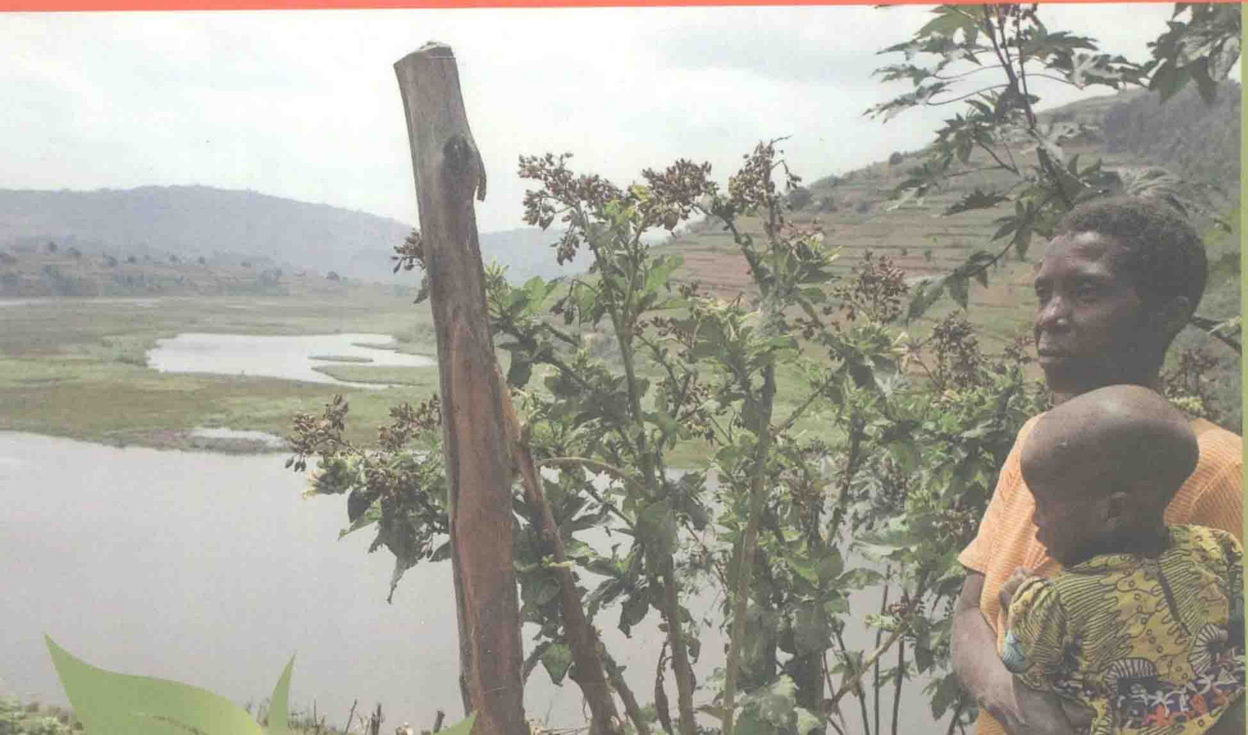
Peatlands - guidance for climate change mitigation through conservation, rehabilitation and sustainable use



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MITIGATION OF CLIMATE CHANGE IN AGRICULTURE SERIES

Second edition

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MITIGATION OF CLIMATE CHANGE IN AGRICULTURE SERIES 5

Peatlands - guidance for climate change mitigation through conservation, rehabilitation and sustainable use

Second edition

Hans Joosten, Marja-Liisa Tapio-Biström & Susanna Tol (eds.)

