Studies from the EIP-AGRI Focus Group Nature-Based Solutions for water management under climate change

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AGRICULTURE & INNOVATION

funded by European Commission

Swales and keylines in rainfed semiarid conditions

Alfonso Chico de Guzmán, María Almagro Bonmatí

Website 1 | Website 2

GEOGRAPHICAL REGION:

Mediterranean South

INVOLVED ACTORS IN THE DESCRIBED NBS:

Farmers

SOURCES OF INFORMATION, REFERENCES, WEBSITES

https://www.regeneration-academy.org/water-management
https://www.regeneration-academy.org/crop-management
https://www.wocat.net/library/media/25/
http://crkeyline.ca/what-is-keyline-design/

FUTURE PLANS:

Planting trees/aromatics along the swales
Extend this practice to other fields

DESCRIPTION OF THE NBS:

Swales are shallow trenchs dug along the land's contour, with a berm on the downhill side created with soil from the trench. All points along a contour line are exactly the same height above sea level. Therefore, a trench along the contour captures water in the landscape, slowing and spreading it across the contour line. Trees can be planted directly downhill of each swale, so that when it rains and the swales fill up, the rain sinks slowly into the soil directly into the roots of our trees.

Keyline pattern cultivation consists of subsoil ripping (without inverting the soil) along the contour lines to slow down run-off flow while acting as micro-water management storage ditchs across the landscape. The main goal is to control erosion and increase soil water storage capacity.

HOW THE SOLUTION IS CURRENTLY APPLIED IN THE FIELD?

15 kms of swales (4 m width x 1 m height) in a rainfed cereal field
The keyline pattern cultivation has been adapted to local conditions (and combined with swalws) to facilitate machinery works

SUCCESS ELEMENTS FOR IMPLEMENTATION

Erosion control

Water harvesting

Crop yields improved in the long term

Cost-effective water management practice

The innitial investment can be offset after few years

If well adopted no maintenance is necesary

LIMITATIONS AND DRAWBACKS:

Initial investment (~ 5 € per m) and access to machinery
The size and topography of the field could hamper its implementation and maintenance, but this practice can be adapted to local conditions
Lack of long-term vision

BENEFITS (ECONOMICALLY TO THE FARM, ENVIRONMENT AND SOCIETY):

Soil water erosion is significantly reduced, retaining soil, sediments and associated carbon and nutrients within the farm and avoiding off-site effects (e.g., infraestructure damages, reservoir siltation, etc)

Soil water retention capacity is improved

Higher crop yields

Biodiversity increased if alternative crops/trees are planted along the swales, atracking auxiliary fauna

If adopted at large scale it can become an excellent biodiversity corridor

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More information: www.eip-agri.eu

ACUAsave

Gottlieb Basch

https://www.med.uevora.pt/pt/projeto-acuasave-acao-de-demonstracao-elvas-2018-2/

GEOGRAPHICAL REGION:

Mediterranean North, 40km east from Lisbon;

Sandy soil, but applicable to all agroecologies

INVOLVED ACTORS IN THE DESCRIBED NBS:

Farmers and farmers' associations, service providers, agri-business sector, political decision makers, Ag administration

SOURCES OF INFORMATION, REFERENCES, WEBSITES

https://ecaf.org/

https://www.fao.org/conservation-agriculture/en/

DESCRIPTION OF THE NBS:

Another type of agricultural NbS, conservation agriculture, defined by a combination of conservation tillage, crop rotations, and cover crops has gained traction in many parts of the world. In some regions, variations on the principles of conservation agriculture have been part of traditional agricultural systems for generations. As of 2011, conservation agriculture had been implemented on approximately 125 million hectares across the world (today on over 200 million hectares), with the greatest concentrations by far in United States, Brazil, Argentina, Australia, and Canada (Friedrich, Derpsch and Kassam, 2012). The broad extent of this adoption has been cited as evidence of its implicit benefits for farmers (Brouder and GomezMacpherson, 2014). There is clear evidence that conservation agriculture increases soil organic matter and a range of associated processes including improved sedimentretention. However, crop yield outcomes vary based on practices employed, climate, crop type, and biophysical conditions (Palm et al., 2014). Available evidence on actual changes in crop yields suggests that conservation agriculture has the greatest potential to increase crop yields when implemented as a set of integrated practices in rainfed systems in water-limited or water-stressed regions, including potentially on millions of hectares in Sub-Saharan Africa and South Asia. Decisions to adopt conservation agriculture practices can go beyond immediate changes in crop yield, though. For example, a review of farmer adoption of conservation agriculture, identified reduction in farm operation costs, nutrient use and efficiency, water savings, and crop yield stability as additional factors beyond increased crop yield that motivated adoption (Corsi and Muminjanov, 2019). [The Nature Conservancy]

HOW THE SOLUTION IS CURRENTLY APPLIED IN THE FIELD?

On over 200 million ha worldwide today; see pictures

SUCCESS ELEMENTS FOR IMPLEMENTATION

Applied on more than 200 million hectares worldwide; contribution to the delivery of all soil-mediated ecosystem services, several SDGs, Green Deal and F2F objectives, aplicable to all agroecologies

LIMITATIONS AND DRAWBACKS:

Demanding in terms of knowledge, observation and skills; perceived need of higher herbicide inputs; specific no-till seeding/planting equipment needed.

BENEFITS (ECONOMICALLY TO THE FARM, ENVIRONMENT AND SOCIETY):

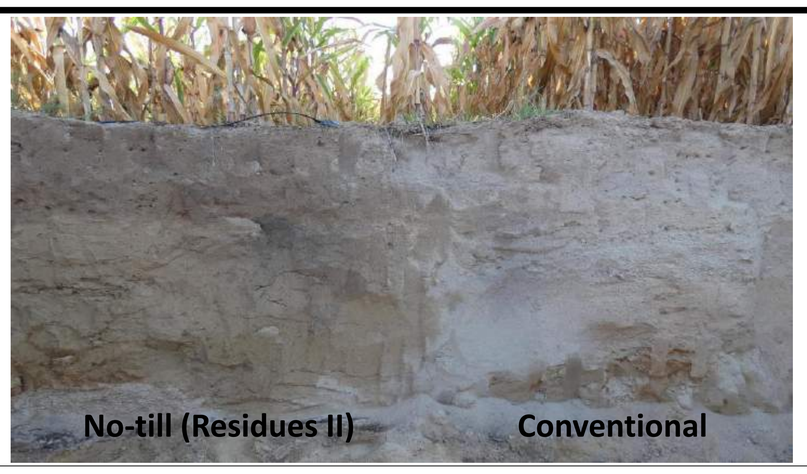
Less costs in terms of labour, capital (machinery, fuel, agrochemicals), equal/high productivities when compared to conventional;

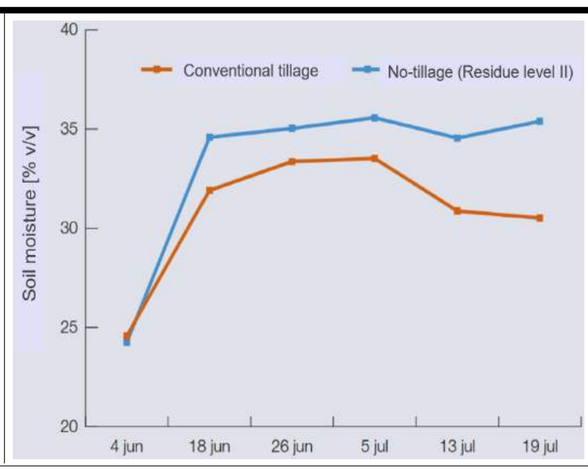
Less surface runoff and erosion, less offsite transport of agrochemicals, carbon sequestration, increase of below and above ground biodiversity, less fuel consumption and other external inputs such as fertilizers, irrigation water and insecticides;

Less labour intensive, more free time, more satisfaction.

FUTURE PLANS:

Create enabling environment for CA adoption so to mainstream this farming approach in both annual and permanent cropping systems





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Application of NBS on the agricultural water network in Veneto and Emilia-Romagna Regions

Andrea Crestani, from Adriano Batilliani

https://www.anbiveneto.it/ | https://www.venetoagricoltura.org/

GEOGRAPHICAL REGION:

Veneto and Emilia-Romagna Regions – Northern Italy

INVOLVED ACTORS IN THE DESCRIBED NBS:

ANBI Veneto, Veneto Agricoltura, Consorzi di bonifica Veronese, Adige Po, Delta del Po, Alta Pianura Veneta, Brenta, Adige Euganeo, Bacchiglione, Acque Risorgive, Piave, Veneto Orientale, Emilia Centrale, Burana, Pianura di Ferrara

SOURCES OF INFORMATION, REFERENCES, WEBSITES

https://www.anbiveneto.it/wp-content/uploads/2021/06/Manuale.pdf

DESCRIPTION OF THE NBS:

A portfolio of Nature Based Solution has been progressively tested and applied since 2000 aiming to support and enhance the management of flooding risk, bank erosion, water quality, biodiversity of the rivers/canals bed, banks and floodplain, and of the sustainable governance of the acquatic and riparian vegetation. The Italian plains, particularly in Veneto and Emilia-Romagna, are furrowed by a dense network of agricultural canals designed to drain water excess, provide irrigation water to a flourishing primary sector, secure the hygiene of the territories conveying the water disposed by urban agglomerates to the sea. ANBI is fully aware that few sectors are affected by profound innovation such as water management, in response to the new challenges of climate change, the defense of biodiversity, the evolution of society. Nowadays, the maintenance of rivers and canals is no longer just a question of hydraulic engineering. The restoration of embankments, the resection of a drain, the construction of a wetland or a flood regulation artifact now requires a vision that takes into account plant and animal species, landscape and socio-economic aspects. Nature Based Solution are more and more identified as a way to match all these diverse and sometime contrasting requirements.

HOW THE SOLUTION IS CURRENTLY APPLIED IN THE FIELD?

The survey, which is not considering the NBS green engeenering projects realized to protect hillslopes from erosion and to restore brooks and streams in mountaunious areas, identified 67 projects already operational and 5 projects founded by the Rural Development Plans. The Consortia are engaged in implementing more NBS and in carry on the management and improvement of those already set up.

SUCCESS ELEMENTS FOR IMPLEMENTATION

The most effective drivers are the strong Public Private Partnership, and the engagement on equal footing of all the stakeholders.

