NATURE-BASED SOLUTIONS IN FOOD SYSTEMS

REVIEW OF NATURE-BASED SOLUTIONS TOWARDS MORE SUSTAINABLE AGRICULTURE AND FOOD PRODUCTION

WAGENINGEN UNIVERSITY & RESEARCH

DISCUSSION PAPER SUMMARY

SEPTEMBER, 2022

Overview

This discussion paper aims to provide information to the Dutch Ministry of Agriculture, Nature and Food Quality (LNV) on Nature-based Solutions (NbS) to understand more about the principles upon which NbS are based for sustainable agriculture and food systems. This research also aims to contribute to an operational framework that could guide applications of NbS on different regions in the world and at different scales, as well to provide relevant scientific material for the development of future policy guidelines.

To address NbS from a food system perspective, the research focused on food production in rural areas. As climate change involves adaptation and mitigation measures, we limited the research to climate adaptation.

A desktop research was conducted to gather secondary data on the subject. NbS case studies implemented in the Netherlands, in Europe, and in the global south (Latin America, Africa, and Asia) were reviewed.

This discussion paper provides information and knowledge relevant for decision makers to assist on the development of policy towards NbS uptake. This study improves our theoretical understanding of NbS towards sustainable agriculture and food production.

Research Questions

1. Which are the NbS definitions, principles and concepts mostly used for sustainable agriculture and food systems?
2. How do NbS contribute to food security and circularity under climate change conditions?
3. Which are the drivers, opportunities and hindering factors for successful implementation of NbS in the food system?
4. What kind of NbS case studies at different scales and geographical regions can be found as examples for NbS implementation in the food system?
5. What are the factors supporting multi-stakeholders participation, the available NbS tools and NbS business models that could jointly explore potentials for NbS?

NbS definitions, principles and concepts mostly used for sustainable agriculture and food systems

NbS definitions

There are different definitions that various international organizations use. The definition of NbS from the European Commission (EC), can be used under European and Dutch contexts, whereas the International Union for Conservation of Nature (IUCN) and the United Nations Environment Assembly (UNEA) definitions can be applied indistinctively for the global north and for the global south contexts. The EC, IUCN and the most recent UNEA definitions could be used for policy, research and practice for food systems.

European Commission (EC)

"Solutions that are inspired and supported by nature, which are cost-effective, simultaneously provide environmental, social, and economic benefits and help build resilience. Such solutions bring more, and more diverse, nature and natural features and processes into cities, landscapes and seascapes, through locally adapted, resource-efficient and systemic interventions."

NbS is a rather new (umbrella) concept. Every definition, aims at using natural processes to address societal and environmental challenges, like climate change adaptation, food production and biodiversity loss. Having a universally agreed NbS definition is important for the application of measures and policy development worldwide. It is up to decision-makers and other stakeholders to decide on which NbS definition is best to use depending the particular case.

International Union for Conservation of Nature (IUCN)

"Nature-based Solutions are actions to protect, sustainably manage, and restore natural and modified ecosystems in ways that address societal challenges effectively and adaptively, to provide both human well-being and biodiversity benefits. They are underpinned by benefits that flow from healthy ecosystems and target major challenges like climate change, disaster risk reduction, food and water security, health and are critical to economic development."

United Nations Environment Assembly (UNEA)

"Actions to protect, conserve, restore, sustainably use and manage natural or modified terrestrial, freshwater, coastal and marine ecosystems, which address social, economic and environmental challenges effectively and adaptively, while simultaneously providing human well-being, ecosystem services and resilience and biodiversity benefits."

NbS principles

NbS principles should embrace nature protection, rehabilitation and management but not all the interventions could be considered NbS, for the reason that not every NbS can be implemented everywhere. The IUCN proposed eight NbS principles which are essential in providing a better understanding of the NbS definition(s):

IUCN NbS principles

1. Embrace nature conservation norms (and principles)
2. It can be implemented alone or in an integrated manner with other solutions to societal challenges (e.g., technological and engineering solutions).
3. They are determined by site-specific natural and cultural contexts, including traditional, local, and scientific knowledge.
4. Produce societal benefits fairly and equitably, in a manner that promotes transparency and broad participation.
5. Maintain biological and cultural diversity and the ability of ecosystems to evolve over time.
6. Are applied at a landscape scale.
7. Recognize and address the trade-offs between the production of a few immediate economic benefits for development and future options for the production of the full range of ecosystem services.
8. They are an integral part of the overall design of policies, and measures or actions, to address a specific challenge.

