Carbon Credits from Peatland Rewetting
Climate – Biodiversity – Land Use

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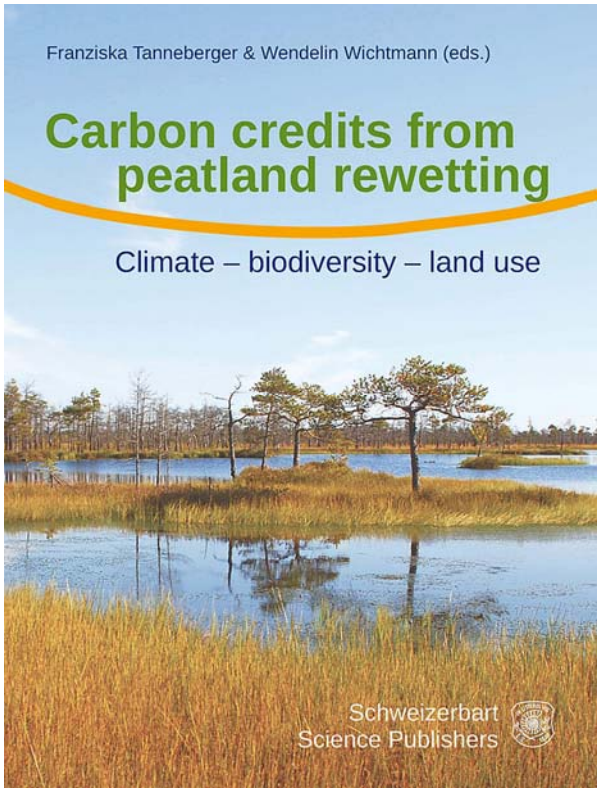

Peatlands cover about 3 % of the world's land surface, but they have been accumulating dead plant material as peat for millennia and now store some 550 Gt of carbon. During the 19th and 20th centuries, large-scale drainage of peatlands was carried out in many countries for land reclamation purposes. Most were taken into agriculture and forestry, and a smaller area was used for peat extraction. Drainage of peatlands leads to mineralisation of carbon and nitrogen from the peat, releasing the greenhouse gases CO_2 and N_2O to the atmosphere and thus contributing significantly to global warming. It is estimated that such land use induced changes are responsible for 6 % of anthropic CO_2 emissions, with well-known hotspots in south-east Asia (SEA) and central and eastern Europe (CEE).

It is also well known that rewetting of drained peatlands reduces their greenhouse gas emissions. Belarus, in the centre of the continent, has a higher proportion of peatland than any other European country (14.2 % of the land area), of which around half (1.5 million hectares) had been drained by the end of the Soviet era. Some small-scale rewetting initiatives were masterminded by Nikolai Bambalov starting in the 1970s, but it took the drought of 2002—when most of the drained peatlands burned—to convince the authorities that the problem was significant. Since that time, there have been large rewetting projects countrywide, funded from a variety of international sources. In addition to developing and applying rewetting and conservation management techniques, these projects have focused increasingly on establishing financial sustainability for peatland rewetting through the sale of carbon credits, which was first proposed at a conference of the Michael Otto Foundation (MOF) held in Minsk in June 2007.

This book arises from the three-year project "Restoring peatlands and applying concepts for sustainable management in Belarus – climate change mitigation with economic and biodiversity benefits" which was developed in 2008 by the Michael Succow Foundation (MSF), conducted under the auspices of the International Climate Initiative (ICI) of the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) and co-ordinated by RSPB (UK). It is written for a wide audience, from scientists and peatland site managers to decision makers and climate change politicians, by 44 authors whose contributions are mostly attributed individually and have been deftly assembled like a jigsaw puzzle by the volume editors. Key terms (e.g. mire, peatland) and other important concepts are explained in separate text boxes, and this enables the reader to utilise the book not only as a source of information about specific topics, but also as a textbook on peatland ecology and management.

