

The Livelihoods concept integrated into the DPSIR analytical tool

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1. Introduction

Wetlands and wetland agriculture have made, and continue to make, a significant contribution to the functioning of many societies around the globe. Indeed, in many parts of the world – particularly in developing countries – wetlands are vital resources for achieving food and water security and improving livelihoods (Silvius et al., 2000). Wetlands are critical reservoirs of natural capital that have traditionally been used for a wide range of livelihood activities including fishing, agriculture and the collection of forage resources (Nicholas, 1998). It is probably safe to say that today the interest in wetlands and their associated agricultural systems is higher than ever before. It is also observed that in many cases the increase in interest comes also from people who before did not have a relation with the wetland-agricultural system that they now exploit. They are people who make use of the increase in transport and trade opportunities and the general increase in accessibility to wetlands.

Sustainable management of agriculture – wetland interactions is critical to continued provision of the range of ecosystem services provided by the wetlands. One of the key objectives of achieving sustainability is to ensure “wise use” of wetlands – defined within the Ramsar Convention Text as “the maintenance of their ecological character, achieved through implementation of ecosystem approaches, within the context of sustainable development”. Ecological character is defined as the “combination of ecosystem components, processes and benefits / services that characterize the wetland at any given point of time”. Several components of ecological character are essentially manifestations of the ways human societies are linked to wetlands, the choices and tradeoffs they make, and the governance systems that influence their behavior.

In this context, maintaining a broader “nested socio-ecological perspective” is important for devising strategies and actions for sustainably managing agriculture – wetland interactions. This requires appreciating two dimensions of these interactions. Firstly, the agriculture-wetland systems need to be recognized as socio-environmental systems, as systems in which the ecological and socio-economic component interact constantly. The ecological component is best captured by referring to ecosystem services; the socio-economic component is operationalized by using the concept of livelihoods. These two concepts – ecosystem services and livelihoods – were also at the core of the Millennium Assessment. The systems also need to be looked at as dynamic systems, wherein the ecosystems as well as socioeconomic conditions constantly change, driven by both natural and man-made factors.

In response to Ramsar Resolution VIII.34, Wood and van Halsema wrote the document “Scoping agriculture –wetland interactions: Towards a sustainable multiple-response strategy” (FAO. 2008). They applied the DPSIR analytical tool to capture the dynamic nature of wetland-agriculture systems. The present paper provides an answer to the question how the concept of livelihoods can be incorporated in the DPSIR analytical tool. This question has become opportune in the framework of the GAWI project, a project conceived and implemented by a consortium of international knowledge and research institutes, including Wageningen

UR and Wetlands International. The vehicle for the Dutch contribution to the GAWI project is the Wetlands, Water, and Agriculture Project, supported financially by the Ministry of Agriculture, Nature and Food Quality, The Netherlands. The answer to this question is important for the GAWI activities in 2010, in which year a number of pilot workshops will take place to test the analytical framework developed thus far by the GAWI partners under practical conditions.

In this text we will introduce the DPSIR analytical model (section 2) and the livelihood concept (section 3). The latter is discussed in general, as well as more in particular in relation to human well-being and poverty, and to sustainability (sections 4 and 5). The core issue of this paper – how to incorporate the livelihood concept into the DPSIR model – is discussed in section 6: the livelihood concept linked to the DPSIR analytical tool. In Section 7 the next step is taken. It describes in practical terms how livelihoods as they exist in the real world should be mapped.

2. The DPSIR analytical tool

DPSIR stands for Drivers, Pressures, State, Impact, and Responses. DPSIR is an analytical tool used to understand the causes of environmental change and the subsequent socio-economic impacts in order to formulate the most adequate responses (R). It is a linear cause-effect model. It assumes natural and human-made factors of change (Drivers) that cause Pressures, which in turn lead to a change in the State of the environment. Changes in State lead to socio-economic Impacts and this triggers Responses, either by governments or other players. The DPSIR analytical tool was originally proposed by the European Environmental Agency and adopted by many national and European institutions, EEA, and Eurostat among others (Giupponi, date?). It did not evolve out of the blue, but apparently had predecessors, like the PSR scheme (Pressure – State – Response), adopted by the Organisation for Economic Cooperation and Development (1994), and the DSR (driving force – State – Response) of the UN Commission on Sustainable Development (1997), (Giupponi, date?).

Wood and van Halsema used the following definitions for the five elements of the DPSIR analytical tool. They present examples that present from wetland-agriculture situations. The MA equivalents are given in parentheses after the title of each category.

