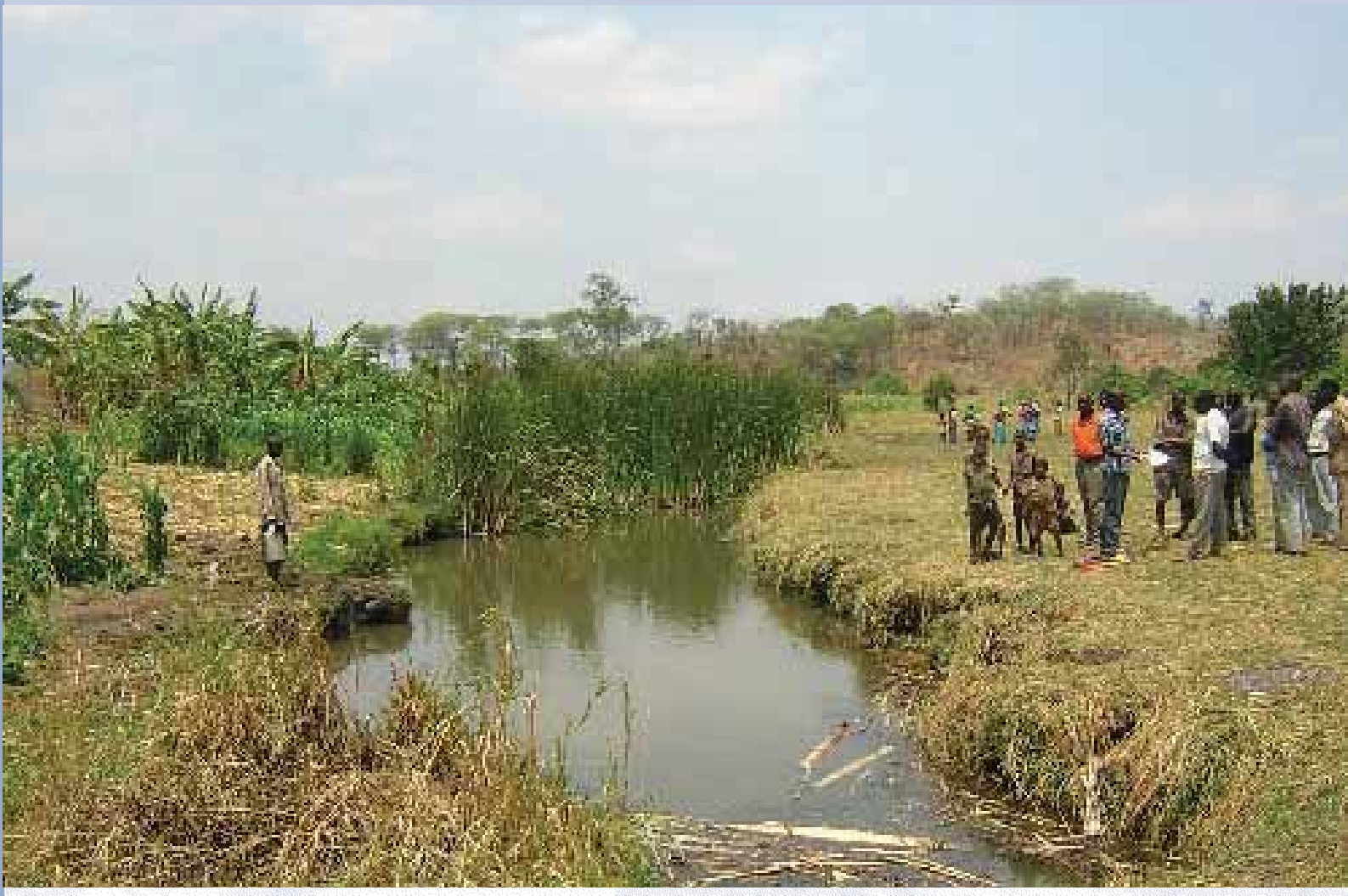
ISSN 1020-1203

FAO
WATER
REPORTS

33

Scoping agriculture–wetland interactions

Towards a sustainable multiple-response strategy



WAGENINGEN UR

Ramsar

FAO FIAT PANIS

FAO
WATER
REPORTS

Scoping agriculture–wetland interactions

33

Towards a sustainable multiple-response strategy

Coordinated and edited by
Adrian Wood
and
Gerardo E. van Halsema

With substantive contributions by the partner organizations of the project Guidelines on Agriculture, Wetlands and Water Resource Interactions (GAWI):

