Restoring Peatlands and Applying Concepts for Sustainable Management in Belarus

An analysis of project implementation and cost-effectiveness

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Disclaimer

The study aimed to investigate projects using an ecosystem-based approach either to climate change mitigation and/or adaptation in terms of their objectives, project set-up and implementation, barriers experienced and costs and benefits.

This case study has been carried out as part of the research study "Assessment of the potential of ecosystem-based approaches to climate change adaptation and mitigation in Europe" alongside four other case studies. The research project was commissioned by the European Commission, DG Environment (Contract no. 070307/2010/580412/SER/B2). The final report will be made available by the European Commission by the end of 2011 and was prepared by Ecologic institute and Environmental Change Institute, Oxford University Centre for the Environment.

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1 Summary

This report presents an analysis of the ongoing Belarus Project, which explores the potential of carbon emission reductions from rewetting degraded or depleted peatland located within the Belarusian territory and the opportunity to trade credits representing these reductions in a voluntary carbon market. Peatland rewetting as applied in the Belarus Project represents an ecosystem-based approach to climate change adaptation and mitigation and is approached in this report as such.

Several factors which can greatly influence the success and political/public acceptance of ecosystem-based approaches have been analyzed, such as the project set-up, stakeholder involvement, awareness raising activities and monitoring frameworks. These aspects can, however, also present difficulties and require targeted measures to be overcome. Challenges to and key factors in ensuring successful project implementation are thus outlined within the context of the Belarus Project.

Additionally, an assessment of costs and benefits associated with the project has been conducted. An initial analysis suggests that the approximate cost of avoiding a tonne of CO_2 emissions within this project is €7.11, but that a large portion of incurred costs will decline over time after the initial investments and re-wetting measures have been implemented. On the benefits side, carbon emissions reduction via sequestration and storage are estimated at 2.9 t CO_2/ha/year. In addition to mitigation, the project also contributes to climate change adaptation through micro-climate regulation, soil degradation prevention, water regulation and retention and peat fire prevention.

Several overarching considerations applicable to ecosystem-based approaches more generally are also presented, based on the findings of the European Commission project “Assessment of the potential of ecosystem-based approaches to climate change adaptation and mitigation in Europe” (service contract no. 070307/2010/580412/SER/B2), of which the Belarus Project comprises one of five explored case studies.

2 Characterization of the project

The Belarus Project outlines the potential of carbon emission reductions from rewetting degraded or depleted peatland located within the Belarusian territory. By assuring these emission reductions are verifiable and thus tradable in the voluntary carbon market, the initiative proposes a self-sustainable scheme, which integrates the provision of restored habitats for local/endangered species with the increase of carbon storage capacity in Belarus. Habitat restoration also helps to re-establish basic ecosystem functions and create ecological corridors and reservoirs allowing for the migration of species and the enhancement of their populations. The project further delivers social, cultural and economic benefits to the government and local communities by enhancing the capability of Belarusian ecosystems to provide goods and services in a sustainable manner.

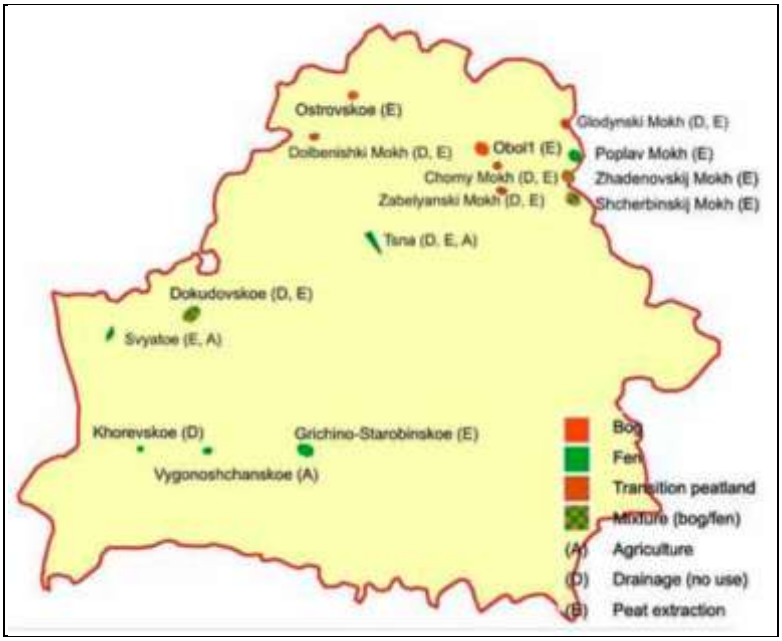

Figure 1: Current and potential project sites (map prepared by A. Thiele)

Source: Wichtmann and Tanneberger (2009)

Initially planned from September 2008 to July 2011, the project has been granted an extension until December 2011 in order to fulfill the project objectives and enhance the procedures for the monitoring of results. To date, six of the 10 designated restoration sites have already implemented measures and are being monitored for further evaluation by project partners (see Figure 1 and Table 1).

Table 1: Overview of the project sites

Site Name (BY)	Site Name (RU)	Area (ha)	Implementation	Works financed by KfW	Current Status	Cooperating organization
Hryčyna-Starobinskaje	**Grichino-Starobinskoe**	3,505.0	2009	Construction	Rewetted	UNDP/GEF
Obal'	**Obol**	1,096.8	2009	Construction	Rewetted	UNDP/GEF
Poplaŭ Moch	**Poplav Mokh**	414.6	2010	Engineering design and construction	Rewetted	UNDP/GEF
Žadzienaŭski Moch	**Zadenovsky Mokh**	753.3	2010	Engineering design and construction	Rewetted	UNDP/GEF
Ščarbinski Moch	**Shcherbinski Mokh**	1,322.8	2010	Engineering design and construction	Rewetted	UNDP/GEF
Ostrovskoje	**Ostrovskoe**	773.1	2011	Construction	Eng. plan developed	GEF SGP
Dakudaŭskaje	**Dokudovskoe**	1,945.8	2009	Engineering design	Rewetted	GEF SGP
Horėŭskaje	**Khorevskoje**	190.5	2011	Engineering design	Contract to be concluded	GEF SGP
Žhada	**Zhady**	3,380.0	2011	All	Eng. plan developed	KfW
Dalbeniški	**Dolbenishki**	5,501.0	2011	All	Eng. plan developed	KfW
	Total	**18,882.9**[1]				

Source: Adapted from table in Rewetting Peatlands website (last visited in June 2011).

