LEarning and action alliances for NexuS EnvironmentS in an uncertain future

LENSES

WP5

D5.3 Module for decision support on Nexus-related technical effectiveness of NBS

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Project partners

Project Website

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1. Executive summary

LENSES' goal is to enhance system understanding, as well as gather and structure knowledge in order to unravel complexity and manage uncertainty in water-energy-food (WEF) systems, with their dynamic evolution. It is important to analyze how activities in one area may impact the coordination of institutions and policies for resource management in another area, for the purpose of building resilient Nexus systems that recognize climatic, social, or technological change. For this reason, Participatory Structured Decision-making (SDM) are developed to take advantage of the potential systems thinking based on collective intelligence as a viable and effective philosophy for assisting in the development of a systemic approach to the Nexus.

In this document the **Module for decision support on Nexus-related NBS selection** is presented, as well as the methodology that was followed for the implementation of the tool, which is a catalogue holding a list of existing nature-based solutions (NBS), making them available to the wider public. The tool is based on the NBS framework that has been developed within Tasks 5.1 and 5.2 and more specifically in deliverables *D5.1: Report on the review of existing frameworks* and *D5.2: Roadmap to navigate the available catalogues of Nature-based Solutions and finalized list of candidate NBS*. Additionally, the tool incorporates part of the work of Task 6.3, where business and governance model frameworks for Nexus-related NBS are developed, and more specifically guidelines for users to develop their own business plan for selected NBS are provided. This document reflects the methodology that was followed for the development and implementation of the tool along with the architecture of the system.

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2. Introduction

LENSES aims at contributing to improved water allocation and enhanced food security while at the same time preserving the ecosystems and aid climate change adaptations by supporting the operationalization of the Nexus paradigm. Stakeholders should be able to access an evidence-based framework as well as guidance in order to select the solutions that incorporate nature-based approaches, so as to increase the resilience of the water-energy-food (WEF) Nexus. The module for decision support on Nexus-related nature-based solutions (NBS) selection allows the selection of NBS and is built on available methodologies and information for selecting an NBS. At the same time, it provides KPIs in order to assess their technical effectiveness; effectiveness in improving service under specific conditions, climate resilience of the solution and contribution to adaptation. Furthermore, the user is able through an easy-to-use and user-friendly interface to explore a list of available NBS, search by keyword in order to find a specific NBS, as well as use filters for the attributes of the NBS in order to narrow down their results. Other than that, the tool contains guidelines for the development of a business plan with the purpose of making the selected NBS more sustainable. This document reflects the approach for the development of the module for decision support on Nexus-related NBS selection (i.e., *NBS Tool*).

In **Section 3** of the document, the overall approach of the design and development of the tool is presented, along with the user requirements and a timeline. Furthermore, the dependencies with other tasks are reflected, as well as the data that are used in the tool and the process of collecting them.

In **Section 4**, the tool is described in detail. The system architecture is presented, as well as the main features of the tool and its functionalities, accompanied by images of the implementation of the tool.

In **Section 5**, the document concludes with the future additions to the NBS Tool.

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3. Overall approach

In the context of Task 5.3, the **Module for decision support on Nexus-related NBS selection** is envisaged and more specifically a catalogue of available NBS, along with key performance indicators (KPIs), to assess their technical effectiveness, United Nations' Sustainable Development Goals (SDGs) with specific targets and indicators that could be achieved by the implementation of a specific NBS, as well as real case examples. In order to develop the tool, many intermediate steps were defined and implemented. Firstly, the analysis of the NBS Framework that was developed and provided by Task 5.1 and Task 5.2 was conducted, with the purpose of understanding the connections among the different NBS attributes. Afterwards, discussions with Task Leaders from WP5 and WP6 took place, in order to identify the correlation to the NBS framework represented in the tool. Based on the output of this work, the NBS tool was envisaged and implemented. In this chapter, the timeline, along with the dependencies with the other tasks, is described, as well as the framework analysis and the methodology followed, at greater length.

3.1 Actions and Timeline

As it is shown in Figure 1, the first step was to analyze the NBS Framework that was developed in Tasks 5.1 and 5.2. After that, discussions with WP6 partners took place in order to discuss about possible connections to the NBS framework. Subsequently, the wireframes for all the pages of the tool were designed and after that, the implementation of the UI templates started. During June, the final input from Task 6.3 regarding the business model was prepared and the implementation of the tool begun. In August, the tool was finalized and became available for use.

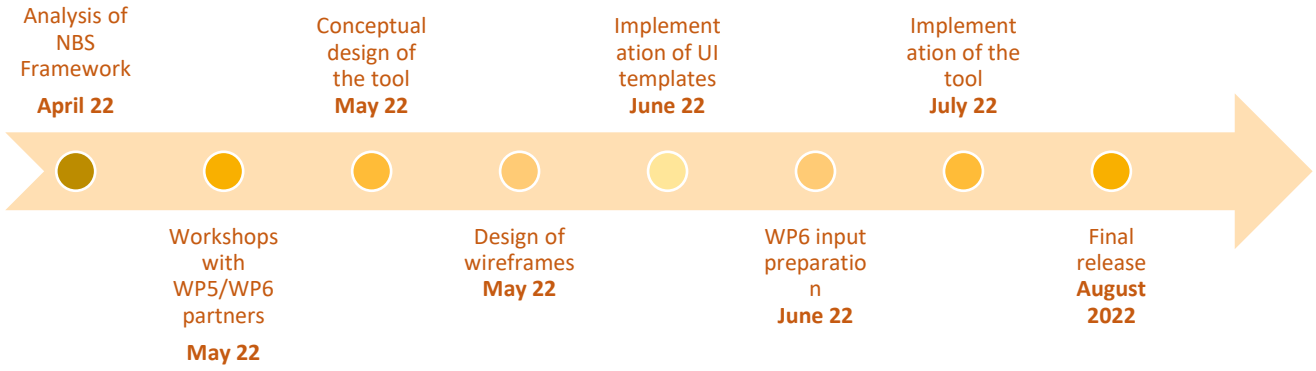

Figure 1: Actions and Deadlines for Task 5.3

3.2 Dependencies with other tasks and expected inputs

The design and development of the **Module for decision support on Nexus-related NBS selection** was heavily based on the information of the NBS Framework, and more specifically the database schema is supporting the framework in its entirety. Furthermore, a process of analyzing the association with WP6 was followed, to identify what could be relevant to the NBS tool and beneficial to its potential users.

As shown in Figure 2, the NBS framework was used as the point of reference throughout the implementation of the tool. The information was used to populate the tool, as well as draw relationships among different attributes that accompany each NBS. Furthermore, due to the connection identified between WP6 and the NBS tool, inputs from Task 6.3 were included, regarding the business model, and more precisely guidelines in the form of questions which will allow the development of a business plan. This way the selected NBS will become more sustainable.

Additional information will be incorporated in the tool later on in the project, deriving from work in the context of Task 6.1, regarding real case examples of NBS in pilot areas, along with a socioeconomic analysis.

