Introduction

Land is a limited resource. But we take it for granted. Land is also much more than a commodity.

We depend entirely on land and its soils, water, vegetation - and animal life - to sustain our livelihoods. Considering this, it is astonishing how little we know about the many challenges and problems there are behind sustainable land management: but we are equally ignorant about how many potentially good practices exist.

Research can be immensely helpful in this context. However, science and research often focus on single, isolated aspects of the interconnected challenges of land management. Of course, for a still largely disciplinary science, individual elements are much easier to analyse and describe.

In particular, if research intends to make sense for land management practice, it needs to pull together various different aspects, such as water availability (too little - too much), soil organic matter and fertility, productivity and potential yields, climate change (climate mitigation as well as adaptation), river or coastal zone management, maintenance of intact ecosystems, and governance; all of these with a long-term perspective of land management in mind.

Land is of multi-dimensional character. It is multi-scale, multi-functional, multi-sectorial, multi-actor based: it needs people from practice and research to interact as equal partners. The kind of research needed to deal with this complexity and these challenges we term implementation-oriented research. Integrated modelling and scenario development can help to test innovations and to integrate research results into forms that can help to inform decision-making.

This book is based on a seven-year-long research programme with the participation of more than 600 scientists. The 12 regional projects within the programme gained experience in land management contexts as different as those in Angola, Botswana, Brazil, China, Germany, Madagascar, Namibia, the Philippines, Russia (Siberia), and Vietnam. With the help of some 140 coordinators and specialists from the participating projects, lessons were learned about knowledge management and science-practice interaction. Furthermore, many case studies with their practical challenges were identified, discussed, and systematically described.

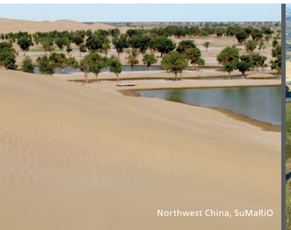
Exploring alternatives

For decades we have been told that, with a growing world population, we need to expand the area of arable land. Ten billion people or more by 2050 would inevitably create a demand for more land to produce food. Yet, surprisingly, this 'inevitability' is likely to be wrong. Among the more important reasons for current regional and local food shortages are often not simply too few hectares of arable land - but worldwide, hugely uneven, patterns of distribution and consumption. This is on top of poor technologies used, inappropriate land chosen, or conversion of land that is difficult to farm; there are also incorrect choices of crops, the loss of traditional knowledge, lack of awareness about possible or even ongoing land management innovations - or inappropriate application of fertilizers and pesticides that serve to undermine and impoverish local ecosystems. The list is long.

With its many practical examples, this book explores alternatives to the often perceived 'either – or' choice between agricultural intensification on the one hand, and expansion of arable land on the other. There is a third route to satisfy human needs for food, fibre, and fodder. This is the strategy of sustainable intensification: It principally is possible to harvest more food on the same land without long-term environmental destruction and loss of fertile soils. The key question is how. This route of sustainable intensification is explored in the book with examples from practice. While huge challenges remain, there are, worldwide, many practical examples of steps being in this direction. Some of these steps are described in the book, together with possible routes to take from here.

Making sense of research in the context of sustainable land management makes a good fit with the development of fresh and open-minded perspectives. Thus integrated and integrative approaches – meaning participatory methods, involving researchers and practitioners - are needed, as well as a corresponding self-understanding of the roles of research. And, last but not least, suitable framework conditions of funding and research management are crucial.

With all of this in mind, the book aims to be useful to land management practitioners who wish to incorporate research into their work of planning and budgeting the use of land, of choosing appropriate farming technologies, to those who are consulting, set-up research programmes, run international dialogues on the future of agriculture, and to scientists who want to conduct research that can successfully support sustainable land management in practice.


