



Natural Water Retention Measures

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A photograph of a young child sitting on a stone ledge, looking out over a large body of water. The water is surrounded by tall reeds and a wooden pier in the distance. The sky is blue with some clouds.

Case Study

Rehabilitation of heaths and mires on the Hautes-Fagnes Plateau



This report was prepared by the NWRM project, led by Office International de l'Eau (OIEau), in consortium with Actéon Environment (France), AMEC Foster Wheeler (United Kingdom), BEF (Baltic States), ENVECO (Sweden), IACO (Cyprus/Greece), IMDEA Water (Spain), REC (Hungary/Central & Eastern Europe), REKK inc. (Hungary), SLU (Sweden) and SRUC (UK) under contract 07.0330/2013/659147/SER/ENV.C1 for the Directorate-General for Environment of the European Commission. The information and views set out in this report represent NWRM project's views on the subject matter and do not necessarily reflect the official opinion of the Commission. The Commission does not guarantee the accuracy of the data included in this report. Neither the Commission nor any person acting on the Commission's behalf may be held Key words: Biophysical impact, runoff, water retention, effectiveness - Please consult the NWRM glossary for more information.

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I. Basic Information

Application ID	<i>Belgium_01</i>		
Application Name	Rehabilitation of heaths and mires on the Hautes-Fagnes Plateau		
Application Location	Country:	Belgium	Country 2:
	NUTS2 Code	BE33	
	River Basin District Code	Meuse	
	WFD Water Body Code		
	Description	The project is located in the Hautes Fagnes in the Ardennes.	
Application Site Coordinates (in ETRS89 or WGS84 the coordinate system)	Latitude: 50,5 WGS84 coordinate system	Longitude: 6,083 WGS84 coordinate system	
Target Sector(s)	Primary:	Hydromorphology	
Implemented NWRM(s)	Measure #1:	N2 Wetland restoration and management	
Application short description	Actions include restoring 1400 ha of peaty and wet habitats, abandoning spruce plantation for natural habitats on 630 ha and regenerating 400 ha of oak and birch forests.		

II. Policy context and design targets

Brief description of the problem to be tackled	Surrounding municipalities and private landowners made investments in the area in order to develop a forestry activity. The first step was to dewater and dry the area through heavy drainage works. The hydrological regime of the plateau was deeply modified and the water retention capacity reduced. Spruce plantation even increased the drying through evapotranspiration. Drainage works and spruce plantation led to increase the population of conifer or herbaceous species, such as <i>Molinia caerulea</i> .		
What were the primary & secondary targets when designing this application?	Primary target #1:	Biodiversity and gene-pool conservation in riparian areas	
	Primary target #2:	Self-regulation of water by filtration / storage / accumulation by ecosystems	
Which specific types of pressures did you aim at mitigating?	Pressure #1:	WFD identified pressure	2.3 Diffuse – Forestry
	Pressure #2:	Floods Directive identified pressure	Other pressure contributing to flooding / flood risk
Which specific types of adverse impacts did you aim at mitigating?	Impact #1:	WFD identified impact	Altered habitats due to hydrological changes
	Impact #2:	Floods Directive identified impact	Other Environmental impacts
	Impact #3:	Floods Directive	Landscape

CS: Hautes-Fagnes Plateau, Belgium

		identified impact	
Which EU requirements and EU Directives were aimed at being addressed?	Requirement #1:		
Which national and/or regional policy challenges and/or requirements aimed to be addressed?	Heaths and mires are priority habitats types. They have an ecological interest at European level and they are rare and endangered at the Wallonian level. A regional plan to preserve heaths and mires has been implemented through LIFE projects (6 are completed and 2 are still running).		

III. Site characteristics

Dominant Land Use type(s)	Dominant land use	312
	Secondary land use	321
	Remarks	
Climate zone	cool temperate moist	
Soil type Select from the list with the FAO classes in Annex 3	Peat soil (36%), sub-peat soil (10,5%), moist soil (17%), dry soil (29%), alluvial soil (8%)	
Average Slope	gentle (2-5%)	
Mean Annual Rainfall	1200 - 1500 mm	
Mean Annual Runoff		
Average Runoff coefficient (or % imperviousness on site)		0 - 10%
	Remarks	
Characterization of water quality status (prior to the implementation of the NWRMs)	In the area, the water is acid and dystrophic and pollution free. There are specific problems related to organic pollution around the Michel-Baraque, of the Rigi mont and of the Botrange. There also is eutrophication along the road crossing the haute Fagnes (due to snow removal).	
Comment on any specific site characteristic that influences the effectiveness of the applied NWRM(s) in a positive or negative way	<i>Positive way:</i> The vast expanse of the area influenced positively the project efficiency. If allowed economy of scale.	
	<i>Negative way:</i> The slope of the area was an obstacle to restore a big area at a limited cost. The wet climate reduced the works possibilities. Nesting periods and hunting periods also have to be addressed.	