More specifically, the tasks associated to the NBS tool are the following:

- **Task 5.1** – Critical review of existing NBS evaluation frameworks
- **Task 5.2** – Identifying the potential role of NBS
- **Task 6.1** – Real case examples of NBS along with a socioeconomic analysis
- **Task 6.3** – Business and governance models for NBS deployment

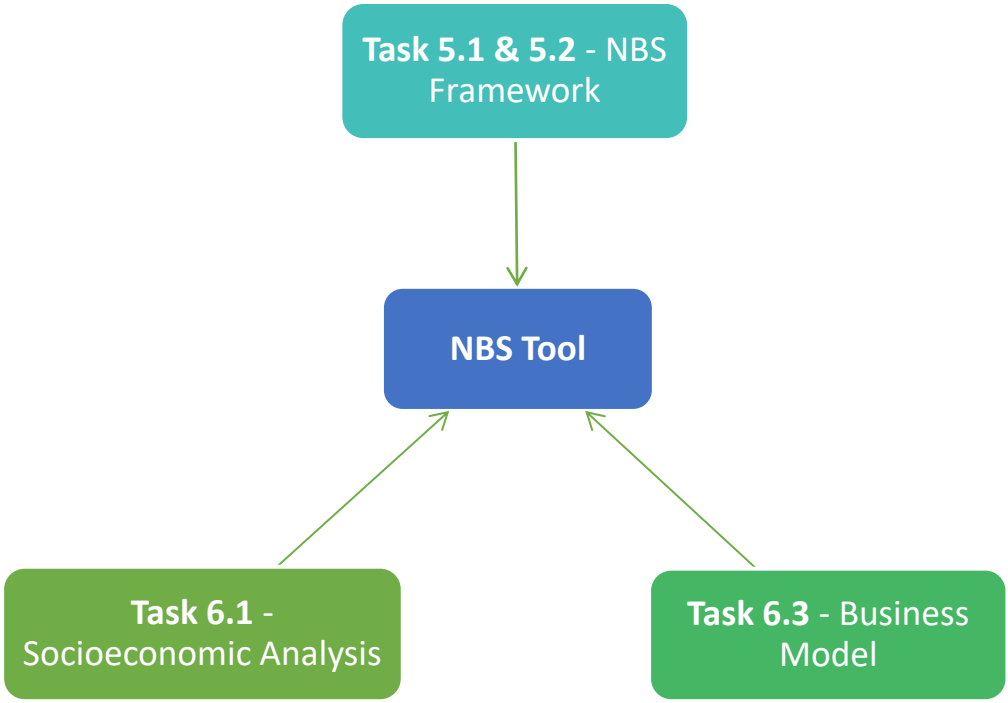

Figure 2: Dependencies of Task 5.3 with other Project tasks

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3.3 Framework Analysis

The **Module for decision support on Nexus-related NBS selection** provides information on NBS, based on the work produced in WP5 and more specifically on the NBS framework developed and presented in D5.1 and D5.2. The NBS framework is based on research around innovation actions that highlight the multi-functional role of NBS and their potential ability to fulfil multiple social, economic and environmental goals. The NBS framework contains an NBS classification scheme along with a list of NBS that apply to the WEF Nexus.

Each NBS included in the classification scheme comprises the following attributes:

- **Type** of engineering or management applied to biodiversity and ecosystems,
- **Level** of ecosystem intervention,
- **Approach** that could be followed,
- **Challenge** that the NBS is expecting to solve,
- **Ecosystem services** that the NBS is delivering,
- **KPIs** in order to assess their technical effectiveness,
- **SDGs** connected with each NBS.

Moreover, research was conducted in order to gather descriptive information for each NBS, to facilitate users with limited domain knowledge. The results are presented in Table 2 of Annex I. The connections among the attributes of each NBS are reflected in Figure 3.

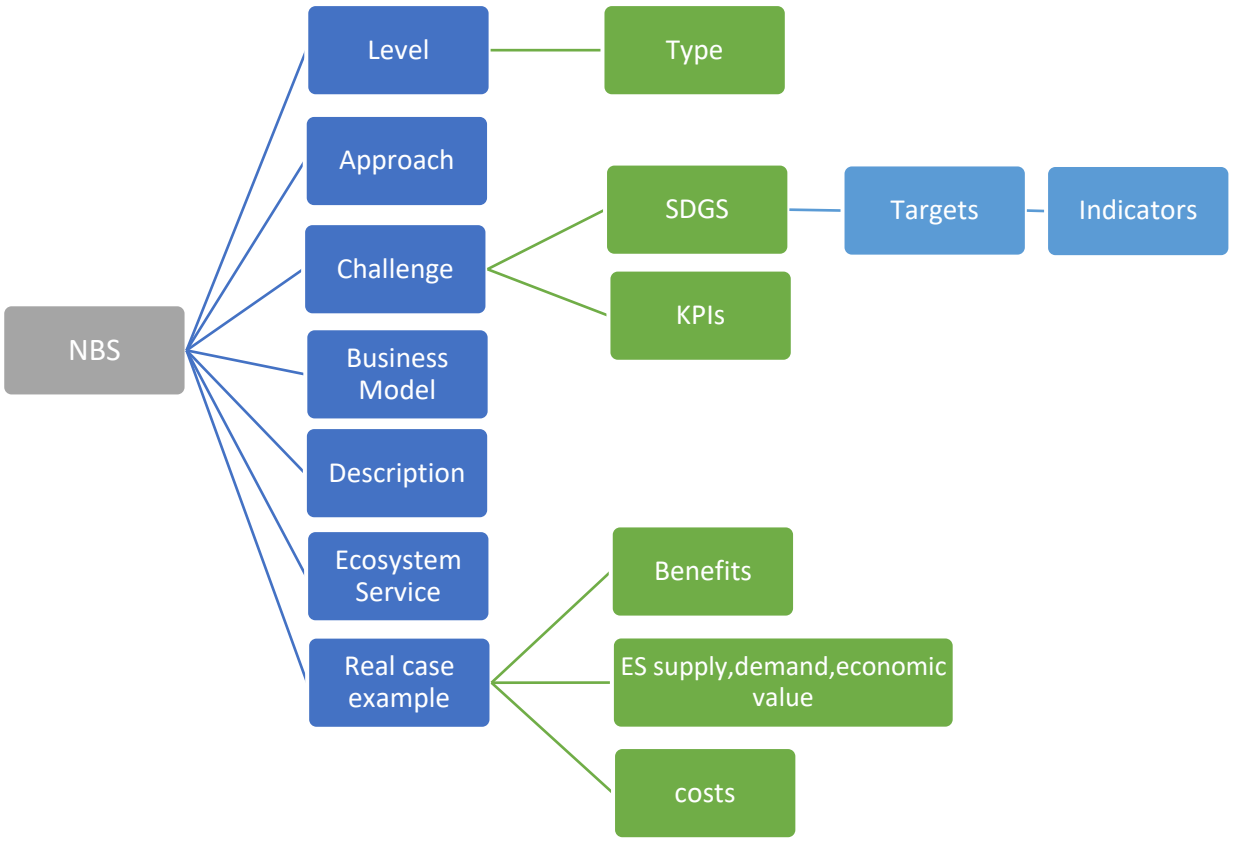

Figure 3: NBS Tool - Connections among attributes

Therefore, each NBS presented in the tool comprises:

- A **description** of the selected NBS,
- A **level** of ecosystem intervention, multiple **approaches,** multiple **challenges** with KPIs, multiple **ecosystem services**, multiple **SDGs** with targets and indicators
- A **real case example** in pilot areas, if available,
- as well as the **business model** that could be developed in order to make it more sustainable.

Additionally, the potential connection between the NBS and various SDGs was examined, leading to a selection of SDGs to be incorporated in the tool content, as per their relation to the WEF concept. Thus, the users can acquire knowledge on the SDGs they can work towards, by implementing a selected NBS. The SDGs can be assessed using specific targets and indicators. This information is reflected in Table 3 of Annex I**Error! Reference source not found.**. The correlation between each NBS and the SDGs is achieved through the challenges that each NBS is addressing. The matrix presenting the association among challenges and identified SDGs is available in Table 4 of Annex I.