Project background and initiation

Peatland covers approximately 2.4 million ha of the Belarus territory[2]. Given that around half of this area has been affected by drainage and peat extraction activities, the fragmentation suffered by these damp habitats and their local species has been extensive. This need promoted an earlier peatland restoration initiative undertaken and funded by the United Nations Development Programme (UNDP) and the Global Environment Facility (GEF), which triggered further interest in continuing such efforts. Based on the achievements of this initiative and the need to control peat fires, the Belarusian Government started discussions with NGOs to enhance peatland restoration at a large scale, but no wider strategy has been developed or established.

Based on this background, the project was undertaken by an international consortium of environmental organizations from the UK, Belarus, and Germany[3] with an overall budget of €2.5 million. The partnership includes the Royal Society for the Protection of Birds (RSPB), Akhova Ptushak

[1] According to internal documents (i.e. quarterly reports) the Ostrovskoje, Dakudaŭskaje and Horėŭskaje sites are not counted towards the total rewetted area of the project (in the case of the last two, the reason for this is not explained in the document and no answer was obtained from the contacts). Nonetheless, the website still shows all sites except Ostrovskoje as part of the project.

[2] International Peat Society. Available on http://www.peatsociety.org/index.php?id=101. Last visited on 10.08.2011.

[3] The project is financed by the Federal Republic of Germany through KfW Entwicklungsbank in the framework of the International Climate Protection Initiative of the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU). The BMU is the funding organisation, while KfW functions as an organ through which the finances reach the chief project partner of the consortium (RSPB). The RSPB is then responsible for the administration of the finances based on the annual budget plans proposed by each of the partners.

Batskaushchyny (APB) - BirdLife Belarus, and The Michael Succow Foundation (MSF). These organizations combine their experience in peatland restoration and management with an innovative methodology to assess carbon emissions from such ecosystems. In their function as restored natural connectivity areas, rewetted peatland sites become part of the green infrastructure network of Belarus.

Accordingly, the key project objectives are to: (1) rewet 14,000 ha of degraded peatland, (2) quantify greenhouse gas (GHG) emissions from degraded and re-wetted sites, (3) increase carbon storage in re-wetted sites, (4) increase the number and abundance of wetland species and (5) develop a framework that allows for the sustainable use of peatland (Restoring Peatlands, 2010a). Further, the project will also evaluate the possibility to enter the regulated market in 2012+ with credits from the undertaken peatland restoration.

It is important to mention that site selection is a crucial step which takes place prior to the implementation of project measures. The process includes criteria such as alternative land use scenarios and peat layer degradation level in an effort to decouple the project's objectives and actions from the interests of specific stakeholders, like agricultural organizations or peat extraction companies.

Overview of project achievements to date and secondary effects

The initial project goals have been achieved to a great extent and new ones have been set. Progress is being made following the project schedule, as the project is still ongoing. A cost-neutral extension (i.e. a prolongation of the project's activities without requiring additional funding from the sponsor) has been agreed upon and new interest has been sparked in investing in peatland rewetting initiatives. Further, the need has been highlighted for an integrated and self-sustainable framework which addresses: (1) the extensive CO2 emissions from degraded peatland; (2) the loss of biodiversity and ecological balance in such degraded sites; and (3) the costs and suffering resulting from recurring peatland fires. More generally, the project benefits local communities through improvements in their quality of life, new economic activities (cranberry and blueberry gathering, fishing, hunting) and tourist and recreational areas as well as the Ministry of Environment, Ministry of Forestry, forestry enterprises (e.g. for the reduction of peatland fires and fire-fighting costs).

Furthermore, the analyzed case study has been both influenced by and influential on Belarus's natural reserves and protected areas legislation and peatland management and protection regulation. The project triggered e.g. the recent establishment of a piece of legislation on peatland protection in Belarus, which could set the foundation for the development of an international peatland conservation regulation. It was also mainly responsible for the adoption of the Verified Carbon Standard (VCS) in Belarus and the inclusion of peatland rewetting and conservation activities in the latest version of the standard (Restoring Peatlands, 2010c).The project has also influenced national and regional spatial planning by its restoration work, which could lead to the declaration of the restoration sites and their surroundings as national reserves or protected areas.

On-the-ground results of the project are also notable. To date, six depleted/degraded peatland sites have been successfully restored, amounting to over 9,000 ha of restored land. The ecosystems in these territories are now in the process of re-establishing their functions and some are starting to yield ecosystem (ES) services like food provision, microclimate regulation and landscape

enhancement, amongst others. The water level and the vegetation in the rewetted sites are being closely monitored both to maintain the ongoing restoration process and to assess the levels of greenhouse gases (GHG) being emitted. Important progress has also been made in the development of a regulatory framework that sets the bases for the sale of emission reduction certificates from peatland restoration in Belarus. The funds emerging from this trade are to serve as a "revolving fund" that will allow for the restoration of the remaining degraded peatland sites in the country. Several secondary effects, both positive and negative, have also emerged and are listed below.