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Executive Summary

Peatlands provide many important ecosystem services, including water regulation, biodiversity conservation, and carbon sequestration and storage. To safeguard these services and mitigate climate change, these highly sensitive areas should be protected from further degradation. Peatlands and organic soils contain 30 percent of the world's soil carbon but only cover 3 percent of the Earth's land area. Fifteen percent of peatlands are drained and used for agriculture, grazing, peat mining and forestry, especially for bioenergy plantations. Including emissions from peat fires, these drained peatlands emit almost 6 percent of anthropogenic CO_2 emissions. This represents almost 25 percent of emissions from the entire land use, land use change and forestry sector. Once the peat carbon is lost, the losses are virtually irreversible. Peatland conservation, restoration and improved management are low-hanging fruit for climate change mitigation.

This report provides information on management and finance options to achieve emissions reductions and enhance other vital ecosystem services from peatlands. A decision support tree guides users through options for the management of both cultivated and uncultivated peatlands. The report also summarizes the methodologies and data available for quantifying greenhouse gas emissions from peatlands and organic soils. Practical approaches are presented concerning measuring, reporting and verification, and accounting of greenhouse gas emissions. Country-specific case studies illustrate the problems, solutions and opportunities associated with peatland management. This report is a handbook for policy-makers, technical audiences and others interested in peatlands.

10 elements of strategic action:

1. **Identify occurrence and status** (pristine, drained, abandoned, under productive use) of all peatlands worldwide.
2. **Improve assessment** of greenhouse gas emissions from peatlands. Improve methodologies for measuring, reporting and verifying (MRV).
3. **Conserve** all reasonably intact peat swamps.
4. **Prevent** further degradation of already degraded peatlands through a range of activities, including:
   - halting the intensification of artificial drainage in already drained areas;
   - installing hazard monitoring and mitigation schemes to avoid and restrain uncontrolled fires and soil erosion;
   - halting the expansion of agricultural practices that require drainage (shift land use activities currently carried out on peatlands, such as oil palm and pulpwood plantations, to mineral soils and practice paludiculture); and
   - halting uncontrolled, selective and illegal logging.
5. **Restore** degraded peatlands by rewetting, reforesting (in the tropics), and subsequent conservation or paludiculture. Restoration of peatlands reduces emissions, improves water regulation, benefits biodiversity and opens up other income options.
6. **Target** financial resources to peatland conservation, restoration and improved management.
7. **Stimulate and apply** existing and developing climate financing mechanisms on the compliance market (Kyoto Protocol, REDD+, NAMAs), the voluntary market (private sector investment in peatland rehabilitation) and from other sources.
8. **Support** local communities at the earliest stage and stimulate community development to overcome their opportunity costs and dependence on unsustainable peatland use.
9. **Ensure** that greenhouse gas criteria are integrated into credible certification and subsidy schemes for products derived from drained peatlands, including biofuels, palm oil, wood pulp, and other products from agriculture, horticulture and forestry. Each country that imports such products should review their domestic policies for these prodcuts.
10. **Share** experiences and expertise on peatland conservation, restoration and improved management among countries rich in peatlands and organic soils, especially those in need of capacity building.

This report provides guidance for these actions. The main strategies are:

- Secure undrained peatlands to prevent emissions.
- Rewet drained peatlands to reduce emissions.
- Adapt management of peatlands that cannot be rewetted.