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NbS typology

There are three types of NbS identified:

1. **Intrinsic**
To make better use of existing natural or protected ecosystems

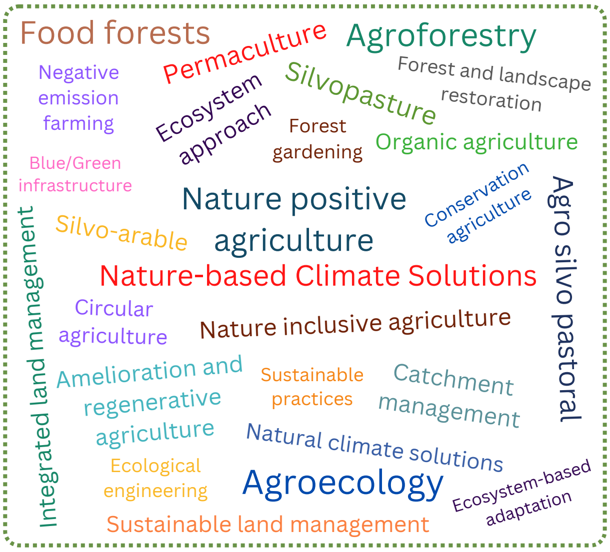
2. **Hybrid**
Based on modifying managed or restored ecosystems

3. **Inspired**
Involve the creation of new ecosystems and/or the use of new technologies copying ecosystems to increase service provision sustainably

Groot et al., 2020

NbS terms

Besides the wide overarching definitions and types of NbS, researchers, organizations, practitioners and decision-makers have adapted previous concepts (CSA, Agroecology, etc.) and new (NbS) concepts to deal with specific forms of agricultural practices and with climate change. Likewise, there has been grouped different agricultural and food system terms that fall under the NbS umbrella which enable their design and implementation.



Summary of terms that fall under the umbrella of NbS that could be applied to food systems

Since the NbS concept is so broad, the risk exists that it becomes too vague or confusing for proper application. On the contrary, thinking and working with nature instead of fighting natural processes is promising but requires a change in mindset. One that NbS can help to achieve.

NbS concepts

Concepts such as Climate-smart agriculture (CSA), Agroecology, and Nature-Based Solutions (NbS) have different origins, and different scientific and political progressions.

Agroecology	Climate-smart agriculture	Nature-based Solutions
The agroecological approach regards farm systems as the fundamental units of study, and mineral cycles, energy transformations, biological processes, and socioeconomic relationships in these systems are analyzed as a whole	This is agriculture that sustainably increases productivity and resilience (adaptation), reduces GHG (mitigation), and achieves national food security and development goals	These are actions to protect, sustainably manage, and restore natural or modified ecosystems that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits

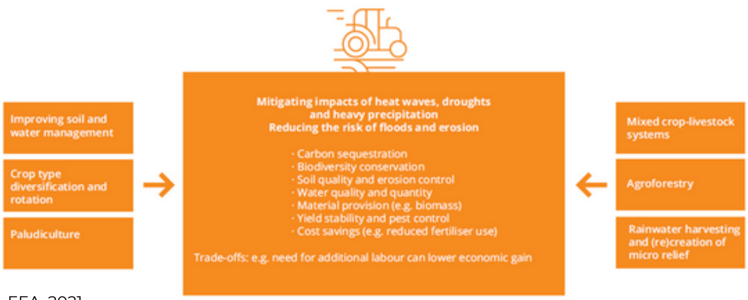
Hrabanski and Le Coq, 2022

NbS contribution to food security and circularity under climate change conditions

NbS and climate change

Worldwide increasing challenges -such as climate change jeopardizing food security, water resource provision, and enhancing disaster risk- must be solved. NbS are increasingly prominent in climate change policy, and their adaptation concepts are being promoted worldwide because of their cost-effectiveness, multi-benefits, and wide applications.

Key nature-based solutions for addressing climate change impacts on agriculture, their benefits and trade-offs



EEA, 2021

Opportunities and knowledge products of NbS have opened up a portfolio of NbS measures, which can offer efficient scopes for addressing conservation, climate, and socio-economic factors by maintaining healthy and productive agricultural systems, especially at the risk of adverse climate change scenarios.

Various farming systems across Europe and in the global south use NbS. A key principle is that ecologically based diversification reduces vulnerability to hazards while at the same time it can increase productivity.