Moreover, the tool contains a business model guide, with clear steps in the form of questions and tips, that can be used by anyone without prior knowledge, in order to start developing a business plan, aiming to enhance the sustainability of the implemented NBS. This guide derives from the identified association with WP6 and is considered a valuable supplemental section that completes the user experience.

3.4 Methodology

The goal of the NBS Tool is to provide to the users a catalogue of available NBS along with KPIs and a business model, to be able to implement the selected NBS, assess it, as well as develop a business plan to make it sustainable. The first step towards the design of the tool was to define the users and the actions they are able to perform. Taking this into consideration, a number of user stories were created, for the purpose of defining the requirements, and they are presented in detail in this chapter.

3.4.1 Users

The tool is available to the public, meaning that the potential users can be either internal from LENSES project or external. The two types of potential users fall into the following categories:

- People who would like to implement an NBS, but do not have the required domain knowledge in order to do so,
- People who have knowledge on NBS, but would like to apply filters for the purpose of finding the solution that better fits their needs.

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3.4.2 User Stories

U.S. 1 - List of NBS

As a user I want to be able to see a list of all NBS in a table view so that I am able to select one and be directed to its respective page.

Priority: Must have

Acceptance Criteria:

- The user should be able to have access to a list of NBS in a table view form.
- The list should contain the title of the NBS, the type of NBS, the ecosystem services and the SDGs connected with it.

U.S.2 - Filters

As a user I want to be able to apply filters at the NBS list so that I am able to find the NBS I am interested in.

Priority: Must have

Acceptance Criteria:

- The user should be able to apply filters, namely the following parameters: challenges, approaches, types, ecosystem services, and SDGs.
- The user should be able to see the predefined options of each parameter.
- The user should be able to reset all filters.
- In case there are no results the system should return a message.

U.S.3 - Select an NBS

As a user I want to be able to select an NBS from the list and go to its page so that I am able to see all relevant information.

Priority: Must have

Acceptance Criteria:

- When the user selects a specific NBS, the system should direct them to their respective page.
- The NBS page should include:
  - The photo of the NBS,
  - The title of the NBS,
  - A description of the NBS,
  - The type of NBS,
  - The approaches connected with the selected NBS,
  - Applied examples of the selected NBS, if one exists,
  - The challenges connected with the selected NBS as buttons and when clicked to provide all connected KPIs as well as SDGs based on the challenge,
  - The user should be provided with all Recommended Indicators as well as the Additional Indicators if they wish,
  - The ecosystem services.

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U.S.4 - Search by keywords

As a user I want to be able to search by keywords based on the title of the NBS so that I am able to find relevant NBS.

Priority: Must have

Acceptance Criteria:

- Keyword search should be combined with filter application.
- In case there are no results the system should return to the user a message.

U.S.5 - Export information in an excel file

As a user I want to be able to export the information provided on the dedicated page of each NBS in an excel file.

Priority: Must have

Acceptance Criteria:

- The user should be able to export on an excel file the following information regarding the selected NBS: the title, the description, the type, the approaches connected with it, the challenges, the SDGs, the ecosystem services and the KPIs.

U.S.6 - Glossary

As a user I want to be able to have access to a glossary so that I understand all the definitions of the tool.

Priority: Must have

Acceptance Criteria:

- The user should be able to access a catalogue of words along with their definitions in a different page.
- The user should be able to search for a word.

U.S.7 - Guidelines for Business Model

As a user I want to be able to view guidelines for the development of a business plan so that I am able to make the NBS selected more sustainable.

Priority: Must have

Acceptance Criteria:

- Guidelines should be in the form of text and images in a dedicated page.

U.S.8 - Export business plan in a PDF file

As a user I want to be able to export the information provided on the business plan guidelines in a PDF file.

Priority: Must have

Acceptance Criteria:

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- The user should be able to export in a PDF file all the information regarding the guidelines of the business plan.

U.S.9 - Visit Lenses Website

As a user I want to be able to access the Lenses website so that I am able to learn more about the project.

Priority: Must have

Acceptance Criteria:

- The system should provide a button as a link to the website of the LENSES project at the footer.

U.S.10 - Contact details

As a user I want to be able to have access to a contact email so that I have the ability to contact the system administrator if needed.

Priority: Should have

Acceptance Criteria:

- The user should be able to find the email of the administrator.

The above requirements were presented to Task 5.3 partners for validation and then they served as a basis for the design of the tool. Additionally, research was conducted in order to identify other relevant tools, concerning NBS or catalogues. After that, wireframes were designed as a visual insight of the tool to be developed. The wireframes include the requirements described in the user stories, as well as the styling of the pages and the color palette.

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3.4.3 Wireframes

In this chapter, the wireframes designed for each page of the tool are presented. Wireframes play an important role in the design process of a tool, since they depict the components and the available user actions in each page. The wireframes served as a visual guide during the implementation of the UI templates for the NBS tool.

Figure 4 depicts the wireframe of the NBS page. The page contains the title of the NBS, its description, type, the approaches that could be followed, the challenges and the ecosystem services it is associated with, as well as examples of applied NBS. Furthermore, on the top right there is the option for the user to export all the information that is included in the page.

Figure 4: NBS Tool - Wireframe of NBS page

Figure 5 depicts the wireframe of the main page of the tool. In this page, there is a search functionality that allows search by keywords, as well as filters in order to narrow down the results based on the needs of each user. Moreover, there is a list of available NBS along with additional information.

Figure 5: NBS Tool - Wireframe of Main page

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Figure 6 presents the wireframe for the glossary page. This page includes terminologies as well as a search functionality with the purpose of allowing the users to search for a specific term that is included in the tool.

Figure 6: NBS Tool - Wireframe of Glossary page

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Figure 7 reveals the wireframe for the business model page. Its content is plain text and photos, which during the implementation was replaced by text and various shapes.

Figure 7: NBS Tool - Wireframe of Business Model page

4. NBS tool – Final version

4.1 System architecture

The system architecture of the **Module for decision support on Nexus-related NBS selection** is based on a monolithic approach. The monolithic approach of software development is the traditional unified model for the design of a software program. The system has been designed and implemented as a single application, with each component being strongly coupled with the others. There is no architectural separation between the frontend interface and the backend business logic layers.

The application has been developed in PHP programming and scripting language, with the use of Laravel framework, which allowed for rapid development and prototyping. The front-end interface is compiled and served directly from the backend, and utilizes the traditional combination of HTML5/CSS3/JS. There is no need for a dedicated frontend compiler or any application that can serve Javascript pages, since the backend itself serves the interface. Therefore, the backend and the frontend are integrated and implemented in a single architectural layer. This provides the application with a great degree of autonomy, removing the need for orchestration and concurrency between different software components.

The information provided through the platform is contained inside a PostgreSQL database. PostgreSQL is an open source, relational database management system (DBMS), with full SQL support, an assortment of features ready to use out of the box, and a wide range of plugins that can provide any needed functionality. In addition, the files that are required both for the application and for providing information to the users are stored in the server's filesystem. The database, in conjunction with the file system, is the application's storage layer.

The webpages are served through the Apache web server, which is able to parse and interpret the PHP files, execute their instructions, direct the backend layer into retrieving and compiling the data, and serving the client with the resulting website. The Apache web server also provides access and error logging, which can be useful for maintenance and troubleshooting purposes. The log files produced by the server are stored in its file system.

The specifications of the server's physical hardware, as well as its operating system, are presented in Table 1.

