for each of these actors, and at which moment in time?
- Which are the factors and actors in the way of agroecological practices being mainstreamed?

Once these questions are answered, and the spectrum of actors and their strengths is drawn out, an effective strategy for the push for SLM and agroecological policies in dryland regions can be developed. Strategies to influence policy include advising, advocacy, lobbying and activism, which can be informed by either evidence or interest and values.

5. Policy recommendations

Below follow a few recommendations to three major categories of actors in the dryland arena: policymakers and donors, CSOs and farmer organisations, and scientists.

5.1. Recommendation to policymakers and donors: Agricultural investment patterns need to change

Mainstreaming the agro-ecological approach will be a crucial step in finding structural solutions for major global challenges- one of them is the massive degradation and desertification of land. Building agro-ecological resilience requires a fundamental change in agricultural investment patterns. For example, the UNCCD argues for a case in point to build production systems based on the intensification of locally available and adapted biodiversity using local knowledge. This would require enabling small-scale farmers to develop their skills, expertise and voice, while supporting their use of agro-ecological farming practices. Furthermore, it requires a truly integrated perspective on dryland management which means breaking the silos and much more collaboration between all stakeholders involved. It also requires careful listening to farmer experiences on the ground.

Over the past decade, resources available to CSOs and Farmer Organisations working on degradation and desertification have declined due to shifting priorities of donors. For this reason, donor organizations should critically review this situation and be open to the active role that local level institutions and CSOs can play. They should make resources available to support initiatives to scale up agroecological approaches in drylands, including initiatives that support local knowledge building and sharing.

5.2. Recommendation to CSOs and FOs: Strengthen engagement with policymakers

The key challenge for CSOs and Farmer Organisations is how to engage with policymakers. It is difficult to convince policymakers about the effectiveness of agroecological approaches on the ground. CSOs have to invest in understanding political decision making processes and how to engage and deal with power imbalances, but also in strengthening their technical agroecological knowledge. There is therefore, an urgent need to improve documenting and packaging and in their experiences so that these can be effectively communicated.

The focus should not only be on influencing policies; it is equally important to look at opportunities to support government in the implementation of good policies.

5.3. Recommendation to scientists

The call for change is gradually getting louder. Numerous agroecological experiences have shown that the involvement of scientists in participatory research processes with local farmers adds significant value through the exchange of knowledge between farmers and scientists. Scientists can play a key role in bridging the gap between local experience and scientific evidence. However, the success of this can only come about if scientists listen well and open their minds towards a new way of understanding local farmers by working towards a multi-functional approach to agriculture. If scientists succeed in this, they are ready for a refreshing scientific experience that may well lead to many valuable new perspectives and insights.

6. Conclusions

The resilience of farming communities and their ecosystems depends to a large extent on their ability to develop their skills and voices to choose their own development pathway. Scientific evidence is only the beginning of policy change in dryland management. Most importantly, policy-makers need to acknowledge that a different approach is needed; one that is based on participation of indigenous and local communities and that combines indigenous knowledge with the latest scientific findings about sustainable dry land management. Capitalising on successful practical experiences requires a deeper grasp of agroecological principles on the one hand, and of policy processes on the other. For example, in Iran, nomadic pastoralists have collaborated with scientific bodies such as the CESNESTA who help them to use the land more sustainably and conserve natural resources. It requires curiosity and an open mind. The call for change to sustainable agriculture is getting louder in both policy and scientific debates. Farmers are becoming more and more powerful in voicing their concerns and proposals. Additionally, there is a growing movement of conscious consumers' organizations who want responsible food systems. Policymakers are facing the huge costs of disasters caused by climate change, degradation and desertification. Part of the solution is within reach; it is time to act.

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