Table 2: Secondary project effects

Positive effects	Negative effects
Increased awareness on the importance of restoring and maintaining proper peatland conditions	Opportunity costs arising from the constrained use of sites for peat extraction, mass production of food or biomass
Reduced incidence of peatland fires (and thus reduction of financial and human resources needed to fight them)	Increased dependency on coal and other fossil fuels while peat briquettes are an eco-friendly substitute
Secure funding for peatland restoration through the sale of carbon credits	Pressure exerted on the peat industry (extraction and processing) affecting employment rates and social security
Validation of the country's support to international conventions for climate change (UNFCCC), for biodiversity conservation (CBD) and against land degradation (UNCCD)	Limited ability to cover energy demand with local resources (which is required by regulations)
Transfer of knowledge and technology from abroad	
Enhanced ecological education in local communities	
Enhanced aesthetic characteristics of the landscape	
Increased attractiveness for tourism and recreation	

Source: own elaboration. Based on the interviews conducted during the mission in Minsk, Belarus. June 2011.

Climate change impact(s) addressed and relevant measures/actions

The project additionally addresses the following climate change relevant aspects, namely:

- Drainage and/or degradation of water bodies, depletion of water resources
- Increased erosion
- Increased salinisation and risk to water quality
- Ecosystem/habitat degradation
- Biodiversity loss
- Migration, differential social impacts

These aspects are addressed via the following actions/measures for climate change adaptation (A) and mitigation (M):

- Ecosystem conservation and restoration (A)
- Ecosystem services maintenance and enhancement (A) - e.g. monitoring of water table levels to restore the target vegetation)

- Natural infrastructure conservation (A)
- Reducing threats to biodiversity (A) - e.g. reducing habitat fragmentation, degradation, and loss
- Key habitats management (A) - e.g. for bird species like the aquatic warbler, great spotted eagle, white egret and black grouse
- Reservoir endowment (A)
- Carbon sequestration (M)
- Terrestrial carbon stores conservation (M)
- Bioenergy (M) - e.g. development of paludiculture[4] and planning for a biomass briquette production facility

[4] Paludiculture: The productive utilization of rewetted peatlands for climate and environment relief, renewable energy resource production and rural area development. For more information see: http://www.paludiculture.com/index.php?id=35

3 Ecosystem-based approach

The ecosystem-based outlook revolves around the ecosystem, making it the starting point when designing solutions. The understanding of the term 'ecosystem-based approach' varied amongst interviewees, but can generally be summarized as "a means of addressing environmental challenges from the perspective of ecosystems themselves, thereby facilitating the conditions that would "permit ecosystems to restore, maintain and support their natural processes." Measures resulting from adopting such an approach were differentiated as (1) aiming towards physically modifying the ecosystem or (2) stopping its alteration.

The perspective offered by the ecosystem-based approach was found to give its employer the ability to evaluate options from a holistic point of view, considering not only a segment of the system in study (in terms of space, sector or problem type), but also the direct/indirect effects that different scenarios and measures could have on related or surrounding systems. This characteristic of integration, combined with the rising need for views that decouple environmental protection and economic sustainability (e.g. rewetted peatland deemed as a system providing raw materials and biomass for the production of pharmaceuticals and energy, respectively), is what has made ecosystem-based approaches appealing when it comes to changing paradigms.

The ecosystem-based approach as relates to peatland rewetting was described as the restoration of services and functions of peatland by utilizing a solution that is complementary to the ecosystem. In the case of this project, this comprises the restoration of all basic biosphere functions of the peatland to a semi-intact state. This includes the conservation of the peat layer (when it still exists) and the restoration of the hydrological regime, the vegetation type, and the fauna native to these forms of wetlands. This is done by restoring the peatland's water table to its optimal level through the introduction of solutions in line with the ecosystem (i.e. dams, reservoirs and control devices) that maintain the stability of the hydrological conditions. The overgrowth of forests in some of the raised bog sites is perceived as an element of green infrastructure which will provide resources for forestry, game, etc. in the future.

Implementing ecosystem-based approaches – initial insights

The rewetting of 6 sites has already been undertaken as part of the project in the last two years. The specific case of the Dakudaŭskaje site shows substantial progress in terms of the restoration and maintenance of the peatland's hydrological regime, which has, in turn, had positive effects in the restoration of natural habitats for local biodiversity. According to the representative of the forestry authority responsible for the management of the site, the return and establishment of typical peatland flora[5] and fauna[6] has been gradually developing since the rewetting of the site in 2009. This has had positive effects for activities like berry picking, fishing and hunting, which were either non-existent or had reduced in significance in the area.

[5] e.g. siege, moss, sphagnum, reed

[6] e.g. beaver, grouse, duck, white egret

That the effectiveness of such an approach in achieving the specific objectives of this project have been found to increase substantially when combined with engineered approaches.7 The earlier adoption of approaches that were 100% ecosystem-based proved to be effective only in smaller areas of land, whereas the combined approach that has been utilized during the past two years allows for the coverage of greater land extensions at reduced costs.

Adopting an ecosystem-based approach requires more precise planning and control of the water table levels. For instance, a rewetting project whose only objective would be to prevent peatland fires without any considerations for biodiversity restoration would not regard high water levels to be a hindrance in achieving the project's goal. Rewetting the site would be sufficient to keep the fires from taking place. In contrast, the project being analyzed in this case study pursues objectives of carbon sequestration, peat fire incidence reduction and biodiversity restoration. In order to achieve these multiple objectives, it is necessary not only to rewet the site, but also to control the water levels, since both scarcity and excess of water can impede the proliferation of specific vegetation types (e.g. native species).

For biodiversity, the positive effects after the first months of the rewetting are clearly visible. This is particularly noticeable in Dakudaŭskaje where the growing vegetation and fauna contrasts with the complete lack of plant and animal populations in the neighboring peat extraction site. Some bird species like Bluethroat, Water Rail and Spotted Crake appeared at the site for the first time in 2011, while the population of cranes has gone from one pair to two pairs.

Regarding the mitigation of climate change, the methodology to be used for monitoring GHG emissions is currently being adapted to the specific conditions in Belarus, and thus positive results in this rubric are predicted, but are yet to be quantified.

The protection of project sites by their designation as local reserves has also been found to be crucial to making progress and ensuring the sustainability of the site development. The reason for this is that, once declared protected, the area becomes non-eligible for peat extraction activities. Finally, the importance of awareness and understanding of the approach by the local government and community was recurrently mentioned as being especially relevant to project success.