Food and Agriculture Organization of the United Nations (FAO)
Ramsar Convention on Wetlands (Ramsar)
Wageningen University and Research Centre (WUR)
International Water Management Institute (IWMI)
Wetland Action (WA)
Wetland International (WI)

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
Rome, 2008

ISBN 978-92-5-106059-9

Contents

List of tables

List of figures

List of boxes

Documents available on CD-ROM

Using the DPSIR database

1. Opening the database
2. Adding a new case to the database
3. Entering data for new case(s)
4. Running queries
5. Viewing reports
6. Compacting the database

FAO Water Reports 33 - Scoping agriculture–wetland interactions – Towards a sustainable multiple-response strategy

System requirements to use the CD-ROM:

- PC with Intel Pentium® processor and Microsoft® Windows 95 / 98 / 2000 / Me / NT / XP
- 256 MB of RAM
- 50 MB of available hard-disk space
- SuperVGA monitor
- 256 colours at 1024 x 768
- Adobe Acrobat® Reader (not included on CD-ROM)

Summary

Agriculture–wetland interactions (AWIs) are becoming more important as rising demand for food production exacerbates pressures on wetlands. The Millennium Ecosystem Assessment (MA) identified agriculture as the major cause of wetland degradation and loss. However, while some ecosystem services, such as regulating and supporting services may be reduced, agricultural development has considerably increased the provisioning services of wetlands. More recently, the Comprehensive Assessment of Water Management in Agriculture (CA) concluded that the pressures on wetlands will probably increase, with the prospect of serious loss of wetlands and their ecosystem services. This is a major challenge as the regulating and supporting ecosystem services that wetlands provide are essential for the functioning of river basins, the maintaining of ecological flows, and the sustainability of agricultural production. Hence, there is a need to explore how to improve the nature of AWIs in order to ensure an appropriate balance in ecosystem service use, i.e. a sustainable supply of all services, and not only provisioning ones.

In 2002, the Ramsar Conference of the Parties (COP) 8 requested the Ramsar Scientific and Technical Review Panel to "identify, document and disseminate good agriculture-related practice" with respect to wetlands. At the following Ramsar COP, the Guidelines on Agriculture, Wetlands and Water Resource Interactions Project (GAWI) was launched to help progress this work. This report is its first official output. As such, it is part of an initial knowledge consolidation phase, to be followed by guideline development, field testing, outreach, dissemination, and capacity building.

This report explores the nature of AWIs through the application of the drivers, pressures, state changes, impacts and responses (DPSIR) framework to 90 cases drawn from around the world. The analysis is set within the context of a literature review and a conceptualization of AWIs. The review concludes that economic and population pressures have been the major driving forces in wetland transformation. The drive to increase economic output (especially food production) has led to excessive emphasis on provisioning services, frequently crop-specific, at the expense of regulating and supporting services and involving excessive water use. The outcome has been wetland degradation and situations where water resources in a river basin are overallocated and where environment flows are inadequate. These pressures will increase and continue for the next three decades at least.

The MA stresses that a rebalancing of ecosystem services is needed in order to sustain productivity, but that a perfect balance is not always feasible owing to priorities such as the Millennium Development Goals (MDGs). The CA focuses on the provisioning services and the need to make them ecologically sensitive, with attention to agro-ecological opportunities, multiple-cropping systems, and achieving diversity within agricultural landscapes.

The MA and CA provide vital guidance for the GAWI work, drawing attention to different concepts and scales of analysis, including: ecosystem services; the functioning of linkages within river basins; multiple use in agro-ecosystems; and the landscape scale of management.

The report discusses the role of wetlands in attaining the MDGs, especially poverty reduction. It stresses the need to see wetlands as potential contributors to development in many ways and, hence, the need to enhance their functioning as multiple-use resources providing a range of ecosystem services.

The DPSIR framework was used to analyse the 90 cases in order to scope out the dynamics of AWIs and their concomitant impacts in socio-economic and ecosystem

services terms. The major trends and occurrences identified in the DPSIR elements confirm the findings of the MA and CA, i.e. ecosystem services tend to be skewed towards overexploitation of provisioning services at the expense of regulating and supporting services.

The main drivers operating towards the exploitation of ecosystem services are natural resources dynamics and market demands (global and local). Another substantive driver is government policy – covering a wide range of issues not only regulation of wetland use. Drivers with regard to climate change and natural variability are conspicuously low or absent, expect for Africa.

These drivers translate into pressures on wetlands related to increased agricultural activities such as: expansion (especially in Africa and the Neotropics), intensification (especially in the Neotropics and Asia), and increased water use/depletion. The pressure of increased water depletion is highly divergent across the regions, depending mainly on overall water resources availability. Pressures stemming from nature conservation remain limited to Europe.