Resilience to climate disasters is closely linked to farms with increased levels of biodiversity. An agro-ecological approach supports biodiversity, which has growing importance in the global debate on NbS and agri-food systems.

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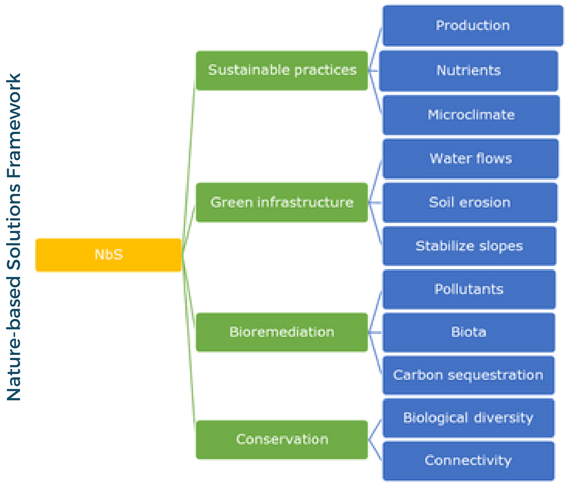
NbS and food security

The ongoing effects of climate change on the agricultural sector impact food production and peoples' livelihoods and compromise food security at both global and regional levels. NbS measures that conserve or improve nature often have dual effects of emissions reduction and increasing resilience, delivering benefits for mitigation and adaptation to climate change. NbS seek to maximize the ability of nature to provide ecosystem services that help address climate change adaptation measures in food security.



Simelton et al., 2021

The NbS framework above, demonstrates various measures and their essential primary function. These primary functions have focused on the multiple areas where there is a scope for NbS in achieving ecological sustainability in food systems and food/water security in climate change scenarios.

NbS and circularity

Circular food systems aim to optimize the use of resources and reduce food losses through the efficient use of land and closing the water, nutrient and carbon cycles to minimize resource loss and environmental degradation. Thus, the use of NbS for food production could encourage the use of regenerative resources and add value to the food system.

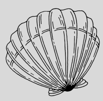
Circularity in food systems also implies changes in consumer behaviour and governance structures. Circular agriculture is a term commonly used in the Netherlands. However, organic farming has been globally used as the prototype of (re)cycling materials since this is one of its central features. It is important to clarify that circular agriculture is not per se organic farming. In any case, channelling resources as long as possible has the clear potential to benefit both farmers and nature.

Selected examples of NbS applied to circularity are:

The use of mushrooms as a degradation mechanism
http://pleurotus.hu/en#b3

Rotterzwam is located in Rotterdam, and the company collects coffee grounds from local pubs, large corporations and restaurants. Coffee residues are a fertile substrate for growing oyster mushrooms. They mix coffee husks and mushroom sprawn to grow oyster mushrooms. The mushrooms are sold to local restaurants and shops in the city. The entire process is sustainable and local, an outstanding example of an urban NbS used towards a circular economy.

Seashells waste reutilization
https://gdp-industries.org.au/restoring-southern-australian-reefs-with-recycled-seashells/



Recycling of seashells to re-establish mussel and oyster reefs and is a practice that has been taking place in several places around the globe like Australia, New York, Thailand. Small marine organisms and larvae use the reef for their shelter. The loss of this habitat causes losses in the ecosystems and affects fish populations and food supply. Seashells are being reused as material for building artificial reefs for oyster or mussels' recruitment. This application also helps to mitigate coastal erosion and to enhance soil strength.

Drivers, opportunities and hindering factors for successful implementation of nature-based solutions

NbS drivers

Climate change is one of the most important drivers identified for the design, planning and implementation of NbS in the agri-food sector.

The NbS political momentum is facilitating a transition of society and from the agri-food sector, to accelerate the adoption of sustainable practices through strategic public interventions private investments, and corporate leadership.

The biodiversity crisis is an important NbS driver in the agri-food sector. There is a need to foster NbS and Ecosystem-based approaches as means to halt the rapid biodiversity loss directly and indirectly caused by unsustainable agricultural practices.

Farmers are great drivers of NbS as they can combine their traditional knowledge with new skills to safeguard the ecosystems on which our food production depends.

NbS opportunities

The global and EU policies are providing medium or strong explicit support for NbS. Even though there is still a slow recognition, NbS has a strong political potential in the agri-food sector.