In summary, the following advantages of using an ecosystem-based approach were identified:

- Provides the ability to target multiple objectives (e.g. climate change mitigation, peat fire control and biodiversity conservation) simultaneously by controlling various factors under a single approach;
- Helps to increase the knowledge and understanding of peatland ecosystems, the differences each individual site presents, and how to better manage them in a changing environment;
- Raises awareness and enhances the visibility of the services provided by ecosystems in the local community's and government's perspectives;
- Ensures the sustainability of the restoration efforts (this would not have been possible without actively considering the dynamics ruling the entire ecosystem);
- Permits the development of independent, self-regulating areas/habitats;

[7] For instance, the process employed to determine the optimal water table level in the project sites and the design and construction of dams were considered engineered solutions employed by the project.

- Allows for the planning of actions on a local level that have global scale effects and clarified the relations between them.

Other initiatives using ecosystem-based approaches in the region

A similar peatland rewetting project was conducted by the UNDP and GEF in Belarus in 2006. The main objective of the initiative was to mitigate climate change through the restoration of peatland; nonetheless, it did not include the establishment of a mechanism for the selling of emission reductions. Cooperation between the projects has been extensive, to the point that the project manager of the UNDP/GEF project, Ms. Olga Chabrouskaya, is since 2011 project manager of the new project.

The Institute of Nature Management of the National Academy of Sciences and the National Center for Bioresources are both Belarusian organizations that have employed ecosystem-based approaches in the past. Some of these efforts have been made specifically to restore the ecosystem services provided by peatland. The consortium has worked closely with these organizations during the course of the project.

Furthermore, similar efforts are being undertaken in countries like Germany, Ukraine, Poland and Russia. Although the two projects are managed independently from one another, there are strong links between the Belarusian and the Ukrainian initiatives. These links refer mainly to the sharing and transfer of experiences and technology.

4 Project implementation, barriers and success factors

Management structures and stakeholder involvement

Although the number of entities and organizations involved in the project is considerable, the management structures have been kept simple to avoid inefficiency (see table 3). A steering committee comprised of the RSPB, APB, MSF, UNDP, the Academy of Sciences in Belarus and the Ministry of Natural Resources and Environmental Protection of Belarus convenes periodically to engage in the planning and strategic decision-making processes. The agreements reached by the steering committee are then turned into project tasks administered by the project manager and executed by the experts, who are organized in a modular structure and work directly with consultants and service providers.

Accordingly, the project is divided into 7 specialized modules which are focused on the different areas of the project. Each module has an appointed leader and clearly defined activities and responsibilities. Such a structure has made planning and progress tracking easier and has had positive impacts on the efficiency of the project tasks.

Table 3: Project Structure

Structural Level	Element	Function
Strategic level	Steering committee	Strategy and planning
Management level	Project Manager	Mission administration and coordination
Operational level (specialized modules)	Carbon/Climate Module	Monitoring of carbon emission reductions and preparation of the documentation required for the sale of emission reduction certificates
	Rewetting Module	Preparing and executing practical measures for the restoration of the selected project sites
	Biomass Module	Management of biomass production, including the establishment of a biomass briquette production facility
	Administration Module	Preparation of annual audits and reports and the management of funds
	Biodiversity Module	Observation and periodical reporting on the development of birds and other species within project sites
	Communication Module	Contacting external audiences i.e. media, stakeholders
	Capacity Building Module	Sharing of knowledge and experience within the project

Source: own elaboration. Based on interviews conducted during the mission in Minsk. June 2011.

Initially, the project lacked a management structure in Belarus; all of the administration tasks were based in Germany and Britain. This created hurdles for the organization and administration of the project activities, especially given the variety and level of specialization of such activities. After this phase, which lasted roughly one year, the administration of the project was restructured and divided it into the seven specialized modules mentioned above. Each module has a coordinator responsible for the management and fulfillment of its activities. This allowed for an extended presence of the consortium in Belarus and more efficient task administration.

Numerous additional stakeholders were also involved in the planning/development and implementation process of the project, including:

- **NGOs** and the environmentalist community (e.g. RSPB, APB, MSF): transfer of knowledge and technology as well as the strategic planning and administration of project activities.
- **Local enterprises** (i.e. forest enterprises, agricultural enterprises, construction companies, engineers): in the design, development, support and sustainability of implemented measures at the local level, including maintenance and repairing activities as well as facilitating access to the sites.
- **Local community** (individuals, schools): in raising the local understanding of peatland ecosystems and in disseminating and adopting new attitudes towards them.
- **Academic and scientific institutions** (Institute for Peat, Bio-resources Institute): in providing the local expertise required for the implementation of measures and the resources for building capacity in Belarus.
- **Government** (Ministry of Agriculture, Ministry of Environment, Ministry of Forestry): in facilitating the use of the land and opening a multi-level communication channel.
- **Beltopgaz** (overlook the peat industry in Belarus), peat extracting and processing companies, all Belarusian citizens: in participating in workshops and other events to raise awareness on the effects of peatlands on biodiversity and climate change.

Instruments for project implementation

Among the instruments used to implement the project was the communication of information to both the public and to stakeholders. In terms of raising public awareness, a strong effort has been undertaken to organize events, workshops and conferences as a means of showcasing the project to both national and international audiences. The effectiveness of so-called 'field seminars' was also emphatically mentioned. These seminars take place in the project sites and involve local stakeholders (i.e. local community, local authorities and forest enterprises). Furthermore, on-site information boards containing general data on the details and purpose of the project were set-up. These activities were further supported by the construction of a website, the distribution of leaflets and handouts and the organization of a photo exhibition in one of the main museums in Minsk.

Another instrument, research and monitoring, is still underway, mainly focusing on the adaptation of the carbon emission assessment model in Belarus. Once this adjustment period is over and reductions in the emissions of CO2 start to be soundly quantified, the trading of carbon emission credits in the voluntary market will be used as a funding instrument for the restoration of peatland that is still in degraded or depleted status.