Northwest China, SuMaRiO


Okavango Delta, TFO


Southwest China, SURUMER

Order hardcopy of the book or download the PDF
www.wocat.net/makingsense
www.ufz.de/makingsense

Watch videos
https://www.wocat.net/en/knowledge-base/slm-videos.html

Take a more detailed look at the SLM technologies and approaches in the WOCAT database
https://www.wocat.net/en/knowledge-base.html
https://qcat.wocat.net/en/wocat

Find out about the BMBF research programme 'Sustainable Land Management'
http://modul-a.nachhaltiges-landmanagement.de/en/modul-a

Cover photos from top left to bottom right: Germany, Hanspeter Liniger; Brazil, Hagen Koch; Brazil, Johann Köppel; Madagascar, Maren Wesselow; Ifugao Philippines, Josef Settele; Okavango Basin, Manfred Finckh.

Making sense of research for sustainable land management






… in the field

How can we manage the dwindling resources of fertile soil, available water, biodiversity and natural habitats under conditions of a changing climate?

By …

- maintaining soil cover through maintenance of crop residues, mulching, crop rotation, intercropping and agroforestry, all of which decrease erosion and evaporation, and increase water infiltration.
- assuring minimum soil disturbance through no / minimum tillage with direct seeding, which enhances soil biotic activity, maintains intact and interconnected pores (in turn improving water holding capacity), and soil aggregates, while reducing greenhouse gas emissions.
- maintaining or improving soil fertility through building up soil organic matter via practices such as manuring, composting, adding fertilizer and even biochar. This fits well in a system of integrated crop-livestock management.
- using locally adapted plant species, including salt or drought tolerant plants (where appropriate), and avoiding the cultivation of water-demanding crops in arid areas.
- harvesting and using water more efficiently to reduce water shortages and salinization.
- combining management of natural and semi-natural systems to fulfil demands for food and non-food products while balancing their use with maintenance of ecosystems and their services (avoiding overexploitation and degradation).
- implementing integrated crop-livestock management, zoning, and rotational grazing, developing fodder banks for multiplication of fodder plants to reduce pressure on natural and semi-natural areas.

Managing land sustainably…

The book provides evidence of how practices of sustainable land management – existing as well as new – can be adapted to specific local and regional contexts. It shows how research can support decision makers and advisors from a variety of sectors - at national, regional, and local levels - in comprehending the complexity of sustainable land management. It assists them in identifying and developing suitable solutions for prevention or restoration of land degradation, improvement of yields, increasing resilience in production systems, and making water management more efficient. A special focus targets measures for climate change adaptation and mitigation.

Part 1

This section consists of seven chapters, synthesizing practice-relevant results of the 12 research projects and drawing conclusions from seven years of experience.

1. Local land management - the soil, vegetation, water and climate nexus
2. Landscape management – adapting to climate change
3. Mitigating climate change
4. Protecting biodiversity and ecosystems
5. Bridging gaps between research and practice
6. The contribution of research
7. Conclusions and key messages

Part 2

This part comprises 30 case studies that describe SLM technologies, as well as approaches for their implementation. Those case studies can also be found in the WOCAT online database.

… mitigating climate change

How is it possible to mitigate climate change through land management, using land as a carbon sink?

By …

- preventing conversion from land uses with high climate mitigation potential towards ones with lower potential, by protecting forests, wetlands, and grasslands, and reducing conversion to agricultural land and urban sprawl.
- reversing, where practical, conversion by reforestation, re-wetting wetlands, and restoring organic soils – and also on farmland, by using appropriate agricultural practices.
- reducing emissions from agricultural practices: increasing carbon storage by extensification, no-tillage cultivation, soil enrichment, reduced drainage / ground water level management in mineral and organic soils to reduce CO_2 and methane emissions (e.g. in rice cultivation).
- developing nationwide strategies for climate change mitigation to optimize land use according to natural conditions (soils, climate, water levels etc.).
- combining - where possible - climate change mitigation with adaptation measures and strategies.
- maintaining intact ecosystems within production systems and in a diverse landscape of production, semi-natural, and natural systems, thus improving resilience to climate change.
- planning for long-term investments, providing incentives to do so, and finding ways to compensate trade-offs.
- improving governance of natural resources and adapting schemes of ‚payments for ecosystem services' to local conditions.