LIMITATIONS AND DRAWBACKS:

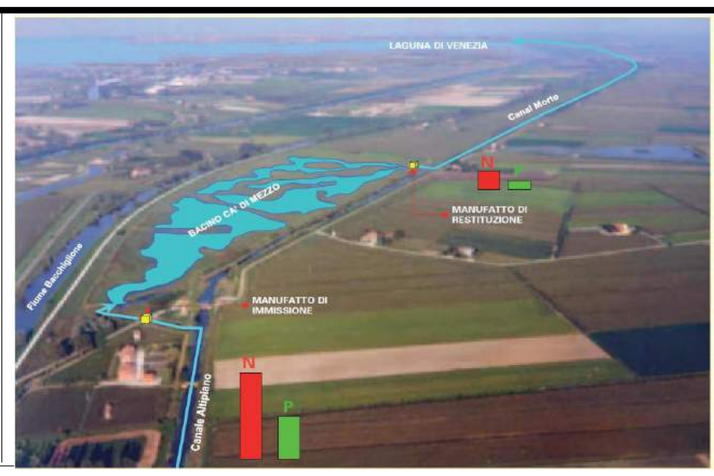
In many cases there are uncertainty that can become real risks, which impacts are not easy to be assessed beforehand. Gaining experience over the last 20 years the Consortia are becoming able to correctly managing NBSs. Also from the economical point of view.

BENEFITS (ECONOMICALLY TO THE FARM, ENVIRONMENT AND SOCIETY):

In the large majority of the projects farmers did not had any direct economic benefit, unless in some case a negligible reduction of the OPEX of the canals. NBSs are producing ecosystem services, which are not rewarded or marketable. Nevertheless, developing more the multifunctionality of NBS, significant indirect benefits could be produced, namely water storage, better water quality, support to F2F compliance, dynamic rivers' Eco-flows managements. The benefits for the environment are on the contrary clear: increased biodiversity and complexity of the ecosistems, higher resilience. Society is enjoying a more healthy, pleaseant landscape which fruition is fast increasing.

FUTURE PLANS:

ANBI is reproducing the experience in other areas in Italy. The next steps will be to mpove towards an higher degree of multifunctionality and to design criteria aiming to make NBSs part of a larger network of infrastructures dedicated to a dynamic management of Eco-flows.



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More information: www.eip-agri.eu

The Tullstorp stream project

Christoffer Bonthron

www.tullstorpsan.se | https://www.facebook.com/tullstorpsan

GEOGRAPHICAL REGION:

Southern Sweden

INVOLVED ACTORS IN THE DESCRIBED NBS:

Landowners, municipality, county administrative board, Tullstorp stream economic association

SOURCES OF INFORMATION, REFERENCES, WEBSITES

www.tullstorpsan.se

DESCRIPTION OF THE NBS:

River restoration - in total actions are implemented at 20 km of the rivers total length of 25 km. Actions - meandering (S-curved riverbed, flooding areas (areas dedicated to flood during high level of water in the river), two-stage ditches (the V-shaped river bed is broaden with terraces that are higher than the river bottom in combination with slight slopes allowing more water in the river during high level).

Wetlands - most wetlands are side wetlands meaning that they are positioned a step away from the river. An existing drainage has been cut, water enters the wetland from the drainage and then a regulated outlet secures a water level in the wetland. Some wetlands are connected to the river and acts as combined wetlands and flooding areas for the river.

SUCCESS ELEMENTS FOR IMPLEMENTATION

The project has a holistic systems perspective on the catchment area, integrated objectives and is driven by the landowners, based on voluntary actions, in a democratic organization as a prerequisite for joint decision making about wetland establishment and future management. A full time employed project manager.

LIMITATIONS AND DRAWBACKS:

Improvements to the funding system, i.e. what kind of subsidies a project can apply for as well as longer-term assurance of the flow of the funding, improvements to regulations and guidelines, adapting them to a systems perspective on river restoration actions and a balance between agricultural production and actions establishment.

BENEFITS (ECONOMICALLY TO THE FARM, ENVIRONMENT AND SOCIETY):

- No flooded fields, better effects of existing drainage systems
- Biodiversity, reduction of nutrients, water regulation, sedimentation and water cleaning
- Recreation and nature experiences

FUTURE PLANS:

At the moment a pilot project is under construction - a combined circular system of - Multifunctional water reservoirs, Recirculating water with irrigation & Customized drainage. The basic idea of this project is that water should be able to be stored in a multifunctional water reservoir when there is excess of water. When there is a drought the water is "harvested" from the storage and used in a recirculating irrigation system and a system of customized drainage and finally, to a certain extent, returned to the water system.

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More information: www.eip-agri.eu

Wide row vegetable transplanting in rolwd cover crop

Peter Caky

DESCRIPTION OF THE NBS:

Intercroping cabbage in to rolled mulch of hairy vetch or another overwinter cover crop legumes are prefered. Cover crop is terminated by roller crimper in full or end of bloom. Mulch of rolled crop shading soil, keeps moisture, protect soil against water erosion and overheating. Soil capilarity is hold so good water infiltation in heavy rain is achieved. Cover crop also helps biological activity in soil and make enviroment for predators. Legume cover crop fixes Nitrogen.

GEOGRAPHICAL REGION:

Slovakia, Sub-Tatra Basin

INVOLVED ACTORS IN THE DESCRIBED NBS:

Peter, Miroslav, Igor Čaky

SOURCES OF INFORMATION, REFERENCES, WEBSITES

https://photos.app.goo.gl/aMTUh57jTmdQxrt6A

HOW THE SOLUTION IS CURRENTLY APPLIED IN THE FIELD?

In 2019/2020 first test in hairy vetch. Area 3x100m
In 2020/2021 failed to establish hairy vetch due to complicated weather condition. But in 2021 no-till transplanter tested.
In 2021/2022 crimson clover as cover crop selected on 4ha field.

SUCCESS ELEMENTS FOR IMPLEMENTATION

Proper cover crop selection and establishment is crucial. Right termination time of cover crop and no-till vegetable transplanting in rolled mulch.

LIMITATIONS AND DRAWBACKS:

Cover crop termination time and plant transplanting time must corelate.

BENEFITS (ECONOMICALLY TO THE FARM, ENVIRONMENT AND SOCIETY):

Erosion free wide row crops growing, efficient rain water management, nutrient recycling. Growing system that is in line with regenerative agriculture.

FUTURE PLANS:

Discovering other cover crops or mixes to use, tune no-till transplanting,.

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More information: www.eip-agri.eu

BUVARD:BUffer strip runoff Attenuation and pesticide Retention Design tool

Nadia Carluer, Claire Lauvernet, Michaël Rabotin, Florent Veillon

https://polldiff.inrae.fr/ http://buvard.irstea.fr/

GEOGRAPHICAL REGION:

The first version of BUVARD was developed for the whole of France, but considered only the water flow mitigation. A new version is developed, on sediments and pesticides, and directly connected to the available soil databases. This new version has been implemented in the Brittany region (West of France) and will be gradually extended to other french regions

INVOLVED ACTORS IN THE DESCRIBED NBS:

BUVARD was developed by researchers, to be used by farmers, agricultural advisors, or to be used in an educational context

SOURCES OF INFORMATION, REFERENCES, WEBSITES

Muñoz-Carpena, R.; Parsons, J. E. & Gilliam, J. W. (1999) Modeling hydrology and sediment transport in vegetative filter strips *Journal of Hydrology*, 1999, 214, 111-129

Carluer, N., C. Lauvernet, D. Noll and R. Munoz-Carpena (2016). Defining context-specific scenarios to design vegetated buffer zones that limit pesticides transfer via surface runoff. *Science of the Total Environment* **575**: 701-712.

R. Muñoz-Carpena, C. Lauvernet, N. Carluer (2018). Shallow water table effects on water, sediment and pesticide transport in vegetative filter strips: Part A. Unsteady rainfall infiltration and soil water redistribution. *Hydrol. Earth. Syst. Sci*. **22**, 53-70

DESCRIPTION OF THE NBS:

Buffer Zones can be useful to prevent and limit the transfer of pollutants from agricultural fields to water resources, in parallel **with agricultural good practices**.

Vegetated Filter Strips (VFS) are particularly useful for suspended matters and pollutants transported through surface runoff (pesticides, phosphates).

To be efficient, they need to be properly designed, considering the particular context in which they are implanted: BUVARD is a free online tool, developed to size VFS, once a flow diagnostic has been performed and the position of the VFS has been chosen.

It takes into account the topography of the upslope zone, its soil, the soil occupation, the local climate and assesses the VFS dimension, given the desired efficiency.

HOW THE SOLUTION IS CURRENTLY APPLIED IN THE FIELD?

The new version of the tool is based on a map interface that allows the user to visualize the location where he wants to place a VFS. The soil type and climate are provided by the interface; the user must fill in the soil occupation (both for winter and summer) as well as the depth of the water table under the grass strip.

SUCCESS ELEMENTS FOR IMPLEMENTATION

VFS need to be correctly implemented and maintained in order to be efficient: appropriate choice of species to be sown, good climatic conditions for the implantation, attention paid to the formation of gullies. VFS are efficient only if surface runoff is laminar: the tool warns the user when topography may induce concentrated runoff. Anyway, one must remain vigilant on this point as the band ages.

LIMITATIONS AND DRAWBACKS:

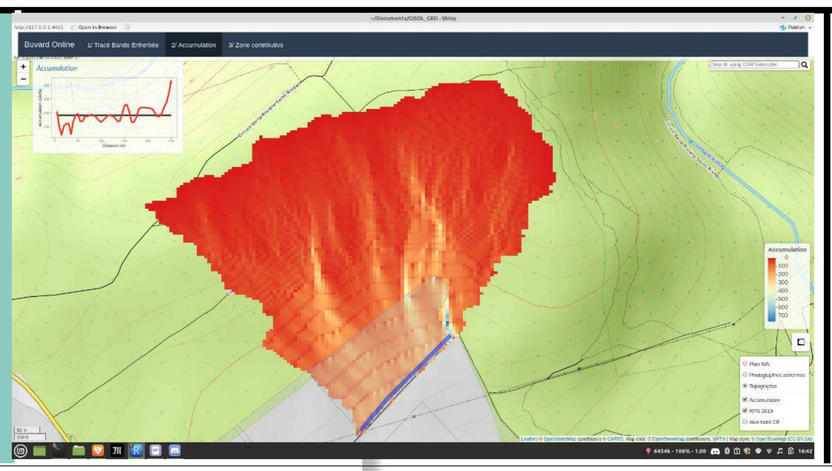
When flow concentrates before entering the VFS, it can be appropriate to grass the talweg upslope the VFS. VFS are also sensitive to hydromorphy: if the water tale depth is correctly filled in, the predicted VFS size should reflect this low efficiency. If hydromorphy is only seasonal, the VFS may be efficient in summer. Otherwise, it can be more appropriate to use an artificial wetland.