After Forewords from three major sponsors (UNEP, the Minister of Natural Resources and

Environmental Protection of the Republic of Belarus, MOF), the Introduction (Chapter 1) explains the context of the project, and is signed by the chief executives of three NGOs (APB-Birdlife Belarus, RSPB, MSF).

Chapter 2 describes the extent, formation, typology, uses and condition of Belarussian peatlands, as well as the state of knowledge and experience in rewetting. All peatlands in Belarus are owned by the state and allocated to one of six 'peat funds'. Of these, the one that is most readily available for rewetting is the fund of extracted peat deposits (255,600 ha). Rewetting proceeds through stages of scientific justification, site selection, engineering planning, ecological and state expertise, and implementation. A gap in hydro-technical know-how for rewetting was filled in 2010 by the publication of a practical guidebook in both English and Russian.

Chapter 3 deals with peatlands and climate. First, the processes of greenhouse gas formation and controlling factors are clearly and concisely—but at the same time comprehensively—explained, and a global overview of peatland CO_2 emissions presented. Here, as in all other part of the book, the scientific information is up-to-date and knowledge gaps are identified. Then, methods for measuring gas emissions from peatlands are introduced. The text box explaining how the global warming potential (GWP) of a peatland site is calculated is especially valuable for students and scientists wishing to carry out similar calculations for other sites, but also demonstrates for decision makers and politicians the transparency and reliability of these calculations. The remainder of the chapter describes the GEST (Greenhouse gas Emission Site Type) approach for large-scale estimation of GWP which, despite a paucity of calibration data, already delivers more detailed assessments than the use of IPCC default values and, because it is founded on ecohydrological principles, has enormous potential for further refinement. It is based on utilising vegetation, which integrates the local site conditions, as a proxy for GHG emissions. Adding ecological knowledge on vegetation succession enables quantitative prediction of the development of GWP for individual sites under different management scenarios.

Chapter 4 focuses on peatlands and biodiversity—always a difficult topic as biodiversity is seldom a major investment driver for peatland restoration, but often the ecosystem service for which tangible gains can be most readily demonstrated. We soon forget to notice the lack of fires that otherwise might have happened, or the absence of greenhouse gas emissions that might otherwise have occurred; but we can hardly miss the abundance of nature on rewetted fenland. Departing briefly from her usually concise factual delivery in Box 13, Tanneberger quotes from an observation by one E. Hesse visiting similar fens near Berlin on a warm May evening in 1909, when he heard "the cawing of terns, the screaming of Lapwings, the piping of Redshanks, the yodelling of Godwits, the bleating of snipes, the trumpeting of Cranes, the booming of the Bitterns, the gobbling of Black Cocks, the whispering of Pipits, the whirring of *Locustella* warblers, the rattling and whistling of Aquatic Warblers, the plain song of the Whinchat …." There is emphasis on the Aquatic Warbler (*Acrocephalus paludicola* Vieillot 1817), which is the only globally threatened songbird of mainland Europe. Fens in Belarus provide breeding habitat for 40 % of the current world population. This bird's unusual behaviour, with 75 % of broods fathered by two or more territorial males and all cared for exclusively by their mothers, makes it an umbrella species for the habitat whose presence indicates satisfactory functioning of the whole supporting ecosystem. This chapter performs a 'textbook' function that will be especially valuable for site managers, by providing a review of methods for evaluation and monitoring of peatland biodiversity drawn from various sources including the Brooks & Stoneman *Bog Management Handbook*, the Schumann & Joosten *Global Peatland Restoration Manual* and the recent *Fen Management Handbook* by McBride *et al*. From the interesting illustrations in text boxes we learn that arthropod abundance is still suppressed in peatland that was rewetted to reduce radionuclide release after the 1986 Chernobyl accident, and about the biodiversity trajectory for Poplau Moch where recovery of former bog characteristics after rewetting is precluded by the fact that it has been mined down to a fen peat layer.

