

Chapter 10

From analysis to guidance

AIMS AND CONTEXT OF THE GAWI INITIATIVE

The goal of the GAWI initiative is to support the development of “sustainable agriculture–wetlands interactions”. This is seen in terms of achieving healthy wetland ecosystems that sustain human well-being. Using the ecosystem services framework, sustainability requires that a balance be attained, and maintained – among the multiple ecosystem services, and within the service types. Overdependence on one or a limited number of services is the major cause of exceeding the carrying capacity and damaging the resilience of wetland ecosystems, and hence their ability to operate and cope with shocks. In the long term, this leads to the destruction of the ecosystem with the loss of services it provides (provisioning, regulating, cultural and support). In terms of the GAWI work, the emphasis is not so much on realizing such balances through measures that will mitigate the negative impacts of agriculture in wetlands, but rather in rebalancing the state of ecosystem services so that multiple provisioning and non-provisioning services can be put to fruitful use. This will involve support from regulating, cultural and support services for provisioning ones, while the provisioning services are developed in ways that help maintain the regulating and support services.

In searching for this balance in wetland ecosystems, it has to be recognized that there are increasing demands upon these areas as a result of population growth, changing consumption patterns in response to improving standards of living, and measures to help address the MDGs, especially poverty reduction and food security (Chapter 3). As these demands are primarily directed towards enhancement of the provisioning services, there is an urgent need to counter this trend with a more explicit recognition and utilization of the wider services that ecosystems can offer (e.g. regulating, cultural and support). The important and growing role of wetlands in contributing to livelihoods has been emphasized in recent work such as the CA, which points out their high potential in meeting growing demands for food and water. Indeed, the drivers behind such pressures (population and economic growth) are likely to remain for several decades, and the demands for increased economic output and food production are set to grow substantially for the next 30 years. The expectation is that more wetlands will be affected negatively unless appropriate action is taken. In this situation, it is critical to develop and apply guidelines for sustainable AWIs that can: (i) rebalance the ecosystem services; (ii) manage and reduce the negative impacts associated with the use of provisioning services; (iii) stimulate the generation of income from other ecosystem services; and (iv) ensure the maintenance of the full range of ecosystem services in these areas.

PROBLEMS, SCOPE AND “ISSUES” OF SKEWED ECOSYSTEM SERVICES IN AWIS

A first step in moving towards such guidance is to develop appropriate tools to understand the situation of wetlands today as they interact with agricultural pressures.

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The DPSIR framework has been used for this purpose in the expectation that better analysis of the situation can help to inform guidance about future responses. The database analysis in Chapter 3 has shown the diverse range of drivers, pressures, state changes, impacts and responses that are encountered in AWIs. Population pressures, local and international markets, and government policies are the major drivers, with climate change beginning to be seen in some areas. These are leading to pressures in wetlands in the form of agricultural expansion, agricultural intensification, and increased alteration of water resource conditions. State changes in the biophysical characteristics of wetlands affected by agriculture are seen mainly in the form of changes in the hydrological regime in the wetlands, biodiversity loss, sedimentation in wetlands, loss of soil fertility and increased soil erosion, and water pollution. The socio-economic impacts are mostly seen in positive increases in crop production and to a lesser degree in aquaculture, while subsistence agriculture and other gathering practices in wetlands have declined. Negative socio-economic impacts are found in up to almost half of the cases in some regions, with increased socio-economic differentiation and conflicts. Responses are mostly seen at the field level with technical measures to address state changes and, to a lesser degree, pressures.

The five cases subjected to detailed DPSIR analysis show the diversity of experience and confirm the need for individual and context-specific application of the DPSIR method. They include examples of the potential for applying PES where markets are sufficiently developed, and the need for GAPs in catchments as well as wetlands, including methods to adjust wetland agriculture towards the conditions in these areas rather than changing the conditions completely. Moreover, there is evidence of the need to consider how to address major external drivers, such as in the demand for palm oil and rice, as well as the question of how to maintain symbiotic relationships between rice and fish/shrimps/prawns within wetlands and in upstream/downstream situations.

Overall, the GAWI analysis confirms the picture that the MA and CA have identified, with a skewed pattern of exploitation of ecosystem services in wetland ecosystems. The exploitation of one, or a limited set, of specific provisioning services, such as rice cultivation, aquaculture, and irrigated vegetables, is frequently re-enforced and overdeveloped by increased market access and/or demand for the product in question. Such drivers may lead to a mono-use of ecosystem services, even to monocropping, and cause major changes in the state of the ecosystem. This is especially the case with agriculture in wetlands, where the resources base and environment are purposely altered and optimized to maximize food production through water control infrastructure, drainage and land development, and fertilizer and pesticide use. At the same time, the consequences of these interventions on the other specific functions and services of the ecosystem have frequently been disregarded and not controlled.