The resulting biophysical state changes are mainly changes in water resources (from diminishing resources to altered flood regimes) and a general loss in biodiversity. Changes in soil characteristics (fertility loss and erosion) are predominantly an African phenomenon. Deteriorating water quality is less widely reported except in Europe (where it is the second-most severe state change).

The consequent socio-economic impacts are diverse and multiple. The most frequent impact is losses in subsistence agriculture, which are offset by substantial gains in market-oriented agriculture. This indicates a transformation, with increased market-oriented agriculture generally being associated with a monoculture of intensive water and resources use. The third-most frequent impact is increased social-economic differentiation and associated conflicts over resource use. The transformation in agriculture often represents a differentiation in access to natural resources and the associated benefits. For example, aquaculture and crop intensification in Asia lead to the loss of inland and coastal fisheries. The fact that additional gains in subsistence agriculture are limited is a reflection of a negative feedback cycle in which productivity losses drive further expansion. Europe forms an exception with regard to impacts, as the loss in regulating services (e.g. flood control and water purification) is reported as the dominant impact. This is because its agriculture is in decline, and because of the explicit valuation of these services in European Union (EU) policies and regulations.

The valuation of regulating, cultural and supporting services and their economic management/exploitation at the local context is generally low in the cases analysed. This hampers response options considerably as few concrete economic reasons are being presented and developed that can effectively counter the pressures for market-based agriculture. Exceptions are mostly limited to countries of the Organisation for Economic Co-operation and Development (OECD), where specific services (e.g. flood control, water purification, and recreation) are being revitalized and exploited. There is urgent need to enhance the options for valuing and exploiting non-provisioning ecosystem services whose economic benefits can accrue within the local context, especially in non-OECD economies.

The database analysis of DPSIR elements confirms the general trends depicted by the MA and CA. However, in devising response strategies to rebalance ecosystem services through revitalizing regulating and cultural services, curbing multiple *in situ* provisioning services, or fostering good agricultural practices (GAPs), the DPSIR analysis will need to be conducted in detail for each site and case. To be effective, responses must be geared towards the specific drivers, pressures, states and impacts that operate in each case and setting.

In order to show how the DPSIR framework can highlight key and multiple areas for responses in moving towards sustainable AWIs, the report explores its application in five case studies:

(i) swamp wetlands in Ethiopia – responding to multiple livelihood and food security pressures;
(ii) river floodplains in Europe – revitalizing the regulating services of flood control;
(iii) peat forests in Southeast Asia – the need to respond in terms of global market trends and local management practices;
(iv) tropical river basins with aquaculture and irrigated agriculture in Asia – concerted approaches in multiple responses in crop, fish/aquaculture and lagoon restoration; and
(v) integration of rice–fish systems in Thailand.

Response scenarios for all 90 cases were studied separately. Some 63 percent of the cases had responses that attempted to address AWIs, while 7 percent showed evidence of an established sustainable-use regime (usually low-intensity subsistence agriculture). However, 7 percent of the cases showed evidence of increasing agricultural exploitation.

The identified response scenarios were grouped into four categories:

(i) conservation (33 percent);
(ii) livelihood development and conservation (33 percent);
(iii) water resources and river basin planning (26 percent); and
(iv) payments for environmental services (PES), financial and market mechanisms (5 percent).

In regional terms, the dominant approaches are: conservation in Europe; livelihood development and conservation in Africa, the Neotropics and North America; and water resource management in Oceania. Asia shows the most balanced pattern of responses. These variations reflect the different socio-economic conditions of the regions.

The overall picture shows there are combinations of country-specific or site-specific factors that have made particular responses feasible or led to particular responses being implemented. These multiple factors may relate to: public awareness and support; community motivation and local organization; government policies; national or international legislation; resource availability; and interest from international agencies, non-governmental organizations (NGOs), and interest groups.

Building on the above analysis, a number of courses of action can be identified:

- Reduce pressures from agriculture and negative state changes and impacts by diversifying provisioning services used.
- Diversify demands on wetlands so that different ecosystem services can generate income, especially through PES.
- Manage basin-level land use to facilitate the maintaining of ecosystem services.
- Make agricultural practices more sensitive to ecosystems and their requirements.
- Redirect the drivers of change to meet specific needs in ways that do not create negative state changes.

