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Impact of integrated natural resource management: challenges and experiences for sustainable livelihoods perspective: An overview

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Abstract
To meet the challenges of poverty and environmental sustainability, a more integrated approach to research is required. Such an approach must embrace the complexity of systems and redirect research towards the greater inclusion of issues such as participatory approaches, multi-scale analysis and an array of tools for system analysis, information management and impact assessment. Poverty has many faces and poverty reduction many pathways in different contexts. Lack of food and income interact with lack of access to water, energy, protection from floods, voice, rights and recognition. Among the pathways by which agricultural research can increase rural prosperity, integrated natural resource management deals with a complex nexus of issues, with tradeoffs among issues that are in various stages of recognition, innovation, scenario synthesis and creation of platforms for change. Rather than on a portfolio of externally developed 'solutions' ready for adoption and use, the concept of sustainable development may primarily hinge on the strengths and weaknesses of local communities to observe, innovate, connect, organize collective action and become part of wider coalitions. 'Boundary work' supporting such efforts can help resolve issues in a polycentric governance context, especially where incomplete understanding and knowledge prevent potential win-win alternatives to current lose-lose conflicts to emerge. Integrated research-development approaches deal with context ('theory of place') and options ('theory of change') in multiple ways that vary from selecting sites for studying pre-defined issues to starting from whatever issue deserves prominence in a given location of interest. A knowledge-to-action linkage typology recognizes situations of increasing complexity. Current impact quantification can deal with the first, is challenged in the second and inadequate in the third case, dealing with complex social-ecological systems.

Keywords: Natural Resource Management (NRM), Sustainable livelihoods, Agro-Ecosystem

Introduction
About one billion of the world's 1.4 billion extremely poor people live in rural areas and depend on agriculture and related activities for their livelihoods. Poor rural people are directly and indirectly dependent on natural resources for their livelihoods, relying on a suite of key natural assets from ecosystem and biodiversity goods and services to provide food, fuel and fibre. Food insecurity and mal-nutrition remain among the world's most serious health problems. In low- and middle-income countries, nearly one third of children are underweight or stunted. Environmental degradation and especially climate change are increasingly affecting nutrition through their impact on food security, sanitation, water and food safety, health, maternal and child health-care practices and socioeconomic factors. The world's poor rural people and especially farmers of the 500 million smallholdings are both victims and drivers of environmental degradation, and account for a major share of the world's poor. They account for one third of the global population and constitute the largest share of the developing worlds undernourished. They also provide up to 80 per cent of the food consumed in a large part of the developing world. Smallholder farmers manage vast areas of land and natural resources – representing more than 80 per cent of farms in Africa and Asia. They are the backbone of the rural economy and are in the front line of managing natural resources and climate impacts, relying directly on climate-affected natural resources for their livelihoods and being especially vulnerable to health and nutrition challenges. Poor rural people – including poor smallholders – are facing a series of interconnected natural-resource management challenges, which risk reversing impressive gains made over the past century in reducing poverty.
Integrated natural resource management is a scientific and resource management paradigm

uniquely suited to managing complex natural resource management challenges in densely settled landscapes where people are highly dependent on local resources for their livelihoods, thus heightening the tension between livelihood and conservation aims. The explicit effort to bridge productivity enhancement, environmental protection, and social well-being (Sayer and Campbell, 2003b) therefore makes INRM strategically relevant in such situations. INRM as "an approach to research that aims at improving livelihoods, agro-ecosystem resilience, agricultural productivity and environmental services. It does this by helping solve complex real-world problems affecting natural resources in agro-ecosystems.

Implementing a regional research-for-development initiative involving multiple stakeholders at multiple levels, and accountable to different actors (farmers, national, and regional agricultural research institutes), is no simple task. It requires careful thought regarding institutional aims and design, key concepts that will help to anchor program evolution, and effective program governance. It also requires periodic evaluations to adjust program directions and governance as needed to effectively position the program to make unique contributions or to address challenges emerging through implementation. Adding to this complexity is the emphasis on the development and testing of new methodologies and approaches for integrated natural resource management (INRM) at different scales. This requires a strong methodological backbone to operationalize a social learning process at village, district, and higher levels and to link actors at different levels in a research and innovation process.

IFAD (2014) reported 10 core principles for clients in ENRM. They promote productive and resilient livelihoods and ecosystems

1. Scaled-up investment in multiple benefit approaches for sustainable agricultural intensification;
2. Recognition and greater awareness of the economic, social and cultural value of natural assets;
3. 'Climate-smart' approaches to rural development;
4. Greater attention to risk and resilience in order to manage environment- and natural-resource related shocks;
5. Engagement in value chains to drive green growth;
6. Improved governance of natural assets for poor rural people by strengthening land tenure and community-led empowerment;
7. Livelihood diversification to reduce vulnerability and build resilience for sustainable natural resource management;
8. Equality and empowerment for women and indigenous peoples in managing natural resources;
9. Increased access by poor rural communities to environment and climate finance; and
10. Environmental commitment through changing its own behaviour.

Cultivable land is the most important natural resource for rural development and is key in determining the livelihood strategies of the rural poor. Agriculture accounts for most land use in developing countries and three quarters of the 1.2 billion people surviving on less than one dollar a day live and work in rural areas. The ownership, management and productive use of cultivable land is a key determinant of economic growth and has a direct though complex effect on how other natural resources such as water, forests, pasture and biodiversity are used. The future role of agriculture is one of the key unresolved issues in the current rethinking of poverty environment-agriculture linkages (Baumann, 2002). The notion that agricultural growth based on small farms would drive rural development is being called into question. Agriculture has declined sharply in relative terms both as an employer and a contributor to GDP and the long-term decline in agricultural commodity prices has weakened both the sector and the case for small farmer development. The agricultural sector is more integrated into the world economy with generally negative consequences for the terms of trade; and evidence that agriculture is pushing against natural resource boundaries is fairly conclusive (Table 1). These trends have led to what has been termed a 'loss of confidence in the rural development project' (Ashley and Maxwell 2002) and funding to the sector and in particular to agriculture has declined despite evidence that poverty is still largely a rural phenomenon.