Drivers (indirect drivers)

These are any natural (biophysical) or human-induced (socio-economic) factors that lead directly or indirectly to a change in the wetland ecosystem, or in socio-economic processes that influence wetlands and AWIs. Simply put, drivers are the underlying causes that lead to pressures on wetlands or agriculture–wetland-related processes. Examples are: population dynamics, market development, natural environmental processes, government policies, and community behaviour. Some drivers operate by influencing ecosystem processes.

For example, market opportunities may lead to the establishing of a sugar-cane estate and so changing land use in a wetland, while population growth may cause agricultural expansion into a wetland. Some drivers operate more diffusely, by altering other drivers. They may be seen as “deeper causes”, such as broad policies

or their failings, international economic circumstances, and the cultural value systems in a society, which create other specific influences on people's behaviour and situations.

Pressures (direct drivers)

Pressures are the consequent results of the drivers on the wetland environment or wetland-related agriculture and any associated socio-economic developments. Pressures are how the drivers manifest themselves on the wetlands and wetland-related societies/activities through processes related to the transformation of wetlands or the disturbances of their ecological state. In other words, they represent strategies to satisfy the drivers. They are seen here as processes, or activities, that are operating on a generalized scale.

Examples are: agricultural colonization in wetlands, vegetation clearance, agricultural intensification, nature conservation, and water resources management and use.

State changes (changes in ecosystem services)

State changes in the (wetland) ecosystem can be described in terms of biophysical processes that determine the ecological character of the ecosystem and/or the natural resources base. They include changes in the quantity and quality of the various environment elements in the wetland (soil, water, plants, animals, etc.) and their consequent ability to support the demands placed on them (for example, biodiversity, environmental functioning and their ability to support human and non-human life, and supply resources) – in other words, the state of the ecosystem and especially its regulating and support services.

Examples are: water resources, water quality and pollution, soil characteristics (chemical and biological), and biodiversity.

Impacts (human well-being and poverty reduction)

These are the socio-economic results that come from changes in the state of the wetland environment. In other words, they are the way in which the socio-economic characteristics and condition of a wetland society are affected, especially the provisioning services.

Examples are: livelihood gains from market-oriented production, food and nutritional changes in subsistence situations, socio-economic differentiation and conflicts, and recreational development.

Responses (strategies and interventions)

These are actions in response to drivers, pressures, state changes and impacts. These may be technical and institutional or involve policies and planning. They can be implemented by a range of actors. Some examples of responses are:

- technical or socio-economic actions that try to address specific impacts;
- institutional development by communities that respond to state changes by improving wetland site management coordination;
- planning by basin-level organizations that respond to pressures within a river basin with initiatives for water and land-use management;
- national-level policies and economic development measures that try to address the needs in the society and especially achieve sustainable and ecologically sound economic development;

- international-level responses, including government-to-government types of cooperation, actions of international NGOs (INGOs), and international agreements to which national governments adhere.

Exploration of responses has been limited in most uses of the DPSIR model to date. As a result, considerable attention was given to the question of how best to analyse this material. This led to three characteristics of the responses being seen as important:

- actor,
- measure,
- drivers addressed.

Actor focus

Responses can be found at different levels:

- household – usually concerning day-to-day management;
- community – typically involving local institutions and local policy, as well as coordinated action at a wetland site and maybe the catchment;
- NGOs – often linked to community initiatives, but also including wider perspectives;
- state – involving policies, policy implementation and legislation, major engineering measures and formal research.

Type of response/measure

A second dimension of the responses can explore their nature:

- technical – in terms of specific management practices being addressed, whether these relate to water, crops, natural vegetation, soil or land;
- institutional – in terms of the development of capacity at the community to state level or arrangements for undertaking wetland and catchment management;
- policies from community-level by-laws up to national-level policies;
- planning interventions by the community or the state.