These activities need to be undertaken *in situ* (within a wetland site) and basinwide (including catchments and wetlands). However, for these actions to be applied, knowledge needs to be developed in a number of areas, especially:

- carrying capacities of wetlands under different agro-ecological and socio-economic conditions in order to identify the ecological bounds for different provisioning uses;
- GAPs in wetlands or basins for agriculture as the primary provisioning service, practices to address negative pressures and state changes (especially for indirect basin-level AWIs) and maximize production in a sustainable manner;

- GAPs for secondary provisioning services, where agriculture is assigned a secondary role in a wetland and is subservient to regulating or cultural services – primarily for *in situ* interactions;
- developing regulating services, especially hydrological ones, as the primary ecosystem services in wetlands;
- enhancement of biodiversity and cultural services as a secondary livelihood support or supplement to the income for wetland agriculture.

The report concludes that:

- AWIs are governed by diverse and situation-specific configurations of DPSIR elements, with particular diversity in the state changes and impacts reflecting how drivers translate into agricultural exploitation.
- The DPSIR analysis provides a new and informative conceptual approach to AWI analysis by incorporating the ecosystem services concept. In addition to showing how AWIs lead to negative impacts in state changes, this method also shows 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 as it entails a redistribution of economic benefits among stakeholders.
- Agricultural intensification in wetlands is leading to socio-economic and ecosystem service differentiation, with specific groups benefiting and those who rely on subsistence uses of wetlands losing out. This is a negative feedback loop where losses in subsistence agriculture and uses lead to further pressures and wetland conversion.
- Responses need to be case-specific and address the DPSI elements of that case in their particular context with recognition of specific facilitating factors.
- The real driving forces in AWIs need to be addressed. 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, e.g. with GAPs to address impacts, and policy changes to redirect drivers.
- Responses need to:
  - foster GAPs to reduce negative state changes at basin and wetland site level;
  - restore and economically exploit regulating and cultural services, whereby economic benefits can be tapped for associated compensation measures and benefits redistributed among stakeholders;
  - invigorate permissible multiple provisioning service exploitation, such as fishing, agriculture and gathering, to enlarge livelihood benefits while staying within the ecological resilience boundary.

While different organizations need to be engaged in taking this work forward, it is suggested that the GAWI initiative take up for immediate elaboration:

(i) guidelines for DPSIR application 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) ways to address socio-economic impacts through diversified livelihood responses.

Acknowledgements

This publication is the result of a two-and-a-half-year process that has drawn together critical thinking and practical experience concerning agriculture and wetland interactions. The process began at the Ramsar Conference of Parties (COP) 9 in Uganda, involved a workshop in Wageningen (the Netherlands) in early 2006, saw the development of a team of Wetland Action and Wageningen University researchers, and involved collaboration with the various other partners of the Guidelines on Agriculture and Wetlands Interactions (GAWI): the Food and Agriculture Organization of the United Nations (FAO), Ramsar Convention on Wetlands (Ramsar), International Water Management Institute (IWMI), and Wetlands International (WI) to generate case studies. The review of the output of this process has been considerable, involving workshops in Slovenia in April 2007 and Wageningen in October 2007, as well as feedback from members of the Ramsar Scientific and Technical Review Panel. This report has been prepared for presentation at the Ramsar COP 10 in the Republic of Korea in October 2008.

The process was funded by the Government of Netherlands through the Ministry of Agriculture, Nature and Food Quality (LNV), and by the FAO – Netherlands Partnership Programme (FNPP) – Agrobiodiversity component. In addition, the Government of Slovenia supported the GAWI initiative by generously hosting the workshop in April 2007. MedWet provided generous support in the initiation of the GAWI initiative by facilitating the GAWI partnership at the Ramsar COP 9 in Kampala (Uganda). It gave financial support to the first Wageningen workshop in February 2006 and its preparation, as well as the GAWI presentation at the World Water Forum IV in Mexico in March 2006. The Ramsar Secretariat provided active support and guidance, and it facilitated a link between GAWI and the Scientific and Technical Review Panel (STRP) and its Working Group 5 "Wetlands and Agriculture", and the participation of GAWI at the STRP 13 and 14 meetings in Gland (Switzerland).

In addition, the GAWI work and outcomes were presented and discussed at the following events and fora: the water for food and ecosystems session at the World Water Forum IV in Mexico (March 2006), coorganized by FAO, the Netherlands and the World Conservation Union (IUCN); and the side event "The world is drying – How do we feed the world?", at the SBSTTA-13 session of the Convention on Biological Diversity (CBD, Rome, February 2008), coorganized by the IWMI, CBD, the Ramsar Secretariat and GAWI.