For monitoring and evaluating NbS, there is a potential to develop NbS indicators for agriculture. Such indicators could bring opportunities to understand and value the NbS co-benefits, their trade-offs and to get support of stakeholders (e.g. IUCN Global standard for nature-based solutions).

EU funding and initiatives towards a green recovery are have the potential to encourage the use of NbS as a mean to increase the uptake of nature-based farming practices (e.g. agro-ecological agronomic practices and agroforestry), green infrastructure (e.g. hedgerows, buffer strips, fallow land, extensive pasture) and biodiversity-friendly practices.

NbS barriers

At the EU and global levels, there still exist shortcomings in the design and implementation of policies that support NbS. As adopting conducive national and local policies is central to facilitating the uptake of NbS, the lack of EU and global requirements for mainstreaming NbS and monitoring its implementation is a critical gap.

Insufficient economic incentives for food producers; limited action perspective; lack of proper community and stakeholder involvement; lack of a concrete and shared vision for NbS.

Lack of NbS-specific and integral knowledge for their planning, implementation and maintencance.

Agricultural governance is siloed, creating distance between policy on biodiversity and ecosystems and policy on food systems. Regime resistance towards viable (alternative) NbS practices in order to keep current capital-intensive agro-economic system.

Difficult to monetize ecosystem services. The benefits that NbS could provide are hard to quantify and hinder making proper cost-benefit analysis to justify investments in NbS.

Biodiversity is underpinning NbS, and therefore the effectiveness of such approaches is determined by the resilience of species and ecosystems to the impacts of climate- and weather-related hazards.

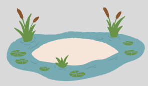
Nature-based solutions across various scales

Large- and small-scale NbS

The large-scale NbS are realized across landscapes and intersect with different ecosystems (e.g., rivers, floodplains, forests). These types of NbS require integrated planning strategies and strong collaboration between different actors (e.g., water basin authorities across provinces, regions, or countries).

Small-scale NbS are usually realized within a specific place (e.g., farm, plot level).

Rehabilitation and restoration of rivers and floodplains (e.g., channel re-profiling, sediment dredging, changing the natural forms of rivers, extending floodplains) are an exaple of large-scale NbS with direct and/or indirect impact on agriculture and food production.



Rainwater harvesting measures (e.g., ponds, swales, wetlands) are examples of small-scale NbS used in agricultural areas to mitigate flooding and water scarcity.

The geographical scale and context of a situation determine which type of NbS can be implemented and how local people perceive NbS. Consequently, the physical, socio-economic, and cultural scales are considered. When looking at the usability of the different types of NbS, it appears that intrinsic, inspired, and hybrid NbS can work differently at different scales.

Selected examples of nature-based solutions at different scales and regions in food systems

Global South

Agroforestry

Agricultural systems use trees as a Nature-based solution to create optimal growing conditions and conserve biodiversity. agroforestry covers more than one species on a given piece of land. By featuring at least two species, agroforestry systems are not perse biodiversity-positive. It still depends on the choice and mixture of chosen species.

There are plans or small initiatives to implement agroforestry activities like shade trees in coffee plantations in Honduras and trees for timber combined with annual crop production and animal husbandry in Indonesia. Trees provide shelter from climate extremes and diversify the incomes of farmers in Rwanda. Uganda uses trees for fuel and extractive industry. Peru has planned interventions for ecosystem restoration.

- Contribution: Sustainable landscapes, biodiversity, socio-economic challenges, and diversification of farming.
- Scale: Large and small scale.
- Location: Honduras, Indonesia, Peru, Rwanda, and Uganda.
- Type of NbS: Hybrid.
- Pros: Climate Change mitigation, soil health improvement, and surplus products.
- Cons: More time consumption to benefit, occupies more land and reduces photosynthesis activity.

To know more:
-Trees on farms as an NbS for biodiversity conservation in agricultural landscapes: https://www.worldagroforestry.org/publication/trees-farms-nature-based-solution-biodiversity-conservation-agricultural-landscapes
-Trees in farms for biodiversity, Honduras: https://treesonfarmsforbiodiversity.com/honduras/

Improved rice cultivation

Water management techniques such as alternate wetting and drying and midseason drainage limit the time rice paddies spend in an anaerobic state, thereby reducing annual methane emissions while at the same time-saving water. Additional management techniques applied to upland rice, such as fertilizer applications, residue, and tillage management practices, reduce the amounts of nitrogen and carbon emissions.