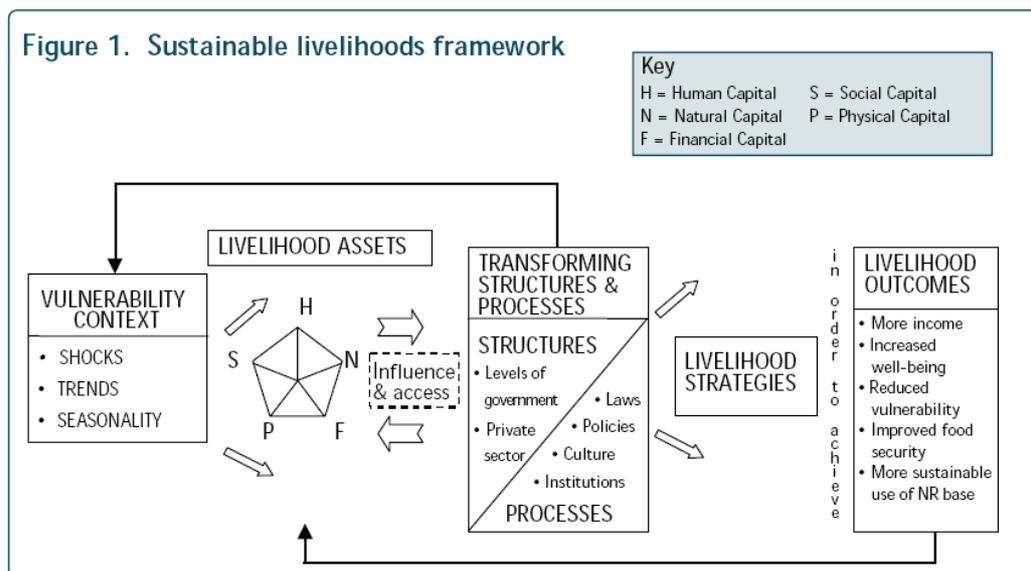
DPSIR focus

A third dimension for thinking about responses is to explore how they address different elements of the DPSIR model and what measures or actions are relevant for these different elements. For example, it is possible to see responses that try to address drivers as needing to have a much wider remit (policy responses perhaps) compared with ones that address state changes that may be specific technical measures.

3. The Livelihoods concept

The concept of livelihood has been subject to intensive academic and practical explorations. Chambers was one of the first to introduce a systematic account of the livelihood concept. He described livelihoods as “adequate stocks and flows of food and cash to meet basic needs” Chambers, 1989). Since this first definition, the concept has evolved considerably. The most widely accepted definition of livelihoods stems from Chambers and Conway: livelihoods comprise the capabilities, assets (including both material and social resources) and activities required for a means of living (Carney, 1994; reference forthcoming). More recent research on the concept has highlighted the role of rights and freedoms in determining livelihoods. Since this first definition the concept has evolved considerably. The concept was adopted by development practitioners world wide, who refined it and deducted methods to analyze stakeholder situations. In the process they managed to use the concept to systematically build up a more holistic picture of position of stakeholders. The information was often used to design initiatives to improve the well-being of target groups - often the poor and deprived. (For a definition of the concept human well-being, see below.)

Figure 1. The livelihoods framework



Source: ?

Central to the concept of livelihoods is the notion that every individual of group has to manage five types of capital. Scoones (1998) gives a thorough description of the livelihood concept, relating it in many ways to the real world conditions in which (rural) communities live. He defines the five main types of capital that are commonly identified as follows:

- Natural capital – the natural resource stocks (soil, water, air, vegetation) which are essential for sustaining livelihoods

- Economic or financial capital – the capital base (cash, credit, savings, remittances and economic assets), which allows individuals and households to make livelihood decisions about investments in natural, human or other forms of assets
- Human capital – the skills, knowledge, ability to provide labour and good health, and physical capability which allows individuals and households to successfully pursue different livelihood strategies
- Physical capital – the basic infrastructure, manufactured goods and tools which are required to produce or pursue livelihood strategies
- Social capital – the social resources and relations (networks, social claims, relationships of trust, affiliations, associations) upon which people draw when pursuing different livelihood strategies that demand coordinated actions.

At any specific moment in time, individuals or groups may possess different combinations of these five types of capital in their 'livelihood portfolios.' If a group is lacking in one category of assets, capital might be converted from one form into another (Stocking and Murnaghan, 2001). The simplest example is when financial capital is spent to buy physical capital or any other type of capital. The stock of financial capital will deplete, and the stock of other capital will increase. Ultimately, changes in the level of available assets may affect the ability to engage in sustainable practices. Livelihood portfolios are therefore dynamic. Individuals or groups make strategic choices how they can the highest possible benefit, or in other words, achieve the highest possible well-being. Such livelihood strategies are susceptible to change over time and space, as local and external conditions change.

The different types of capital flow constantly. The dynamic nature of capital is important because if capital remains idle, it adds nothing to human well-being; livelihoods cannot be created from capital that remains an endowment, a promise or potential. One type of capital is constantly substituted for another. The livelihood concept is therefore not a static concept, but rather a dynamic one. As we will see (section 6), this allows the concept to be integrated into DPSIR, which is also a concept that takes the dynamic nature of real world situations into account (dynamic socio-environmental systems).