Under the slightly mysterious title "Driving forces and funding options", Chapter 5 explores the maze of policy developments that have created the potential for financing peatland rewetting by trading carbon credits. It begins by outlining the legal obligations of landowners in Belarus to 'recultivate' worked-out peat mines. Nature conservation became a legitimate after-use only in 1997, but for the last 15 years has been the one most usually implemented. The peatland is rewetted in preparation for transfer to the forest fund. However, in practice, many 'depleted' sites are simply abandoned for financial reasons. The next section, from Hans Joosten, summarises the 'long and winding road' through the Ramsar Convention, CBD and UNFCCC to establishing peatland

rewetting as an accountable activity under the Kyoto Protocol, that was embarked upon in the 1990s and still has a little way to go. But, he concludes, peatlands have now arrived in the UNFCCC deliberations and they are there to stay. The intricacies of carbon trading mechanisms are then explained. Wetland projects "were up to now" completely absent from the voluntary market, and because accounting for land use activities that might involve peatland rewetting remains non-mandatory under the Kyoto Protocol (and Belarus has not yet elected to include any relevant activities in her national accounts), it seems that we have not yet reached a point where the compliance market could be used to finance rewetting projects either. A description of how an emission reduction project in Belarus would be presented to the voluntary market does much to clarify how the procedure should work in practice. However, perhaps it is not made completely clear until Section 7.8 that peatland carbon credits were actually ("eventually") sold—for the first time ever—under the auspices of the BMU-ICI project.

Chapter 6 discusses land use options for rewetted peatlands. There is a box devoted to the potential for peatland tourism in Belarus; and harvesting of medicinal plants, berries and fungi is explored. However, the chapter's main focus is paludiculture—which is the sustainable commercial cultivation of biomass on wet and rewetted peatlands. The constraints are that the peat layer should remain sufficiently wet that it is conserved, and that the system is peat-forming. The 80–90 % of net primary production (NPP) that would decompose rather than be incorporated into the peat layer may be harvested and utilised. The range of potentially exploitable plant species able to thrive under high water table conditions is limited, but includes *Sphagnum* (an effective substitute for 'white peat' in horticultural growing media), black alder *Alnus glutinosa* (for timber and high-quality furniture) and large wetland monocots including common reed (*Phragmites australis*), reed canary grass (*Phalaris arundinacea*), cattail (*Typha latifolia*, *T. angustifolia*), reed sweetgrass (*Glyceria maxima*) and great pond sedge (*Carex riparia*). The main candidates for cultivation in Belarus are the reeds (*Phragmites*, *Phalaris*) and detailed information is given about harvesting and utilisation for energy production. There are advantages for GWP, in that avoided greenhouse gas emissions are estimated at almost 30 t CO_2-eq ha^{-1} $year^{-1}$; for biodiversity, in that management is or can easily be made compatible with habitat requirements for other wetland species including the Aquatic Warbler; and economics, in that enterprise based on wetland species avoids substantial costs that presently dictate the ongoing need for society to heavily subsidise conventional agriculture (e.g. meat production) on drained peatland.

Chapter 7 is devoted to the BMU-ICI project. The first two pages give potted descriptions of the seven project partners—who they are and what they do. Achievements of the project are then listed as:

- rewetting of 14,000 ha of peatlands;
- development of an international peatland carbon standard (VCS) and an internationally approved baseline and monitoring methodology for peatland rewetting and conservation;
- assessment of GHG emissions and biodiversity values at project sites before and after rewetting;
- promotion of the objectives and results of the project;
- demonstration of sustainable management of peatlands by using plant biomass for fuel production;
- capacity building for Belarussian scientists; and
- development of a twin project in the Ukrainian part of the transboundary 'Paliessie' (Polesie/ Pripyat) wetlands.

Then, an account of long-term project impacts is followed by sections on project actions in: site selection and rewetting, climate, biodiversity, policy, and communication and capacity building. In the fourth of these there is a small tribute to Vladimir Tarasenko, who was heading the Belarus delegation at the 2009 UNFCCC meeting in Bonn when he passed away suddenly although only in his early forties. Lessons learned are also covered, and the chapter ends with information about the twin project in Ukraine—which began late in 2009 and has encountered very different organisational issues because the focus peatlands are mostly privately owned in small parcels.