The analysis also confirms that this imbalance often has implications for the medium-term and long-term sustainability of the wetland agriculture and aquaculture, and more immediately for the regulating and support ecosystem services of wetlands. As a result, it is suggested that the way ahead has to involve a rebalancing of the use of ecosystem services. This must ensure that the provisioning services are not exploited to the state where the regulating and support ecosystem services are undermined with negative *in situ* and downstream consequences, such as through flood control and an altered hydrological regime. Moreover, these regulating and support ecosystem services need to remain functioning in order to maintain the provisioning services.

SCOPING OUT REBALANCING OPTIONS

Building on these global and case study levels of analysis, a number of areas for action can be identified in order to move towards sustainability in AWIs, and at the same time to help meet the increased demands being made of wetlands. These include:

- reducing the pressures from agriculture on wetlands and the negative state changes and impacts by diversifying the provisioning services used;
- diversifying the demands on wetlands so that different ecosystem services can generate income, especially through PES;
- managing basin-level land use in ways to facilitate the maintenance of ecosystem services;
- improving agricultural practices so that they are more sensitive to ecosystems and their requirements;
- redirecting the drivers of change so that the specific needs can be met in other ways that do not create negative state changes in wetlands or elsewhere in the river basin system.

These activities can and need to be undertaken at different scales, *in situ* within a wetland site, and basinwide – including catchments and wetlands. They are discussed below in order to explore some of the major conceptual and practical issues involved.

Diversifying provisioning services

In order to reduce the pressures operating on wetlands while maintaining or increasing the total livelihood benefits from these areas, a diversification of the provisioning services that are used is being proposed, as in the two “ecosystem” scenarios of the MA, “adapting mosaics” and “techno gardens” (MA, 2005b). (Some examples of this approach were identified in Chapter 9 with respect to the “Livelihood Development and Conservation” responses and traditional sustainable-use wetland management regimes.) The diversification of provisioning services (consisting of crop production, livestock, fisheries and gathering) has the potential to cut two ways into the problem of unsustainable AWIs:

- Diversified agriculture and other provisioning services are deemed to be more in line with the diverse ecosystem characteristics, resulting in overall lower stresses (i.e. pressures and state changes) on the system while providing more scope for non-provisioning services to coexist (or even thrive) with agriculture.
- Diversified agriculture has the potential to sustain multiple livelihoods and thereby address negative socio-economic impacts, such as marginalization, differentiation and conflicts, and their resulting feedback pressures for further expansion/intensification of agriculture in wetlands by affected stakeholders.

The new pattern of provisioning services would be more ecologically suitable for the wetlands and should help maintain regulating and support services with a different, but possibly higher, total value of provisioning output.

The DPSIR analysis is especially useful in helping explore the potential trade-offs and value of such a multiple-use regime as it can identify which provisioning services are affecting which livelihoods and stakeholders, where there are tensions and potential trade-offs, and what is driving the skewed provisioning or overdevelopment of one specific provisioning service. However, the amount of evidence of multiple-use regimes is limited in the database cases, and more attention needs to be given to identifying and exploring the dynamics of such experience. Moreover, it remains a challenging aspect of this approach to identify how to restrict the impacts of market-driven agricultural responses that frequently steer agricultural production into selected products and production systems, often with monocropping. Conversely, it is important that the responses proposed, whether affecting provisioning, regulating or cultural services, reflect market realities.

Diversifying into other ecosystem services for livelihood benefits

The key message of the MA is that ecosystems provide multiple services with which to support human well-being. From this are derived the concept and argument for the conservation and sustainable use of ecosystems through a balanced use of these

multiple services. However, the analysis in this report shows that the general and global benefits from the regulating, cultural and support services, such as climate-change mitigation, a healthy environment, and aesthetic value, do not provide strong enough drivers at the local contextual level to push for the utilization of ecosystem services in this balanced manner. Rather, the very concrete and economic drivers that push in the contrary direction for provisioning services lead to a skewed utilization of ecosystem services.

