

Case Study

***NBS for diffuse pollution control in the
Agro Pontino plain***

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I. Basic Information

Application ID			
Application Name	Nature-based solutions for climate change adaptation and water pollution in agricultural regions. Lot 6: LDP in a Mediterranean environment		
Application Location	Country:	Italy	Country 2:
	NUTS2 Code		
	River Basin District Code		
	WFD Water Body Code		
	Description	The project is located in three sub-basins (MOS-RMA-100, MOS-RMA-110 and MOS-790) of the Agro Pontino plain, in the province of Latina (Lazio Region)	
Application Site Coordinates <i>(in ETRS89 or WGS84 the coordinate system)</i>	Latitude: 41°25'06.4" N	Longitude: 13°00'21.6"E	
Target Sector(s)	Primary:	Agriculture	
	Secondary:		
Implemented NWRM(s)	Measure #1:	off - line wetland	
	Measure #2:	off - line wetland	
	Measure #3:	buffer strip	
	Measure #4:	buffer strip	
Application short description	<p>The Agro Pontino is the result of a heavy landscape transformation caused by the “Great Land Reclamation” of the 1920s. Such transformation has continued until today, adding an intense industrial (1960s and 1970s) and then residential (1990s-2000) development to the environmental pressures due to crop and livestock farming, causing progressive pollution of surface and groundwater and a growing artificiality of the landscape, with important losses in terms of ecosystem services. The water quality of most of the artificial and natural watercourses of the area is considered "poor" or "bad", according to the parameters established by the Water Framework Directive (WFD), and the most important pollution source are the intensive farming practices in the area. In this context the Life+REWETLAND project, coordinated by the Province of Latina, aimed at promoting NBS to control diffuse pollution and improving the quality of surface waters of the Agro Pontino. The project led to the drafting of an Integrated Environmental Restoration Program (ERP) of the Pontine Plain, which identifies several NBS typologies that should be promoted on an area of about 700 km², entailing a network of 220 km of drainage channels. Beside acting at large scale by developing the ERP, Life+REWETLAND project implemented four pilot projects aimed at demonstrating the effectiveness of constructed wetlands and buffer strips to control diffuse pollution.</p>		

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II. Policy context and design targets

Brief description of the problem to be tackled	The present study analyses how Nature-based solutions (NBS) may contribute to reduce water pollution by retaining and processing diffuse pollutants generated by farming practices (Nitrogen, Phosphorus, sediments and pesticides) while delivering, at the same time, other benefits beyond water pollution control, such as shelters for biodiversity, amenity and recreational opportunities.		
What were the primary & secondary targets when designing this application?	Primary target #1:	Reducing water pollution from agricultural runoff	
	Secondary target #1:	Water body ecological restoration	
	Secondary target #2:		
	Remarks	All the 4 implemented NBS are designed to achieve water purification with the broader perspective of water bodies ecological restoration, also in aesthetic terms through extensive interventions	
Which specific types of pressures did you aim at mitigating?	Pressure #1:	Water pollution from agricultural runoff	Nitrogen/Phosphorous
	Pressure #2:		
	Remarks		
Which specific types of adverse impacts did you aim at mitigating?	Impact #1:	Water pollution from agricultural runoff	Nitrogen/Phosphorous
	Impact #2:		
	Impact #3:		
	Impact #4:		
	Remarks		
Which EU requirements and EU Directives were aimed at being addressed?	Requirement #1:		
	Requirement #2:		
	Requirement #3:		
	Remarks		

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Which national and/or regional policy challenges and/or requirements aimed to be addressed?	National Law 152/06 (application of the WFD), River Basin Management Plan of the “Appennino Centrale” River Authority, Regione Lazio Water Safeguard Plan.
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III. Site characteristics

Dominant Land Use type(s)	Dominant land use	Agricultural use
	Secondary land use	
	Other important land use	
	Remarks	
Climate zone	temperate sub-continental	
Soil type	Backfill Sands Colluvium / sand / gravel Silts and clays Calcareous silts / peaty clay / peat	
Average Slope		
Mean Annual Rainfall	1035 mm (year 2014)	
Mean Annual Runoff		
Average Runoff coefficient (or % imperviousness on site)	0.24 MOS-RMA-100 0.35 MOS-RMA-110 0.15 MOS-790	
	Remarks	
Characterization of water quality status (prior to the implementation of the NWRMs)	The water quality of most of the artificial and natural watercourses of the area is considered "poor" or "bad" according to the parameters established by the Water Framework Directive (WFD)	
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>	
	<i>Negative way:</i> the Selcella canal buffer strip has a slope of about 25%, which reduces the efficiency in sediment removal	