Chapter 8 describes the practical rewetting work carried out at the nine Belarussian project sites. For four of these, the descriptions take the form of short summaries only. For the remaining five—three bogs in northern and central Belarus, plus one fen in the north and another in the south—detailed accounts and maps are given. A similar treatment is afforded to the 'most beautiful' Jelnia Mire which provided the picture for the cover of the book but was restored within two other APB-Birdlife Belarus projects. As might be expected, the demonstrated biodiversity benefits are generally more convincing than those for carbon at this early stage; for example, work at Dalbeniski peatland did not begin until late 2010 and, at the time of writing, completion of the construction works was expected by July 2011. As also noted for the project in Ukraine, at least some of the peatlands were

previously abandoned and had developed some tree cover, and so did not strictly comply with all of the site selection criteria (notably Criteria 4 and 7) given in Section 7.2 for projects aimed at generating carbon credits. On the other hand, life in practice is never perfect and it could be extremely difficult to find available pilot sites that totally lacked such attributes.

Chapter 9, entitled 'Recommended research and monitoring activities in rewetted peatlands', looks to the future. Gaps in the GEST model are identified and plans are outlined for its further development into six modules GEST-HERB, GEST-WATER, GEST-FOREST, GEST-TRANSIENT, GEST-FIRE and GEST-PREDICT, each employing a different proxy for GHG fluxes depending on the field situation. The differences between research and monitoring are explained. Alongside monitoring of GHG emissions and proxies, demonstrated biodiversity benefit is flagged as an attribute that improves the attractiveness of peatland rewetting and could enable the generation of premium-priced carbon credits. The final paragraph echoes a familiar plea for safe storage and open-access availability of data to avoid pointless 'continuous re-invention of the wheel'.

Chapter 10 acknowledges the partners and authors who contributed to both the project and the publication. It is followed by lists of references and contributors, and an index.

The book is attractive, and printed on good-quality paper with running headers identifying the section number and topic throughout. It is also quite reasonably priced, in both the English version and the simultaneous Russian edition which is advertised on the final page. The 11″ × 8″ (28 × 21 cm) format—just a little shorter than A4—makes for a slim volume with large illustrations and user-friendly text boxes. To limit the number of colour-printed sheets, the colour Figures are gathered into four-leaf bundles following pages 20, 52, 116 and 156. In these, the 'jigsaw puzzle' goes slightly wrong in that consecutive numbering of Figures is demoted in favour of achieving an arrangement that fits neatly onto the pages. As there is no index of Figure numbers, brief searching is needed to locate some of the illustrations as one is referred to them by the text. There are a few scattered typos; also, although the authors / editors have excellent English, some Germanic word-orderings have survived. It may be that parts of the text have been harvested from interim reports without full updating to the end of the project; but this seems an almost-inevitable penalty of the impressively timeous publication, which was achieved within the project's three-year timeframe. Overall, everything is clear, or becomes so fairly quickly, and the whole is very readable.

This is a massively important publication, in that it teases out and clarifies practical linkages between the 'old' topic of peatland restoration and 'new' directions in high-level policy development, such that we begin to see a route towards simultaneously satisfying the principles of environmental and economic sustainability in peatland management. Despite their larger carbon stocks and longer carbon cycles, peatlands received much less attention than forests in the development of thinking about the management of terrestrial carbon for climate change mitigation, largely because they were more 'difficult'. Here we have the whole story of persistence and innovation that was needed to restore this Cinderella once again to her rightful position of visibility. Or, invoking some of the famous words of UN Under-Secretary General Achim Steiner from 2007, it brings peatland protection and restoration—as a key "low hanging fruit" for cost-effective climate change mitigation—finally into the banquet hall. As a clear account of the issues and how they can be addressed at all levels, this book should be read and built upon by politicians and policy-makers, by environmental practitioners, and by every established and intending peatland science specialist.

Olivia Bragg and Michael Trepel, February 2013