Table 1: System specifications

Operating system (OS)	Ubuntu 20.04 LTS
CPU	2 cores
Memory	4GB RAM
Hard drive	40GB SSD
Traffic	20TB

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Figure 8 shows the application's logical architecture and data flow. Whereas the implementation architecture follows the monolithic principle, the system can be thought of as being separated in the frontend interface, the backend business logic layer, and the data storage layer.

As the schematic shows, the users request information by using the frontend interface and its control elements (buttons, forms, etc.). These requests are routed to the backend business logic layer, where they are translated into machine readable queries. These queries are forwarded to the database, which retrieves the relevant data and passes it back to the business logic layer. The business logic layer formats this data into information meaningful to the users, and serves it in the form of HTML pages back to the frontend interface.

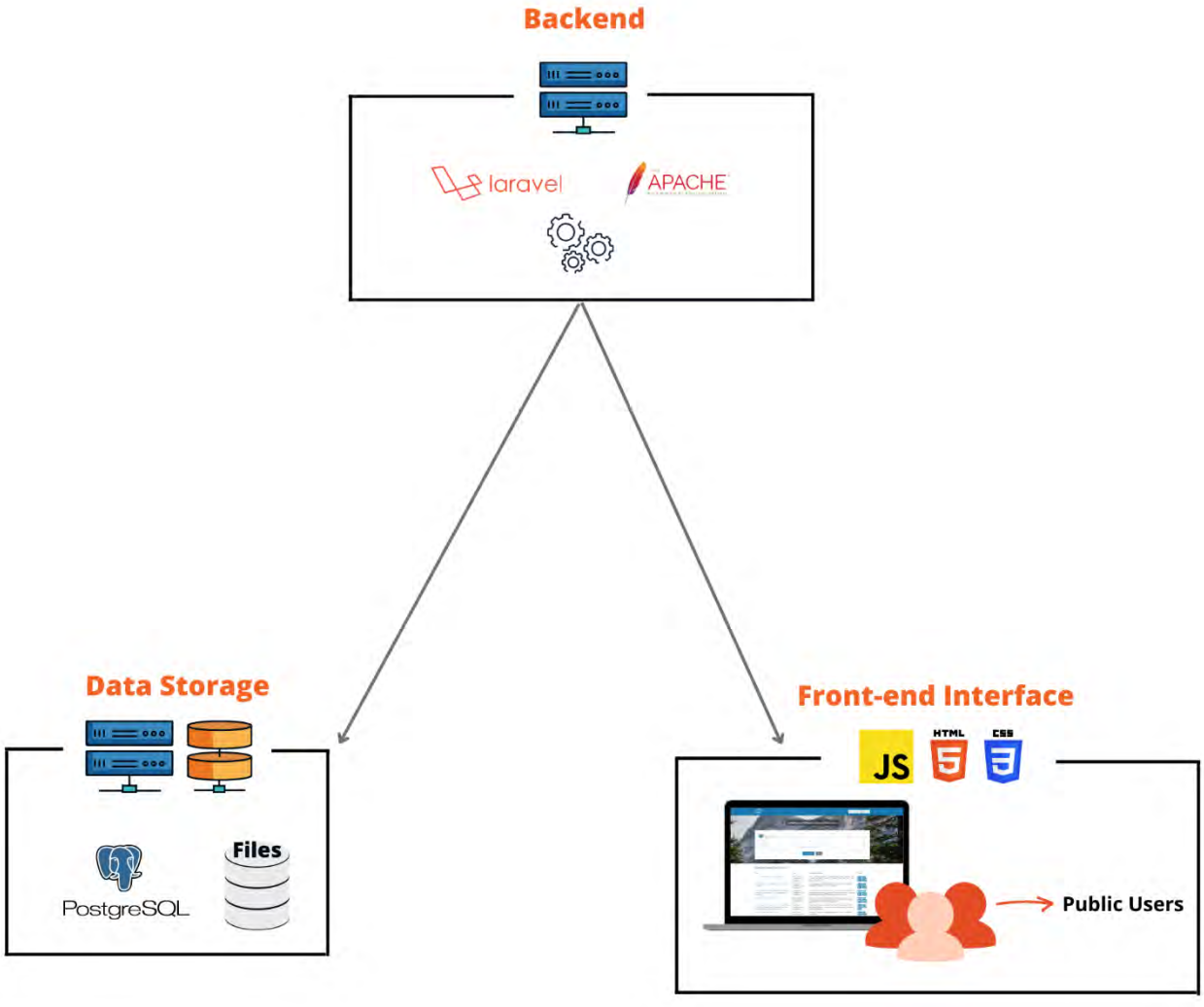

Figure 8: System Architecture

4.2 Main features

The **Module for decision support on Nexus-related NBS selection** was developed based on the wireframes that were created and depicted in chapter 3.4.3. The tool is publicly available at this link.

In this chapter, each page of the tool is described in detail accompanied by an image of the respective page of the tool.

4.2.1 Main page

As it is shown in Figure 9, the main page contains a search functionality to allow the users to search for a specific NBS based on keywords. Below the search bar, the following filters are available:

- Challenge,
- Approach,
- Type,
- Ecosystem service,
- SDG,

which provide a list of available options in order for the user to select one or more. The filters can be used for the purpose of narrowing down the results. Below the filters, there is a list of 54 available NBS along with the following additional information:

- Type,
- Ecosystem services,
- SDGs.

This information is connected with each NBS respectively. The user can select one of the NBS in the list provided and be directed to the corresponding NBS page where detailed information is provided (Figure 10).

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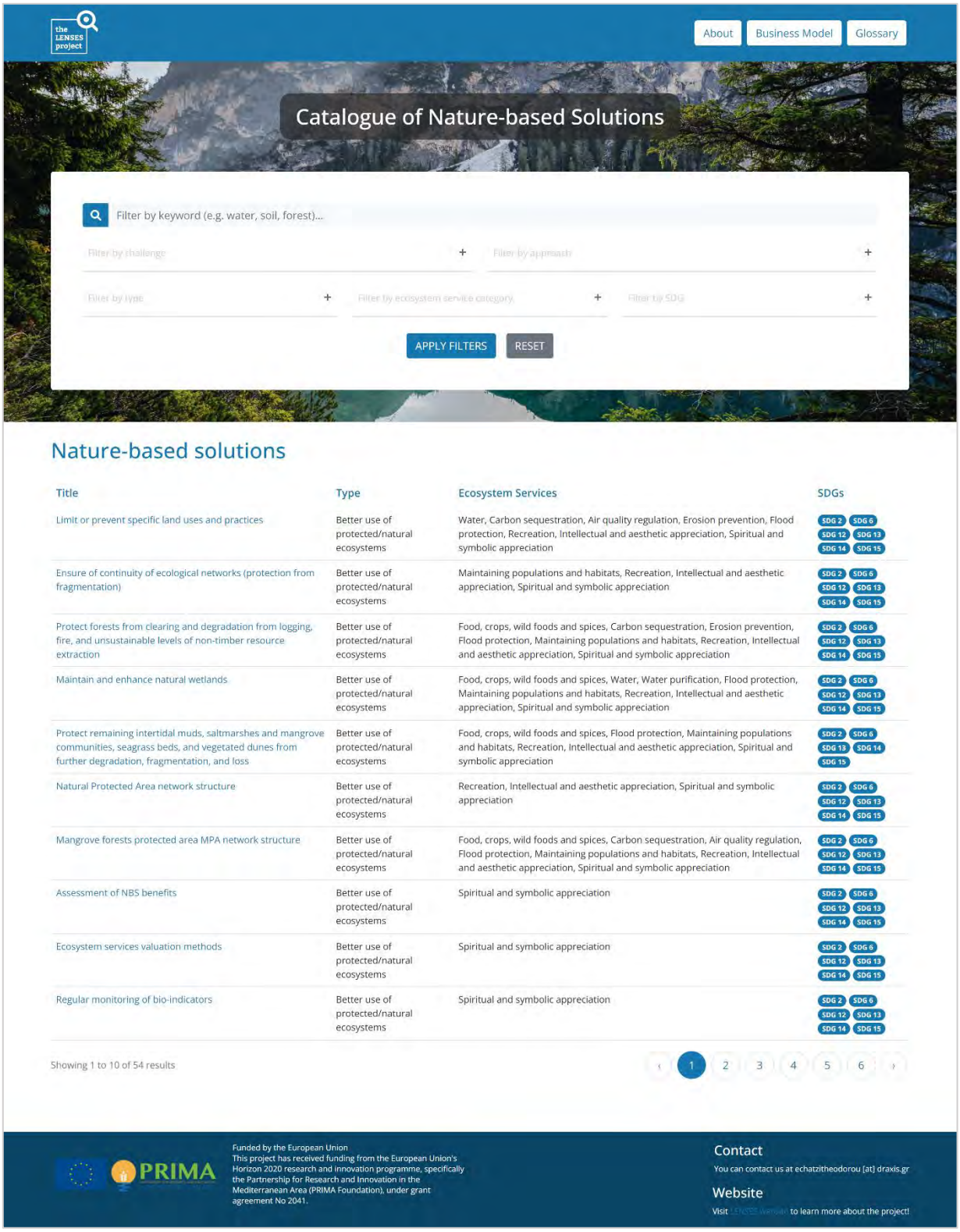