IV. Design & implementation parameters

Project scale	Medium (eg. public park, new development district)	<i>Medium scale project involving three sub-basins (MOS-RMA-100, MOS-RMA-110 and MOS-790),</i>
Time frame	Date of installation/construction	2014
	Expected average lifespan (life expectancy) of the application in years	The lifespan of the NBS is expected to be in the range of decades (around 50 years)
Responsible authority and other stakeholders involved	<i>Name of responsible authority/ stakeholder</i>	<i>Role, responsibilities</i>
	1. Latina Province	In charge of the NBS development and recipient of public funds for its realization
	2. Municipality of Latina	The Municipality co-financed a constructed wetland in Marina di Latina, and it currently owns and

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		manages it.
3.	Circeo national park	The park authority provided funding for the construction works of the Pilot Project 1
4.	Consorzio di Bonifica dell'Agro Pontino	Management and ordinary and extra-ordinary maintenance of the land reclamation works and devices
5.	U-space s.r.l.	Project monitoring, drafting of reports and assessments.
6.	Farmers associations (CIA, Coldiretti and Confagricoltura)	Landowners. Involved in the Rewetland project through their market organisations

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The application was initiated and financed by	The NBS were financed by the Lazio Region. The funds were used by the province of Latina to implements the NBS. The construction of the 4 NBS occurred in: 2014	
What were specific principles that were followed in the design of this application?	Achieving water purification with the broader perspective of water bodies ecological restoration, also in aesthetic terms through extensive interventions	
Area (ha)	Number of hectares treated by the NWRM(s).	4.6 ha (Effective area of the 4 NBS)
	The area of the project is approximately 5,4 ha. The biodiversity is affected by the project in the area itself.	While the effective area of the NWRMs is mentioned above, the effective area of all the NWRMs in the sub-basins of study area is about 50 hectares
Design capacity	Villa Fogliano wetland: 1062 m ³ d ⁻¹ Allacciante wetland: 734 m ³ d ⁻¹	
Reference to existing engineering standards, guidelines and manuals that have been used during the design phase	<i>Reference</i>	
	1.	<i>URL</i>
	2.	
	3.	
	4.	
	5.	
Main factors and/or constraints that influenced the selection and design of the NWRM(s) in this application?	The sites and designs of the NWRMs were chosen in order to meet the necessities of decreasing the load of nitrogen and phosphorous in the Agro Pontino plain and improving the quality of the water bodies.	

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)
Water quality Improvements	Wetlands and buffer strips (BS) remove nutrients and contaminants thanks to physical (adsorption and sedimentation) and several biological processes. The different design of these NWRMs determine strong variations in the removal capacities of the two NWRMs. The data provided refers to the effects of wetlands and buffer strips at sub-basins scale	TN ($\text{g m}^{-2} \text{y}^{-1}$) TP ($\text{g m}^{-2} \text{y}^{-1}$) Glyphosate ($\text{g m}^{-2} \text{y}^{-1}$)	CW 2; 20 BS 28.8 CW 0.2; 1.1 BS 1.1 CW 0.1; 4 BS 0.2

VI. Socio-Economic Information

What are the benefits and co-benefits of NWRMs in this application?	The environmental benefits of NWRMs are: the improved water quality (removal of pollutants from agricultural source); the reduced flood risk; biodiversity (increased number of aquatic fauna and the appearance of species of naturalistic interest). The social benefits are represented by: recreation and health opportunities for the local population; educations (natural areas are appreciated by schools).		
Financial costs	Total:		
	<i>Capital:</i>	€ 621,485.90	
	<i>Land acquisition and value:</i>	€	
	<i>Operational:</i>	€/year 10,720	
	<i>Maintenance:</i>		
	<i>Other:</i>		
Were financial	Yes		

compensations required? What amount?	<i>Total amount of money paid (in €):</i>		
	<i>Compensation schema:²</i>		
	<i>Comments / Remarks: The NBS have been built on public soils and have been financed by public funds (Life+, Municipality and Circeo National Park); O&M costs are covered by Municipality of Latina and Circeo National Park)</i>		
	<i>Actual income loss: 480,847.44 €/year</i>		
	<i>Additional costs:</i>		