As was already mentioned earlier, the livelihood concept can be applied to individuals as well as to groups. Groups would be a community or something similar that share a common background and a unique relation to the ecosystem on which they depend. A definition along these lines makes it possible to distinguish between different groups of people – livelihood systems – living *in*, or at least *depending on*, one and the same ecosystem, for example indigenous people, spontaneous settlers, government-supported settlers, and commercial firms setting up large scale agricultural production units. Typically, each of these groups will have a different background and a different relation to the ecosystem, yet, they all use the same ecosystem.

Individuals or groups must be able to mediate their claims to each type of capital. A person claiming expertise in a certain field must mediate this claim (e.g. by showing a certificate or diploma). A person or firm who wants to produce crops on a field must prove his or her right of access to that land. Of central importance in claiming rights are local, national, and even international institutions, including markets, systems of governance and policies in a country. As Neefjes (2000) puts it, “All these things – the government structures, policies, laws, markets, cultural practices and institutions – are important in defining rights and responsibilities, and also in defining the terms on which different capitals can be used and (re)generated, and be substituted for others”.

The MA team also applies the livelihood concept. They use slightly different definitions of the five types of capital than those explained above; the MA speaks about ‘natural resources’, ‘infrastructure’, ‘finances’, ‘social capital’, and lastly, ‘human capital’. The latter includes skills, labor, and knowledge. The MA also proposes an additional, sixth category. ‘political capital’. In accordance with general practice we include ‘political capital’ in the component ‘social capital’. Social capital is described as the social contacts and networks that people maintain.

4. The livelihoods concept and human well-being (poverty)

Individuals and groups make use of these five different types of capital, some of which they may possess in adequate amounts, and others of which they may lack, with the ultimate goal to pursue well-being. They design strategies to put the different forms of capital to their possible use, achieving the best possible amount of benefits. The MA relates the livelihood concept directly to the concept of human well-being. The five types of capital are employed to achieve human well-being. 'Human well-being' is defined by the MA in terms of satisfying all aspects of human life:

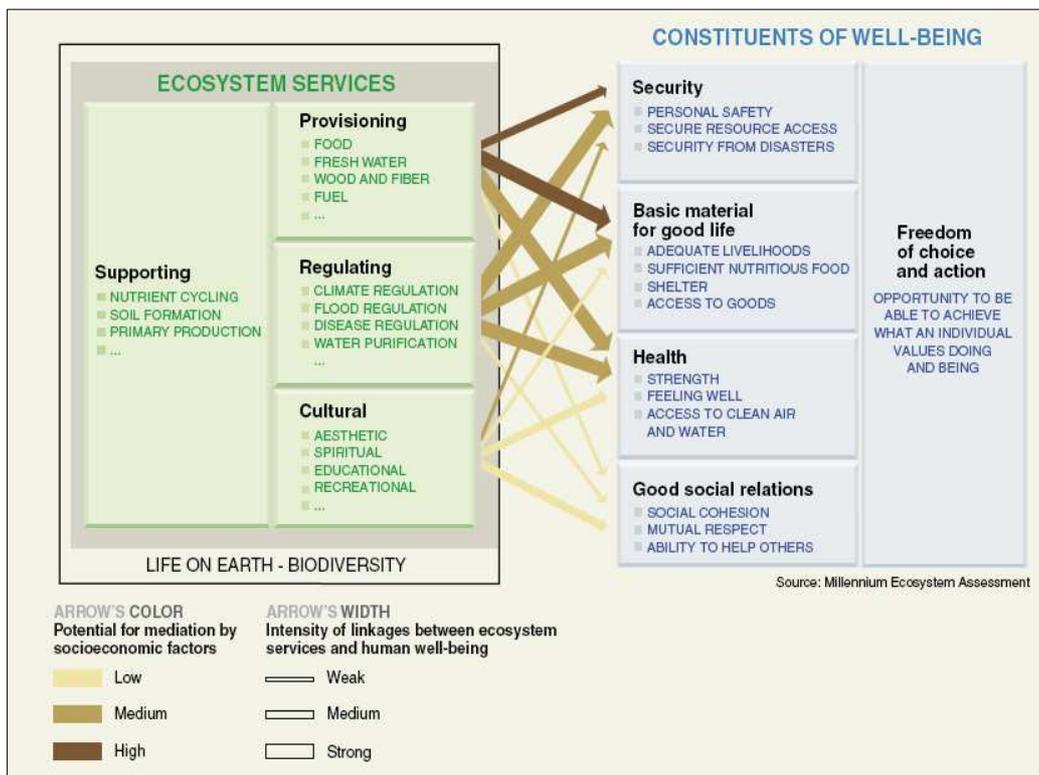
"... includes basic material needs for a good life, the experience of freedom, health, personal security, and good social relations. Together these provide the conditions for physical, social, psychological, and spiritual fulfillment" (MA, 2005: page 73) ¹.