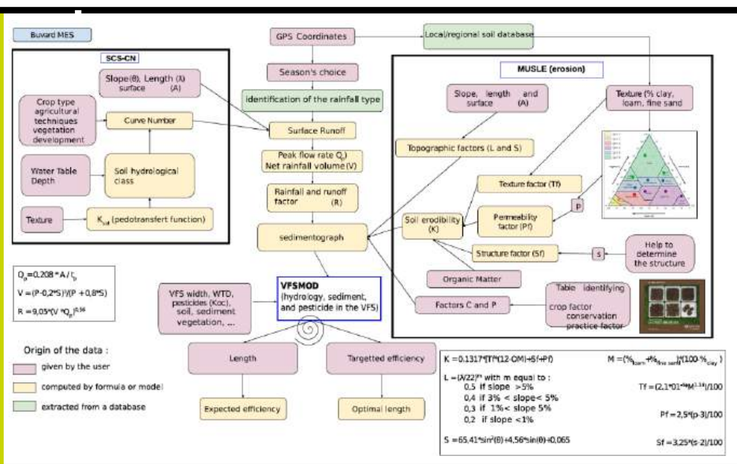
BENEFITS (ECONOMICALLY TO THE FARM, ENVIRONMENT AND SOCIETY):

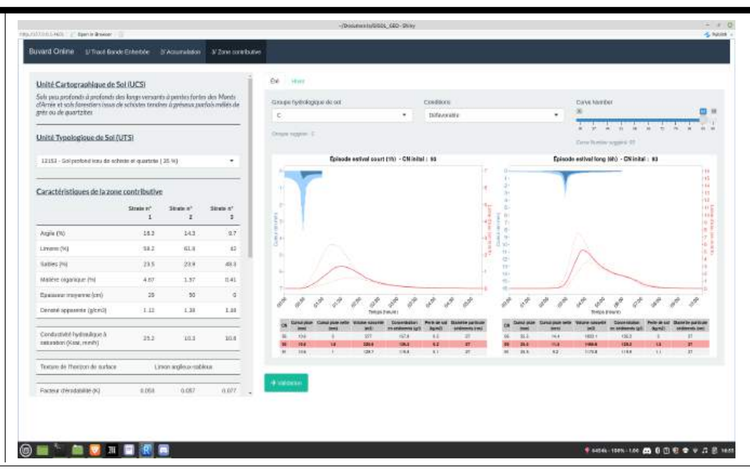
VFS consume agricultural lands but their sizing is precisely optimized thanks to Buvard, and they are not expensive to establish or to maintain. They mitigate sediment and pesticide transfer, enhance biodiversity (especially if the grass is mowed late), enhance soil permeability, enhance soil carbon content. VFS improve the landscape.

FUTURE PLANS:

To adapt the new version of BUVARD for the whole of France. And afterwards to extend it to other european countries?







funded by European Commission

Ciasnocha Family Farms & the European Carbon Farmers

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Ciasnocha Family Farms | European Carbon Farmers

GEOGRAPHICAL REGION:

Vistula Delta Region of Żuławy Wiślane in northern Poland. The exact location is the farm is here.

INVOLVED ACTORS IN THE DESCRIBED NBS:

Ciasnocha Family Farms of 700 ha supported by the Common Agricultural Policy of the EU and since 2020 by the European Carbon Farmers – a business spin out of the family farms.

SOURCES OF INFORMATION, REFERENCES, WEBSITES

In English available here.
In Polish available here.

DESCRIPTION OF THE NBS:

Supported by the Common Agricultural Policy of the EU, Ciasnocha Family Farms has transitioned its model of production away from intensive conventional production to the regenerative production model. In 2004 we have transitioned to minimum tillage with cover crops and a diverse rotation of spring cash crops. In 2008 we have transitioned further into the permanent grassland that we are in right now. This model enables us to drastically lower our input costs and environmental externalities associated with those while providing a set of ecosystem benefits, such as reducing runoff of nutrients from our fields, carbon sequestration and biodiversity increase.

HOW THE SOLUTION IS CURRENTLY APPLIED IN THE FIELD?

We have transitioned our whole farm area from annual to perennial crops. Therefore, the whole farm area participates in this land-use change, which has a positive effect on our water, as well as carbon and energy cycles. As farmers, we are proud to be good stewards of the ecosystem we are the custodians of.

SUCCESS ELEMENTS FOR IMPLEMENTATION

In the case of our family farm, the key success factor was conducting the transition from one model of production (conventional) to a new model of production (regenerative) in a profitable way. Once we knew what our new financial situation after the transition will be and that it will be a better situation than our existing situation back at the time, we were happy to make this transition.

LIMITATIONS AND DRAWBACKS:

When presenting our work, we are often being asked why are we not ashamed that we stopped producing food (cereals) and now we only produce animal feed. For this we answer that A) We are still producing food and B) there is systemic work to be done in order to transform cereals production into regeneration. We do hope the work of FG46 will contribute to pushing in this direction.

BENEFITS (ECONOMICALLY TO THE FARM, ENVIRONMENT AND SOCIETY):

Transitioning towards our current mode of operations have generated numerous economic (greater profitability per hectare, lower input costs, lower financial risk of production), environmental (according to the Cool Farm Tool sequestration of 6,5 t/CO2e ha/year for 20 years since the day of the land-use change, limitation of fertilizer run off, biodiversity increase) and social (lowering erosion affecting local communities, permanent annual employment for our employees) benefits.

FUTURE PLANS:

Both Ciasnocha Family Farms and the European Carbon Farmers are committed to **putting farmers at the center of climate change mitigation and adaptation efforts in a profitable way**. Synthesis of our work done so far, as well as a comprehensive proposal of what is needed to be done to make this true is presented in the proposal and an appeal for the creation of ***the Working Group on Climate Neutral and Nature Positive Agriculture*** available in English here and in Polish here.




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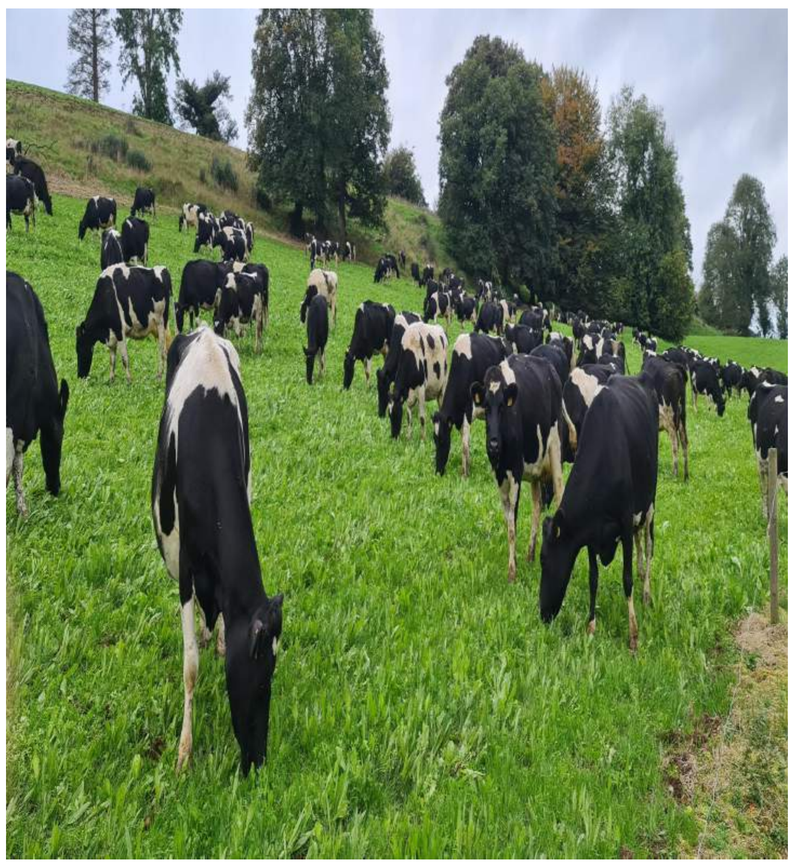
More information: www.eip-agri.eu

Multi Species Sward

Martin Crowe

Twitter @martincrowe



GEOGRAPHICAL REGION: Ireland

INVOLVED ACTORS IN THE DESCRIBED NBS:

Farmers and a=Advisors

SOURCES OF INFORMATION, REFERENCES, WEBSITES

Teagasc.ie

DESCRIPTION OF THE NBS:

Multi Species Swards(MSS) instead of mono-cultures like perennial ryegrass swards. The MSS can include, but not exclusuive to, Plantain, Chickory, Red and White clover, ryegrass, timothy etc. This sward has a deeper rooting system which makes it more resistant to drought.

HOW THE SOLUTION IS CURRENTLY APPLIED IN THE FIELD?

MSS used instead of monocultures when resseding pastureland

SUCCESS ELEMENTS FOR IMPLEMENTATION

Reduced need for chemical Nitrogen, improved animal rperformance and reduced loss of N to ground water and watercourses

LIMITATIONS AND DRAWBACKS:

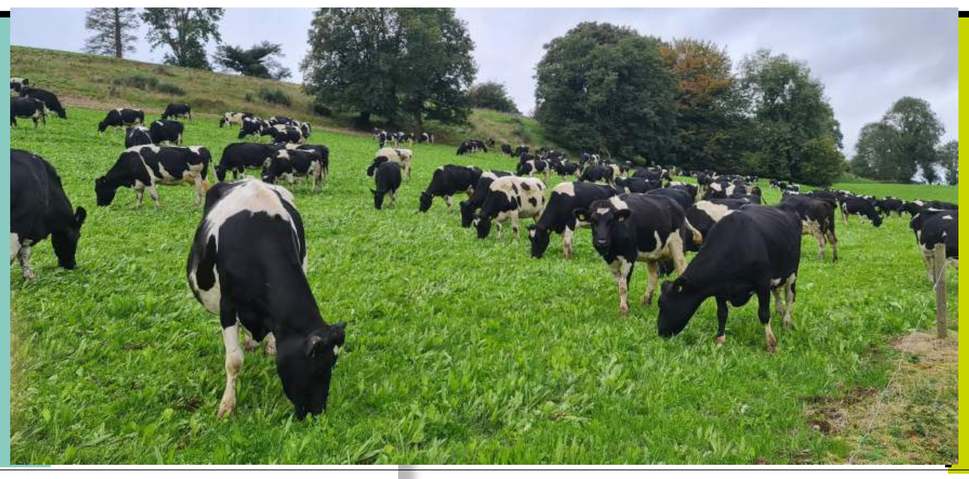
The persistency of the sward and weed control

BENEFITS (ECONOMICALLY TO THE FARM, ENVIRONMENT AND SOCIETY):

Reduced chemical N applied, reduced N in the watercourse and reduced overland flow of water

FUTURE PLANS:

Greater adoption of MSS on farm and trials to see success of stitching in MSS to existing swards