Since 2017, there have been efforts to build and deliver the Sustainable Rice Landscapes Initiative (SRLI) to increase resource use efficiency and reduce climate change and other environmental impacts through the sustainable transformation of rice-based landscapes.
SRLI provides a vehicle to deliver massive GHG emissions reductions through NbS while achieving a broad set of co-benefits across multiple geographies and issue areas. With a starting focus in south-east Asia, key countries include Thailand and Vietnam.

- Contribution: Water management, food security, food production, and climate change.
- Scale: Small scale.
- Location: Thailand and Vietnam (with significant opportunity to scale up or replicate in rice-growing areas of West Africa and Latin America).
- Type of NbS: Inspired.
- Pros: Increased productivity, optimal resource use, reduction in GHG emissions.
- Cons: Labour costs, irrigation required, and training required.

To know more:
-WBCSD, Nature-based Solutions: Sustainable Rice Landscapes Initiative:
https://wedocs.unep.org/bitstream/handle/20.500.11822/28814/SustRice.pdf?sequence=1&isAllowed=y

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Europe

Straw mulch and soil management

In many Mediterranean areas, citrus orchards exhibit high soil loss rates because of the expansion of drip irrigation that allows cultivation on sloping terrain and the widespread use of glyphosate. To mitigate these non-sustainable soil losses, straw mulch could be applied as an efficient solution to reduce soil losses in clementine plantations, which can be considered representative of a typical Mediterranean citrus orchard.

An NbS case study in Spain showed that mulching could be used as a helpful management practice to control soil erosion rates due to the immediate effect on high soil detachment rate and runoff initiation reduction in conventional clementine orchards on sloping land, by slowing down runoff initiation and by reducing runoff generation and, especially, sediment losses. Straw mulch is also a sustainable solution in glyphosate-treated citrus plantations.

- Contribution: Soil management, food production, and runoff initiation reduction.
- Scale: Small scale.
- Location: Spain.
- Type of NbS: Hybrid.
- Pros: Retain soil moisture, prevent soil erosion, fertilization, and insulate temperature.
- Cons: Insect developments and not suitable for hilly terrains.

To know more:
-Straw mulch as a sustainable solution to decrease runoff and erosion in glyphosate-treated clementine plantations in Eastern Spain. An assessment using rainfall simulation experiments: https://www.sciencedirect.com/science/article/abs/pii/S0341816218304946?via%3Dihub

Paludiculture

In the federal state of Mecklenburg-West Pomerania, 57 % of the peatland area is used for agriculture (20, 531 ha as arable land, 143, 998 ha as permanent grassland) and therefore drained, causing greenhouse gas (GHG) emissions. Drainage-based agricultural use of peatlands is the largest single source of GHG emissions in the federal state of Mecklenburg-West Pomerania. Lowering the water table leads to a significant loss of water, exacerbating climate change impacts, particularly droughts.

Climate-friendly, productive wet peatland utilization is termed 'paludiculture,' which ensures that both the land's productivity and the peat are preserved. Crops of the example region are mainly bioenergy crops and growing substrates. Options for food production are the cultivation of berries or the grazing of water buffalo. Through paludiculture, emission of up to 3 Mt CO2 could be avoided annually, and the role of peatlands in the water cycle and the regional climate could be partly restored.

- Contribution: Social and environmental challenges, disaster risk reduction, climate change, food production, water management, and biodiversity.
- Scale: Large and Small scale.
- Location: Germany.
- Type of NbS: Inspired.
- Pros: Multifunctional crops (medicine, fodder, energy, food) and flood risk reduction.
- Cons: High amount of water required.

To know more:
-EEA, Paludiculture case (Germany): peatland restoration for climate change mitigation and adaptation: https://www.eea.europa.eu/publications/nature-based-solutions-in-europe
-Greifswald Mire Centre, Paludiculture - agriculture and forestry on rewetted peatlands: https://www.moorwissen.de/en/paludikultur/paludikultur.php

As seen in the examples above, NbS can be implemented at different geographical scales, in different habitats and can contribute to different global challenges. Most examples of NbS in food systems show that NbS were implemented at a large- and/or small-scale level (landscape or farm-level).

In terms of socio-economic and cultural challenges, there is a risk of suggesting “solutions” without defining clearly the problem, who created such problems, or what types of risks (e.g. corporate greenwashing, disservices and maladaptation) are involved.