Constituents of human well-being include material inputs such as food, clean water, materials for shelter, and livestock; they are the elements that make human well-being possible. If 'development' can be considered to be the enhancement of human well-being, then it follows that poor people must lack sufficient levels of these constituents. Development is seen as enhancement of well-being, entailing transition for those who are deprived –from conditions of ill-being, or the "bad life", to well-being or the "good-life". Poverty is "the pronounced deprivation of well being" (World Bank, 2001).

There is a strong link between human well-being and ecosystem services. Figure 2 shows these relations. The width of the arrows is a measure for the intensity of the linkages between ecosystem services and human well-being. Clearly, the provisioning services and regulating services of ecosystems contribute most to basic materials for good life and security.

¹ For the full text of Chapter 3, Ecosystems and Human Well-Being: a Framework for Assessment, of the Millennium Assessment, link to:
<http://www.millenniumassessment.org/documents/document.301.aspx.pdf>

Figure 2. Relation between ecosystem services and human well-being



source: MA, Ecosystems and Human Well-Being, p. 78

Poverty in the above mentioned perspective can be defined and characterized as “the pronounced deprivation of well – being” (World Bank, 2001). In terms of policy targeting, it would be useful to highlight the complexity and heterogeneity associated with the concept of poverty. Broadly, the literature distinguishes between poor and long term poverty, or the ‘chronic poor’, and those who fall into poverty as a result of adverse shocks (transitory poor). Within the chronic poor, there are those who are so physically and socially disadvantaged that they would remain poor without welfare support (they are the ‘destitute’), and those who are poor because of lack of access to assets and opportunities. Furthermore, within the non-destitute category, one could distinguish in terms of depth of poverty, i.e. the distance from the poverty line. People significantly below the poverty line form the ‘core poor’. Different categories of poverty reflect different forms and states of deprivation of well-being.

5. Livelihoods and sustainability

Undoubtedly, the most well-known and frequently cited definition of 'sustainable development' is that published by the World Commission on Environment and Development, the Brundtland Commission, which suggests that it is 'development that meets the needs of the present without compromising the ability of future generations to meet their own needs' (WCED 1987: 43). Lately, the concept of 'sustainable livelihoods' has received attention.

From a livelihoods capital approach, 'sustainability' is defined as the maintenance of stocks or capital over time, and a sustainable society is one that is able to nurture and enhance these stocks (Warren *et al.*, 2001). We suggest that to this definition should be added the notion that sufficient amounts of stock or capital should be maintained; sufficiently enough to allow for human well-being conditions above absolute poverty level. Poverty is considered unsustainable. Within the sustainable livelihoods framework, sustainability is defined as 'maintenance of stocks or capital over time, and a sustainable society is one that is able to nurture and enhance these stocks (Warren *et al.*, 2001). Alternately, "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: 5).

Alternately, in a nested socio-ecological system, sustainability can be seen as an outcome of interactions between various subsystem variables which are organized at multiple levels and at various temporal and spatial scales. Ostrom (2009; reference forthcoming) identifies four such subsystems variables, i.e. a) resource systems; b) resource units; c) governance systems and d) users which interact to produce ecological, social, economic and political outcomes. A series of second level sub systems as well interaction variables can be defined within this framework.

Underlying these approaches is the consideration of 'non-determinism' of sustainability. Thus, sustainability is seen as dynamic process to which one strives, and is conditional on biological, ecological, social, economic, political, cultural, and historical points of view. This also means to say that sustainability cannot be guaranteed as a sole outcome of certain factors being in certain states.

Although there are a number of different adaptations of the sustainable livelihoods model, the main concept remains the same. To cite Scoones one more: "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: 5).