IV. Design & implementation parameters

Project scale	Medium (eg. public park, new development district)	6 Natura 2000 areas
Time frame	Date of installation/construction (MM.YYYY)	01.2007
	Expected average lifespan (life expectancy) of the application in years	

Responsible authority and other stakeholders involved	<i>Name of responsible authority/ stakeholder</i>		<i>Role, responsibilities</i>	
	1. Agriculture, Natural Resources and Environment General Direction		Beneficiary and coordinator of the life project	
	2. Natural Habitat and Agricultural Studies Department		Partner of the project, data collecting about environment watching	
	3. Nature and Forest Department		Partner of the project, forestry, hunting, fishing and nature conservation	
The application was initiated and financed by	<p>The application was initiated by the administration of the Wallonia Region (Agriculture, Natural Resources and Environment General Direction, more specifically the Natural Habitat and Agricultural studies Department and Nature and Forest Department, collaborating with the Natural Park of the Hautes Fagnes-Eifel Management Commission).</p> <p>The application was financed by the European Commission (Life Project) and the Public Services of Wallonie.</p>			
What were specific principles that were followed in the design of this application?	The main idea was to continue the restoration of the heaths and mires area in the Walloon region. It started 5 years ago (Saint Hubert, Croix Saille and Tailles plateau projects). Restoration methods have been developed in the region for 20 years.			
Area (ha)	Number of hectares treated by the NWRM(s).		1400	
	Text to specify		The area of the rehabilitation is 1400 ha and is located upstream, in the Ardennes mountains. The application will impact a downstream area.	
Design capacity	<p>The project was not designed for its water retention capacity. Although, about 8 km of drain were plugged and 23 ha of mires were submerged. We can evaluate the volume of water in mires and ponds between 120 000m³ and 360 000m³ depending on rain falls (the water retained in soil is not counted).</p> <p>The project design is based on experimental project in Northern America and Europe. Methods implemented are a mix of Canadian approach (soil restoration with replant program ...), European approach (remoistening, flooding), heath restoration. All these methods are adapted to the local conditions.</p>			
Reference to existing engineering standards, guidelines and manuals that have been used during the design phase	<i>Reference</i>		<i>URL</i>	
	1.			
	2.			
	3.			
	4.			
5.				
Main factors and/or constraints that influenced the selection and design of the NWRM(s) in this				

application?	
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V. Biophysical impacts

Impact category (short name) Select from the drop-down menu below: ↓	Impact description (Text, approx. 200 words)	Impact quantification (specifying units)	
		Parameter value; units	% change in parameter value as compared to the state prior to the implementation of the NWRM(s)
Runoff attenuation / control	The drain plugging reduced, development of pounds and rehabilitation of mire contribute to reduce the runoff.		
Peak flow rate reduction			
Impact on groundwater			
Impact on soil moisture and soil storage capacity	The project improved the soil storage capacity. The milling works aimed at removing <i>the Molinia caerulea</i> and help the development of mosses such as sphagnum. The evapotranspiration was reduced thanks to the spruce forest removal.		
Restoring hydraulic connection			
Water quality Improvements			
WFD Ecological Status and objectives			
Reducing flood risks (Floods Directive)			
Mitigation of other biophysical impacts in relation to other EU Directives (e.g. Habitats, UWWT, etc.)			
Soil Quality Improvements			
Other			

VI. Socio-Economic Information

What are the benefits and co-benefits of NWRMs in this application?	The study of the socio-economic impact shows that the main impact is on biodiversity (assessed value 9,8M€/y) and recreational use (0,3M€/y). It also shows that the impact on flood-reduction is not significant.		
Financial costs	Total:	4 500 300 €	Total amount spent for the project
	<i>Capital:</i>	2 614 178 €	Rehabilitation works : Spruce cut, drains plugging, milling, etc.
	<i>Land acquisition and value:</i>	336 750 €	
	<i>Operational:</i>	145 461 €	Maintenance works
	<i>Maintenance:</i>		
	<i>Other:</i>	1 403 911€	Project coordination, awareness-raising campaign
Were financial compensations required? What amount?	Was financial compensation required: Yes		
	Total amount of money paid (in €): About 603 000		
	Compensation schema: A financial compensation was given to spruce plantation owners (who accepted to participate to the project) for the early cut down. An estimation of the value was realized based on Gembloux agronomic university data. The owner received the money got from the wood sale and an extra compensation (5k€ maximum per person). The average compensation was 2 080€. 177ha of private plantation and 113ha of public plantation were cut down and compensated.		
	<i>Comments / Remarks:</i>		
Economic costs	<i>Actual income loss:</i>		
	<i>Additional costs:</i>		
	<i>Other opportunity costs:</i> 29 258€/y		
	<i>Comments / Remarks:</i> The opportunity costs is due to the lack of wood production		
Which link can be made to the ecosystem services approach? <i>Hint: The actual benefits of improving nature's water storage capacity are essentially linked to an improved provision of some of the following</i>	The main ecosystem service improved by the project is the amenities production (insect, birds, and specific flora). It also has a positive impact on landscape maintenance. Another service is the flood security and protection downstream linked with the improvement of the water		