Figure 9: NBS Tool - Main page

4.2.2 NBS page

The NBS page (Figure 10) contains all the information regarding the selected NBS. More specifically, each NBS contains the following information:

- Title,
- Description,
- Type,
- Level,
- Approaches,
- Challenges,
- KPIs for each challenge,
- SDGs along with specific targets and indicators,
- Ecosystem services,
- Examples of applied NBS, if they exist.

Furthermore, the page contains a download function. The user is able to export all the attributes that accompany the selected NBS in an excel file. Each NBS is connected with more than one challenges, ecosystem services and SDGs. For each NBS, there are many challenges that can be addressed, and the user can explore the available information by selecting the respective tab of each challenge. When they select a challenge, the KPIs and the SDGs are updated to show the content associated to that challenge. The ecosystem services are broken down into three categories (i.e., provisioning, regulating & maintenance, and cultural), and by switching tabs the user can identify all the ecosystem services associated to that NBS. Moreover, a number of NBS will contain real case examples of applied NBS in pilot areas. These NBS will be implemented in the pilot areas and will be added in the tool, along with a socioeconomic analysis, and the user will be able to download a file with all the respective information.

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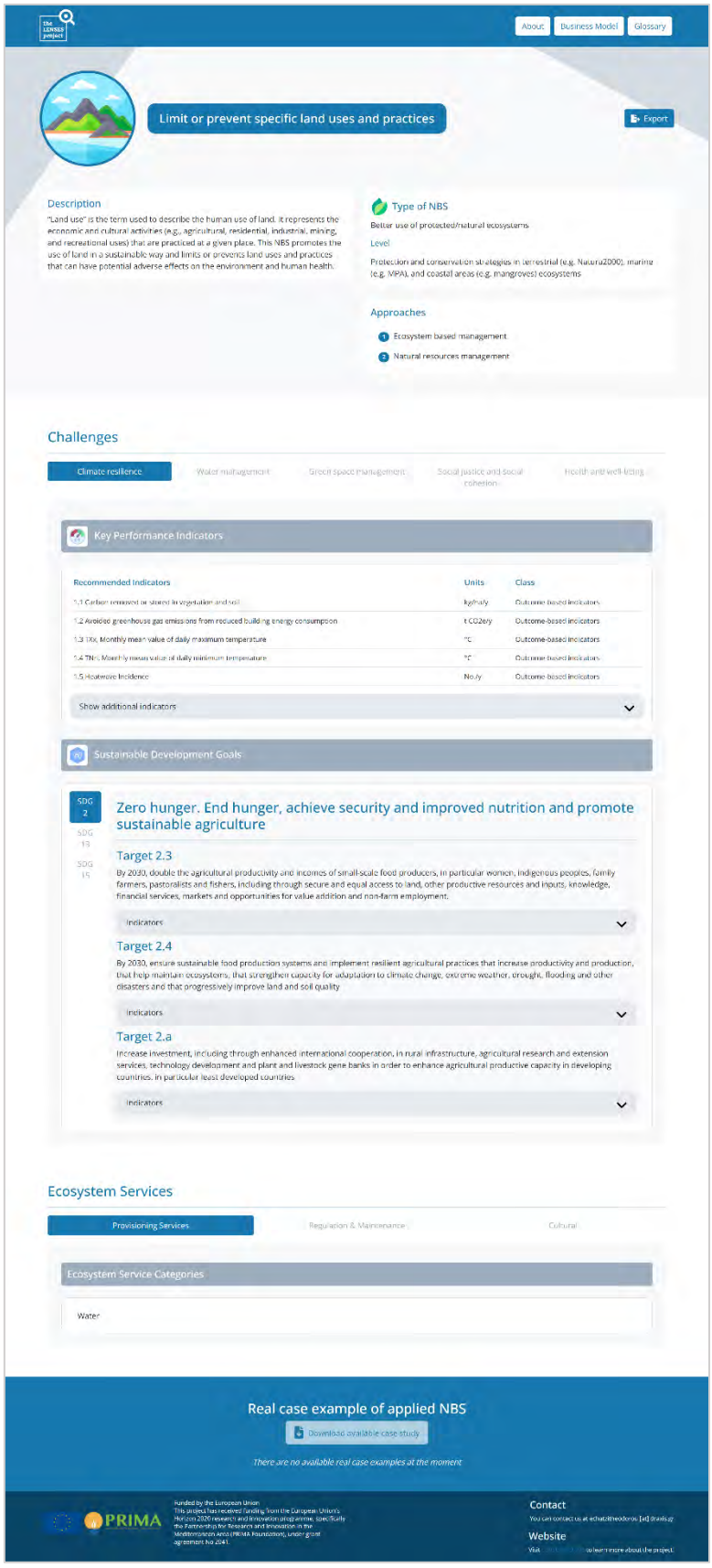

Figure 10: NBS Tool - NBS Page

4.2.3 Business Model page

The Business Model page (Figure 11) contains guidelines in the form of questions in order to assist and drive the users in developing their own business plan, so as to make the selected NBS more sustainable. Users may define necessary resources, partners to collaborate with, governance arrangements to maintain the solution, as well as the solution's cost structure up to a point, to identify possible financing sources. The content is divided into three sections which reflect the three phases one needs to finalize to develop a business plan:

- Value Proposition Phase
- Value Creation and Delivery Phase
- Value Capture Phase

The content is structured as questions one needs to answer to set up their plan, along with tips with the aim of guiding the user through the process.