According to the MA, sustainability of livelihoods has three dimensions, which we label 'internal sustainability', 'social sustainability', and 'ecological sustainability':

- *Internal sustainability* A livelihood is sustainable if it can cope with and recover from stresses and shocks and maintain or enhance its capabilities and assets now and in the future;
- *Social sustainability* A livelihood is sustainable in a social context when it enhances or does not diminish the livelihoods of others; and

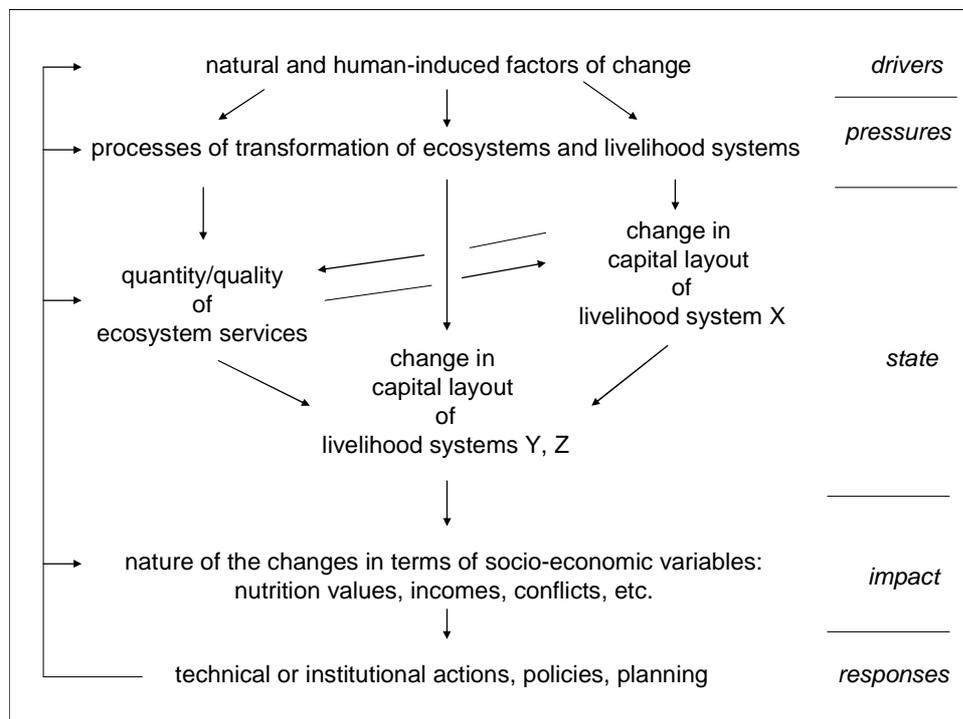
- *Ecological sustainability* A livelihood is sustainable <in the ecological context> when it does not deplete or disrupt ecosystems to the prejudice of the livelihoods and well-being of others, now and in the future.

In particular the last two are interesting, as they appear to include a moral judgement whether a particular group of people (livelihood), through its actions, is having a negative effect on the well-being of other groups (livelihoods) or on the integrity of an ecosystem (wetland-agriculture setting).

6. The DPSIR analytical tool linked to the livelihoods concept

As was explained earlier, the DPSIR analytical tool has five components: Drivers, Pressures, State changes, Impact, and Responses. It is argued here that the same Drivers that set into motion the processes (Pressures) that change the State of ecosystems also affect livelihoods, the livelihoods associated to those ecosystems (Wetland-Agriculture settings). Ecosystems are defined by the services they deliver; livelihood systems are defined by their capital outlay: natural, financial, eco, physical and social capital. In the same way as the Pressures generated by the Drivers change the quantity and quality of the ecosystem services, they affect the five types of capital of each of the different livelihoods that are found in a Wetland-Agriculture setting. The situation is only slightly more complicated in the case of livelihoods, because one particular livelihood system may affect another livelihood system, or a Driver may be generated by another livelihood. Furthermore, it is necessary to differentiate between direct and indirect effects on the capital layout of a livelihood, with the indirect effect being experienced through a change in the ecosystem on which that livelihood depends, and the direct effect being the direct effect of the Driver. Figure 3 illustrates the relations.