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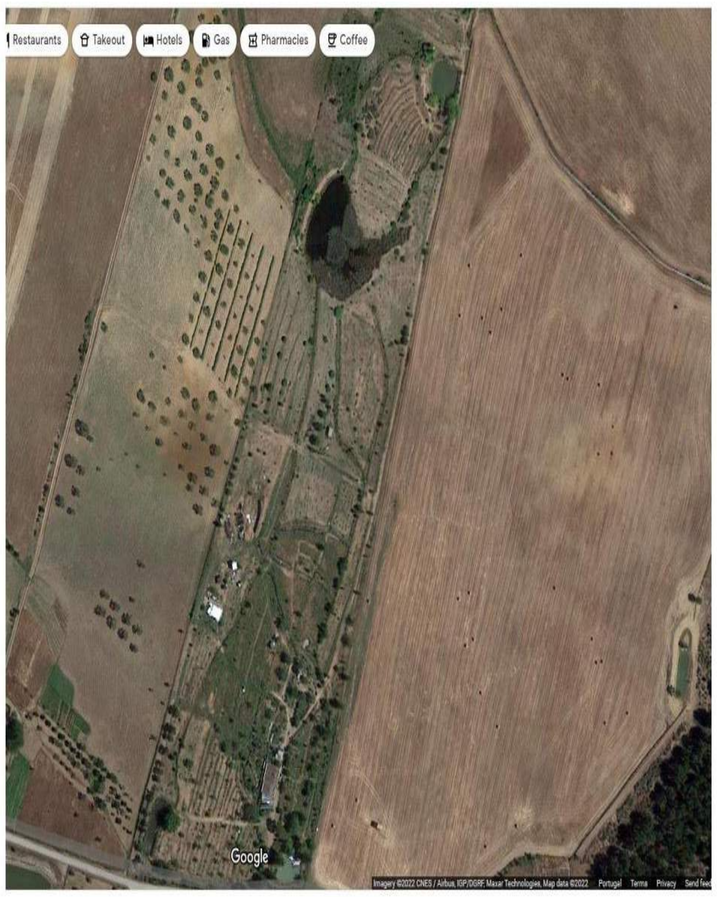
Quinta das Lagoas

Carlota, Claudio and Sara Rodrigues

Website 1 | Website 2



DESCRIPTION OF THE NBS:

Focusing in restoration os soil fertility and structure, after decades of intensive exploitation for, essentially, tobacco and tomato production prior present management; augmenting soil organic matter content; no tillage; permanet soil cover with crops and/or bushes and trees; animals (mostly avifauna) at the farm providing manure; organic regenerative practices; all this resulting higher soil water retention, reduced run-off, less need of water irrigation volumes from at the farm developed ponds and channels system.

GEOGRAPHICAL REGION:

Ladoeiro, Castelo Branco, Beira Interior, Portugal

HOW THE SOLUTION IS CURRENTLY APPLIED IN THE FIELD?

Experimenting higher biodiversity by costantly introducing ‘new’ plants species/varieties

INVOLVED ACTORS IN THE DESCRIBED NBS:

Carlota, Claudio and Sara Rodrigues

SUCCESS ELEMENTS FOR IMPLEMENTATION

Time, human resources, knowledge and patience

SOURCES OF INFORMATION, REFERENCES, WEBSITES

https://quintadaslagoasblog.wordpress.com/

LIMITATIONS AND DRAWBACKS:

Weak commercial channels in the area, unsupportive and unreceptive (conservative) local sociocultural environment

BENEFITS (ECONOMICALLY TO THE FARM, ENVIRONMENT AND SOCIETY):

A good example for local producers as to innovate and become more resilient especially to drought, biodiversity has exploded at the farm, together with stabilizing its productivity, enhancing fertitlity of soil and minimising losses due to erosion

FUTURE PLANS:

Hopefully leading a ‘replicate effect’ while networking with alike minded farmers and/or institutions, local or from elsewhere

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More information: www.eip-agri.eu

WATER+LAND+SCHAP

Liesbeth Gellinck (Flemish Land Agency) from Jeroen De Waegemaek

www.vlm.be/nl/projecten/vlm-projecten/waterlandschap

GEOGRAPHICAL REGION:

Flanders, the northern region of Belgium

INVOLVED ACTORS IN THE DESCRIBED NBS:

At the level of the program: Departments of the Flemish Government (VLM, VMM, L&V, ANB & Omgeving), research institutes (ILVO, VITO & VLAKWA) and Architecture Workroom Brussels

At the level of local coalitions: Local policy makers, farmers' and nature organisations, land owners and many others

DESCRIPTION OF THE NBS:

Water+Land+Schap is a **government programme** that is set up by various departments of the Flemish Government, research institutes and a design office. Water+Land+Schap aims to improve the sustainable water management by speeding up and scaling up nature-based solutions in Flanders' rural areas.

Water+Land+Schap stimulates the development of **local coalitions**: a group of local stakeholders such as farmers, land owners, nature conservationists, and policy makers that coproduce a vision on water management in the area on the long term as well as demonstrate NBS on the short term.

BENEFITS (ECONOMICALLY TO THE FARM, ENVIRONMENT AND SOCIETY):

Water+Land+Schap focuses on **win-win situations** and sets out multiple goals;

+ improved water quantity (soil erosion, flood and drought management)
+ improved water quality (eutrophication, pesticides)
+ sustainable and productive farming
+ landscape development (biodiversity, recreation, heritage,…)

WHICH SOLUTIONS ARE CURRENTLY APPLIED IN THE FIELD?

Water+Land+Schap finances **a wide variety of nature-based solutions** including farming management contracts, buffer areas along the watercourses, hedgerows, active weirs, level-controlled drainage, and alternative crops.

Knowledge on these nature-based solutions are shared with other EU-countries via the project Co-Adapt, funded by Interreg 2 Seas .

FUTURE PLANS:

A first group of coalitions (14) started in 2017 and now proceed to actions in the field.

A second group of coalitions (24) started in 2021. While 16 coalitions now focus on the development of a local vision, 8 coalitions focus on innovation

SUCCESS ELEMENTS

Water+Land+Schap stimulates:

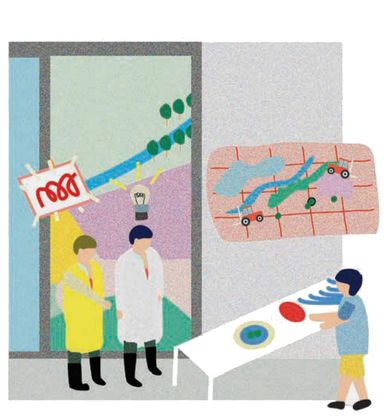
+ Multi-actor cooperation on water management
+ Knowledge exchange on NBS by sharing lessons learned
+ Real-life experiments with NBS (from theory to practice)

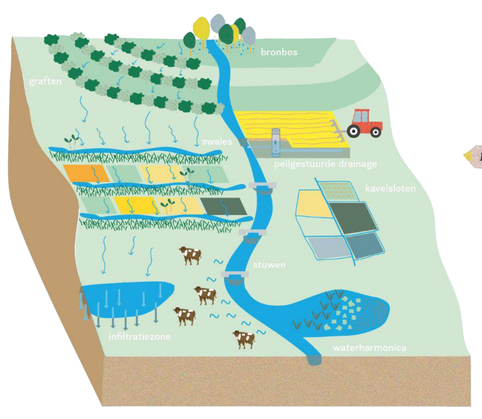
LIMITATIONS AND DRAWBACKS:

An evaluation of Water+Land+Schap highlights the following barriers:

+ Difficulties in transposing broad goals into specific measures
+ Farmers' support for NBS is essential but they are difficult to reach
+ Pilot projects on NBS face structural problems in existing legislation

Water+Land+Schap
Blue Deal
De strijd tegen droogte
Interreg 2 Seas Mers Zeeën Co-Adapt
Medegefinancierd door de Europese Unie
NextGenerationEU





funded by European Commission

Mulch trial – Le Magneraud (17)

Sophie Gendre – s.gendre@arvalis.fr

Website 1

GEOGRAPHICAL REGION:

West of France – Oceanic region

INVOLVED ACTORS IN THE DESCRIBED NBS:

Arvalis – trial

SOURCES OF INFORMATION, REFERENCES, WEBSITES

https://www.perspectives-agricoles.com/teneur-en-eau-des-sols-quel-est-l-effet-des-couverts-d-interculture--@/view-3719-arvarticlepa.html

DESCRIPTION OF THE NBS:

The NBS is a permanent soil cover to reduce evaporation. Three type of cover have been compared : mulch, cover crop destroyed 3 weeks before sowing, cover crop destroyed just before sowing. Objective of this trial is to estimate water saving by soil cover. What we see is that mulch could keep more humidity than other modalities.

HOW THE SOLUTION IS CURRENTLY APPLIED IN THE FIELD?

As it’s a field trial, the solution is partially applied in the field, all things being equal. It means that sowing date, density and variety are not optimized for the solution but it’s a compromise between all the systems tested.

SUCCESS ELEMENTS FOR IMPLEMENTATION

Adapt sowing date to the NBS.

LIMITATIONS AND DRAWBACKS:

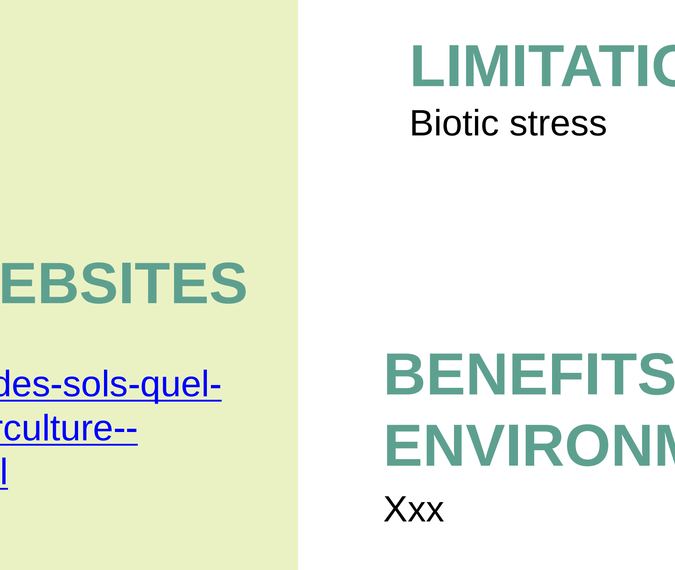
Biotic stress

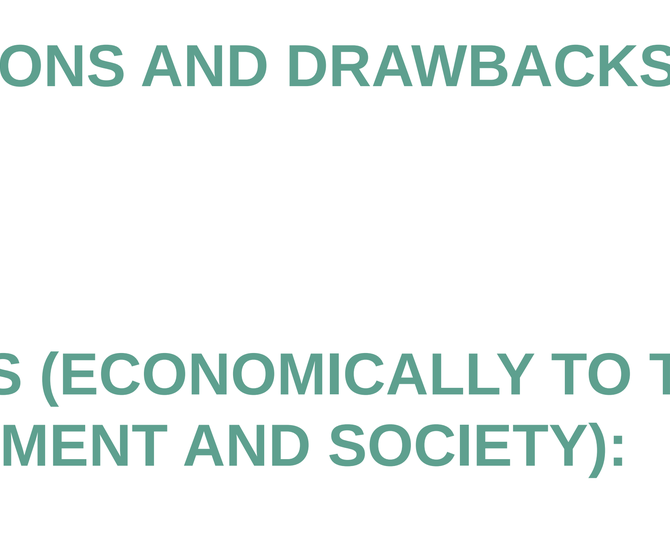
BENEFITS (ECONOMICALLY TO THE FARM, ENVIRONMENT AND SOCIETY):

Xxx

FUTURE PLANS:

A new trial will begin in 2022. An irrigation calendar specific to each modality will take place based on tensiometric values





picture

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More information: www.eip-agri.eu

The model of the European “Local water partnership”

Dr Sławomir Gromadzki, family organic, dairy farm

Website 1 | Website 2

GEOGRAPHICAL REGION:

Poland

INVOLVED ACTORS IN THE DESCRIBED NBS:

Farmers, forest owners, fish farms, local governments, water companies, entrepreneurs, NGOs, public institutions, LAGs,

SOURCES OF INFORMATION, REFERENCES, WEBSITES

http://www.debiut.buzek.pl/wp-content/uploads/2021/12/Zrownowazony-naukowca_wer13_kor.-JJP.pdf

DESCRIPTION OF THE NBS:

European model of public-social-private partnership in the field of water resource management and protection at the local level (micro-catchment / small catchment area).