In the NbS planning process, environmental and societal opportunities, as well as challenges, must be well appreciated and defined. This way, the correct scale, habitat and NbS intervention type (intrinsic, hybrid, inspired) can be identified and implemented.

As learnt from the examples in Europe, the Netherlands and from the global south, NbS make use of and support natural processes such as physical, chemical and biological, which are relevant for the continuation of ecosystem services and sustainable food production.

Not all the case studies considered the different stakeholders and beneficiaries involved. The effectiveness of NbS is related to the scale of implementation (e.g. country, regional, landscape, farm level) and foremost to the acceptance and ownership of multiple stakeholders.

Some examples provided are effective on small scales and do not need the involvement of many stakeholder groups, like the flower edges or strip cultivation. However, other examples require a larger scale of implementation, meaning that more stakeholders need to be involved and must be willing to shape the NbS.

The Netherlands

Flower edges around crop fields (Nature-inclusive agriculture)

Nature-inclusive agriculture is a term used under the NbS umbrella to create more resilient ecosystems. Flower- and herb-rich grasslands help to increase biodiversity and are a way to produce food within the boundaries of nature. Temporary flower edges around crop plots, and fallow land was sown in with flowering plants and are already applied in multiple places in the Netherlands to stimulate functional biodiversity for natural pest control and pollination.

In several provinces, subsidies are available for farmers to create flower edges, like in Flevoland and the southwestern part of the country. In Noord-Holland, experiments are done in pilots with flower edges on fields where onions are cultivated. Using domestic plants also contributes to biodiversity conservation and provides specific habitats for specific domestic bees or other insects, working as well as pest control.

- Contribution: Biodiversity challenges and natural pest control in arable farming.
- Scale: Small scale.
- Location: The Netherlands.
- Type of NbS: Hybrid.
- Pros: Reduction of pesticides use and biodiversity.
- Cons: Extra costs, space, and specialist requirements.

To know more:
WUR, Nature-inclusive agriculture (in Dutch): https://v3.jamdots.nl/view/30079/Natuur-Inclusieve-Landbouw

Strip cropping

Strip cropping can create a robust, plant-based food production system. Strip cropping can help to reduce the geographical spreading of pests and diseases within fields by a high spatial variety of crops. Furthermore, it provides shelter and habitat for local species and biodiversity. In this way, food production can be realized with less chemical pesticides while using structures adapted to agricultural machinery.

Strip cropping is being done on the operational scale by ERF BV near Almere (ERF BV, 2021), and WUR executes experiments at the Farm of the Future in Lelystad (“Farm of the Future in Lelystad,” 2022). The tested rotation is based on the crops most commonly grown by arable farmers in the Netherlands and on local practice. The rotation consists of grass-clover, cabbage, onion, potato, wheat, and carrots.

- Contribution: Environmental, biodiversity, and climate change challenges, and reduction of chemical pesticides on arable farms.
- Scale: Large and small scale.
- Location: The Netherlands.
- Type of NbS: Inspired.
- Pros: Spatial diversification and natural pest control.
- Cons: Adapted machinery required and complex management.

To know more:
WUR, Strip cropping: https://www.wur.nl/en/project/strip-cropping.htm

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Supporting multi-stakeholders, tools and business models to jointly explore potentials for nature-based solutions

Multi-stakeholders

Over the last years, UN institutions (UN Environment, UN Development Programme, and Food and Agriculture Organization), as well as international conservation organizations (e.g., International Union for Conservation of Nature (IUCN), World Wildlife Fund (WWF), BirdLife International and Conservation International), have been implementing community-led nature-based approaches for climate adaptation (i.e., ecosystem-based adaptation) and/or ecosystem-based disaster risk reduction projects across the globe.

NbS require a broad range of stakeholders with different types of experience and expertise who work together. Stakeholders may perceive problems differently from which solutions are searched for. What is considered eligible as NbS can be questioned. A flow of benefits accrues from NbS, though there can also be trade-offs, disservices and disbenefits for specific people.

Participatory approaches might be the useful for NbS planning and implementation, as they also provide sufficient (local) context information relevant for organizations, researchers and policy makers. NbS projects in the agri-food sector need to consider the different stakeholders and actors involved before, during and after their implementation.

It is necessary to consider the complex biophysical and political context, the culture and socio-economic factors of the food producers and organizations involved, which vary widely by individuals, gender, type of landowners, and business size.