Additionally, regulative instruments could be considered in the sites where areas have been reserved or protected and thus now have a different status in the spatial planning of the region in which they are located.

Monitoring

Monitoring activities were included in the project plan since the inception stage, focusing on the reduction of GHG emissions and on biodiversity levels (concentrating specifically on the local vegetation and bird populations). No monitoring of the socio-economic impacts of the project has been undertaken to date.

In the planning stage of the approach, the actual state of the site is outlined and the desired post-implementation state is proposed. Target water table levels are set with the intention of optimizing the process of biodiversity restoration. An effective primary tool of prediction used in this stage is mapping, which helps to characterize the site and its biological community. This information is then used to identify the target biotope desired for the site in the future. Monitoring results in this area will be used to draw conclusions and comparisons to enhance conservation strategies.

In assessing of the amount of CO2 captured, the Greenhouse Gas Emission Site Type (GEST) model developed in the University of Greifswald in Germany is being adapted to meet the specific conditions in Belarus. This model uses vegetation type as a proxy for the levels of CO2 being stored in the peatland. The gathered information on emission reductions is planned to be used to generate funds via the sale of carbon credits.

Challenges to and key factors in assuring a successful implementation

Several barriers were identified which arose during the planning and implementation of the project. In general, there was felt to be a misunderstanding on the side of some stakeholders and authorities about ecosystems, their services and functions and their interactions with their surroundings. Traditions and beliefs of the local populations also needed to be taken into consideration as well as the overarching inability to decouple economic growth from environmental protection.

External considerations created further project barriers. On a legislative side, for example, a lacking management structure in Belarus at the start of the project and the focus of existing local legislation for the approval of voluntary emission reduction projects mostly on the industry and power generation sectors e.g. energy efficiency, renewable energies proved challenging. This issue has marginalized nature conservation approaches since the legislation lacks the necessary level of detail in this area. Furthermore, the price of imported oil and gas is rising and has created additional pressure to substitute them with local energy sources (e.g. exhaustible peat and biomass from peatlands). On the other hand, the necessity to substitute oil and gas as main energy sources in Belarus could spark the development of renewable energies, which would, in turn, assist climate change mitigation. The idea of biomass production in Belarus is considered not only by the project partners, but also by representatives of the peat industry.

Regarding the project specifically, the involvement of a large number of stakeholders sometimes proved to be a barrier as this implied including a more complex collection of interests, which needed

to be accounted for. Difficulties were also experienced in importing specialized equipment necessary8 for the quantification of carbon emissions in the project sites.

Concerning administrative duties and, more specifically, gaining access to funding as humanitarian aid, it was noted that the need to comply not only with local procurement regulations in Belarus but also with the requirements of the funding organization in a foreign country created a lack of efficiency and evoked delays, especially since no overlaps existed between the two procedures. Additionally, the fluctuating exchange rates became a burden given that the funding figures were agreed upon in a foreign currency (€) and adjustments were not permitted.

There were also some obstacles encountered regarding operational duties. This project is part of the International Climate Protection Initiative of the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU), with part of the research being conducted in Germany. During the implementation of the project, difficulties were encountered in importing specialized equipment necessary for the quantification of carbon emissions in the project sites. This issue had to be solved by building the equipment in Belarus, which could have had initial repercussions in terms of adjustment and operation. Nonetheless, the interviewees reported that the equipment is currently functioning adequately.

Given these challenges, the follow factors and actions helped to assure a successful implementation of the project:

- **Awareness raising** in order to improve the understanding of the approach (by the local government and community), involvement and support of the different stakeholders and stimulate the country's identity and national pride (e.g. 'Belarus is the lung of Europe');
- **Relationship building** at every possible level, i.e. with the ministries, local enterprises, local communities and between stakeholders;
- I**nvolvement of local communities** at different stages of the project: Local communities have strongly supported the project because they have witnessed the restoration of ecosystem services (which they perceive mainly as cranberry and blueberry production and increased fish and game populations). While the return of plant and animal populations has brought renewed incomes and a source of recreation to the localities, the restored peatland has meant a reduction of fires and the economic and environmental imbalance that they create;
- **Local government support**: For instance, understanding the role that healthy ecosystems play, in this case peatland, in reducing the frequency and scale of extreme events like peatland fires was key to ensuring political support and obtaining funding for restoration initiatives. Unfortunately, this tends to be forgotten once the problems are solved and the support and attention of the authorities shifts to other (often antagonistic) initiatives;
- **Designating project sites as local reserves** helps to assure the sustainability of the measures taken by keeping the sites free from external pressures (i.e. use of land for further peat extraction or other economic activities);
- **Availability and transfer of experience**: The combination of national and international expertise was key to the success of the project;

[8] There were problems with the Belarusian border authorities in terms of import/export laws.

- **Funding and financial control**: Assure that sufficient funds are readily available to proceed with the project tasks and appropriately control such activities in order to guarantee an efficient use of the finances. Also demand reasonable **compensation from the international community** for sacrificing development opportunities in favor of conserving and maintaining globally sound ecosystem services (including carbon credits mechanisms);
- **Staff**: Prepared and capable staff members were key to achieving the project objectives;
- Develop and **adopt renewable energies** (e.g. biomass) in the project areas in order to reduce peat/oil/gas dependency;
- **Highlighting the benefits** of rewetting initiatives as regards the reduced frequency of peat fires and the costs incurred to control them.

While the management structures and involvement of stakeholders responded to challenges and evolved throughout the course of implementation, several aspects were highlighted that would have been particularly helpful. Forming a management team in Belarus that would have been involved in the project from the start, for example, would have improved coordination between the steering committee and the experts, consultants and service providers on the ground. In addition, the implementation process would have benefited from a greater inclusion of professionally trained staff (e.g. hydrogeologists, hydromorphologists).