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Acknowledgements

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Abbreviations and acronyms

AAU	**Assigned Amount Unit** The Units are issued to industrialized countries under the Kyoto Protocol in an amount equal to the caps they assumed.
Annex 1	**Annex I to the UNFCCC** Industrialized countries are listed in Annex I to the UNFCCC to differentiate obligations these countries have under the UNFCCC from those of developing countries. Most of the Annex I countries also agreed to binding caps under the Kyoto Protocol.
CAP	**Common Agricultural Policy** A system of European Union agricultural subsidies and programmes
CBD	**The Convention on Biological Diversity** An international legally binding treaty. The Convention has three main goals: conservation of biological diversity (or biodiversity); sustainable use of its components; and fair and equitable sharing of benefits arising from genetic resources.
CDM	**Clean Development Mechanism** Mechanism created under the Kyoto Protocol to finance climate mitigation projects in developing countries via creating CERs
CEH	**The Centre for Ecology & Hydrology**
CERs	**Certified Emission Reductions** Offsets created by CDM projects that can be used by industrialized countries to meet their emission reduction commitments under the Kyoto Protocol
CM	**Cropland Management** Type of activities that a country can choose to include in their LULUCF accounting under the Kyoto Protocol
CMP	**Conference of the Parties serving as the Meeting of the Parties** The annual UN conference and decision making body for the Kyoto Protocol
COP	**Conference of the Parties** The annual UN conference and decision-making body for the UNFCCC
CSA	**Climate-smart agriculture**
CUPP	**Conservation of Undrained or Partially drained Peatland** VCS project category that would cover for example activities to protect a peatland from being drained.
DO	**Domestic Offsetting** Mechanism to create domestic offsets in the EU under the EU ETS.
DSS	**Decision Support System**
ERU	**Emission Reduction Unit** Offset credits created by JI projects that can be used by industrialized countries to meet their emission reduction commitments under the Kyoto Protocol. ERUs are created by either converting an AAU or RMU into an ERU.
EU	**European Union**

EU ETS	**European Emissions Trading Scheme** Emissions trading scheme established in the EU.
FM	**Forest Management** Activities that involve the management of forests. This could include activities such as changing the logging rotation in a forest to increase the average carbon stock stored in the forest.
GCF	**Green Climate Fund** Climate fund and UNFCCC financial mechanism recently established under the UNFCCC to finance climate mitigation and adaptation.
GEST method	**Greenhouse gas Emissions Site Types method** The GEST approach is a method for assessing greenhouse gas fluxes from peatlands using vegetation and water level as a proxy.
GEF	**Global Environmental Facility** Facility to provide finance under UNFCCC and other environmental treaties (Convention on Biological Diversity, UN Convention to Combat Desertification, and Stockholm Convention on Persistent Organic Pollutants).
GHG	**Greenhouse gas** The six greenhouse gases / groups of gases listed in the Kyoto Protocol are Carbon dioxide (CO_2), Methane (CH_4), Nitrous oxide (N_2O), Hydrofluorocarbons (HFCs), Perfluorocarbons (PFCs) and Sulphur hexafluoride (SF_6).
GM	**Grazing land Management** Type of activities that a country can choose to include in their LULUCF accounting under the Kyoto Protocol.
IMCG	**International Mire Conservation Group** An international network of specialists having a particular interest in mire and peatland conservation.
JI	**Joint Implementation** Mechanism created under the Kyoto Protocol to finance climate mitigation projects in industrialized countries via the creation of ERUs.
KP	**Kyoto Protocol**
LULUCF	**Land use, land-use change and forestry** An umbrella term that covers a range of different types of activities affecting land, land use change and forestry, such as forest management, grazing land management etc.
M.a.s.l.	**Metres above sea level**
MICCA	**Mitigation of Climate Change in Agriculture Programme of FAO**
MRV	**Measuring, reporting and verification**
NAMA	**Nationally appropriate mitigation action** Action undertaken in developing countries to mitigate climate change under the UNFCCC.
NAPs	**National Adaptation Plans** National plans developing countries are to develop to support adaptation to climate change.