Table 1: Constraints and opportunities in access to cultivable land (Source: Baumann 2002).

Constraints	Opportunities
Limited natural capital and poor NR base; Limited financial capital to invest in conservation; Little information and awareness of rights limited; Property rights to natural resources insecure; Limited political inclusion in decision-making on development; Local institutional capacity to support adaptation to livelihood constraints limited; Lack of opportunities leads to negative diversification and further depletion of capital assets increasing household vulnerability.	Ability to maximise trade-offs and substitution of capital assets; Local awareness of environmental degradation leads to positive action that supports agriculture; Local production can make use of new technology and markets; Household labor deployed to maximum advantage; Social capital networks support adaptation to livelihood constraints;

NRM and livelihood activities are embedded in a complex web of historical, political and social relations that often enables a powerful minority to dominate the majority. It is important in any analysis to take these various institutions into account and understand conflicting interests and the relative political strengths of different organizations (WFP). Ashley (2000) reported the application of livelihoods approaches in NRM. There are three points to note about the use of livelihoods approaches: 1) The livelihoods analysis is done by local communities, with facilitation of outsiders, to help with their own decision-making, as well as to generate lessons to share with others; 2) Livelihoods analysis is not part of the project cycle – for planning or review – but is an intrinsic component of the project; 3) Apart from the specific use of livelihoods analysis, the project reflects a 'livelihoods approach' at a deeper level. Early ideas for the project focused on comparing economic returns to wildlife and other land-uses under different conditions. Other professionals were focusing on the institutional and policy conditions needed, and on the ecological implications of community wildlife use. The decision to prioritise the livelihood impacts of different wildlife uses reflected a commitment to prioritise what mattered to local residents and would drive their decision-making.

Diversification is a complex process and there is still much research to be done to understand why it is happening and what affect it is having on rural poverty and natural resource management (Baumann 2002). 'Livelihood diversity results in complex interactions with poverty, income distribution, farm productivity, environmental conservation and gender relations that are not straightforward and sometimes counterintuitive and be contradictory between alternative pieces of case study evidence'(Ellis 1999). In general, it is clear that the international economic environment and structural adjustment programs have hastened de-agrarianization, implicit in the market's search for optimised returns on investment (Bryceson 2001). The declining productivity of natural resources has also been isolated as a key factor pushing people out of agriculture and into non-farm based activities. Further trends that can be isolated for a thumb-nail sketch are that it is often the very poor and the relatively rich that for different reasons are most prone to diversify their livelihood strategies.

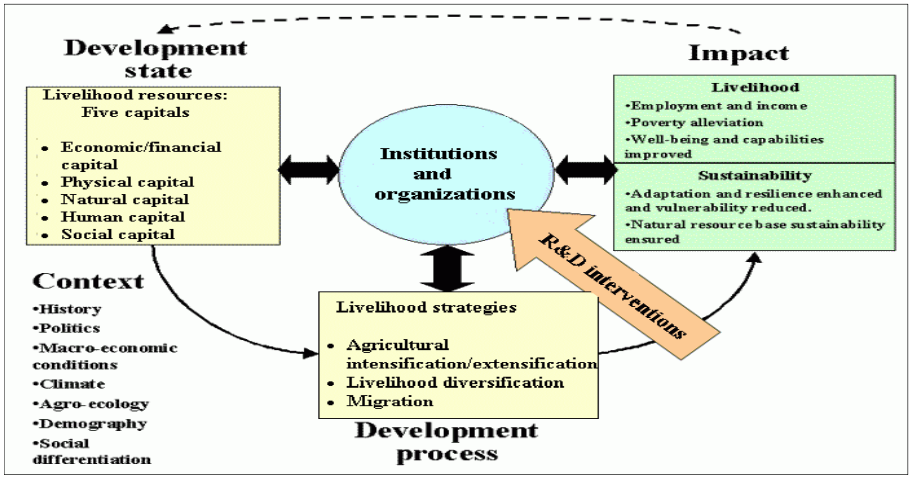
Positive experience of diversification the focus has shifted onto the types of livelihood strategies that are emerging and the types of resource access, capability enhancement and political economic factors, upon which they have been based, and the conditions under which they make become more sustainable and poverty alleviating. The focus in SL research on access to land issues has been to capture the diversity and heterogeneity of responses rather than to quantify their incidence. Examples of such types of SL research include Brock and Coulibaly (1999) on livelihoods in Mali; Haan *et al* (2000) on migration and livelihoods in Bangladesh, Ethiopia and Mali; and Goodrich (2001) with a summary of livelihoods research in Mali and Ethiopia.