Finally, the land is state-owned in Belarus. A partial solution to autonomy barriers was to declare the sites as protected or reserved areas in order to be able to apply the project's approach sustainably. This would be effective mostly to control initiatives led by local authorities to interfere with the ecosystems' natural cycles. Unfortunately, central authorities have historically 'changed their minds' and removed the protected status of certain areas to further conduct economic activities like peat extraction

5 Costs and benefits

Both the costs and benefits of the Belarus peatland rewetting project were analyzed, following the typology developed within the project "Assessment of the potential of ecosystem-based approaches to climate change adaptation and mitigation in Europe"[9] to the extent possible. This typology was also applied to four other projects applying ecosystem-based approaches, the results of which are summarized at the conclusion of this chapter.

Costs

Over the period from 2010 to 2011, one-off costs related to administration and management are estimated to add up to approximately €391.000; one-off costs related to ecosystem maintenance and restoration are estimated to be around €42.000. Recurrent administrative, management and information costs are estimated to add up to €235.000. Table 6 gives a detailed overview of the financial costs of the overall project and the Dakudaŭskaje site specifically.

Table 4: Financial costs of the restoring peatlands projects

	Type of activity	Specified activity	Costs [€]
One-Off Costs	Administrative, management and information costs	Carbon Module Budget. May 2010-April 2011	Implementations: 130,940.00 Travel Costs: 9,000.00
		Biodiversity Module Budget. May 2010-April 2011	Implementations: 15,000.00
		Biomass Module Budget. May 2010-April 2011	Implementations: 105,566.00 Travel Costs: 1,660.00
		Communication Module Budget. May 2010-April 2011	Implementations: 8,292.00 Travel Costs: 1,000.00
		Management Module Budget. May 2010-April 2011	Implementations: 2,700.00 Travel Costs: 35,271.00
		Scientific justification of the project *(Dakudaŭskaje)*	5,000.00
		Development of the engineering project *(Dakudaŭskaje)*	7,000.00
		Equipment for monitoring GHG emissions (used for all the project sites)	70,000.00
	Costs related to ecosystem	Rewetting Module Budget. May 2010-April 2011 *(Dakudaŭskaje)*	Implementations: 5,831.00

[9] Naumann, Sandra, Gerardo Anzaldua, Pam Berry, Sarah Burch, McKenna Davis, Ana Frelih-Larsen, Holger Gerdes and Michele Sanders (2011): Assessment of the potential of ecosystem-based approaches to climate change adaptation and mitigation in Europe. Final report to the European Commission, DG Environment, Contract no. 070307/2010/580412/SER/B2, Ecologic institute and Environmental Change Institute, Oxford University Centre for the Environment

	maintenance and restoration	Hydro-construction works including equipment, services, operation. *(Dakudaŭskaje)*	36,406.90
Recurrent Costs	Administrative, management and information costs	Staffing Costs AOP May 2010-April 2011	68,908.00
		In-kind contribution of UNDP - Project Manager's salary and travel expenses	Salary: Oct. 2008-Apr. 2009: 5,922.22
			Salary: May 2009-Apr. 2010: 11,501.31
			Travel Expenses: May 2009-Apr. 2010: 672.47
		Co-funding from RSPB - Salaries RSPB staff	Dec. 2008-Apr. 2009: 22,500.00
			May 2009-Apr. 2010: 15,000.00
		Co-funding from RSPB - Salaries of the two CIM Experts	Dec. 2008-Apr. 2009: 70,003.88
			May 2009-Apr. 2010: 46,669.25
		Salaries (monitoring staff - *Dakudaŭskaje)*	June 2009-May 2010: 3,410.59
			June 2010-May 2011: 1,497.18
		Social Payments to the Fund for social protection of the population/ State insurance company *(Dakudaŭskaje)*	June 2009-May 2010: 1,146.47
			June 2010-May 2011: 564.68
		Income tax *(Dakudaŭskaje)*	June 2009-May 2010: 262.18
			June 2010-May 2011: None reported
	Costs related to ecosystem maintenance and restoration	Repairing of water regulating devices: 1 man-day (Average monthly salary: 210 €/month) *(Dakudaŭskaje)*	38.18 €/yr (supposing 4 reparations in the year)

An initial analysis suggests that the approximate cost of avoiding a tonne of CO_2 emissions is €7.11. The nature of the measures dictates that a large portion of the above costs will decline over time after the initial investments and re-wetting measures have been implemented. Salaries, engineering and construction costs will remain stable. In terms of opportunity costs, the peat industry and forestry could suffer from reduced yields based on the restricted availability of land for this purpose.

Benefits

On the benefits side, carbon emissions reduction via sequestration and storage (estimated at 2.9 t CO_2/ha/year) is the major benefit provided by the project. Furthermore, the avoided emissions from peat fires add to the climate change benefits provided by the project. A main category of benefits is also related to climate change adaptation, as the project contributes to:

- Micro-climate regulation (control of frost and humidity) benefiting neighboring agricultural lands;
- Protection from soil degradation;
- Water regulation and retention through the construction of dams and reservoirs (stabilization of the water level); and
- Prevention of peat fires.

Furthermore, provisioning ecosystem services such as food production benefit the local population. The economic value of provided cranberries, blueberries, mushrooms and fish is estimated to be around €2,300 per year.

Socio-economic benefits include the avoided expenditure from peat fire prevention and from the reduced frequency of peat fires, adding up to approximately €11,000. Table 7 provides an overview of the benefits related to peatland fire prevention and control:

Table 5: Benefits related to peatland fire prevention and control

Determining factors	Before rewetting		After rewetting	
	Concept	Cost	Concept	Cost
Personnel	5 fire fighters permanently and exclusively available	4,725 € (210 €/month* 4.5months* 5 persons)	No permanent availability or exclusivity is necessary	No exclusive cost
Machinery	1 machine permanently and exclusively available	N/A	No permanent availability or exclusivity is necessary	No exclusive cost
Resources necessary to control fires	80 men-days	763.64 €/fire	0,166 men-days	1.59 €/fire
Frequency of fires	8-10 per year	6,872.76 €/yr	1 per year	1.59 €/yr

In the short-term, the project is expected to provide jobs through the research, construction, supervisory, maintenance and monitoring work. In the long run, biomass harvesting jobs could emerge and the Academy of Sciences plans to set up a laboratory for GHG emission measurements. At the moment, about 25 management jobs are being provided through the project. In the future, the project might also have a positive impact on eco-tourism in the region. Table 8 provides a detailed overview of the benefits provided by the case study site, while box 6 presents briefly the results of nation-wide study aiming to estimate the value of the ecosystem services of natural peatlands in Belarus.