Brazil, INNOVATE


Vietnam, LEGATO


Vietnam, LUCCi


Madagascar, SeLaMa –


Brazil, Carbrocial


West Siberia, SASCHA


West Siberia, KULUNDA


Germany, COMTESS


Germany, CC-LandStraD

… in the landscape

How can we manage human and environmental interactions at a landscape level involving off-site effects?

By …

- developing overall management plans for river basins, including their continuous adaptation, e.g. making use of integrated modelling and scenario development as a means to integrate different scales of space and time.
- taking account of local practices, which can have significant impacts on water availability and quality, while developing management of the whole basin.
- reducing the disaster risk of "too much or too little" water by adapting water and land management to deal with extreme rainfall events and variability, especially through providing storage capacity and maintaining regulating ecosystem services.
- regulating groundwater and river flows with respect to human needs (e.g. irrigation, hydropower, cities) while maintaining important ecosystems (riparian forests, wetlands) and soil quality, while taking effects on, and of, the climate into account.
- acknowledging the special role of coastal zones to manage sea level rise and the risks of salt water intrusion. Making use of natural ecosystems to protect coast (especially mangroves, salt meadows, etc).
- acknowledging the interactions between different dimensions and areas of land within a landscape, and compensating for either damages through unsustainable management, or for investments in sustainable management.

… jointly by research and practice

How can people from research and practice better work together to produce solutions for sustainable land management?

By …

- using these following approaches and methods for implementation-oriented research and dissemination of sustainable land management practices:
  - awareness-raising and communication of complexity of land
  - good outreach, and outreach materials
  - environmental awareness and education
  - innovative and multiple use of media
  - participatory filming
  - capacity building and training of stakeholders at all levels
  - participatory monitoring
  - empowerment of the local population and other decision-makers
  - strengthening cross-cutting institutions and cooperation
  - suitable knowledge management and transparency.
- designing research projects while respecting and taking care of:
  - joint target setting, co-designing with people from both practice and research
  - science-practice dialogue, long-term stakeholder involvement and integration
  - co-production of knowledge, and potential solutions
  - adequate and sensible decision support and multi-level integration of knowledge for decision makers
  - allocating time and budgets necessary for successful cooperation across sectors and disciplines, and among scientists and non-scientists, and also by providing competent management of these tasks.
  - changing framework conditions in land management practice to support the impact of research. Improvement of governance, policies, laws, and incentives for sustainable land management.
  - adapting framework condition in science, and science funding, to better support implementation-oriented research.

… preserving ecosystems and biodiversity

How is it possible to protect biodiversity and ecosystems, and their services for human needs, while current land use and land use change often reduces biodiversity - and thus functions and services of ecosystems?

By …

- protecting ecosystems through legislation and/or using incentives, and developing overall protection plans. Improving the interconnectivity of natural land at different scales, providing corridors for biodiversity with structural landscape elements, and avoiding fragmentation.
- reducing or reversing conversion of land from natural, semi-natural and extensive use to highly industrialized agriculture, and by reducing degradation of ecosystems
- making use of synergies and co-benefits between climate change mitigation, adaptation and ecosystem preservation.
- making intensification of land use sustainable by respecting ecosystem functions and limits of intensification to prevent damage, and by reducing pressure on natural land (land sharing and land sparing).
- implementing measures within agricultural production systems, e.g. crop rotation, intercropping, flower strips and integrated / biological pest management, diversification at field and landscape level, protection of riparian forests, and ecological disaster risk reduction.
- avoiding over-exploitation of semi-natural and natural systems (collection of natural products food and non-food, grazing, etc.) and developing sustainable use strategies.
- combining nature protection measures with intensive communication to better inform and involve local people.
- improving governance of natural resources and adapting schemes of ‚payments for ecosystem services' to local conditions.