<p><i>ecosystem goods and services:</i></p> <ul style="list-style-type: none"> - <i>Freshwater for drinking.</i> - <i>Water provision to deliver water services to the economy both for drinking and non-drinking purposes.</i> - <i>Water security (reliability of supply and resilience to drought).</i> - <i>Health security (control of waterborne diseases).</i> - <i>Flood security and protection.</i> - <i>Storm surge protection.</i> - <i>Biomass production.</i> - <i>Amenities (associated to habitat protection): fish and plants, tourism, recreation, and others.</i> - <i>Benefits of improved coastal water quality and ecological status for a sustainable commercial production of shellfish with human health and welfare values.</i> 	<p>retention capacities of the area.</p>
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VII. Monitoring & maintenance requirements

<p>Monitoring requirements</p>	<p>The monitoring is now on :</p> <ul style="list-style-type: none"> - Botanic monitoring on 835m² implemented by the life project team. 288m² are realized by the Agriculture and natural areas department. 100m² will be added for the meadow monitoring - Odonates monitoring at 45 points - Birds monitoring through 9 listening points. It comes in addition with water birds observation during the two migration periods - Black grouse monitoring : realized by the Walloon administration with Liege University - Lepidopterous insects monitoring : The only species to be monitored is the <i>Boloria aquilonaris</i> - An impact assessment on hydrological works is running <p>All the monitoring are realized or framed by the Agriculture and natural environment department and the Nature and Forest Department.</p>
<p>Maintenance requirements</p>	<p>A conservation plan “After life” was designed. It defines all the maintenance tasks (mowing and grazing, maintenance of hydraulic structures, etc). The Agriculture and natural environment department and the Nature and Forest Department, Walloon administration, the natural park of the hautes fagnes, the friends of the fagnes association, the</p>

	Patrimoine Nature, enterprises, farmers, communes and private owner are involved in the maintenance.
What are the administrative costs?	

VIII. Performance metrics and assessment criteria

Which assessment methods and practices are used for assessing the biophysical impacts?	An impact assessment on hydrological works is running. The biodiversity is measured through the monitoring (described above)
Which methods are used to assess costs, benefits and cost-effectiveness of measures?	The project did not assess costs, benefits or cost-effectiveness of the measure. The European Union realized an economic assessment of the project.
How cost-effective are NWRM's compared to "traditional / structural" measures?	No cost-effectiveness assessment was realized.
How do (if applicable) specific basin characteristics influence the effectiveness of measures?	Peaty soils are generally steep in the "Hautes Fagnes" region. Methods and technologies were adapted.
What is the standard time delay for measuring the effects of the measures?	

IX. Main risks, implications, enabling factors and preconditions

What were the main implementation barriers?	For private and municipal areas, the adherence to the restoration project and to have their plot restored. The period to realize works was very short (July to October). The short period of works required many enterprises available at the same moment.
What were the main enabling and success factors?	Half of the area of the site project is a national nature reserve including Natura 2000 areas (some deteriorated). It was an element in favor of the implementation of the project. It led to ambitious objectives (wide area). There also were areas under national property (but not included in natural reserve) was also favorable. Indeed, Walloon administration was the head project and wanted to realize a deep restoration.
Financing	The project was financed 50% by the European commission and 50% by the Wallonia administration.
Flexibility & Adaptability	
Transferability	There are still wide areas of heaths and mire that could be restored in the Walloon region.

X. Lessons learned

Key lessons	Even if forestry activities were removed, there are still economic benefits linked to biodiversity and recreational use.
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XI. References

Source Type	<i>Project Report</i>		
Source Author(s)	The LIFE 2012 team : Julie Plunus, Maite Loute, Didier Mackels, Dominik Arens and Valeri Dumoulin		
Source Title	Restauration des landes et tourbières du Plateau des Hautes Fagnes, Final report, covering the project activities from 01.01.2007 to 31.12.2012		
Year of publication	2013		
Editor/Publisher	Life project, deliverable		
Source Weblink	http://biodiversite.wallonie.be/fr/life-tourbieres-hautes-fagnes-2007-2012.html?IDC=3391		
Source Type	<i>Project Report</i>		
Source Author(s)	Simon Standaert, Bernard De Clavel		
Source Title	Etude de l'impact socio-économique de la conservation et restauration de la nature dans les Hautes Fagnes		
Year of publication	2011		
Editor/Publisher			
Source Weblink	http://biodiversite.wallonie.be/fr/publications.html?IDC=3404		
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	3.		
	4.		

XII. Photos Gallery



Figure 1 Importance of flooding the mires at the Mistens. On the left the Grenzweg. (Picture André Drèze, mai 2012)



Figure 2 Sphagnum mosses "resurrection" in an area recently flooded (Parc naturel Hautes Fagnes-Eifel)



Figure 3 Heather and cranberries remarkable development in dry heaths (Parc naturel Hautes Fagnes-Eifel)