Table 6: Benefits of the overall project and Dakudauskaje site

Type of benefits	Explanation	Estimation of benefits
Environmental Benefits (Ecosystem Services)	Carbon emissions reduction via sequestration and storage (ca.50% of peat composition is C)	Estimated 2.9 tCO_2e/ha*year Estimated 2.5 tCO_2e/ha*year (average of all sites)
	Genetic/species diversity maintenance	Estimated 200-300% increase in biodiversity
	Avoided emissions from peat fires	N/A
	Erosion and peat storm control	N/A
	Landscape and amenity values	Aesthetic conditions of the area were considerably enhanced
	Ecotourism and recreation	Two ecological paths for education and bird watching were

		established and a third one is planned.
	Cultural values and inspirational services	World War II partisans used peatland as a hideout A museum is planned for the area, including an exposition about peatland
Socio-economic benefits	Avoided expenditure from peat fire prevention	€ 4,725
	Avoided expenditure from reduced frequency of peat fires	€ 6,871.17
	Food production	• Cranberry: approx. €1,670 /yr (1 ton/yr at market price: €1.67/kg) • Blueberry: approx. €490/yr (0.5 ton/yr at market price: €0.84 to €1.12 /kg) • Mushrooms: N/A • Fish: approx. €222.6/yr (5kg/day at market price: €0.84/kg) (total absence before rewetting) • Game: N/A
	Biomass production	N/A

Reflections on cost-benefit findings

In addition to the specific findings from the Belarus project, several further overarching conclusions regarding the costs and benefits associated with ecosystem-based approaches have also been established in the project "Assessment of the potential of ecosystem-based approaches to climate change adaptation and mitigation in Europe". On the basis of the Belarus project and four additional case studies, the following findings have been ascertained.

A number of limitations arise regarding the calculation of costs and benefits associated with ecosystem-based approaches. Not only is the amount and quality of evidence extremely varied, but knowledge about possible opportunity costs and socio-economic/ecological benefits is often lacking in quantitative terms. However, available evidence nevertheless indicates that the majority of projects adopting such an approach, including CO_2 sequestration projects, can be considered as cost-effective when long-term benefits are included. This finding also holds true in comparing the benefit-cost ratio of ecosystem-based approaches with traditional engineered approaches, given the additional ecological and socio-economic benefits created. In particular, the following categories of benefits have been identified as being of major importance in such cost-benefit calculations: climate regulation, water regulation and supply, habitat creation, landscape amenities, recreational opportunities and socio-economic effects.

6 Concluding remarks

The Belarus Project revealed innovative perspectives, techniques and methodologies that integrate climate change mitigation with biodiversity conservation while keeping in mind the synergies and dynamics of these matters with communities and economic activities. Importantly, the project also presented peat industry organizations with an opportunity to look at a problem from a new perspective and recognize the existing trade-offs and conflicts of interest surrounding this issue.

In implementing the project, a closer interaction and cooperation between partners in different countries was enabled, emphasizing the importance of stakeholder communication. It further highlighted the significance of strict financial controls and the importance of having qualified staff members in the team and in the country in which the measures are being implemented. The project also showed that outcomes must not only be reached during the implementation phase, but also have to be planned for and sustained after the project ends.

More generally, one of the principal contributions of the project has been the development of a methodology to achieve high-resolution assessments of greenhouse gas emissions in large areas based on the vegetation present in these sites. This methodology is adaptable to the specific environmental and biotope conditions in and outside of Belarus and enables the user to monitor the emission reductions and their changes in time. Moreover, the project sparked the inclusion of peatland rewetting and conservation (PRC) activities as a category that is eligible for receiving credits under the Voluntary Carbon Standard (VCS). This took place in March 2011 and was a crucial step towards assuring the sustainability of this project and those to follow.

The project has also influenced Belarusian carbon trading and peatland conservation policies. The initiative has opened the doors for discussion about the development of legislation that would allow for carbon emissions reduction trading in the country. On the other hand, recent legislation has been passed in Belarus regarding peatland protection and conservation. These are efforts that will likely be viewed as benchmarks in the development of international peatland protection policy and, together with the PRC chapter of the VCS, which could lead to the integration of peatland in the coverage of the post-Kyoto international climate treaties driven by the UNFCCC.

Although there are still more sites in Belarus that require rewetting, the lack of funding has not permitted the application of measures. If the project is successful in establishing the desired 'revolving fund' from selling emission reductions, this problem could be at least partially solved. However, the possibility of consulting additional funding sources was also raised, including green funds[10] or budget funds. In the case of peat extraction or other industrial activities involving harmful physical alterations of the environment, a budget funding scheme can be a good option to assure restoration once the site has been depleted. In this scheme, the agreement allowing the contractor to extract materials from the site also obligates it to plan for the costs of establishing the proper environmental conditions after extraction activities have ended and includes these costs in the contractor's budget. This funding scheme therefore secures the funding of restoration activities even before the site has been affected.

[10] Green funds were described as money paid to the Ministry of Environmental Protection by companies to compensate for the pollution caused by their activities.

Alongside securing finances to ensure the sustainability of project results, there is also the need to increase awareness of the value of rewetting peatlands within the general public and policy circles as well as in the forestry sector. A national ranking exists for the forest enterprises in each region in Belarus, which is inter alia calculated with figures from logging and timber income per hectare of controlled territory. Since rewetting reduces the area available for timber production, forest enterprises that have favored rewetting have also fallen in the national ranking. The Lidskij Forest Enterprise of the Lida region where the Dakudaŭskaje project site lies, for example, has suffered from a below average ranking (75 out of 96) that affects its status at the national level. This lack of support for and consideration of the benefits of rewetting peatlands should be addressed with targeted information and public awareness campaigns.