These approaches are designed to take into account the elements, interactions, actors, and governance arrangements of social□ecological systems. They also give special attention to experimentation and learning. As a result, approaches those draw on systems thinking, such as integrated environmental or ecosystem management and integrated natural resources management (INRM), have emerged for the management of social ecological systems (oorbach, 2010). Applying systems thinking to natural resources management comes from the rationale that designing solutions to complex environmental problems requires awareness the larger system into which the problems and solutions are embedded (Laniak *et al*., 2013)

The "sustainable rural livelihoods" framework described ... *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, and maintain or enhance its capabilities and assets, while not undermining the natural resource base.*

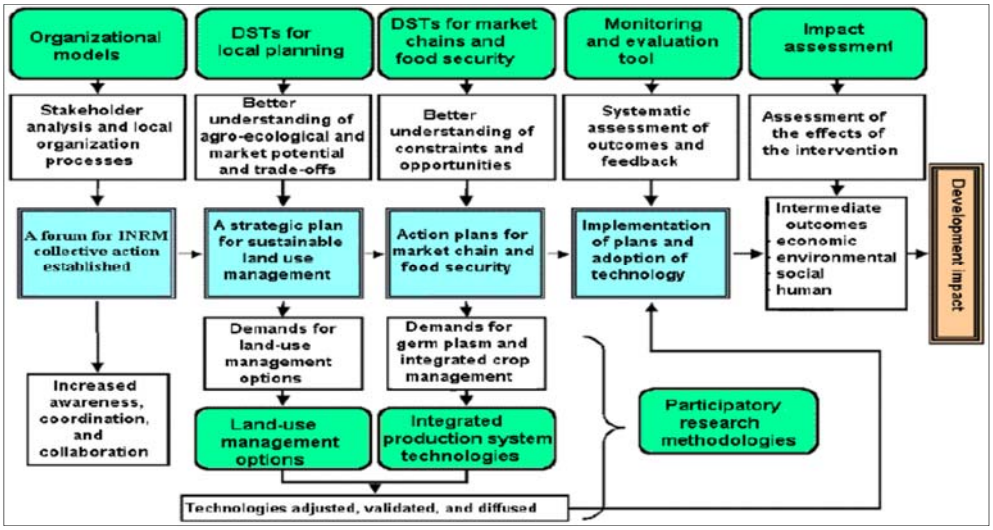
Households and communities use three broad clusters of livelihood strategies: (1) agricultural intensification/extensification, (2) livelihood diversification within agricultural activities or nonfarm activities, and (3) migration. Livelihood strategies are part of the development processes that enable individuals, households, and communities to reach a modified development state and move from an initial development state toward a subsequent one. If people change their livelihood strategies, then their livelihood outcomes will also change. Because this is a dynamic process, livelihood outcomes are not static (Fig.1a).

A generic path to development impact was constructed for CIAT's INRM strategy (Fig. 1b). Because INRM interventions move beyond the farm to the landscape, they require collective action that involves local institutional planning, implementation, and evaluation activities. The rounded boxes (five at the top and three at the bottom of Fig. 1b are the CIAT R&D interventions and correspond to those targeted at the institutions and organizations presented in the above analytical framework. The center row of four double-bordered boxes represents the process steps. The unshaded boxes are the expected outcomes of the interventions. The strategic and action plans, along with the adoption of technologies, improve land use management, strengthen competitiveness, promote integrated production systems, and foster community empowerment. These changes in turn affect broader sustainable development goals by producing changes in the economy, the environment, the people, and their organizations.



(a)

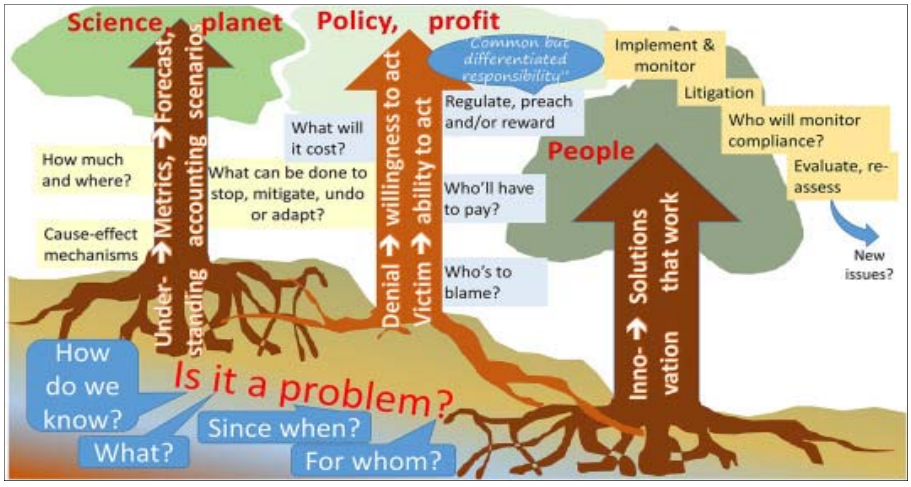
Fig 1(a): Analytical framework for integrated natural resource management impact assessment on sustainable rural livelihoods [Source: Scoones, 1998].



(b)

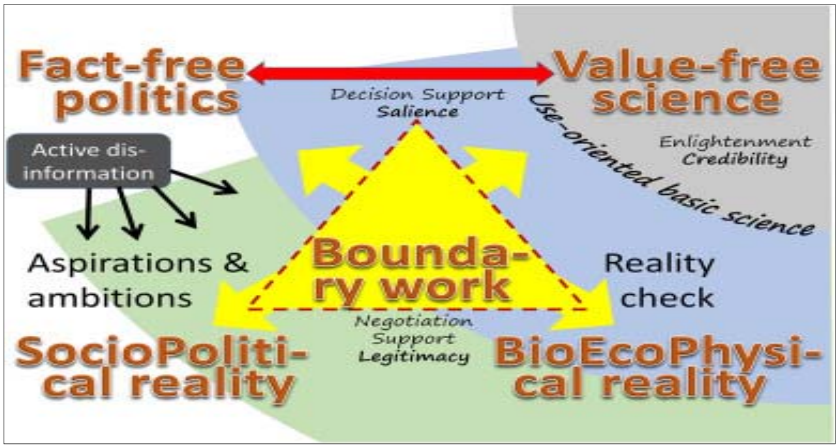
Fig 1(b): Paths to development impact of CIAT's integrated natural resource management strategy. DST stands for "decision support tools."