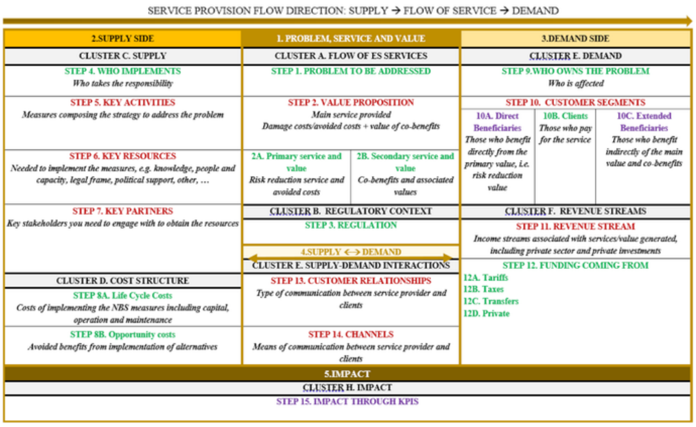
NbS Tools

A large variety of tools and data have been developed worldwide to support the mainstreaming and uptake of NbS, ranging from methodologies, software, catalogues, repositories and e-platforms to guidelines and handbooks. NbS tools and data can make a valuable contribution to overcoming the barriers that hamper the wide uptake and implementation of NbS.

The NbS tools can aid in the planning, design, implementation, monitoring and evaluation phases as well as help to address specific challenges end-users are facing. Tools can, for example, inform and aid the planning processes by selecting and evaluating NBS, simulating NbS implementation, calculating the costs and benefits of NbS, supporting stakeholder involvement and facilitating collaborative processes.

Some tools could be easy to understand and use, while others might need an in-depth understanding and/or training on how to apply the tool. The language in which a tool is provided can be a barrier or an enabler to using certain NbS tools. If tools are in English, potentially, a higher number of end-users can make use of the tools. On the other hand, if a tool is not provided in the native language, some end-users are likely to face a language barrier.

NAIAD- NbS Business Model Canvas



Beatriz Mayor, 2019

Below are selected examples of NbS tools that can provide relevant data to policymakers, government officers, food companies, agricultural producers and other actors from the agri-food sector:

RECONECT	Demonstrates, references and upscales Nature-Based Solutions in rural and natural areas.	http://www.reconect.eu/
Nature-based Solutions Evidence Platform	Explores nature-based interventions that address climate change impacts, compares socio-economic, and environmental effects.	https://www.naturebasedsolutionsevidence.info/evidence-tool/
IUCN Global Standard for NbS	Helps to design, implement and verify NbS actions. Governments, companies, NGOs and others can use the guide and self-assessment tool to design NbS projects.	https://www.iucn.org/theme/nature-based-solutions/resources/iucn-global-standard-nbs
Nature-based Solutions Investment Platform	Enables investors to see the landscape of climate opportunity in one place, to inform strategy, navigate, source and execute investments aligned with science-based net zero pathways.	https://nbs.capitalforclimate.com/about

NbS Business Models

The NbS Business Model Canvas can help to identify significant economic and societal benefits for agri-food actors, businesses and governments. When evaluating the suitability of NbS projects, it is important to understand the business model case for that investment from the perspective of multiple stakeholders and beneficiaries.

Investments in NbS projects for the agri-food sector are increasing as they create a positive return for society and the environment. NbS investments are currently (politically) motivated by public institutions and private organizational commitments to sustainability with the aim to contribute to a greater global agenda.

While developing the business model canvas, several types of financing mechanisms and incentives need to be considered to increase the adoption of NbS in agriculture.

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Conclusions and recommendations