Finally, the role of the government is also crucial given that future perspectives and major decisions regarding resource use are made at the local and regional levels by the corresponding authorities and government organizations. It is often the case that alignment must exist between the government's interests and the project objectives in order to take the initiatives forward. In short, success is highly dependent on the level of interest of the local authorities.

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Annex

Figure 2: Signaling on the Dakudaŭskaje site (G. Anzaldua)

Figure 3: Diverse vegetation returning to the rewetted peatland (G. Anzaldua)

Figure 4: Diverse vegetation returning to the rewetted peatland (G. Anzaldua)

Figure 5: Wooden dam reinforced with peat and impermeable material (G. Anzaldua)

Figure 6: Wooden dam reinforced with peat and impermeable material (G. Anzaldua)

Figure 7: Main water reservoir (G. Anzaldua)

Figure 8: Blocked lateral draining channels and main reservoir (G. Anzaldua)

Figure 9: Bird tracks (G. Anzaldua)

Figure 10: Bird tracks (G. Anzaldua)

Figure 11: Blueberry plants (G. Anzaldua)

Figure 12: Cranberry plants (G. Anzaldua)

Figure 13: Young ducklings in the main water reservoir (G. Anzaldua)

Figure 14: Active peat extraction site adjacent to the rewetted area in Dakudaŭskaje (G. Anzaldua)

Overview of ecosystem services according to MA 2005 typology and expert interviews

Ecosystem service	Comments
Provisioning Services	
Food Sustainably produced / harvested crops, fruit, wild berries, fungi, nuts, livestock, semi-domestic animals, game, fish & other aquatic resources etc.	• (++) 10 x increase (Interview – Maksimenkov) • (+) Could increase in the long term perspective (Interview – Yazubets) • (+) Berries, mushrooms, fish and meat (Interview – Chabrouskaya, Thiele/Minke, Valasiuk)
Fibre / materials Sustainably produced / harvested wool, skins, leather, plant fibre (cotton, straw etc.), timber, cork, etc.	No effect identified (Interview – Thiele/Minke, Yazubets)
Fuel Sustainably produced / harvested firewood, biomass etc.	• Peat will become a strategic resource (Interview – Maksimenkov) • (+) Biomass, Paludiculture (Interview – Maksimenkov, Thiele/Minke) • Biomass harvest will increase but without reaching economic comparability to peat extraction. (Avg. Peat Extracted= 500 tonnes/hectare) (Interview – Yazubets)
Ornamental resources Sustainably produced / harvested ornamental wild plants, wood for handcraft, seashells etc.	No effect identified (Interview – Yazubets)
Natural medicines Sustainably produced / harvested medical natural products (flowers, roots, leaves, seeds, sap, animal products etc.	(+)(Interview – Chabrouskaya, Thiele/Minke, Yazubets)
Biochemicals & pharmaceuticals The ecosystem is a (once-off or continuous) for ingredients / components of biochemical or pharmaceutical products	(+)(Interview – Thiele/Minke, Yazubets)
Water quantity	(++) (Interview – Thiele/Minke)
Regulating services	
Climate / climate change regulation Carbon sequestration, maintaining and controlling temperature and precipitation	(+)(Interview – Maksimenkov, Thiele/Minke) Since there is no commonly approved methodology of assessment this cannot be estimated (Interview – Yazubets)
Water regulation Flood prevention, regulating surface water run off, aquifer recharge etc.	(+)(Interview – Maksimenkov, Thiele/Minke, Yazubets)
Water purification & waste management Decomposition / capture of nutrients and contaminants, prevention of eutrophication of water bodies, etc.	• (+)(Interview – Maksimenkov) • (+) 10% of the plant will turn to peat (Interview – Thiele/Minke)
Air quality regulation	(+)(Interview – Maksimenkov, Thiele/Minke, Yazubets)
Erosion control Maintenance of nutrients and soil cover and preventing negative effects of erosion (e.g. impoverishing of soil, increased sedimentation of water bodies)	(+)(Interview – Maksimenkov, Thiele/Minke, Yazubets)
Natural hazards control Avalanche control, storm damage control, fire regulation (i.e. preventing fires and regulating fire intensity)	• (++) Forest fires, peat storms (Interview – Maksimenkov, Thiele/Minke) • No effect identified (Interview – Yazubets)

Biological control Maintenance of natural enemies of plant and animal pests, regulating the populations of plant and animal disease vectors etc.	• (+) Invasive species take over when peat is extracted (Interview – Maksimenkov) • (+) Invasive species will be suppressed (Interview – Thiele/Minke)
Pollination Maintenance of natural pollinators and seed dispersal agents (e.g. birds and mammals)	
Disease regulation of human health Regulation of vectors for pathogens	• (-) Malaria (Interview – Maksimenkov) • (-) Harmful parasites and microorganisms that come in contact with the human (Interview – Maksimenkov) • No effect identified (Interview – Yazubets) • (+) Ticks proliferate in dry peatland (Interview – Thiele/Minke)
Genetic / species diversity maintenance Protection of local and endemic breeds and varieties, maintenance of game species gene pool etc.	• Maintenance of species , increase in flora and fauna • (++)(Interview – Yazubets) • (+) (Interview – Thiele/Minke)
Cultural & social services	
Ecotourism & recreation Hiking, camping, nature walks, jogging, skiing, canoeing, rafting, recreational fishing, animal watching etc.	• No effect identified (Interview – Yazubets) • (+) (Interview – Thiele/Minke)
Cultural values and inspirational services, e.g. education, art & research	No effect identified (Interview – Yazubets)
Landscape & amenity values Amenity of the ecosystem, cultural diversity & identity, spiritual values, cultural heritage values, etc.	Protection and increase of the cultural landscape of the region