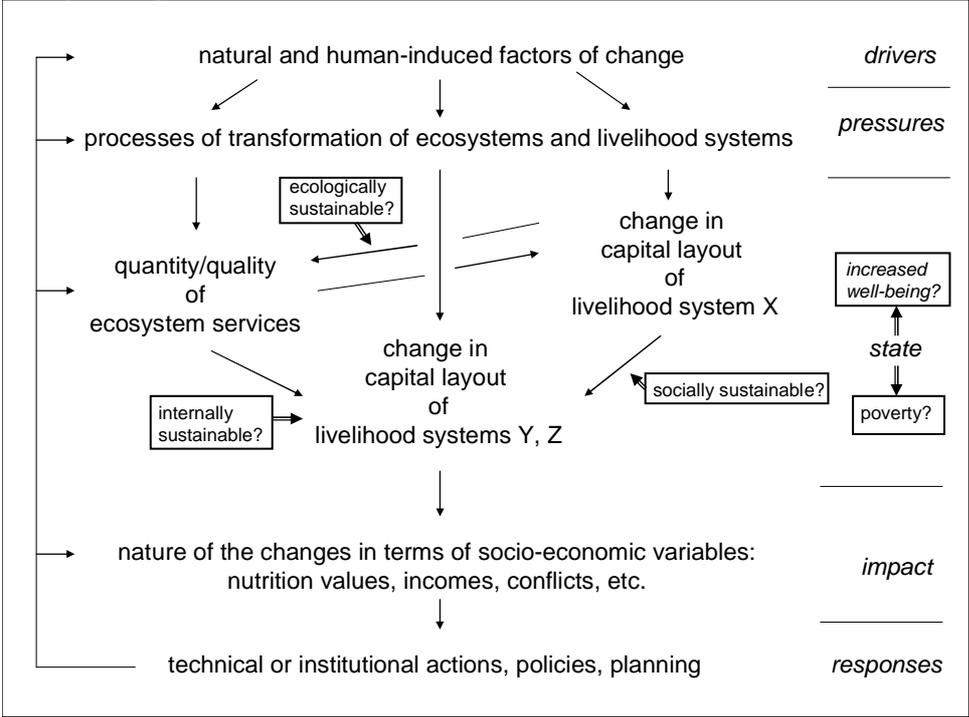
Figure 3. The DPSIR analytical tool applied to both ecosystems and livelihoods



The Wetland-Agriculture settings where the Pressures are felt are assumed to be hydrological units where different groups of people, with different backgrounds and different relations to one and the same ecosystem, interact with each other and with the eco-physical environment in which they live. The situation is dynamic, as is always the case. The factors of change – Drivers – can occur from outside the eco-

social-physical setting, or are generated inside it. The Pressures affect the ecosystem itself and the livelihoods X, Y, and Z. Livelihood X is an important one, because it affects the ecosystem itself, as well as the other livelihood systems Y and Z (directly or indirectly). An example of a livelihood system Z is a commercial firm that settles into a wetland-agriculture setting with the support of the authorities to set up a large scale agricultural enterprise. The changes in State are changes in ecosystem services and in the capital layout of the prevailing livelihood systems. The changes in State have an effect on incomes, nutrition values, conflicts, etc. This is the Impact to which Responses are being formulated.

Figure 4. The relations between DPSIR, livelihoods, sustainability, human well-being, and poverty



In Figure 4 it is shown that it is within the domain of State changes that the issues of sustainability, human well-being and poverty find their expression. Ecological sustainable livelihoods respect the integrity of the ecosystem (see definition MA, above). The other way around is also true: an unsustainable relation will diminish either the quality or the quantity of the ecosystems, or both. In the same way, a socially sustainable or unsustainable relation between two livelihoods may exist. The relation is sustainable when neither of the ecosystems will lose its capacity to provide for its well-being. In practice the relation is often more often one-sided, in the sense that one livelihood is dominant over the other. In the Figure, Livelihood X is dominant over Livelihoods Y and Z. A critical question is whether the Drivers and Pressures result in an increase of human well-being or in an increase in poverty. This must be considered for each livelihood separately.

7. Mapping livelihood profiles

To conclude the discussion, we will briefly explain how livelihoods are being identified in practice and how livelihood profiles are being constructed. These two actions are the first steps to be taken when under practical conditions the DPSIR analytical tool is applied and livelihood analyses are planned. Note that the information in this section is only meant to introduce the subject; further details are worked out in the subsequent phase of the GAWI project.

Although a livelihood system may be operated without experiencing competition from other livelihood systems, the situation today is that more often than not other livelihood systems are interested in the same services. Some of them may have its roots in a completely different, often urban, environment, like e.g. a commercial firm. It is safe to say that in every wetlands-agriculture setting today competition for ecosystem services is increasing. Typical Drivers that are at the root of these conditions are population growth, change in consumer demand, increased transport and communication opportunities, etc. Wetland-agriculture systems today are dynamic socio-environmental systems.