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Economic costs	<i>Other opportunity costs:</i>
	<i>Comments / Remarks:</i> Data provided refer to estimations made on sub-basins scale of the farmland income loss during a time period of 20 years.
Which link can be made to the ecosystem services approach?	An estimation of the monetization of the ecosystem services has been made with value transfer method for the NWRMs within the investigated basins obtaining a value ranging from 1,642,082 €/y to 1,908,229 €/y for scenario 1 and from 187,807 €/y to 209,844 €/y for scenario 2.

VII. Monitoring & maintenance requirements

Monitoring requirements	The REWETLAND project included a complete Monitoring Program assigned to two companies: the SIBA s.p.a. (group leader) and BIOPROGRAMM s.c. Four sampling campaigns were carried out from 2014 to 2015.
Maintenance requirements	N/A
What are the administrative costs?	N/A

VIII. Performance metrics and assessment criteria

Which assessment methods and practices are used for assessing the biophysical impacts?	The assessment of TN,TP and TSS in the NBS was carried out with a theoretical estimation of the treatment performance of the REWETLAND NBS sites. Where data of TP, TSS and Glyphosate were not present, the parameters have through an experience-based analysis founded on the literature data.
Which methods are used to assess costs, benefits and cost-effectiveness of measures?	Costs: Reverse engineering Benefits and Cost-effectiveness: Value transfer method
How cost-effective are NWRM's compared to "traditional / structural" measures?	N/A
How do (if applicable) specific basin characteristics influence the effectiveness of measures?	N/A
What is the standard time delay for measuring the effects of the measures?	N/A

IX. Main risks, implications, enabling factors and preconditions

What were the main implementation barriers?	The Business Model envisaged by Rewetland failed for two main reasons: <ol style="list-style-type: none"> 1. the lack of knowhow transfer and capacity building towards a key actor: the Consorzio di Bonifica Agro Pontino; 2. the lack of financial resources through ordinary channels to replicate the NBS realization at larger scale.
What were the main enabling and success factors?	The Greenchange business model is based on entrusting farms with state-owned areas bordering waterways for the construction and management of NBSs (typically linear arboreal/shrub

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	formations or wetlands) whose primary objective is to support biodiversity, but which also perform a function of reducing diffuse pollution.
Financing	NWRMs were financed by the Lazio region
Flexibility & Adaptability	N/A
Transferability	The condition for this business model to be replicable is the availability of public land properly located to allow the realisation of NBS effective for diffuse pollution removal.

X. Lessons learned

Key lessons	<p>The the positive experience of the Consorzio Acque Risorgive demonstrates that a systematic implementation of NWRMs can be a successful approach to reduce the water pollution at sub-basin scale. Moreover, this approach was carried out with reasonable construction and O&M costs while providing several benefits. If monetized through a “value transfer” exercise, the approach shows a high value provided by the NWRMs every year for the community.</p> <p>The pollutant removal capacity of the NBS have been estimated through specific models and the removal rates are in the range expected according to scientific literature but lower than the most performing existing case studies. Investment and O&M costs of the NBS implemented in the present case study are in line with similar systems implemented in other Italian sites. the approach proposed by Rewetland – to realize some demonstration NBS, show to the local people that they could provide benefits, develop a program to replicate the NBS at larger scale, find the financial resources to implement NBS at large scale through the ordinary funding channels (River basin management plans, Flood risk management plans, funds supporting habitat and biodiversity) – clearly failed. The Greenchange project developed a completely different “win-win” approach, involving the farmers and entrusting them to manage public areas to realise NBS (buffer strips).</p>
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XI. References

Source Type	<i>Project Report</i>		
Source Author(s)	<i>IRIDRA srl</i>		
Source Title	Nature-based solutions for climate change adaptation and water pollution in agricultural regions. Lot 6: LDP in a Mediterranean environment - Feasibility Study		
Year of publication	2020		
Editor/Publisher	Joint Research Centre - JRC		
Source Weblink			
Key People		<i>Name / affiliation</i>	<i>Contact details</i>
	1.	<i>Fabio Masi</i>	masi@iridra.com
Source Type	<i>Project report</i>		

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