In order to move towards a more balanced use of ecosystem services in wetlands, there is an urgent need to make non-provisioning ecosystem services economically tangible and relevant in the socio-economic impacts and contexts in which the ecosystems are situated and used. There are two modalities to do this:

- through direct payments/compensations for delivery of specified non-provisioning services (e.g. water purification, flood attenuation, carbon sequestration, and recreation and tourism) by specified service buyers to service providers (UNECE, 2007);
- through sector-wide approaches to regulations, incentives and compensations that are made available by governments to sectors to induce and foster particular non-provisioning services within and by the sector.

The former are known as “payments for environmental services” (PES), the latter as cross-compliance mechanisms.

The great attraction of the PES approach lies in the mechanisms it provides to reap financial benefits for traditional latent services – particularly regulating (water regulation, flood control and purification) and cultural (recreation and tourism) services – from direct beneficiaries (or service derivers) to service providers. It is proposed that these payments can replace the income from provisioning sources, provided a market can be identified and payments for these services obtained. However, more work is needed to develop ways of assigning values / economic benefits to non-provisioning services in ways that are tangible and affect decision-making, and that can also generate concrete economic benefits, usually by means of averted investment, for the stakeholders involved. This is essential if it is to be possible to identify monetary compensation or payments for these services.

To date, the most successful cases of PES have been based on the principle of cost avoidance, where revitalizing the regulating services of ecosystems is cheaper than the technological alternatives of water purification or refurbishing the dykes (Chapter 5). Other potential payments, which may soon be operational, relate to carbon storage in wetlands and peat forests (Chapter 7), where a market is being developed through policy drivers. However, with respect to ecohydrological infrastructure, biodiversity and other cultural services, rigorous methods that can ascribe specific economic value on these services remain to be developed. Moreover, further understanding of the full range of hydrological services provided by different types of wetlands requires further study (Bullock and Acreman, 2003).

The skill with PES is to transform latent regulating/cultural services into alternative provisioning services that provide land and resource users with an alternative source of economic livelihood and thereby reduce the demand for ecosystem transformation for the development of provisioning services. If successful, PES can be a powerful tool in rebalancing ecosystem service exploitation towards a more sustainable equilibrium, as long as it provides tangible and competitive alternative income compared with traditional provisioning services.

However, in this latter aspect, there are problems as the level of financial compensation offered by PES schemes for environmental land uses¹⁴ is generally considerably less than that which can potentially be obtained through the exploitation

¹⁴ For example, specified forms of land use that are deemed to enhance the regulating and supporting services of ecosystems.

of single provisioning services (Kiersh, Hermans and Halsema, 2005). Questions are still raised as to whether PES can truly (i.e. fully) provide for alternative economic income when compared with traditional provisioning services. Hence, it appears that PES may be primarily a means of providing (additional) secondary economic benefits for land uses that are already predominantly earmarked for environmental uses, a type of economic insulation against sliding into a market-oriented overexploitation of a single provisioning service.

Another key challenge with PES is to ensure that the ecosystem services compensation is actually accrued at the local level, compensating local users and managers for their sustainable use and management, as well as compensating losers for restricting the overdrive of provisioning services. This requires major institutional development as well as mechanisms for measuring the ecosystem services maintained and the different contributions of the various stakeholders and members of the communities.

The value of the DPSIR analysis in this area is that it can help to assess the tangibility of socio-economic impacts from these regulating and cultural services and to identify potential service buyers and service providers. It can also show which ecosystem services are most relevant and where further work is needed in the development of valuation processes. This is especially so for hydrological functions and biodiversity values as discussed above.

Functional and strategic planning at basin scale

The idea of strategic and functional planning of ecosystem services at basin level is another area where actions to improve AWIs are possible. While conceptually sound, there is in practice little evidence of this being applied, even in integrated water resource management. Such planning of ecosystem services, with wetlands as a focus, would involve a development of strategic land-use planning to identify the most appropriate patterns of catchment and wetland use in order to ensure the sustainable functioning of the wetlands. Part of this work would include a technical analysis to identify which wetlands should be kept pristine, in which others to allow development, and the appropriate nature or intensity of this use. In other words, the primary function of some wetlands would be in providing regulating services, while the primary function in others would be in provisioning. However, in each case, there would also be secondary functions from the other ecosystem services, and there would be a need to try to ensure that the primary function did not completely undermine the secondary functions. Hence, where agriculture in a wetland is assigned a secondary function, it would probably be very different to where agriculture is assigned as a primary function (below).

Implementation of such basinwide planning requires the development of technical and institutional support. It also faces various problems, such as existing land uses, winners and losers of land-use changes, and how to enforce changes. As such, this is a highly political process, which supposes, or imposes, a high and probably unrealistic level of governance and regulatory capacity. This concern points to the importance of the DPSIR analysis, as it is more through influencing drivers that progress towards a desired pattern of land use is most likely to be achieved.