Non-Annex 1	**Developing countries** See explanation of "Annex I".
NTFP	**Non-timber forest products**
OTOP	**Polish Society for the Protection of Birds**
PRC	**Peatland Rewetting and Conservation** VCS project category that sets rules on accounting for emission reductions or removals from peatland rewetting or conservation projects.
RDP	**Rewetting of Drained Peatland** VCS project category related to projects that re-wet drained peat, e.g. by damming drainage canals.
REDD+	**Reducing Emissions from Deforestation and Forest Degradation** Topic being negotiated under the UNFCCC related to conservation and enhancement of forest carbon stocks and sustainable management of forests.
RMU	**Removal Unit** Units that are issued by Annex I countries if they generate net removals from their LULUCF accounting under the Kyoto Protocol.
SAC	**Special Areas of Conservation** Defined in the European Union's Habitats Directive (92/43/EEC), also known as the Directive on the Conservation of Natural Habitats and of Wild Fauna and Flora. The Special Areas of Conservation protect the 220 habitats and approximately 1000 species considered to be of European interest.
SSSI	**A Site of Special Scientific Interest** A conservation designation denoting a protected area in the United Kingdom. SSSIs are the basic building block of site-based nature conservation legislation.
SPA	**Special Protection Area** A designation under the European Union Directive on the Conservation of Wild Birds. Under the Directive, Member States of the European Union (EU) have a duty to safeguard the habitats (for example peatlands) of migratory birds and certain particularly threatened birds.
UNCCD	**United Nations Convention to Combat Desertification**
UNDP	**the United Nations Development Programme**
UNFCCC	**United Nations Framework Convention on Climate Change**
UNICEF	**The United Nations Children's Fund**
VCS	**Verified Carbon Standard** Voluntary market standard used to quantify emission reductions or removals.
WDR	**Wetland Drainage and Rewetting** Activities that a country can choose to include in its LULUCF accounting under the Kyoto Protocol.

Contents

Zoige Plateau, the largest peatland in the Tibetan Plateau (altitude 3 500 m), where eco-tourism has been developed by local communities.
Photo: Wu Ning

1. Introduction

Although the majority of peatlands are still in a natural state, many peatlands have been drained and degraded. They have been used for centuries for productive purposes such as agriculture, forestry, grazing and peat mining. Globally, the carbon dioxide (CO_2) emissions from drained peatlands (including emissions from peat fires) amount to two gigatonnes per year (Joosten, 2009a) and represent almost 25 percent of the CO_2 emissions from the entire land use, land use change and forestry sector (LULUCF) (Canadell, 2011).

Unlike the emissions associated with forest clearance, which are largely instantaneous, the emissions from drained peatlands continue for as long as the peatland remains drained and the peat keeps oxidizing. This can continue for decades and even centuries. Conserving, restoring and improving the management of organic soils and peatlands can substantially contribute to reducing atmospheric greenhouse gas (GHG) concentrations. Peatlands also provide other vital environmental services and contribute to food security and poverty reduction.

This report aims at providing countries rich in peatlands and organic soils with information on incentives for reducing emissions. The report also provides details on methodological guidance and available data on quantifying GHG emissions from organic soils and offers practical options for addressing the technical complications involved in measuring, reporting and verification (MRV) and accounting.

The information in this report was compiled by a team of expert authors from Wetlands International, the Mitigation of Climate Change in Agriculture (MICCA) Programme of the Food and Agriculture Organization (FAO) of the United Nations, Greifswald University, Climate Focus, ATLAS Environmental Law Advisory and the Michael Succow Foundation. These authors have contributed to different chapters in the report. This is the second amended edition of the report, which was first released in May 2012.

According to the Fourth Assessment Report (AR4) of the Intergovernmental Panel on Climate Change (IPCC), 14 percent of global GHG emissions are caused by agriculture. Another 17 percent of emissions come from land use change leading to land use systems that contain less carbon than the original natural ecosystems. Dangerous global warming cannot be avoided without emission reductions in the land-based sectors.

Agriculture is the driver for most of the changes in land use. The clearing of forests or grasslands for croplands, pastures or plantations, including biofuel crops, is one major example of agriculture-driven land use change. Demand for energy, which in many developing areas is based on wood, leads to further deforestation and forest degradation.

In order for the land use sector to contribute to the global effort to mitigate climate change, three actions are needed:

1. the avoidance of new emissions from land use change and consequent land use;
2. the improvement of management practices to reduce emissions from existing production systems; and
3. the sequestration of carbon through improved land use and management.