Tomich *et al*. (2004) revealed that a generic framework for understanding the dynamics and specificity of context, we can look at how it interacts with a wider policy arena where change tends to occur in response to pressure, with 'evidence' initially contested in the political sphere. In the dynamics of public discourse on any 'new' topic, key questions may arise along an issue attention cycle. They function as part of multiple knowledge-to-action chains (Fig.2a). The science-based knowledge-to-action chain tends to focus initially on 'understanding', and then moves to metrics for quantification and accounting, to forecasts and scenarios of the likely response to interventions to deal with the issue, or its consequences. Common but differentiated responsibility' and co-investment in stewardship frame the delicate moral balance between the various stakeholders. Actual solutions that work, however, may remain wishful thinking, unless in a parallel process, local solutions have emerged that not only deal with the focal issue, but are aligned with other local needs, abilities and contextual factors. Seen in this light, the relationships between the knowledge systems are key, with trust between the subsystems slow to build up and easy to destroy.



(a)

Fig 2(a): Key questions in an issue attention cycle, interacting with knowledge-to-action chains



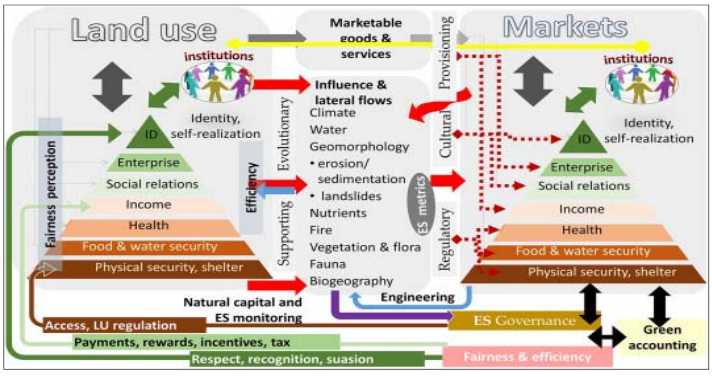
(b)

Fig 2(b): Knowledge deals with ecological, social and economic realities

The positioning of 'boundary work' (Van Noordwijk *et al*., 2016a) on the interface of four entities: a physical and socio-political reality, value-free curiosity-driven academic science and fact-free politics that may try to shape the socio-political ambitions and aspirations with active disinformation campaigns (Fig.2b). The credibility, salience and legitimacy dimensions of science quality have yet to find an effective answer to counteract the latter.

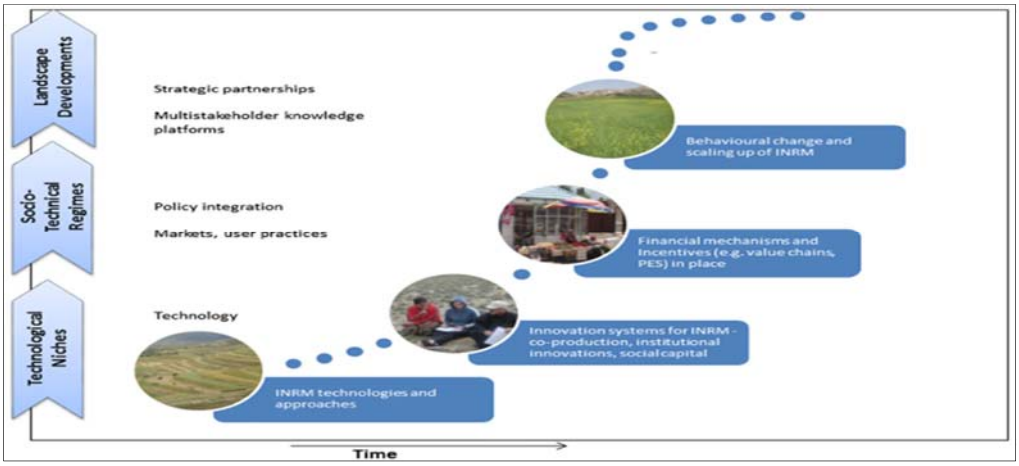
Namirembe *et al*. (2017) also found that the simple market analogue of a buyer, a seller, a service provided and a price, agreements to enhance ecosystem services came to be seen as part of a complex multi-stakeholder arrangement in which the regulatory role of the state, economic incentives and co-investment by the private sector and motivational efforts by development agencies all had to play their role (Fig. 3a). Such auctions, however, proved to be complex multiple learning events, rather than a simple way to establish 'market' value (McGrath *et al*., 2017; Leimona and Carrasco, 2017). Glynn *et al*. (2017) recently reviewed how society at large can improve the management of natural resources and environments by (1) recognizing the sources of human decisions and thinking and understanding their role in the scientific progression to knowledge; (2) considering innate human needs and biases, beliefs, heuristics, and values that may need to be countered or embraced; and (3) creating science and policy governance that is inclusive, integrated, considerate of diversity, explicit, and accountable.

Geels, (2002) reported that the different elements of implementation strategies follow the S-curve of increasing impact with time (Fig.3b). The S-shape is based on the theory of innovation diffusion from transition management and stresses the process of system transformation, or regime-shift, over time following the transition phases namely: pre-development, take-off, acceleration and stabilisation. This representation of the theory of change can facilitate the identification of transition pathways for scaling up of innovative INRM technologies using the multi-level perspective on transition theory that conceptualises transitions from niche adoption, regime shift, to landscape development. We argue that an agricultural innovations systems approach can accelerate the scaling up of sustainable INRM technologies and practices from the niche to the landscape level through a focus on markets and value chains, institutional change and inter-sectorial collaboration, shared learning through multi-stakeholder knowledge platforms, and strategic partnerships. The theory of change can be understood as following the four stages of a socio-technical transition, from pre-development, take off, acceleration and, stabilisation.