To take this approach forward, it is necessary to explore how to address the following building blocks that are not yet sufficiently developed:

- How to select the primary function in subcatchments/systems and wetlands between provisioning (well-established), regulating (emerging for water purification and flood control), and cultural (limited to nature/biodiversity and tourism) ecosystem services.
- How to foster and enhance as much as possible the exploitation and “existence” of the “secondary ecosystem services” to coexist with, and support, the primary services, so that multiple-ecosystem services can be derived from the wetland.

For these issues to be addressed, knowledge is lacking in a number of areas. This is

especially true in the following areas that this GAWI study has identified as requiring further consideration, and often research, in the immediate future:

- a. Carrying capacities of wetlands under different agro-ecological and socio-economic conditions so that the ecological bounds for different provisioning uses can be identified.
- b. Good agricultural practices (GAPs) in wetlands or basins for agriculture as the primary provisioning service; practices that will address/minimize negative pressures and state changes, in particular with regard to indirect basin-level AWIs, and maximize production in a sustainable manner.
- c. Good agricultural practices (GAPs) for secondary provisioning services, where agriculture is assigned a secondary rather than primary function/role in a wetland and is subservient to regulating or cultural services. Hence, this is primarily directed to *in situ* interactions.
- d. Enhancement of biodiversity and other cultural services as a secondary livelihood support or supplement to the income for wetland agriculture.
- e. Developing regulating services, in particular hydrological ones, as the primary ecosystem services in wetlands, as in the Netherlands floodplains, and the Katskill and the Deschutes areas in the United States of America.
- f. Developing cultural services, especially biodiversity conservation, as a secondary productive service – through income generation, when other ecosystem services are the primary ones allocated to specific wetlands. The question here is how to exploit secondary provisioning and regulating services economically to the fullest to provide economic insulation against provisioning pressures and drivers.

In most of these cases, there are potential agencies whose research agenda could cover the issues raised. The CGIAR group in particular could address the first three of the above, especially “b)” and “c)”, with the latter being a particular challenge and area never addressed before. Both “a)” and “c)” need expertise from ecologists. In some cases, such as “d)”, some work is already being undertaken. However, this is mostly within a framework of the EU or the United States of America, and is always dependent on government compensation and regulation. The question is how such enhancement can be achieved in other socio-economic contexts. On the hydrological issues, there remains much work to be done to clarify, measure and value the hydrological roles of wetlands, with inputs needed from wetlands and hydrologists competent in integrated water resources management (IWRM).

Basin-level strategic planning also faces major problems with offsetting impacts. As emerges from the analysis in this report (and this is considered a strong point of the DPSIR approach), AWIs are found to have diverse socio-economic impacts, both within provisioning services, as well as between ecosystem services that directly affect different stakeholders and sectors. Any rebalancing of ecosystem services is consequently bound to involve a redistribution of the benefits derived from the ecosystem among these stakeholders and sectors. This makes the problem of strategic basin planning very complex, and also non-technical, or rather political, in many aspects. Offsetting these impacts will be helped by diversifying the exploitation of provisioning and other ecosystem services (above), as the more diverse the benefits are, the more stakeholders/sectors that can benefit. However, this is not merely a question of technical responses. It is one where attention needs to be given to the differential impact of drivers and pressures upon different groups, as well as the overall demands from powerful drivers (e.g. market forces), or perverse incentives for overdrive.

The DPSIR analysis is useful in exploring the differential socio-economic impacts of AWIs, in other words how diverse benefits relate to diverse stakeholders and DPSI elements. It can also show how negative impacts can be addressed by diverting pressures away from the ecosystem by providing alternative livelihood/economic benefits from other sectors of society. In terms of functional and strategic planning at

basin level, more work needs to be done to specifically adapt the DPSI analysis to a spatial pattern of the drivers, pressures, state changes and impacts.

SCOPE FOR GAWI GUIDANCE

There is much to think about in terms of further scoping and development of the ways of addressing AWIs. However, in regard to meeting the goals of the GAWI initiative, the guidance in terms of where this guidance should be directed is clearer. From a pragmatic point of view, it can be suggested that the GAWI project should focus on areas or fields that are: (i) feasible; and (ii) deemed desirable.