To achieve this, it is necessary to identify 'hotspots' areas where reducing emissions from land use can be the most effective. Other important societal goals, including ensuring food security and maintaining vital environmental services must also be considered. The Box 1 presents an example of efforts to manage sustainably the peatlands of Ruoergai Plateau at the foot of the Himalayas, which provide multiple ecosystem services for millions of people.

Obtaining food security is one of the main goals of the global community, national governments and individual households. Food security is a fundamental human right and a prerequisite for peaceful development. Climate change will affect all of the world's ecosystems, including agricultural ecosystems. For this reason, it is necessary to adapt land management and use to changing temperatures and rainfall patterns. If global average temperature increases by more than 2 degrees Celsius, it will be difficult to secure enough food for the global population, which is projected to increase to 9 billion people by 2050.

Peatlands and organic soils are an example of emission hotspots that we need to focus on to reverse increases in GHG emissions and prevent further dangerous, anthropogenic climate change. Peatlands and organic soils cover only 3 percent of the world's land area but contain 30 percent of its soil carbon (Parish *et al.*, 2008). Only 15 percent of the world's peatlands have been drained and used for agriculture, livestock and forestry, including bioenergy plantations such as oil palm (Joosten, 2009a). These drained peatlands, which make up 0.3 percent of the world's land cover, emit almost 6 percent of global CO_2 emissions (Joosten, 2009a). Organic soils are prevalent in many agro-ecological zones and ecosystems. These soils should be identified to establish suitable management programmes.

A priority is to conserve peatlands in their undrained state. Peatland conservation is one of the most cost-effective ways to stop increases in emissions. Given the limited area peatlands cover and the huge carbon stocks they contain, this a self-evident strategy that would benefit from a globally focused programme. Where natural peatlands have to be converted to productive use, land use options that are compatible with wet conditions (a practice referred to as paludiculture) should be developed and implemented.

Peatlands that are drained and currently used for agriculture or forestry should be rewetted. Rewetting is often easily done in areas where peatlands have been already abandoned due to severe degradation or where productivity is low. There are already good examples of opportunities, which build on traditional knowledge and new science, for developing sustainable livelihoods from rewetted peatland ecosystems. These opportunities include paludiculture and diversifying income sources through mechanisms such as payments for ecosystem services, climate change mitigation funding and tourism development.

Emissions from drained peatlands are of global significance and constitute a major part of national GHG emissions in many countries. Therefore, less damaging and more sustainable management practices have to be implemented in peatland areas that must be kept in productive use for agriculture, livestock and forestry. Management options for minimizing emissions, including fire control, should be identified. High water tables are essential for reducing emissions from cultivated and planted areas. Good practice guidelines should be developed for different agro-ecological zones and production systems. Reduced emissions through good practices could qualify as a practice-based mitigation action.

Chapter 2 of this report provides an overview of the most effective strategies for reducing emissions from organic soils according to their drainage conditions. The water table level in peatland is closely associated with the ecosystem services it can provide. Drainage causes most of the environmental problems related to peatlands. This chapter discusses management practices for avoiding or reducing these problems. The different management situations and options are summarized in a decision support tree for the management of peatlands and organic soils (Figure 2).

For peatlands under productive use, this report provides guidance on how to increase the sustainability of land use and outlines the opportunities, benefits and trade-offs of changing management practices. Chapter 3 offers details about finance options in the compliance market, the voluntary market and other mechanisms for reducing emissions and enhancing co-benefits through peatland conservation, restoration and sustainable use. Chapter 4 discusses the methodological guidance and data available for quantifying GHG emissions from organic soils. It also provides practical solutions for the challenges involved in accounting and MRV. Chapter 5 provides examples of the peatland distribution in countries with extensive peatlands. It also looks at the emissions generated from organic soils in these countries and opportunities to reduce these emissions and enhance other ecosystem services. The report is intended for policy makers, technical audiences and the general public.