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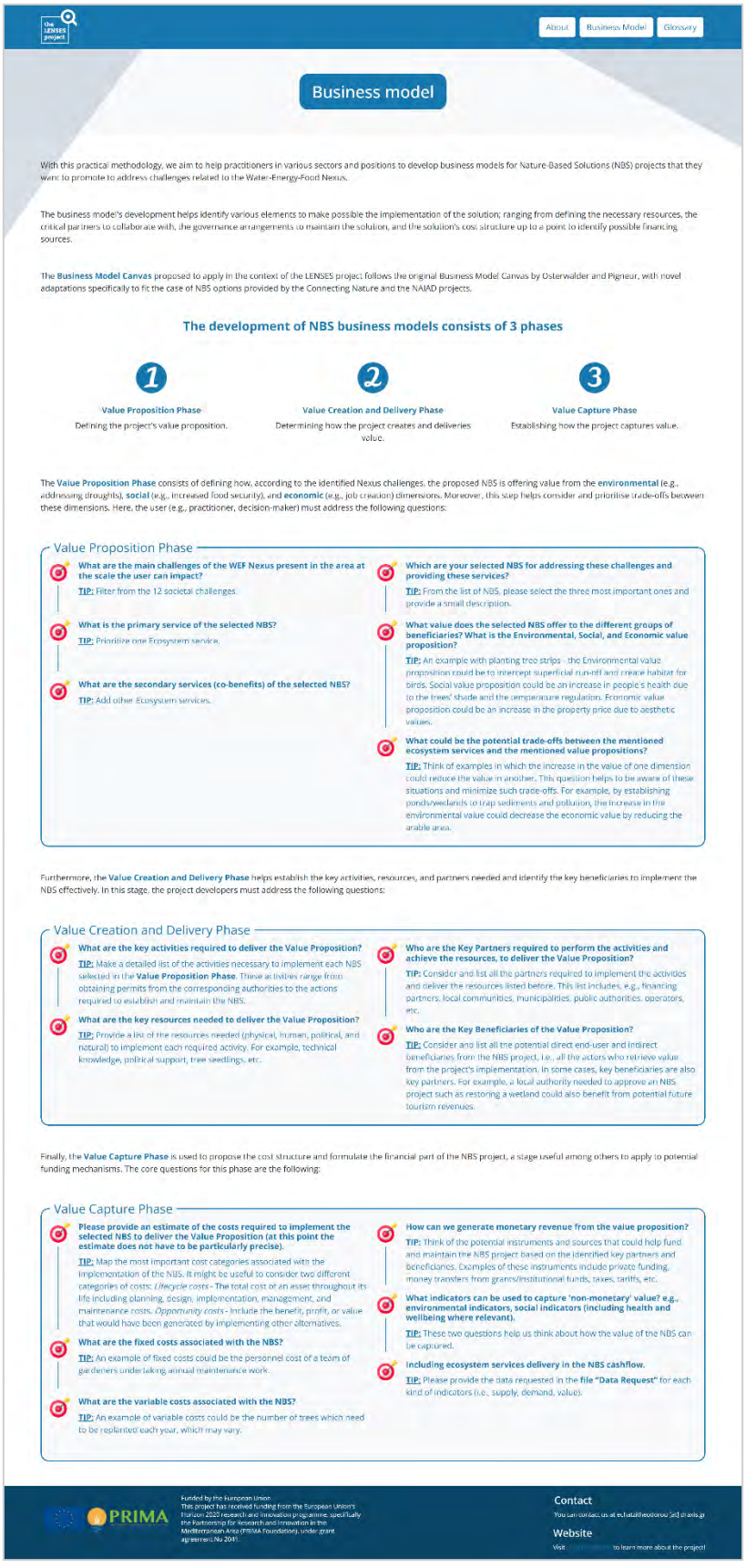

Figure 11: NBS Tool - Business Model Page

4.2.4 Glossary page

The Glossary page (Figure 12) contains a list of terms with an autocomplete search functionality in order to make it easier for the users to better understand specific terms mentioned in the tool in relation to the NBS.

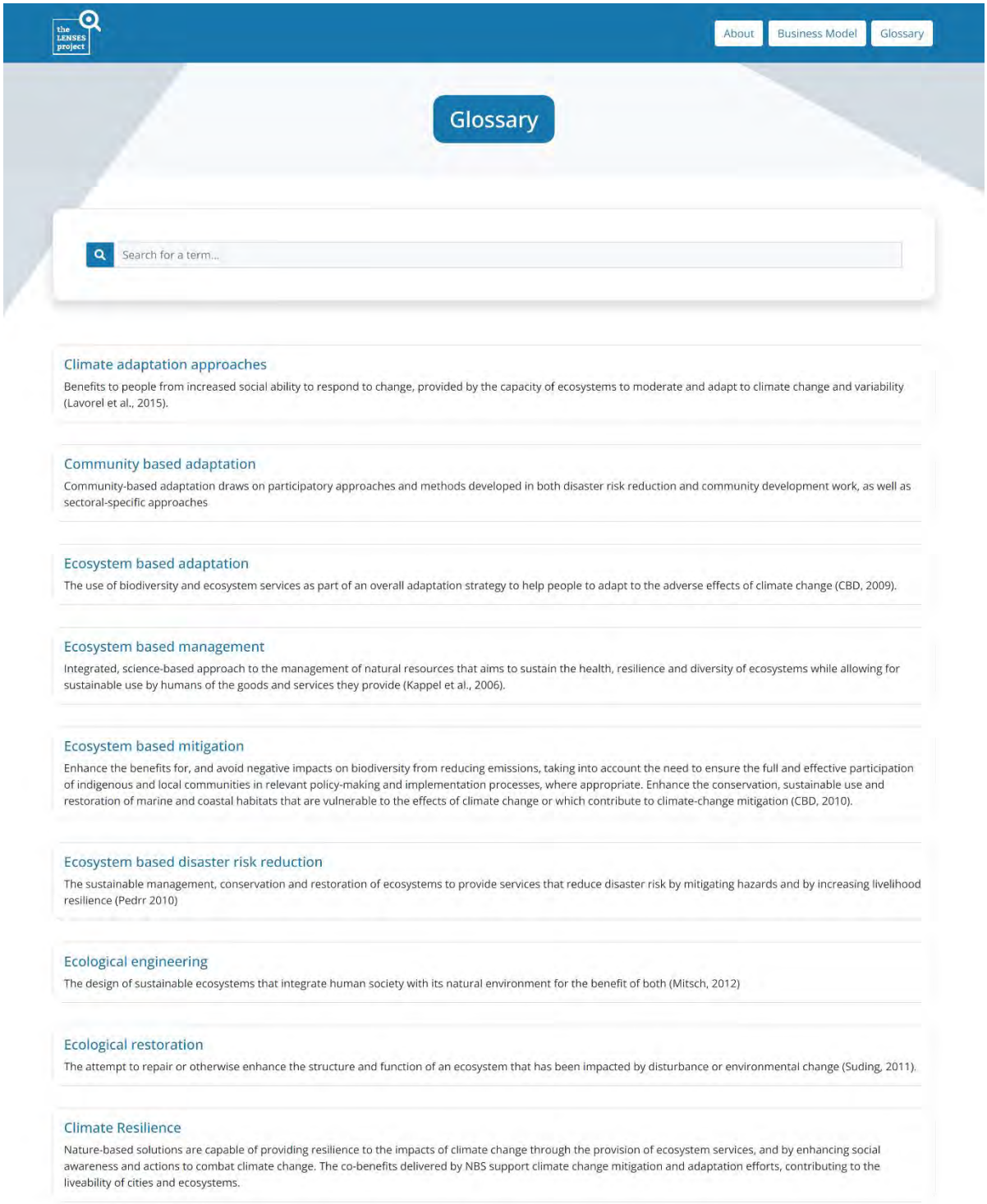

Figure 12: NBS Tool - Glossary Page

4.2.5 About page

Last but not least, an About page was created, as an introduction to the aim and functionalities of the tool, as well as the LENSES project.