- NbS is a rather new (umbrella) concept, and several definitions exist. Every definition, however, aims at using natural processes to address societal and environmental challenges, like climate change adaptation, food production and biodiversity loss. Many terms related to sustainable agriculture and food production fit under the umbrella of the NbS concept. The preference for one definition over another is often related to the purpose and context of the user.
- Nature and ecosystem dynamics are undoubtedly an inspiration to move from linear food production systems to circular food production systems when possible. Ideally, NbS work in a very efficient way (from an energetic and material point of view) and additionally adapt to local conditions. Nevertheless, we need to be aware that the viable implementation of nature-based and circular solutions in our society and current economic system requires interdisciplinary integrated solutions towards food security, financial and legal modifications, and climate change considerations.
- Some NBS drivers identified were climate risks, a shift in the societal valuation of ecologically sound practices, and a pragmatic approach to problem-solving where NbS can be cost-effective.
- Currently, NbS has received a lot of attention in political discussions of several international organizations. This provides opportunities for further upscaling of NbS to address challenges in food systems.
- Several barriers arise in the current food systems that hamper the uptake of NBS in agriculture worldwide. Five important categories of barriers were identified: 1) Financial barriers; 2) Perspective and opportunities for farmers are lacking ; 3) A lack of shared vision in governments and with other stakeholders; 4) Knowledge-related issues in education, knowledge sharing and local knowledge; 5) Overarching these problems is resistance from the current dominant regime.
- The different NbS case studies in the Netherlands, Europe and global south, mentioned directly or indirectly their contributions to the environment, climate change, biodiversity, and socio-economic and cultural contributions. Temporal scales for NbS implementation have an important impact on calculating the cost-benefit of different measures and even support the planning of NbS business models. Geographic, spatial and temporal scales are relevant to identifying the types of policies, legal, governance and financial mechanisms that can support NbS implementation for sustainable food production. The effectiveness of NbS is related to the scale of implementation and foremost to the acceptance and ownership of multiple stakeholders.
- The involvement of stakeholders is key for successful NbS design and implementation. Different stakeholders have different views on problems, and thus in the need to select different solutions. We found out that the benefits of NbS are not always clear or not clearly distributed among stakeholders. Applying participatory approaches can help to increase acceptance.
- Making use of NbS tools can support the mainstreaming and uptake of NbS, ranging from methodologies, software, catalogues, repositories and e-platforms to guidelines and handbooks. NbS tools and data can make a valuable contribution to overcoming the barriers that hamper the wide uptake and implementation of NbS.
- Realizing funding for NBS remains a challenge. Business Models can help identify the right stakeholders, beneficiaries and investors, and the necessary resources to implement NbS projects. As well, to assist agri-food businesses in identifying the added value of the NbS project and to communicate in a simple way what it is intended to do and why, who needs to be involved, and how to make it happen.

Selected recommendations for further research and applications are:

1. Having a universally agreed NbS definition is important for the application of measures and policy development worldwide. It is up to decision-makers and other stakeholders to decide on which NbS definition is best to use. The EC, IUCN and the most recent UNEA definitions could be used for policy, research and practice for food systems.
2. It is advised to embrace NbS principles (for nature protection, rehabilitation and management), but being aware that not all the interventions could be considered NbS.
3. For new NbS projects, feasibility studies are recommended along with the identification of barriers, opportunities and trade-offs. Cost-benefit and risk analysis are also recommended.
4. For already implemented projects, it is suggested to evaluate the impacts of NbS in order to learn and optimize the approaches and solutions for new projects. It is important to consider different scales, geographical location, and climatic, environmental and socio-economic conditions.
5. There is limited information on the potential to scale up (replication on similar contexts), scale out (scaling in a different context), and scale deep (transforming the system) of NbS case studies. Further research is recommended on the scaling dimension of NbS projects.
6. It is suggested to strengthen partnerships between agri-food actors and public and private sectors, to ensure a common vision and long-term commitments towards NBS uptake in food systems.
7. Apply participatory approaches that can help in the design and implementation of NbS and to increase acceptability. Use local knowledge for NbS projects.
8. It is recommended to strengthen the skills and knowledge sharing of different stakeholders to incentivize a mindset change and to achieve successful NbS implementation.
9. Use the tools presented in this study to identify and assess possible suitable NbS. Potentially valuable tools can be missing or underrepresented as a result of the quick search and selection criteria. Therefore, to learn more about the different NbS tools to support the agri-food sector, further research is recommended.
10. Make use of the NbS Business Model Canvas to present the socio-economic benefits of NbS projects, to obtain the support of the right stakeholders and investors, and to convert such NbS projects into partly or fully self-sustaining businesses. It is recommended to unlock investments by exploring possibilities in policy to mainstream NbS and to organize region-specific financing strategies.

Note: The reference list is available on the complete version of the Discussion Paper.

Budding-Polo Ballinas, M., Arumugam, P., Verstand, D., Siegmund-Schultze, M. G. R., Keesstra, S. D., Garcia Chavez, L. Y., de Boer, R., van Eldik, Z. C. S., & Voskamp, I. M. (2022). Nature based solutions in Food Systems: Review of nature-based solutions towards more sustainable agriculture and food production. Wageningen University & Research. https://edepot.wur.nl/578174

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