This scoping for which, what and who are meant to be addressed with the GAWI in general, can (and needs) to be conducted on several grounds, including rate of wetland loss, importance of wetlands for various reasons, and the ability of GAWI to achieve a positive impact. A key consideration is the type of agriculture–wetland situations to be considered. In view of the old divide between nature conservation and development (i.e. wetlands vs agriculture), there is little scope to address either of these two extremes with the GAWI – or for that matter imply that there is a “middle way” that can encompass the whole range of AWIs from pristine wetlands to agricultural production systems. There are ample good reasons to pursue a conservation strategy for biodiversity hot-spots, and these have been pursued by Ramsar since its inception. Similarly, the development of highly intensive agricultural production areas are adequately covered and pursued by the agriculture sector.

In the light of this argument, it can be suggested that the primary area for GAWI support should be in the middle ground, and especially in areas where the agricultural frontier is expanding into wetlands and where there are opportunities to pursue more efficient resources use (especially water and nutrients) and higher productivity, and to further limit or mitigate negative impacts (CA, 2007). The reason for this focus is based on the MA view that the largest and continuing loss of wetlands is to be found in the large “middle ground” of “ordinary” aquatic ecosystems (MA, 2005a and 2005b). Similarly, the CA indicates that the additional land and water resources to meet growing demands are increasingly set to be taken from suitable “ordinary” ecosystems (CA, 2007).

For the purpose of scoping, the large “middle ground” of “ordinary” or common aquatic ecosystems that are set to interact with agriculture will have to be defined in a more specific manner. A possible way to do this is to take Table 3 as a basic wetland typology, and to assess in more detail the suitability and likelihood of agriculture interactions to develop in the coming decades. This should yield a considerably narrowed-down typology of wetlands liable to severe agriculture/aquaculture pressures.

TOWARDS GUIDANCE

To conclude this report, it is appropriate to confirm what the study has achieved and what the key challenges are.

The key points are:

- Agriculture–wetland interactions are governed by very diverse and situation-specific configurations of DPSIR elements, with particular diversity in the state changes and impacts reflecting how drivers are translated into agricultural exploitation.
- The DPSIR analysis has provided a new and informative conceptual approach to the analysis of AWIs by incorporating the ecosystem services concept of the MA. Apart from showing how AWIs lead to negative impacts in state changes (primarily through diminishing regulating, supporting and cultural services), this method also shows that there are direct trade-offs between stakeholders and livelihoods that benefit from different provisioning services within wetlands.
- Restoring ecosystem services and obtaining a symbiotically beneficial balance

in ecosystem services has little evidence-based information or experience. It is an intricate and difficult issue to resolve as it inevitably means a redistribution of economic benefits among stakeholders in order to redress established trade-offs. To date there is only evidence of this in OECD countries and India, where economic compensation measures have been applied.

- Intensification of agriculture in wetlands is leading to socio-economic and ecosystem service differentiation, with specific groups of people benefiting and those who rely on subsistence uses of wetlands losing out. This constitutes a negative feedback loop where losses in subsistence agriculture and uses lead to further pressures and transformation of wetlands.
- Responses need to be specific to a situation/case and address the DPSI elements of that case in their particular context and with recognition of specific facilitating factors.
- The real driving forces in the AWIs need to be addressed, rather than the symptoms. This action will be more effective if there are interventions at multiple levels based on the DPSIR analysis to identify key elements at the different levels, with, for example, GAPs to address impacts, but policy changes to redirect drivers.
- Responses need to be directed on three fronts:
 - fostering GAPs to reduce negative state changes at both basin and wetland-site levels;
 - restoring and economically exploiting regulating and cultural services, whereby economic benefits can be tapped for associated compensation measures and redressing of benefit redistribution among stakeholders;
 - invigorating permissible multiple provisioning service exploitation, such as fishing, agriculture and gathering, to enlarge the livelihood benefit while staying within the ecological resilience boundary.

To conclude, some potential areas of intervention are beginning to be identified around which specific guidance can be developed. However, there are also major challenges in terms of conceptual understanding, research findings and practical experience. To address these, a number of different organizations need to be engaged to take this work forward. However, this work must be undertaken in a coordinated manner with collaboration and dialogue between the organizations undertaking the various elements described above, and with these seen as a series of interlinked “modules”. The necessary dialogue to develop this collaboration has started in the GAWI process, which has led to this report. It now needs to be driven forward with commitment by an appropriate agency. Of these elements, it is suggested that GAWI initiative take up for immediate elaboration: (i) guidelines for the application of DPSIR in AWI response strategies; (ii) a compendium of GAPs for responses of indirect interactions as scoped out in this report; (iii) guidance for good practices in economically revitalizing regulating and cultural services; and (iv) addressing socio-economic impacts through diversified livelihood responses.