(a)

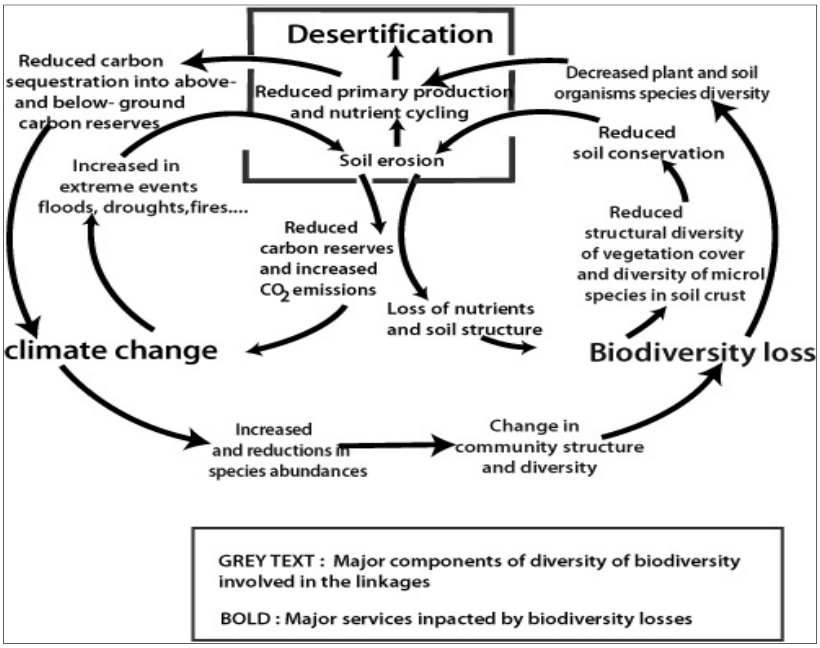
Fig 3(a): Complexity of the relationships between land users ecosystem services and the 'downstream' beneficiaries [Source: Namirembe *et al*., 2017].



(b)

Fig 3(b): INRM theory of change and the transition from niche adoption to regime shift and landscape development [Source: Geels, 2002].

The MA (2005), for instance, highlighted the linkages between climate change and biodiversity loss (Fig.4a). However, declining biodiversity may have an impact on the functioning and resilience of ecosystems. Loss of biodiversity will decrease the species diversity of the plant and soil organisms, reduce structural diversity of vegetation, which in turn will cause loss of nutrients and affect soil structure. This could lead to reduced nutrient cycling, cause land degradation and soil erosion. Land degradation and soil erosion are some of the key factors that contribute to productivity decline and food insecurity. Soil erosion also reduces carbon sequestration above and below ground and increase CO_2 emissions, therefore accelerating climate change. Therefore, loss of ecosystem function and resilience is of particular concern in the light of predicted global warming and the anticipated, but largely unknown, impact this will have on climate, local weather conditions, sea level and human health.



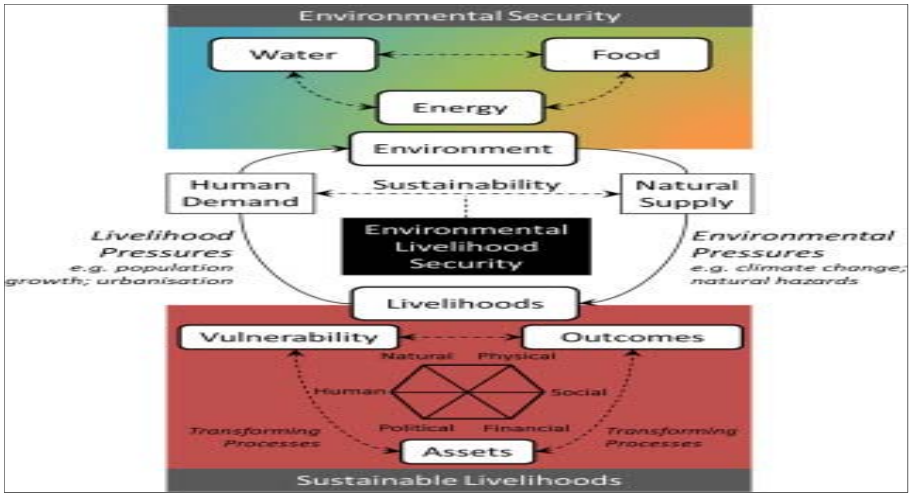
(a)

Fig 4(a): The Linkages Between Climate Change and Biodiversity Loss

(b)

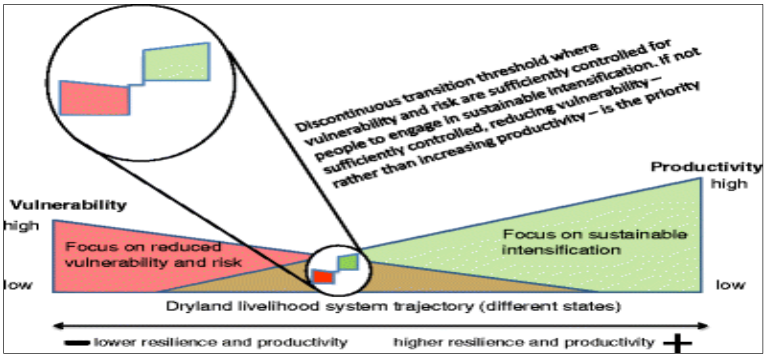
Fig 4(b): Interactions between Ecosystem Services, Human Well-Being and Drivers of Change.