"Local water partnership" involves the involvement of local partners such as farmers, local governments, NGOs, entrepreneurs, public institutions in the process of develop and implement a "Local strategy for retention and protection of water resources ".

HOW THE SOLUTION IS CURRENTLY APPLIED IN THE FIELD?

In Poland, a pilot water partnership is being carried out in each of the 16 voivodeships.

SUCCESS ELEMENTS FOR IMPLEMENTATION

The model is based on the LEADER method proven in the European Union, Extensive experience of local EU partnerships in the implementation of local development strategies, a coherent, universal methodology that can be used in equal environmental, soil, hydrological and social conditions

LIMITATIONS AND DRAWBACKS:

The implementation of the concept requires the application of the model at the European Union level and the adoption and implementation of relevant Community legislation.

BENEFITS (ECONOMICALLY TO THE FARM, ENVIRONMENT AND SOCIETY):

Farmers, forest owners, fish farms, local governments, water companies, entrepreneurs, NGOs, public institutions, LAGs,

FUTURE PLANS:

Our goal is to implement the model throughout the European Union

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More information: www.eip-agri.eu

Water in Balance program – mitigating surface water runoff

Twan Gielen

https://www.waterschaplimburg.nl/uwbuurt/landingspagina/landelijk

2021 set of field demos

GEOGRAPHICAL REGION:

The Netherlands, Province of Limburg (southernmost part, close to both Germany and Belgium)

INVOLVED ACTORS IN THE DESCRIBED NBS:

Local farmers, Water Board Limburg, Province of Limburg, Wageningen Agricultural University, local advisors

SOURCES OF INFORMATION, REFERENCES, WEBSITES

Yearly progress reports, presentations, field demonstrations, news articles in various media.

DESCRIPTION OF THE NBS:

Water in Balance is a project that farmers, water boards, regional authorities, advisers and research institutes together to develop climate change mitigation techniques at farm-scale in such a way, that a win-win scenario for farmers and urban areas is achieved. Key here is that the mitigations techniques can relatively easily be implemented in current practice. Ambition set in 2018 is to –if and where possible- store an additional 10 mm of precipitation in the subsurface.
The measures to reduce or avoid surface water runoff reduce the need for irrigation, reduce erosion, and enhance soil quality and resilience. Positive side effects are expected in the field of water quality, biodiversity and drought mitigation.

Acknowledgements: Water Board Limburg – Bas Rompelberg
Wageningen University - Brigitte Kroonen-Backbier

HOW THE SOLUTION IS CURRENTLY APPLIED IN THE FIELD?

For three years, various sets of field demos and studies have been run to investigate
- Practical applicability of the measure;
- Effectiveness in/contribution to enhanced water infiltration;

Various measures and techniques are deemed viable, and current deployment means are being assessed.

SUCCESS ELEMENTS FOR IMPLEMENTATION

Active participation of local farmers, who take the role of ‘ambassadors’;

Sufficient number of people attending meetings (demonstrations in the field or informative meetings for study groups, for example);

Support from regional government bodies (Water board and/or Province)

LIMITATIONS AND DRAWBACKS:

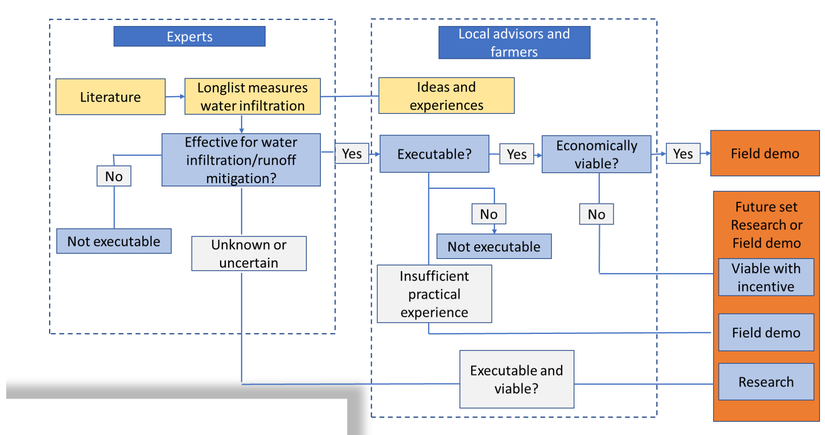
Findings are, that enhancing water infiltration only works until a certain level of precipitation.
Covid-19 was a huge drawback, as at the current status of the project requires communication to support deployment of the techniques tested. Field meetings could not be held, leading to beneficial gains of deliberations on site being missed.

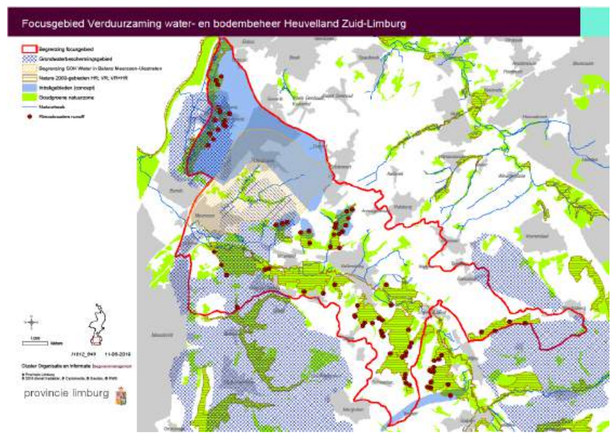
BENEFITS (ECONOMICALLY TO THE FARM, ENVIRONMENT AND SOCIETY):

Some measures have found to enhance net crop yield by few percent, which (at least partly) counterbalances addtional costs made. In general, the mitigation techniques work towards a healthy soil system, reduce erosion, and help avoid flooding of urban areas. Positive side effects are expected in the field of water quality and biodiversity.

FUTURE PLANS:

Continuation of research into current NBS’s, extension of the data set of field demos, deployment of the measures over a larger area and enhanced communication.





funded by European Commission

Zitrus project: better Oranges and Mandarins

Eva Hernández ehernandez@wwf.es

Website 1 | Website 2

GEOGRAPHICAL REGION:

Andalusia, Spain

INVOLVED ACTORS IN THE DESCRIBED NBS:

Edeka and Netto Markendiscount
WWF Germany and WW Spain
Farmers and their employees in Andalusia as well as their related distributors

SOURCES OF INFORMATION, REFERENCES, WEBSITES

https://www.wwf.es/nuestro_trabajo/alimentos/proyecto_zitrus/
https://www.edeka.de/nachhaltigkeit/edeka-zitrusprojekt/zitrus.jsp

FUTURE PLANS:

New farms are added every year to the project, now moving to other regions in Spain. Its good practices are also being replicated in farms not part of Edeka's supply chain

DESCRIPTION OF THE NBS:

The project applies agroecology principles to reduce the environmental impact of conventional Citrus farming around 4 topics:
1. More sustainable water use (on the farm and in the river-basin) adapting to regional climate change forecast.
2. Integrated pest management: Substitution of Highly Hazardous Pesticides and promotion of beneficial insects and natural plague control, application of pesticides based on strict plague monitoring
3. Efficient fertilization and promotion of soil fertility: mineral fertilizers application based on water, soil and leaf analysis; organic matter and fertilizers in plantation parts with low soil fertility.
4. Conservation and promotion of biological diversity: Strong limitation of herbicide use, establishment of green corridors and further habitats, promotion of the ecological infrastructure (e.g. perches, nesting boxes), protection protocols for species of special interest (e.g. fish otter, ground-nesting birds).

HOW THE SOLUTION IS CURRENTLY APPLIED IN THE FIELD?

Farms receive advice and train their own staff to develop pesticide plan, biodiversity, water use and soil management, with support from WWF. Continuos improvement is actively searched.

SUCCESS ELEMENTS FOR IMPLEMENTATION

Strategic partnership between EDEKA and WWF allows to work along the entire supply chain from. An existing sales market facilitates implementation, while impact is incomparably higher. Project partners in Spain are highly motivated and want to make a difference, creating a good project spirit

LIMITATIONS AND DRAWBACKS:

Change in how the farm is managed and even on the background of the staff was needed (e.g, people once in charge of pesticide use are now biodiversity experts). This needs willingness to compromise on all sides, and openness for new practices

BENEFITS (ECONOMICALLY TO THE FARM, ENVIRONMENT AND SOCIETY):

Security of purchase, higher prices per kilo, healthier plantation management

Environmental costs: 36% less environmental costs per produced ton of oranges, considering the categories Land Use, Water Consumption, Pollutants and Green House Gases

In 2018, eight project farms saved 806 Million Litres of water in relation to their water usage rights due to efficient irrigation

Strong reduction of pesticide use in relation to the year before project start (in kg/ha): fungicides (7.5 to 3.1), Herbicides (2.5 to 0.4), Insecticides (2.0 to 0.1) = Data from 2018

21 different ladybird species (project's biodiversity indicator) have been spotted on the project farms (7 species prior to project start). Also, the rare fish otters has resettled on one of the farms, indicator of water quality

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More information: www.eip-agri.eu

Valuta-project - water management in the cachment area

Viivi Kaasonen from Airi Kulmala

https://wwf.fi/en/

https://wwf.fi/alueet/itameri/valuta/

GEOGRAPHICAL REGION:

Boreal, Northern hemisphere, Northern Europe, Finland

INVOLVED ACTORS IN THE DESCRIBED NBS:

Project leader, landowners, constructors and designers/planners, authorities

SOURCES OF INFORMATION, REFERENCES, WEBSITES

https://wwf.fi/alueet/itameri/valuta/
project deliverables:
https://wwf.fi/valuta-hankkeen-kohteet/

DESCRIPTION OF THE NBS:

In the VALUTA-project, the aim is to improve water management in the catchment areas of rivers Inkoo, Ingarskila and Siuntio. The basic idea is to create structures which slow down the flow of water and reduce flooding, since in Finland, most of the fields are heavily ditched so they can be cultivated. In the project wetlands, two-stage channels and sedimentation basins are constructed as well as meandering brooks from straightened ditches are recreated. Wetlands and two-stage channels can both be found in nature. Wetlands accumulate water and remove nutrients from the water. Two-stage channels do not go by the name in nature but are inspired by floodplains by brooks and rivers. Sedimentation basins are adaptations of wetlands and help with water management by accumulating excess sediment and by increasing channel volume. Meandering channels are found in nature and returning straight ditches into meandering form helps to slow down the water flow.