Box 1: Ecosystem services of the peatlands of the Ruoergai Plateau (China)

The extensive Ruoergai (Zoige) peatlands on the eastern Tibetan Plateau are major interfaces between the Tibetan uplands and large lowland rivers. These peatlands, which serve as grazing lands, contain an estimated carbon content of 750 megatonnes (Björk, 1993) – a significant proportion of Chinese peat carbon resources. They are important reservoirs for biodiversity conservation, with numerous endangered and endemic species (Tsuyuzaki et al., 1990; Ekstam, 1993; Schaller, 1998).

Since early times, the peatlands on the Ruoergai Plateau have acted like sponges. They absorbed and retained water during periods of when water supplies were abundant and slowly released it in times of water deficit. In this way, the peatlands slowed down peak discharge, prevented erosion, reduced downstream flooding and guaranteed a steady supply of water to the Huanghe (Yellow) River – a water source that millions of people depend on.

The introduction of livestock grazing 5 000 years ago changed the character of the peatlands on the Ruoergai Plateau, making them more susceptible to erosion (Joosten et al., 2008). At the same time, a complex system of land management, which included sharing grazing lands and their rotational use, emerged as part of a unique cultural heritage. Not only in Ruoergai but also in the entire high altitude area of the Himalayan region, peatlands still function as grazing pastures for nomadic herders, especially when the peatlands are frozen or not waterlogged. Eighty percent of the peatlands on the Tibetan Plateau are grazed or browsed by domestic animals in winter and early summer. The herders prefer peatlands for grazing, because of the earlier plant growth, the higher productivity of forage, the better nutrient availability due to the diversity of forage species, and the availability of water for watering and cooling the livestock.

Peatland degradation increased dramatically with the construction of roads in the 1970s and the rising demand for food, fuel and rangeland. Overgrazing and the resulting decrease in the quality of pasture fuelled the demand for new rangeland. This led to increased pressure on untouched peatlands (Wiener et al., 2003, Wang et al., 2006; Gao et al., 2009), of which almost 50 percent were drained (Yang, 2000).

To increase milk and meat production, traditional husbandry was replaced by a more market-oriented economy. Collective livestock and pastures were divided and allocated to individual households. Pastures were fenced and more infrastructure was developed. Livestock numbers increased dramatically and migration routes of animals were blocked (Li et al., 1986; Long and Ma 1997), which aggravated overgrazing, peatland degradation and desertification. Peatlands in Ruoergai were leased to individual Tibetan herders, which has led to long-term conflicts between nature conservation and livestock grazing (Yan & Wu 2005). The more sedentary managing system brought about new challenges not only for pastoral development but also for peatland conservation.

During the last forty years the area of degraded peatlands has almost doubled, and less than 20 percent of the peatland remain in good condition (Schumann et al., 2008). Peatland degradation leads to increased GHG emissions, whereas moderate grazing may positively influence methane emissions and carbon sequestration (Chen et al 2008; 2009). For this reason, peatland restoration is considered a low-cost mitigation tool.

During the last decade, the ecological restoration of degraded rangelands and forage cultivation in winter pastures have been encouraged by the government to reduce grazing pressure on peatlands in spring. Additionally, several pilot projects by national and international organizations have supported peatland restoration in the Ruoergai Plateau by replanting vegetation (forage cultivation), rewetting (ditch blocking) and establishing co-management systems that involve multiple stakeholders for the many uses of rangeland resources.

In 2007 and 2010, to promote biodiversity conservation and enhance the livelihood of local communities, the Provincial People's Congresses of Gansu and Sichuan approved Wetland Conservation Regulations, which prohibit drainage, peat mining and the reclamation of peatlands. The regulations encourage local people and organizations to get involved in peatland restoration. They allocate 0.3 percent of its yearly budget to peatland restoration. Since 2008, the Chinese government has been working to establish a payment for ecosystem services (PES) mechanism, which would compensate local herders for reducing the number of livestock.