Ecosystems, however, are linked to social systems since humans depend on the ecosystem functions to fulfill their needs and aspiration. Besides, it's also crucial to have elucidated how the direct and indirect drivers or the causalities of change of processes eventually affect the ecosystem services and human well-being (Fig.4b). Effort should therefore be diverted to bridging the gap between ecology and social sciences, to understand the vital links between ecosystems and social systems that finally determine the overall well-being of humanity, with a view to developing appropriate strategies to alter this unfavourable trajectory of Earth's ecosystems. The direct drivers of change affect the ecosystem services; in turn they affect the human livelihoods**.** Biggs *et al*. (2014) reported that the environmental livelihood security was to the challenges of maintaining global food security and universal access to freshwater and energy to sustain livelihoods and promote inclusive economic growth, whilst sustaining key environmental systems functionality, particularly under variable climatic regimes (Fig.5a). It's also address a lack of consideration of 'livelihoods' within nexus frameworks, which is required to ensure water, energy and food securities enable not only sustainable development, but also sustainable livelihoods. The ELS of a system is met when a balance is achieved between human demand on the environment and environmental impacts on humans (Fig.5a). Dryland systems are heterogeneous, which means the development challenges and trajectories to address these vary at fine scale. The spectrum of development challenges facing livelihood systems as a gradient (Fig.5b). At one end are livelihoods systems with a low asset base, where the key challenge is to mitigate vulnerability or risk and increase resilience. At the other end are livelihoods systems with an asset base sufficient to take advantage of opportunities for intensifying production in response to market opportunities. The challenges for these intensifiable livelihood systems relate to environmental sustainability, equity and economic growth as well as agricultural productivity. Food security, poverty reduction and natural resource management are important everywhere along the spectrum. They may be addressed in different sequences depending not only on the starting point but also on the surrounding institutional, political and environmental circumstances.



(a)

Fig 5 (a): Environmental livelihood security [Source: Biggs *et al*., 2014]



(b)

Fig 5(b): Reduced vulnerability and risk, or sustainable intensification

Glynn *et al*. (2017) reviewed that how society at large can improve the management of natural resources and environments by (1) recognizing the sources of human decisions and thinking and understanding their role in the scientific progression to knowledge; (2) considering innate human needs and biases, beliefs, heuristics, and values that may need to be countered or embraced; and (3) creating science and policy governance that is inclusive, integrated, considerate of diversity, explicit, and accountable. Weitz *et al*. (2017b) reported that the interactions between SDG targets, we use a seven-point scale, ranging from high (+3), moderate (+2), and low synergies (+1) to low (−1), moderate (−2) and high tradeoffs (−3) between interventions and SDG targets and between case studies and SDG targets (Fig.6a), respectively.

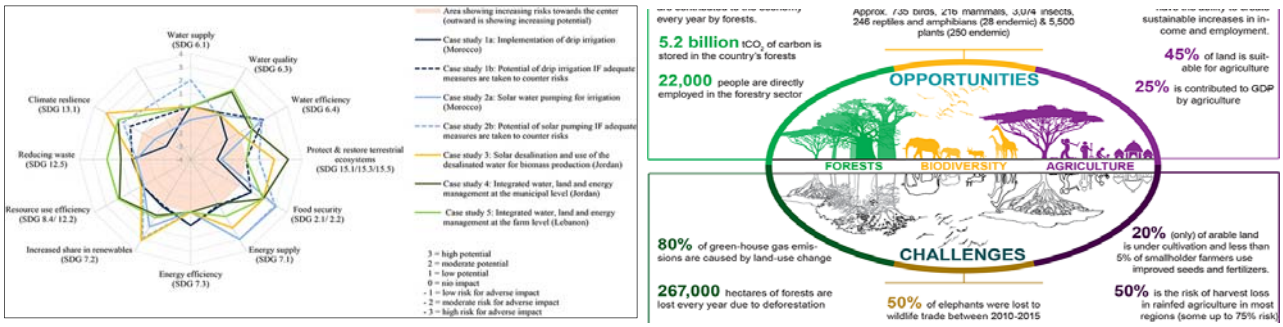


Fig 6(a): Synergies and tradeoffs for the case studies in terms of relevant SDG targets.

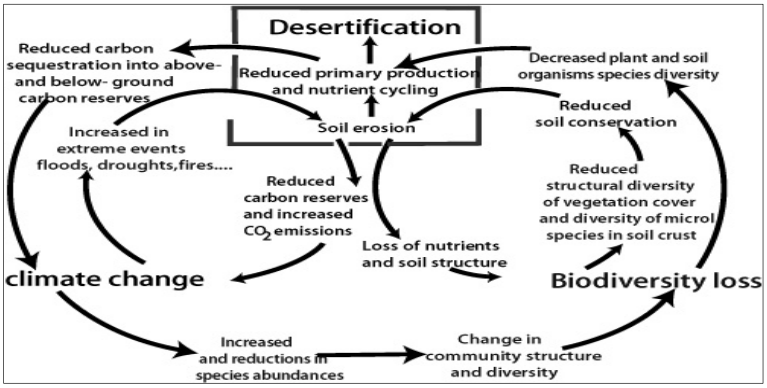
MA (2006) highlighted the linkages between climate change and biodiversity loss (Fig.7a). However, declining biodiversity may have an impact on the functioning and resilience of ecosystems. Loss of biodiversity will decrease the species diversity of the plant and soil organisms, reduce structural diversity of vegetation, which in turn will cause loss of nutrients and affect soil structure. This could lead to reduced nutrient cycling, cause land degradation and soil erosion. Land degradation and soil erosion are some of the key factors that contribute to productivity decline and food

insecurity.