Every livelihood system makes use of the ecosystem services available in the area in one way or the other, employing the capitals that it has at its disposal. Some of the livelihood systems act in accordance with the Ramsar concept of 'sustainable utilization', whereas others do not. In the same way, the actions of some livelihood systems may compromise the social sustainability of others.

Livelihood systems are conveniently described by answers to four questions:

- What is the history of the livelihood group in relation to the agriculture-wetlands setting?
- What are the social characteristics of the livelihood group?
- Which ecosystem services are being used by the livelihood group?
- How is the usage organized?

The history of a livelihood system is essential to know, as it says much about the ecosystem services that are being used, how they are being used, how they are being valued by the people of the livelihood group (not always values in monetary terms, like cultural values!), and last but not least, how access to resources is organized. With regard to the latter aspect, in many indigenous livelihood systems, access to resources is sharply defined, albeit not often on paper and not only embedded in national legal systems.

The social characteristics that we need to know include the usual social parameters: number of persons in the livelihood group; population dynamic characteristics, like birth rate, death rate and life expectancy, and population growth factor; distribution over the two sexes; distribution over age categories; levels of education, occupation, including whether people depend on incomes generated from resources inside the agriculture-wetlands system; and average levels of incomes, per occupation. Other social characteristics include decision making procedures, the hierarchical structure in a livelihood, and gender relations.

The questions about the ecosystems that are being used is relatively simple. Ecosystems provide: supporting services (nutrient recycling, soil formation, hydrological cycles, primary production, etc), provisioning services (food, fresh water, wood and fiber, fuel, construction materials, etc.), regulating services (climate regulation, flood regulation, disease regulation, water purification, pests regulation, etc), and cultural services (aesthetic, spiritual, educational, recreational, etc.). We want to know for each livelihood which service they use and how much of it.

Of all the 4 questions that we seek answers to, the one on the organization of the usage of the ecosystem is probably the most important one. This is because it tells us something about the potential of a livelihood group to put pressure on the ecosystem (change its State), and directly or indirectly, on other livelihood systems in the area. Basically the answer is formulated in terms of how the different types of capital – natural capital, economic capital, human capital, physical capital, and social capital – are being employed.

The data required to draw up profiles of each livelihood in a wetland-agriculture setting are collected in several ways: interviews, observations, measuring, written sources analyses, secondary data collection, etc. The data are acquired from the livelihoods themselves, from government services, from key persons, from NGOs, from libraries, etc.

References

- Chambers, R., 1989, Editorial introduction: vulnerability, coping and policy, in: R. Chambers (ed), Vulnerability, coping and policy, IDS Bulletin, Vol.20, no.2
- Chambers R, and G. Conway (1992) 'Sustainable rural livelihoods: practical concepts for the 21st century, IDS Discussion Paper 296, Institute of Development Studies, Brighton
- DFID, 1999, Sustainable livelihoods guidance sheets, overview, Department for International Development, England.
- Giupponi, date?, From the DPSIR reporting framework to a system for a dynamic and integrated decision making process, MULINO Conference on "European policy and tools for sustainable water management", 21-23 November, Venice (Italy)
- Millennium Ecosystem Assessment (MA) (2005) Ecosystems and Human Well-being: Synthesis. Island Press, Washington, DC.
- Neefjes, K., 2000, Environments and livelihoods, Strategies for sustainability, Development Guidelines, Oxfam, Oxford, UK
- Nicholas, G.P. (1998) Wetlands and hunter-gathers: a global perspective. Current Anthropology, 39, 5, pp. 720-731.

- Scoones, I. (1998) 'Sustainable rural livelihoods: a framework for analysis', IDS Working Paper 72, Institute of Development Studies, Brighton
- Silvius, M., M. Oneka and A. Verhagen (2000). Wetlands: lifeline for people at the edge. *Phys. Chem. Earth (B)*, 25, 7-8, pp. 645-652.
- Stocking, M.A. and N. Murnaghan (2001) *Handbook for the Field Assessment of Land Degradation*, Earthscan, London.
- United Nations World Commission on Environment and Development (WCED), 1987, *Our Common Future*, Oxford: Oxford University Press
- Warren, A., S.P.J. Batterbury and H. Osbahr (2001) 'Sustainability and Sahelian soils: evidence from Niger', *Geographical Journal*, 167(4), pp. 324-341.
- Wood, A., and G.F. van Halsema, 2008, *Scoping agriculture-wetlands interactions*, *FAO Water Reports 33*, FAO, Rome
- WB, 2001, *Attacking Poverty*, World Bank, Washington DC