The Ruoergai example shows how sound peatland management can serve multiple goals. Currently, the peatlands provide irreplaceable grazing ground for thousands of yaks, horses and sheep that are central to the livelihoods of local herder families and provide the country with milk and meat. By keeping groundwater levels high, the peatlands maintain the productivity of upland rangelands. By reducing the speed of water flow, the peatlands retain sediments and provide a supply of good quality, well-filtered water. In addition, restored peatlands provide important soil carbon storage, and the reduced degradation leads to fewer significant CO_2 emissions.

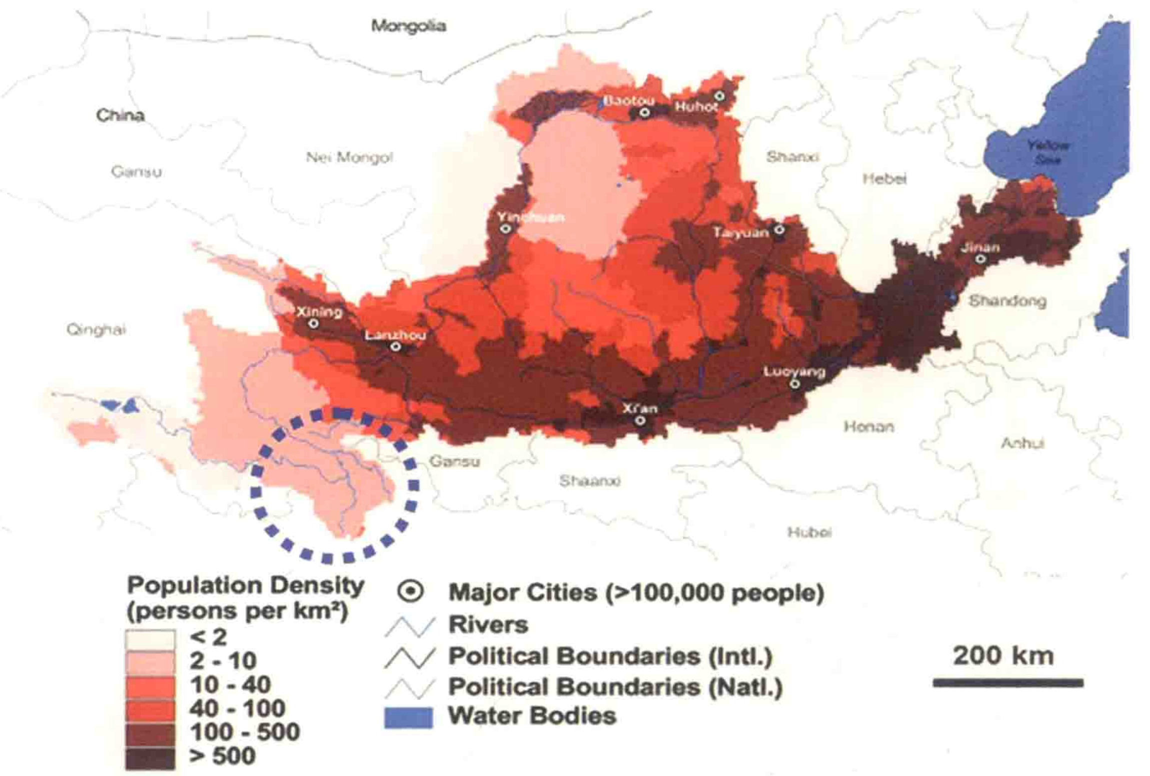

Figure 1. The Ruoergai peatlands on the Tibetan Plateau are crucial for regulating water supply to the lowland Yellow River basin. (Water resource eAtlas, AS09 Huang He (Yellow River), http://earthtrends.wri.org/pdf_library/maps/watersheds/as10.pdf)