McShaffrey, (2006) revealed that nutrient cycling in the ecosystem acts as biogeochemical cycling because it involves movements of chemicals through the biological and geological components of the ecosystem. Each chemical has its own unique cycle, but all of the cycles have common features. Reservoirs such as oceans are those parts of the cycle where the chemical is held in large quantities for long periods of time. On the other hand, in exchange pools such as the atmosphere, the chemical is held for relatively shorter time periods. Figure 7b shows the dynamics of carbon exchange between the atmospheric and oceanic reservoirs. The oceans are a reservoir for water, while a cloud is an exchange pool. Water may reside in an ocean for thousands of years, but in a cloud, for a few days at best. The biotic community may serve as an exchange pool and also serve to move chemicals from one stage of the cycle to another. Likewise, coral endosymbiosis take carbon from the water and turn it into limestone rock. The energy for most of the transportation of chemicals from one place to another is provided either by the sun or by the heat released from the mantle and core of the earth.

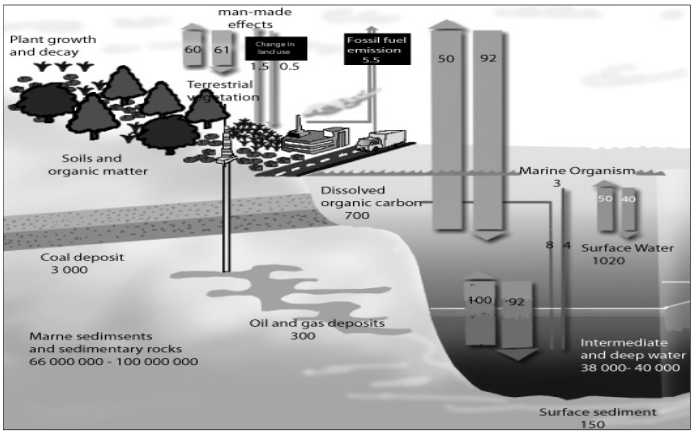
The carbon system is dynamic and coupled to the climate system on seasonal, intranasal and decadal timescales. It is instructive to note that land use changes including alterations of natural plant cover giving rise to changes in carbon sinks account for between 0.5 GtC and 1.5 GtC. Combustion of fossil based fuel to generate energy for domestic and industrial use is responsible for up to 5.5 GtC on a global scale.

The biogeochemical cycles of all elements used by life have both an organic and an inorganic phase. For most of these nutrients, how efficiently these elements cycle from the organic component back to the inorganic reservoirs determines how much is available to organisms over the short term. The major reservoirs for all metabolically important elements are found either in the atmosphere, lithosphere or hydrosphere. Flow from these reservoirs to the organic phase is generally slower than the cycling of nutrients through organic matter decomposition (Pidwirny, 2006).



(a)

Fig 7(a): Major components of diversity of biodiversity involved in the linkages and biodiversity losses



(b)

Fig 7(b): Dynamics of Carbon Exchange Involving the Atmospheric and Oceanic Compartments of the Ecosphere [Source: Centre for Climate Research, Institute for Environmental Studies, and University of Wisconsin at Madison, UNEP and WMO, Cambridge Press University, 1995]

Ashley (2000) reported that the four activities described shared common elements in their livelihoods approach but served different purposes and demonstrates the flexibility of livelihoods approaches. The WILD planning demonstrated that livelihood analysis can be done by communities and serve their objectives as well as ours. The Caprivi CBNRM analysis was initiated by programme staff in order to guide programme development with location specific recommendations. The tourism review similarly aimed to identify guidance for enhancing livelihood impacts but was aimed mainly at outsiders at a much more general level – policy makers and practitioners in Namibia, southern Africa and in UK tourism-development circles. The common elements of the four activities were: 1) Attempts to

understand which livelihood issues were priorities for local people. 2) Exploration of the links between current livelihood strategies and various initiatives in NRM. The livelihoods approach has generally been welcomed for two reasons: it has instinctive appeal to those with a fundamental commitment to enhancing the local impacts of their work, and the findings of the livelihood analyses have been useful. However, Kenya is the only case where others have been expected (and have tried) to take it on board themselves by replicating the methodology in Uganda and Tanzania. The process is still underway but preliminary experience suggests, not surprisingly, that it is more difficult for others to adopt the process and implement the approach, rather than simply use the findings in Table 2.

Table 2: Some examples of findings on content, method and process in NRM activities (Source: Ashley 2000).

	Content: livelihoods and NRM links	**Methods of livelihood analysis**	**Process of developing livelihood approaches**
NN 11.1) Namibia	Linkage with other activities critical: e.g. jobs near home good for fanners	Participatory planning Very skill intensive	Community can do livelihood analysis, serving their and our objectives An obvious focus when pooling sectoral perspectives and prioritising local ones
Caprivi livelihoods & CBNIZ \ I Namibia	To make it relevant to the poor: • plant-based NRM • timing of income dividends • deal with negatives (wildlife damage)	Exploring 'fit' & conflicts with existing livelihoods Included detailed financial analysis of CBNRM income to put in context of livelihoods	Useful for guiding programme development Identifies recommendations for enhancing impacts on and participation of key groups
Tourism & livelihoods Namibia	Fit with drought-coping more important than cash-maximisation Policy-making needs participatory processes to learn about and respond to livelihood concerns	Synthesised wide variety of impacts using SRL framework	A contrast to conventional narrower (economic, environmental, socio-cultural) perspectives. Used to encourage shift in thinking Used to highlight general implications for southern Africa and UK practitioners
1 or pact assessment methodology Kenya	Risk a major barrier to participation by the poor in butterfly farming Butterfly fanning — an adaptive strategy for a few; coping strategy for many Impact on assets more important for the majority than cash flows from II Ngwesi lodge	Integration of skills and methods (participatory tools, stakeholder analysis, quantitative surveys) High demands on PRA and analytical skills	Encouraged analysis beyond cash and economics Approach welcomed but difficulties in adopting the methodology

Calow and Nicol (2001) have found that on the whole the SLA provided an effective means for both understanding access to water issues and then providing policy guidelines in their work in Ethiopia and Palestine. The approach added value in terms of a greater understanding of the multi-dimensional nature of vulnerability. An understanding of how water is combined with other assets to generate income helped in understanding how water insecurity can affect production and income, as well as direct consumption. In terms of policy development and project planning it suggested the need to broaden indicator sets currently used to warn of drought related problems. It was helpful in exploring different dimensions of sustainability and trade-offs between them and in exploring how these are affected by political interests.