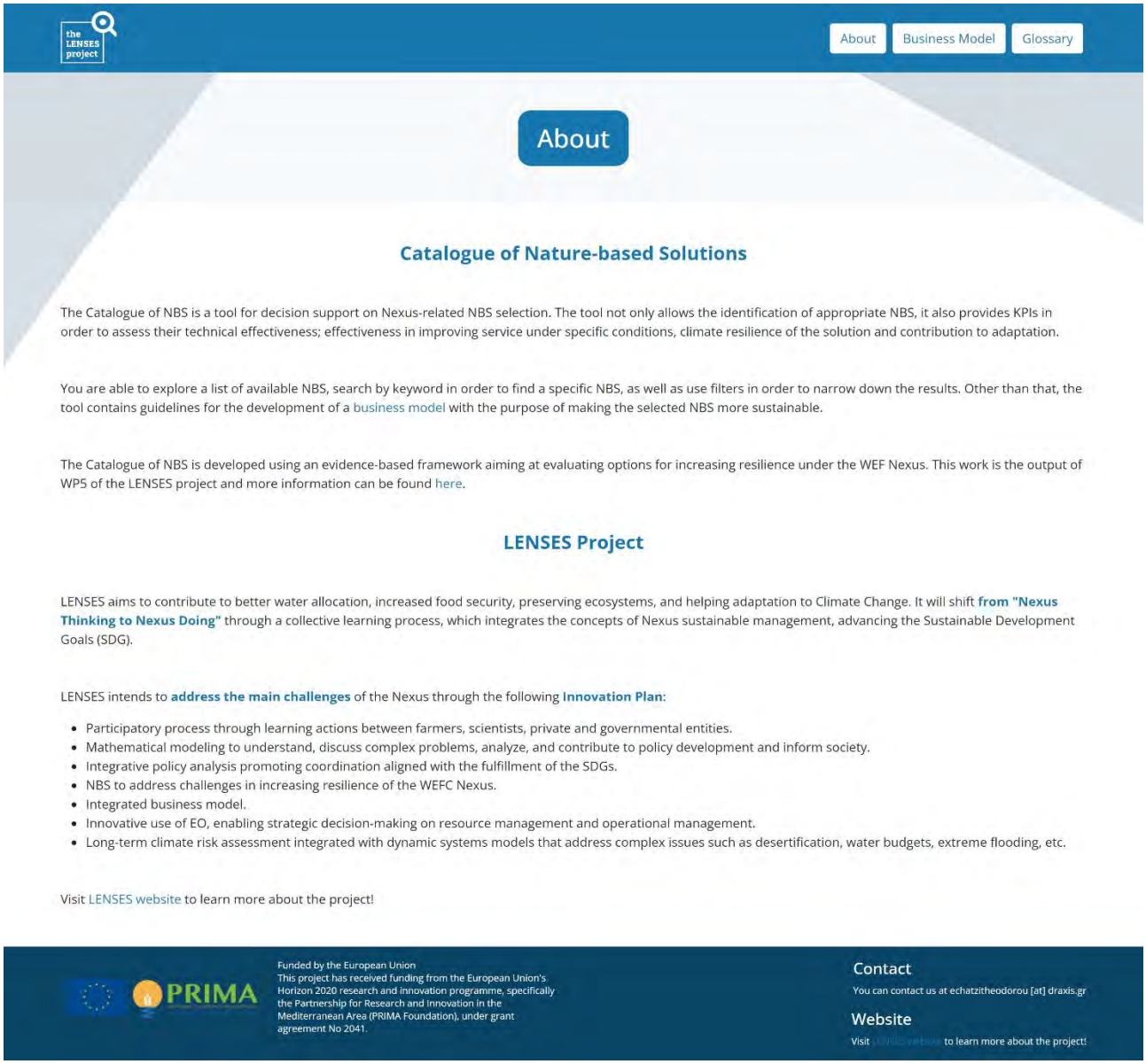

Figure 13: NBS Tool - About page

5. Future Additions

Updating the **Module for decision support on Nexus-related technical effectiveness of NBS** is an active process during the course of the project. A selected amount of NBS that are available in the module, along with their KPIs, will be implemented in pilot areas, and will be assessed in that context. The results, along with valuable information regarding the implementation and the assessment of the selected NBS, will be available in the module in the form of a report, along with a socioeconomic analysis, in order for the users to be able to export and review it.

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6. Conclusions

This deliverable aims to describe the process followed for the implementation of the **Module for decision support of Nexus-related technical effectiveness of NBS**. The overall approach is presented, including the identified dependencies, the framework analysis as well as the user stories and the wireframes that were developed.

The NBS tool is made available to the public and provides a catalogue of available NBS along with different features allowing data search and export of available information. It contains a total amount of 54 NBS along with additional information for each one of them. Moreover, the module consists of a business model in order to assist the users in developing and implementing their own business plan and a glossary with different terms and terminologies that might prove useful to the users. Last, but not least, the tool will be updated with additional content later on in the course of the project, as the real case examples of NBS will be implemented in the pilot areas and will serve as useful examples that provide added value to the tool. The information is presented in such a way in the tool, so as to allow all types of users to navigate the tool and select the most appropriate NBS for their case.

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Annex I - Supplementary information to the NBS Framework

Description of each NBS

Table 2: NBS attributes - Description of each NBS

NBS	Description
Limit or prevent specific land uses and practices	"Land use" is the term used to describe the human use of land. It represents the economic and cultural activities (e.g., agricultural, residential, industrial, mining, and recreational uses) that are practiced at a given place. This NBS promotes the use of land in a sustainable way and limits or prevents land uses and practices that can have potential adverse effects on the environment and human health.
Ensure of continuity of ecological networks (protection from fragmentation)	Wastewater treatment systems have been designed to minimise the environmental impacts of discharging untreated wastewater. Different options for wastewater treatment have different performance characteristics and also different direct impacts on the environment. Some systems have high energy usage, some use materials that have a high embodied energy (e.g. plastics) others occupy a lot of land. If minimisation of environmental impacts is one of the main functions of wastewater treatment systems then they should be designed so that their total impact on the environment is reduced; the whole life cycle of the system must be considered. Ecological connectivity can be defined as the degree of connection between the various natural environments present within a landscape, in terms of their components, spatial distribution and ecological functions. The landscape is composed of a dynamic mosaic of natural and humanized patches. Over the years, the landscape has been modified and fragmented by development. To offset the negative effects of fragmentation of natural habitats, conservation biologists have advised increasing connectivity between habitats. The conservation of natural corridors between habitats is essential to sustain biological diversity in a changing climate and to ensure the maintenance of ecological services to the community.
Protect forests from clearing and degradation from logging, fire, and unsustainable levels of non-timber resource extraction	Forests are one of the best examples of nature-based solutions. Home to 80% of the world's terrestrial biodiversity, forests provide clean air and water, protect against erosion and landslides, and help to regulate the climate by removing carbon from the atmosphere. Primary forests, such as the Amazon, act as significant carbon sinks, sequestering huge amounts of carbon in tree biomass and soils. By preventing deforestation and degradation, which contribute around 13% of global CO2 emissions, we could significantly reduce carbon emissions while staving off the worst impacts of a warming planet .