Thanks are due to the entire team of contributors, reviewers and participants, which included:

- Overall coordinators for FAO and the LNV: Adrian P. Wood and Gerardo E. van Halsema.
- Chapter lead authors: David J. H. Blake (Chapter 8); Alan B. Dixon (Chapter 1 and 2); Gerardo E. van Halsema, (Chapter 3, 5, 7 and 10); Aart Schrevel (Chapter 6); and Adrian P. Wood (Chapter 2, 4, 7, 9 and 10).
- Contributing authors: Alan B. Dixon (Chapter 9); Max Finlayson (Chapter 1); Gerardo E. van Halsema (Chapter 1 and 9); Ritesh Kumar (Chapter 7); Hans Langeveld (Chapter 3); Roy Maconachie (Chapter 4 and 9); Sophie Nguyen Khoa (Chapter 7); Ben Rutgers (Chapter 3); Adrian P. Wood (Chapters 1 and 3); and Henk Zingstra (Chapter 5).
- Reviewers: Matthew McCartney, Karen Frenken, Max Finlayson, George Lukacs, Rebecca Tharme and Gerard van Dijk

- Workshop contributors: Donald Baird, Chris Baker, Gordana Beltram, Matthew McCartney, Rebecca d'Cruz, Nick Davidson, Gerard van Dijk, Max Finlayson, Karen Frenken, Gerardo van Halsema, Wolfgang Junk, Bakary Kone, Spyros Kouvelis, Ritesh Kumar, Hans Langeveld, Nico van Leeuwen, George Lukacs, Roy Maconachie, David Molden, Sophie Nguyen Khoa, Catia Nunes da Cunha, Isabell von Oertzen, Mathieu Pinkers, Aart Schrevel, Sonali Senaratna, Teddy Tindamanyire, Damian Walters, Hans Wolters, Adrian Wood, and Henk Zingstra.

GAWI PARTNERS

FAO – Karen Frenken, Adrian Wood, Gerardo van Halsema
Ramsar – Nick Davidson
WUR – Aart Schrevel, Gerardo E. van Halsema, Hans Langeveld, Henk Zingstra
IWMI – Mathew McCartney, David Molden, Max Finlayson, Rebecca Tharme
MedWet – Spyros Kouvelis
WA – Adrian Wood, Alan Dixon, Roy Maconachie
WI – Ritesh Kumar, Chris Baker

Any mistakes or omissions in the final text remain solely the responsibility of the authors.

List of acronyms and abbreviations

AWI	Agriculture–wetland interaction
BHD	Birds and Habitat Directive (of the EU)
CA	Comprehensive Assessment of Water Management in Agriculture
CAP	Common Agricultural Policy (of the EU)
CBD	Convention on Biological Diversity
CDR	Complex, diverse and risk-prone
CGIAR	Consultative Group on International Agricultural Research
CO_2	Carbon dioxide
COP	Conference of the Parties
CPWF	Challenge Program on Water and Food
DFID	Department for International Development (United Kingdom)
DPSI	Drivers, pressures, state changes and impacts
DPSIR	Drivers, pressures, state changes, impacts and responses
DU	Ducks Unlimited
EIA	Environmental impact assessment
EU	European Union
Euc	Eucalyptus
GAP	Good agricultural/aquaculture practice
GAWI	Guidelines on Agriculture, Wetlands and Water Resource Interactions Project / Guidelines on Agriculture and Wetlands Interactions
GBF17	Global Biodiversity Forum 17
IAASTD	International Assessment of Agricultural Science and Technology for Development
INGO	International non-governmental organization
IPM	Integrated pest management
IUCN	World Conservation Union
IVS	Inland valley swamps
IWMI	International Water Management Institute
IWMRA	Integrated water resource management
LNV	Ministry of Agriculture, Nature and Food Quality (the Netherlands)
LSRB	Lower Songkhram River basin (Thailand)
MA	Millennium Ecosystem Assessment
MDG	Millennium Development Goal
MWBP	Mekong Wetlands Biodiversity Conservation and Sustainable Use Programme
NGO	Non-governmental organization
OECD	Organisation for Economic Co-operation and Development

ONREPP	Office of Natural Resources and Environmental Policy and Planning (Thailand)
PES	Payment for environmental services
Ramsar	Ramsar Convention on Wetlands
RDC	Rural Development Committee
SC	Sugar cane
STRP	Scientific and Technical Review Panel
TEV	Total economic value
UNDP	United Nations Development Programme
WA	Wetland Action European Economic Interest Grouping
WFD	Water Framework Directive
WI	Wetlands International
WTO	World Trade Organization
WUR	Wageningen University and Research Centre (the Netherlands)
WWF	World Wide Fund for Nature