A livelihood that 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 (Scoones, 1998). The sustainable livelihood framework (Fig. 8) has five main basic elements: (i) context, (ii) livelihood resources, (iii) institutional processes, (iv) livelihood strategies, and (v) livelihood outcomes. The framework holds, for example, that: in a particular context, households draw upon particular sets of assets (capital/resources), which they use to construct livelihood strategies. However, depending on the institutional mechanisms in place, these strategies may produce outcomes that may either be negative or positive. In that context, the role of organizations and institutions— the third element (iii) becomes important as together they determine to a large extent access of households to resources and strategies.

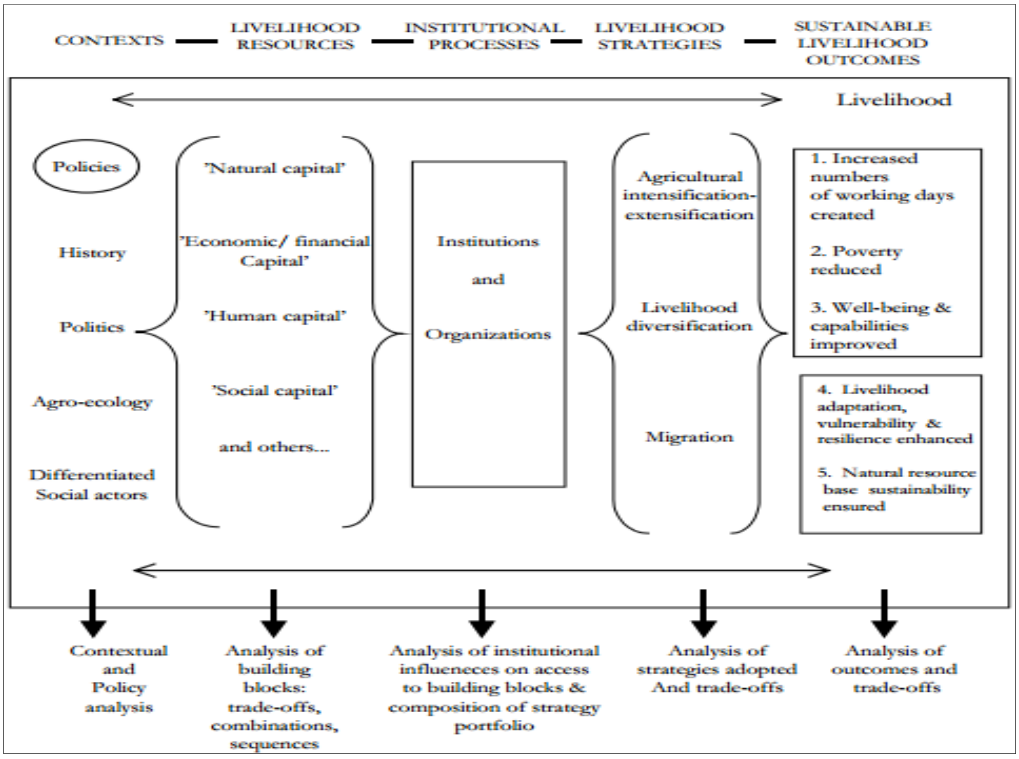


Fig 8: The sustainable livelihood Approach (Source: Scoones, 1998)

Conclusion

Several studies have shown that local people have tremendous knowledge about their environment and problems that affect them; and are capable of making inputs into decisions that affect the management of their environment. Agricultural research is one of the pathway for increase rural prosperity, integrated natural resource management deals with a complex nexus of issues, with tradeoffs among issues that are in various stages of recognition, innovation, scenario synthesis and creation of platforms for change. Firstly, the livelihood strategies adopted by a group of local people in a particular locality do not evolve in a vacuum—they are governed by factors and conditions prevalent in the immediate environment. In specific terms, the choice of a particular livelihood strategy (e.g. in tree planting which may be part of a conservation plan) is largely informed by factors perceived to promote individual interests. The nature of resource use rules existing in a particular locality determines how appropriators use such a resource. As suggested in the Sustainable Livelihood Approach (SLA) rules may create a specific context, which either poses limitations or constraints on users depending on how users perceive such a context (with its associated opportunities and constraints), strategies are adapted to carve out livelihoods accordingly. This goes also for any conservation strategy that may seek to address current food security, environment and resource management challenges that affect the livelihoods of people living in rural areas. This has largely been due to varying socio-cultural, political and even economic circumstances, which define every society. Communities are considered as homogenous: (i) they are all predominantly ewes with respect to ethnic composition, and (ii) subsistence farming features as a key occupation in all the communities. Social organization will be the precondition to both accessing natural capital through gaining communal resource rights, and for maintaining and building natural capital through improved ecosystem management through consensus and cooperation of members. Ultimately, NRM approach that resolve at improving livelihoods, agro ecosystem resilience, agricultural productivity and environmental services, which aims to augment social, physical, human, natural and financial capital, by solving complex real-world problems affecting natural resources in agro-ecosystems with the simultaneous participation of researcher and people.

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