HOW IS THE SOLUTION CURRENTLY APPLIED IN THE FIELD?

Two-stage channels (TSC) in Finland are mainly constructed as a part of a different water management and research projects. Large wetlands are also often constructed with the help of projects. Currently, construction of TSC may obtain financial support in the form of a drainage subsidy. TSC and wetlands are also supported by CAP-AES's non-productive investments and maintenance allowance.

SUCCESS ELEMENTS FOR IMPLEMENTATION

The project work has been going on in the same region for over 4 years now during which time a plenty of good examples have been constructed. The examples improve the popularity of the project and the water management solutions used. Expertise of the project personnel regarding the water management and the process from design to implementation has been beneficial. Every landowner doesn't have to learn the process themselves.

LIMITATIONS AND DRAWBACKS:

The used solutions are expensive to implement which limits the work of the project and especially landowners who would like to implement the solutions themselves. Process requires a lot of knowledge which hinders implementation when someone experienced is not involved. The solutions require land area. Landowners may fear losing their farmland, even though it could provide drainage benefits.

BENEFITS (ECONOMICALLY TO THE FARM, ENVIRONMENT AND SOCIETY):

The solutions help reduce flooding in the area. The less there are floods on fields the better the farming potential. The solutions balance water flow making it possible to prepare for drought as well. They prevent excess nutrients and sediment from either reaching a watershed or remove them from the water. The also have positive biodiversity effects as well as wetlands are nice landscape elements. Nutrient loading from agriculture is a big concern when it comes to water protection. These solutions can help with increasing the social acceptability of farming.

FUTURE PLANS:

Valuta-project continues the work to reduce nutrient loads and eutrophication caused by agriculture and forestry in inland waters and the Baltic Sea. Efforts will also be made to secure funding for similar new projects. Cooperation with landowners is aimed at increasing their interest in constructing water protection structures and utilizing various support opportunities. NBSs will become even more important as climate change is expected to increase autumn and winter rains as well as heavy summer rains. On the other hand, drought periods in the summer become more common.

Photos: WWF Finland/Viivi Kaasonen

funded by European Commission

EIP-AGRI Focus Group 'Nature-Based Solutions for water management under climate change– March 2022

More information: www.eip-agri.eu

Valumavesi-project - two-stage channels in Finland

Pasi Valkama from Airi Kulmala

https://www.syke.fi/en-US

https://www.syke.fi/hankkeet/valumavesi

GEOGRAPHICAL REGION:

Boreal, Northern hemisphere, Northern Europe, Finland

INVOLVED ACTORS IN THE DESCRIBED NBS:

Farmers, environmental engineers, researchers, authorities

SOURCES OF INFORMATION, REFERENCES, WEBSITES

https://www.syke.fi/hankkeet/valumavesi
https://www.mdpi.com/2071-1050/13/16/9349

DESCRIPTION OF THE NBS:

It has been estimated that one-third of agricultural streams and ditches in Finland need maintenance since they do not provide the required drainage performance. Conventional dredging of ditches and streams to ensure agricultural drainage can have severe environmental impacts. Therefore, more sustainable, environmentally friendly drainage methods are needed. Two-stage channels (TSC) may be used for sustainable drainage to improve water retention capacity and prevent flooding. TSCs may also have positive impacts on reduced N, P, SS and C loading and biodiversity. TSCs consists of a main channel, where water flows when water volume is low, and of floodplains where water has more room to flow in times of increased water volume. Vegetation in floodplains prevents erosion and removes nutrients from the water. The structure mimics the features of a natural stream and is therefore more sustainable. With two-stage ditches, natural processes reducing nutrient loads from the water are also possible.

HOW IS THE SOLUTION CURRENTLY APPLIED IN THE FIELD?

Two-stage channels in Finland are mainly constructed as a part of a different water management and research projects. There are approximately 20 km of TSCs in different parts of country. Currently, construction of TSC may obtain financial support in the form of either a drainage subsidy or from CAP-AES's non-productive investments and maintenance allowance.

SUCCESS ELEMENTS FOR IMPLEMENTATION

Multi-benefit NBS to ensure proper drainage status and mitigating flood risk of fields. Farmer's benefit is also environment's benefit. Two-stage channel requires less maintenance than common ditches and thus maintenance costs are lower.

LIMITATIONS AND DRAWBACKS:

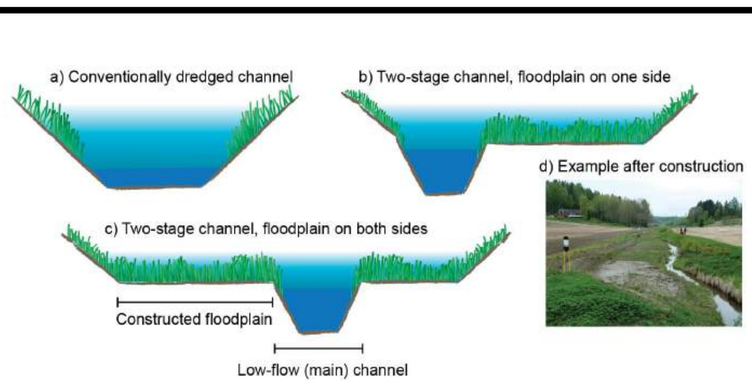
The method is not yet widely accepted by farmers. TSCs need more space and they are more expensive to construct than common ditches. Loosing of productive field area under floodplain leads to yearly crop value lost. TSCs also reduces the arable land area that is entitled to area subsidies.

BENEFITS (ECONOMICALLY TO THE FARM, ENVIRONMENT AND SOCIETY):

TSCs appears more beneficial than conventional dredging regarding water quality, stream and riparian biodiversity, long-term maintenance of the drainage and flood mitigation functions. Farmers profit from well-functioning drainage and flood mitigation through improved crop security and crop yields. The retention and removal of suspended sediment, phosphorus, and nitrogen improves the water quality in streams and in downstream water bodies. The benefits to biodiversity and water quality likely supports to achieve the goals of the Water Framework Directive (WFD)

FUTURE PLANS:

Valumavesi-project provides more information of TSCs nutrient retention capacity, flood mitigation and impacts on biodiversity. It is also investigated the bottlenecks in the financing and governance hindering two stage channels to become more common. Collaboration with farmers and advisers are emphasized to promote TSCs as multi-benefit NBS to farmers and the environment.

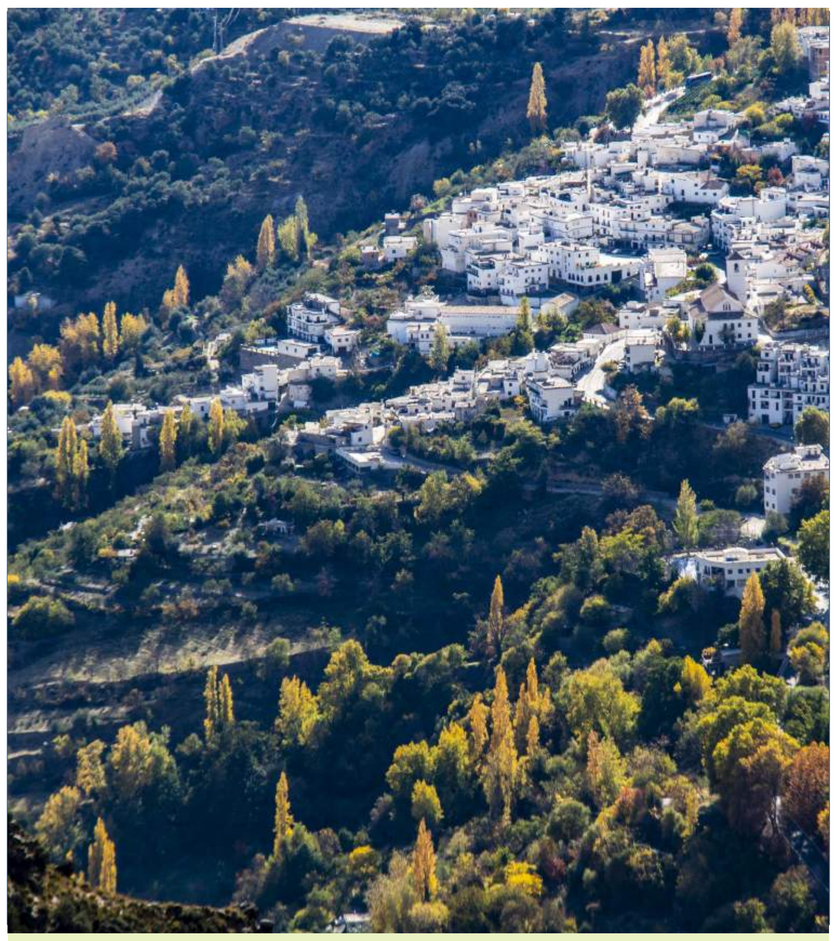


funded by European Commission

“Acequias de careo” of Sierra Nevada

Sergio Martos-Rosillo

Website 1 | Website 2



GEOGRAPHICAL REGION:

Sierra Nevada mountain range (Granada and Almería, Southern Spain)

INVOLVED ACTORS IN THE DESCRIBED NBS:

Farmers, shepherds, inhabitants of rural populations, water, territory and environment planners, researchers, ecologists and politicians.

SOURCES OF INFORMATION, REFERENCES, WEBSITES

https://www.researchgate.net/project/Acequias-de-careo-in-Sierra-Nevada-Spain

DESCRIPTION OF THE NBS:

Nature Based Solutions for Water Mangement has been applied in southern Spain for more than one thousand years using the Water Sowing and Harvesting techniques (WS&H). Rain and surface water are carried and infiltrated (sowing) in the subsoil to be collected (harvested) sometime later. In Sierra Nevada mountain range (Granada and Almería), where probably since the 8th-10th centuries, farmers and shepherds infiltrate melting water in the upper slopes to recharge the aquifers and increase springs and river flow during the summer. Our previous research in the river Bérchules (Granada) has confirmed that the recharge allows duplicating the medium river water flow and generate a storage surplus that will be discharged during the following hydrologic year. These data explain the high efficiency of a “simple” system and its high resilience along -at least- 1200 years of operation.

HOW THE SOLUTION IS CURRENTLY APPLIED IN THE FIELD?

Farmers and shepherds use the “acequias de careo”, long channels excavated in the soil, permeable, catching water from streams and snowdrifts to infiltrate it in the slopes.

SUCCESS ELEMENTS FOR IMPLEMENTATION

This ancient integrated water management system, an example of NbSWM, is an efficient system from a hydrological point of view. In the hydrological basins studied, it is verified that the availability of water resources increases during periods of drought. In addition, this system is an example of a tool to adapt to the impact of climate change. Its resilience capacity demonstrates this, since the system has already overcome the drastic social and climatic changes that have occurred in Sierra Nevada from the Middle Ages to the present.

LIMITATIONS AND DRAWBACKS:

The aging of the population, the emigration of young people, poor forest management and an inadequate agrarian policy, which favors the disappearance of traditional agriculture, are the main threats to the system.

BENEFITS (ECONOMICALLY TO THE FARM, ENVIRONMENT AND SOCIETY):

This NbSWM system generate different ecosystem services, needed for drinkable water supply and local economy. In addition, this system is an example of a climate change adaptation tool that has already demonstrated its efficiency. Downhill of the acequias, landscape effects of increasing water availability for vegetation are clearly visible: lush riverside forests and abundant drought-sensitive plant species (e.g., oak, and chestnut trees), rare in semi-arid mountains. These system are part of the hallmark landscape of this mountain, declared Reserve of the Biosphere by UNESCO in 1986, and National Park in 1999.

FUTURE PLANS:

We are working to recover the abandoned “acequias de careo”, which improve the flow of the springs used to supply the population, irrigated land and those used by shepherds.

funded by European Commission

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More information: www.eip-agri.eu

OL'EVE Family Estate

Antonios Tripintiris (owner) – Eleanna Pana (presenter)

https://www.facebook.com/oleveproducts/1 | https://sigriolivemill.health/

GEOGRAPHICAL REGION:

Sigri area in Lesvos island, Greece

A scenic rural Mediterranean landscape in the middle of the Aegean Sea.

INVOLVED ACTORS IN THE DESCRIBED NBS:

Farm owner and family;
Farm agronomist and technical personnel;
Cultural Association *"Lesvos island of the olive"*;
Neighboring farmers and local society.

SOURCES OF INFORMATION, REFERENCES, WEBSITES

Farm advisors, invited experts from scientific community, on-line research, local knowledge and family tradition.

DESCRIPTION OF THE NBS:

Where there once was a deserted area, there is now an oasis of biodiversity.

In a 200-hectare sea-front peninsula, 40.000 olive trees are cultivated in a certified organic plantation using environmentally friendly practices that transformed an area suffering from desertification to a healthy and productive ecosystem. The application of environmentally friendly agriculture in terraces and the rehabilitation of biodiversity contribute to the regeneration of the local society and economy with multiple environmental benefits for natural resources, native flora-fauna as well as climate since the plantation counterbalance the Carbon footprint created by 2.000 people.

HOW THE SOLUTION IS CURRENTLY APPLIED IN THE FIELD?

Older olive trees along with baby-olive trees, were established in newly as well as restored terraces around the hills of the estate. Natural herbs and a vast variety of tree species (e.g., figs, pomegranates, pines, palm trees) are hosted to promote biodiversity. Nature friendly cultivation practices are applied throughout the plantation to ensure environmental sustainability and the quality of products. These include minimum tillage, N-fixing legumes and green mulching, use of compost that is made of seaweeds, manure and olive cultivation remainings.

SUCCESS ELEMENTS FOR IMPLEMENTATION

The application of an integrated cultivation approach that combines multiple based on nature solutions, traditional practices and modern knowledge in order to achieve a synergistic effect and create a multifunctional landscape.

The vertical production that starts from the olive trees in the estate and continues to a state-of-the-art olive mill and bottling facilities established in a stone-building of local architecture. This resulted in the production of premium quality and award-winning products.

LIMITATIONS AND DRAWBACKS:

Bureaucratic procedures of the National Rural Development Programme and insufficient support to organic and diversified farm holdings.
Work demanding cultivation practices but limited personnel availability in the area.
Limited land availability to expand the farm operations.

BENEFITS (ECONOMICALLY TO THE FARM, ENVIRONMENT AND SOCIETY):

Economic benefits from olives/olive oil and other farm products (e.g., herbs, honey), along with gastronomic and educational activities that attract visitors. Reduced cultivation cost due to the applied practices.

The environmental benefits include reverse of desertification, soil erosion control, flood control, increased soil water storage and aquifer recharge, biodiversity enhancement.

Regeneration of local society with green job opportunities in the estate, development of cooperation and synergies with other local farmers and suppliers (e.g., use of the olive mile, nurseries, supplies), landscape improvement and increased number of visitors.

FUTURE PLANS:

The estate will host a **Living-lab** for the co-development, evaluation and demonstration of NbSs in agriculture. The Living-lab will be established in the framework of MARA-MEDITERRA, an EU project funded by PRIMA, which aims to promote NbSs and share relevant experience and knowledge across Mediterranean. Furthermore, the estate invests in an innovation and conference center as well as gastronomic and educational activities that enhance the visitors' experience.

funded by European Commission

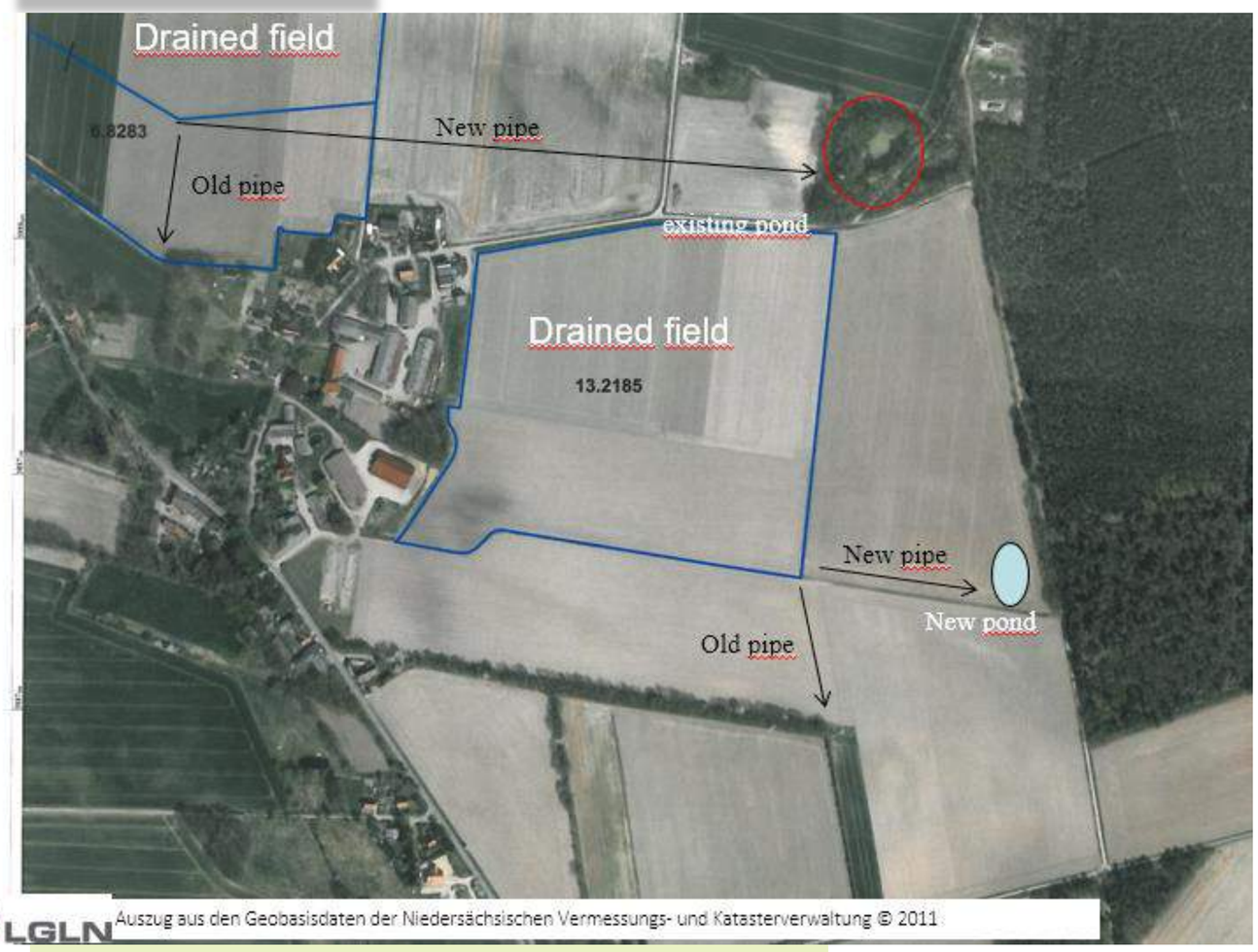
EIP-AGRI Focus Group 'Nature-Based Solutions for water management under climate change– March 2022

More information: www.eip-agri.eu

Managed Aquifer Recharge with Drainage Run off

Elisabeth Schultz

Website 1 | Website 2



Local measure to increase groundwater recharge: In the geest areas of northern and central Europe, which were shaped by several sequential glacial periods, you encounter loamy hilltops next to sandy bottoms. These loamy parts often are artificially drained with buried perforated plastic tubes. Searching for water resources for groundwater infiltration to increase groundwater availability for irrigation, two crop farmers in the northern German landscape Lüneburger Heide (between Hamburg and Hannover) developed the idea to stop leading this drainage water into nearby ditches or natural watercourses. Instead they changed the directions of two main collective tubes and lead the drainage water into (in one case newly created) seepage ponds at a sandy bottom. In that climatic area a mean loss from drainage of 100 mm of seepage may be very roughly estimated, while the mean use of irrigation water is 80 mm. Important to know is, that the nitrate which is typically contained in the drainage water, will be reduced to nitrogen gas due to the anaerobic conditions ot the seepage pond with organic material from surounding shrubs on its bottom. Probes of seepage water under the pond were practically free of nitrates.

GEOGRAPHICAL REGION:

Maritim-subcontinental-Northern German Lowlands; dry loamy sand soils including spot stagnant moisture

INVOLVED ACTORS IN THE DESCRIBED NBS:

Two farmers of the local irrigation board Kettelstorf, County of Uelzen, Germany; Technical authority on hydrogeology and soils Lower Saxony; Project “Aquarius” (EU Interreg 4B NSR)

SOURCES OF INFORMATION, REFERENCES, WEBSITES

www.lwk-niedersachsen.de, webcode 01012396, Langfassung Projektbericht Aquarius, page 134-135 (German language)

SUCCESS ELEMENTS FOR IMPLEMENTATION

1) Local heterogenous soil and subsoil conditions (sand near stagnant moisture) with deep groundwater tables
2) Positive results concerning nitrate contents in drainage water
3) Active information of and inquiry at local farmers on possible sources of water for additional groundwater recharge. Only farmers know the local hydraulic conditions.
4) Organisation of the planning, of geological research and additional financial means for material (supplementing farmers volontary works) during a project;
5) Only investment - no running costs!

LIMITATIONS AND DRAWBACKS:

The limitations resulting from not covered expenses for material and planning work could be compensated, if the involved farmers would be rewarded by additionally permitted groundwater abstraction quota, for example 50 mm of the estimated 100 mm loss mentioned above. However this rewarding system only functions physically, if the additional groundwater from the seepage pond is indeed flowing towards the involved farmers irrigation wells.

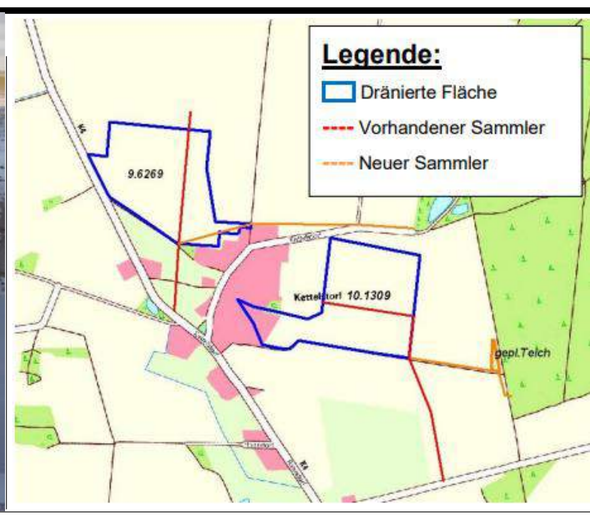
BENEFITS (ECONOMICALLY TO THE FARM, ENVIRONMENT AND SOCIETY):

1. At the moment none for the farmes, but the cost for building a seepage pond and relocation of the main collective tube could be compensated in the future by rewarding with increased permits for groundwater abstraction for the involved irrigation farmers.
2. Increased groundwater supply for groundwater dependant ecosystems (waterbodies, wetlands).

FUTURE PLANS:

The local water authority should be won for promotion of compensating single MAR measures with additional groundwater abstraction quotas. That would mean a powerful incentive for irrigation farmers or irrigation boards to check their individual possibilities in a bottom up process.

Construction of alternative collection drain from before leading into a creek and now to the newly created seepage pond in 2010/11. The pond is now completely ingrown with shrubs.



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Non-Conventional Water Resources in Agriculture

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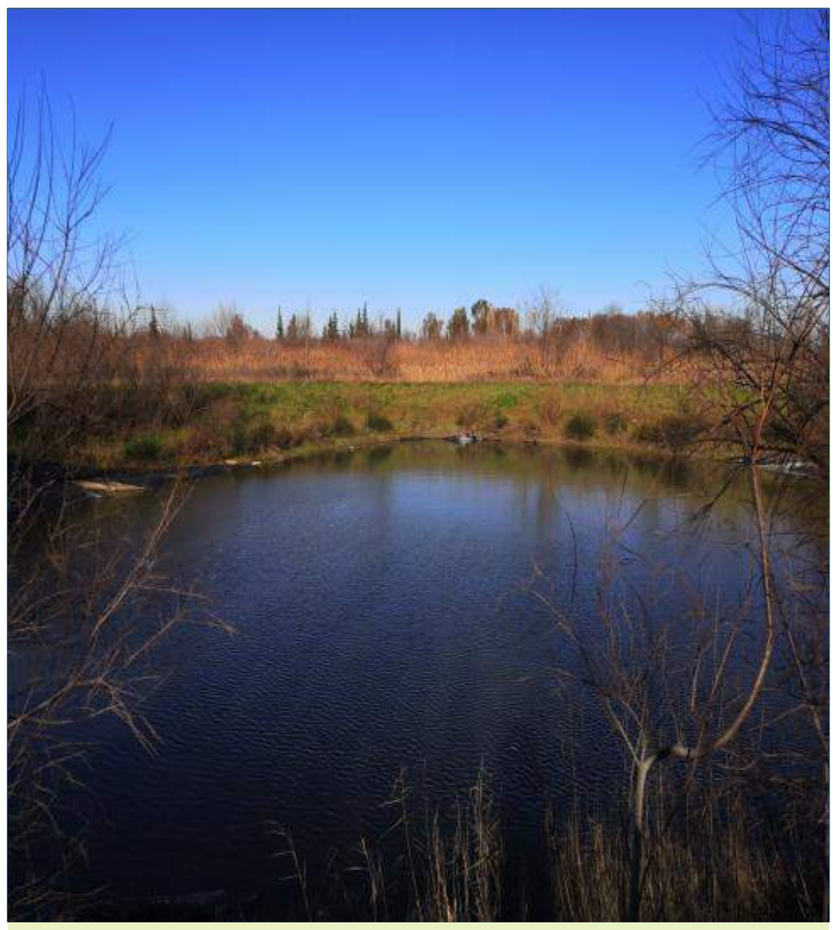

GEOGRAPHICAL REGION:

Sindos area, next to the city of Thessaloniki in Greece

INVOLVED ACTORS IN THE DESCRIBED NBS:

Hellenic Agricultural Organization -Soil and Water Resources Institute (HAO-SWRI)

SOURCES OF INFORMATION, REFERENCES, WEBSITES

Research programmes and expertise, literature review and on-line resources, discussion groups with farmers, invited experts.

DESCRIPTION OF THE NBS:

In an area of 16 ha, the Soil and Water Resources Institute of Hellenic Agricultural Organization is creating an open demonstration farm of NbSs. Aim of the effort is to promote the water recycling and resource efficiency in agricultural production and nature conservation. The effort combines 3 types of NbSs:

- Use of natural systems (constructed wetlands and lagoons) for the treatment and reuse of municipal wastewater as non-conventionsl water resource (NbSs Type III)
- Deployment of resource efficient agricultural practices in greenhouse aquaponics and in organic farm plots, where the reclaimed water will be applied for irrigation. Including: precision/deficit irrigation techniques, composting and agroforestry (NbSs Type II)
- Conservation of natural wetlands that exist in the area (e.g., improvement of water balance and wet buffer zones), as well as environmental interpretation measures (NbSs Type I).

HOW THE SOLUTION IS CURRENTLY APPLIED IN THE FIELD?

Constructed wetlands and lagoons are established in the area for the secondary treatment of 500 m^3/day municipal wastewater. Within the framework of a previus 4-year research project, the reuse of water for irrigation has been tested in the agricultural production of corn and cotton, as well as in greenhouse aquaponics to produce ornamental plants (*Gerbera L.*) and tomato.

SUCCESS ELEMENTS FOR IMPLEMENTATION

The wastewater problem turns into a reliable water source for crop production and nature conservation, adressing climate change challenges. Several parameters should be considered in the design of the entire system (e.g., water treatment units, hydraulic installations, water needs and balance)Integration of Non-Conventional Water Resources into sustainable farming practices.

LIMITATIONS AND DRAWBACKS:

- Well targeted landscape interventions may be required to regulate water flow.
- Social perception regarding crops irrigated with reclaimed water.
- Legislation requirements concerning the wastewater reuse.

BENEFITS (ECONOMICALLY TO THE FARM, ENVIRONMENT AND SOCIETY):

Economic: Reduced water treatment and farming cost, relible and constant water source for the irrigation of dynamic crops, potential source of nutriens (depending on the water quality and treatment level).

Environmental: Efficient use of water resources, conservation of natural water reserves and aquifers, reduced agricultural pollution, contribution to the conservation status of natural wetlands and biodiversity enhancement.

Social: Increase awareness about sustainable farming and natural resources conservation, cooperation opportunities between farmers and authorities responsible for municipal wastewater treatment.

FUTURE PLANS:

The area will operate within the framework of MARA-MEDITERRA project (R&I project funded by PRIMA), as a thematic park to raise awarenes about NbSs, as well as an open innovation hub for the further development and transfer of knowledge to decision makers and farmers.

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More information: www.eip-agri.eu

Farm constructed wetland for agricultural water drainage treatment and retention

Stefano Anconelli (CER) and Attilio Toscano (UNIBO)

https://consorziocer.it/

GEOGRAPHICAL REGION:

Bologna, Emilia-Romagna region, Italy.

INVOLVED ACTORS IN THE DESCRIBED NBS:

Farmers; water/soil/air conservation authorities; irrigation consortia; research institutes; community.

SOURCES OF REFERENCES:

- Braschi, I. et al. (2022). Removal and fate of pesticides in a farm constructed wetland for agricultural drainage water treatment under Mediterranean conditions (Italy). *Environmental Science and Pollution Research*, *29*(5), 7283-7299
- Lavrnić, S. et al. (2020). Performance of a full scale constructed wetland as ecological practice for agricultural drainage water treatment in Northern Italy. *Ecological Engineering*, *154*, 105927
- Lavrnić, S. et al. (2020). Hydrological and hydraulic behaviour of a surface flow constructed wetland treating agricultural drainage water in northern Italy. *Science of The Total Environment*, *702*, 134795
- Lavrnić, S. et al. (2018). Long-term monitoring of a surface flow constructed wetland treating agricultural drainage water in Northern Italy. *Water*, 10(5), 644

DESCRIPTION OF THE NBS:

Located in Northern Italy, a real scale farm constructed wetland provides an example of nature-based solution (NBS) that can cope with water scarcity and diffuse water pollution caused by climate change and unsustainable agricultural practices. The farm constructed wetland aims to enhance water retention as well as to promote pollutant removal/retention (e.g., pesticides, herbicides, nutrients, etc.) and nutrient recovery (mainly nitrogen and phosphorous) from agricultural drainage water produced on a real scale farm (12.5 hectares). It is operated by the irrigation consortium Canale Emiliano Romagnolo (CER) and monitored by CER and University of Bologna (UNIBO). See references for a detailed description.

HOW THE SOLUTION IS CURRENTLY APPLIED IN THE FIELD?

The farm constructed wetland was made in 2000 in Northern Italy and is a part of an experimental farm, occupying about 3% of its total surface area. This natural solution collect surface water runoff and agriculture drainage water that are produced on the farm. The farm constructed wetland was modified in 2016 as case-study site of several research project performed by the University of Bologna and the Canale Emiliano Romagnolo Consortium.

SUCCESS ELEMENTS FOR IMPLEMENTATION:

Farm constructed wetlands can preserve freshwater quantity and quality, ensuring at the same time food security and environmental health. The farm constructed wetland is a well recognized EU demo-site equipped with two mechanical flow meters that record influent and effluent volumes every hour, and two automatic samplers that take influent and effluent water samples on the basis of the inlet water volume and time, respectively. Water level, infiltration, hydraulics and hydrology behavior, retention/removal capacity and biomass production are monitored and assessed.

LIMITATIONS AND DRAWBACKS:

Farm constructed wetlands require large spaces.

BENEFITS (ECONOMICALLY TO THE FARM, ENVIRONMENT AND SOCIETY):

The farm constructed wetland can be used for water retention and nutrient recovery. This natural system requires simple maintenance and easy and low-cost operation. The constructed farm wetland can mitigate runoff impacts during intensive meteoric events, regulate crop water supply (storage capacity), control water pollution, and promote environmental requalification and biodiversity protection. It can also provide opportunities for recreation, education and research activities.

FUTURE PLANS:

A deeper understunding of pollutant removal mechanisms that take place within the farm constructed wetland can enhance water quality and availbility, ensuring pollution control and food security. In addition the system is also able to remove pesticedes that was an object of several past and current experimental activities.

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