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Maintain and enhance natural wetlands	Wetlands are areas of land that are wet for all or some of the time. They support a large diversity of plants and animals that have adapted to fluctuating water levels. Wetlands may be natural low depressions such as swamps, old anabranches of rivers such as billabongs and even artificial water bodies such as dams, water storages and surge areas.
Protect remaining intertidal muds, saltmarshes and mangrove communities, seagrass beds, and vegetated dunes from further degradation, fragmentation, and loss	Mangroves, salt marsh vegetation and seagrasses constitute true flowering plants in marine and estuarine habitats. While seagrass beds are found in temperate and tropical latitudes, saltmarshes are restricted to sub-tropical and temperate regions. It is common to find two or three habitats (mangroves, seagrass beds and salt marshes) co-occurring, however separation between these habitats is attributed to differences in salinity and depth preferences and or tolerances .
Natural Protected Area network structure	Climate and land use changes are major threats to biodiversity. To preserve biodiversity, networks of protected areas have been established worldwide, e.g. Natura 2000 network across the European Union. A practical way to assess changes in network connectivity as a result of different undergoing processes (e.g. global change), consists in the comparison between changes in the relative variation of Equivalent Connected Area and in difference in available habitat area (dA). The structure of the networks by default would lead to a reduction in the number of nodes in future networks, and thus a negative value of dA (Mazaris et al., 2013 https://doi.org/10.1371/journal.pone.0059640). This NBS promotes the enhancement of network structure for protected areas.
Mangrove forests protected area MPA network structure	Mangrove is a forest ecosystem composed of plant species that thrive and live in areas that are submerged in sea water or brackish water due to high tide or exposed during low tide. A mangrove ecosystem includes the forest, the terrestrial and marine wildlife, the soil and its subsoil and other abiotic elements. Also, it includes mangrove lands which had been deforested and turned to beaches and foreshore areas. If the mangrove forest is clearcut and not regenerated or the mangrove trees are uprooted due to strong waves and tsunamis the area through time will be covered with sand through the actions of waves. This resulted in the creation of foreshore and/or beach area. Thus, foreshore or beach areas are formerly mangrove areas. Foreshore or beach areas when planted with mangrove species will revert back to a mangrove forest ecosystem through time.
Assessment of NBS benefits	The assessment of NBS benefits represents a valuable tool for guiding thinking and identifying the multiple values of NBS implementation. It can be used in the NBS action planning process from different stakeholders for a successful implementation of NBS action plans.
Ecosystem services valuation methods	The goods and services provided by natural ecosystems contribute to human well-being, both directly and indirectly. The ability to calculate the value of the ecosystem services is increasingly recognized as a necessary condition for integrated environmental decision-making, sustainable business practice, and land-use planning. The valuation of ecosystem services is a necessary tool for NBS implementation.

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Regular monitoring of bio-indicators	Biological indicators are used to document and understand changes in Earth's living systems, especially changes caused by the activities of an expanding human population. Because maintenance of the integrity of living systems is essential to sustain the ecological services human society depends on, the development and testing of a new generation of biological indicators has become an urgent challenge for modern ecologists.
Agro-ecological practices	Agro-ecology is one of a number of innovative and sustainable approaches to achieve agricultural sustainability. The adoption of agro-ecological practices in agricultural systems worldwide can contribute to increased food production without compromising future food security, especially under the current biodiversity loss and climate change scenarios.
Use grazing management and animal impact as farm and ecosystem development tools	With enhanced management of grazing resources, domesticated ruminants can be used to produce higher permanent soil cover of litter and plants, which are effective in reducing soil erosion and increasing net biophysical carbon accumulation. Agro-ecosystems that include grazing are more productive, stable and resilient when the soil is fully functional biologically, and they provide greater earnings and more abundant ecosystem services.
Change crop rotations	Crop rotation is the practice of planting different crops sequentially on the same plot of land to improve soil health, optimize nutrients in the soil, and combat pest and weed pressure.
Soil improvement and conservation measures	Left alone, soil will gradually improve itself, in a process called succession. Methods of soil conservation and improvement: - For the micro-organisms: mulching, good compost, liquid manure, green manures, agroforestry, afforestation. - To cover the soil: mulching, green manures (when land is fallow), agroforestry, afforestation, etc. - To stop water running off: mulching, green manures, agroforestry, afforestation, use A-frame to make contour ditches, terrace maintenance.
Increase soil water holding capacity and infiltration rates	The improvement of water holding capacity, infiltration rate and aggregate stability are main factors to prevent water and soil loses.
Agro-ecological network structure	All species interact with other species in complex networks. A myriad of ecological interactions occur between individuals in populations, between species, within and between communities and functional groups, and across the cropped fields and other natural and semi-natural habitats in the agricultural landscape, and these produce the emergent structure and dynamics of agricultural ecosystem. For the development of a future "sustainably intensive" agriculture, it is necessary to take into account of these interactions because emergent behavior often associated with complex ecological networks implies that the performance of the agricultural system is very much more than just the sum of the individual parts (Bohan et al., 2013 https://doi.org/10.1016/B978-0-12-420002-9.00001-9). This NBS

	promotes the enhancement of network structure for agro-ecological areas.
Mulching	Mulching the soil surface with a layer of plant residue is an effective method of conserving water and soil because it reduces surface runoff, increases infiltration of water into the soil and soil moisture storage, and retard soil erosion.
Incorporating manure, compost, biosolids, or incorporating crop residues to enhance carbon storage	The carbon sequestration benefit of compost use is two-fold. It adds compost's inherent carbon content to the soil. But it also improves soil productivity, increasing above- and below-ground biomass, which stores more carbon. This positive impact can persist for many years from just one compost application.
Produce and integrate biochar into agricultural soils	Biochar is a black, carbon-rich, material produced by thermally treating biomass materials in zero- or limited oxygen conditions using a process called pyrolysis. When applied to land, biochar is not only a carbon sink, but can act as a soil improver by increasing the water and nutrient holding capacity of the soil. It may also be effective in reducing greenhouse gas emissions from the soil. With the correct calibration, therefore, biochar application could offer considerable benefits in terms of mitigating climate change, improving food security and reducing reliance on chemical fertilisers, all of which could have considerable environmental and economic advantage.
Enrichment planting in degraded and regenerating forests	Enrichment planting (also known as line-, strip-, gap-, and under-planting) is defined as the introduction of valuable species to degraded forests without the elimination of valuable individuals already present. Enrichment planting has been suggested as a technique for restoration of overexploited and secondary forests as it can increase total tree volume and the economic value of forests. Enrichment of natural forests after logging may be appropriate in areas where natural regeneration is insufficient or soil characteristics are not conducive to other uses. Enrichment may also include planting fruit trees or other species with commercial or local value. Enrichment planting can be useful as a technique to establish forest species that cannot grow in open plantations because the trees may suffer from continuous direct insolation.
Forest patches	As potential biodiversity islets, small forest patches (SFP) may deliver several crucial ecosystem services to human society, but they receive little attention compared to large, relatively intact forest patches. Beyond their role as a biodiversity reservoir, SFP provide important in situ services such as timber and wild food (game, edible plants and mushrooms) production.
Hedge and planted fence	Hedges can reduce pollution and improve air quality; slow the flow of rainwater which can help with flood management; provide shelter for wildlife; and help regulate temperature through shading and cooling.

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Flower strips	Flower strips are widely used throughout Europe but come in many different forms and their effects on biodiversity vary strongly. Flower strips, but not hedgerows, enhanced pest control services in adjacent fields by 16% on average. However, effects on crop pollination and yield were more variable.
Use soil conservation measures - cover crops	Cover crops are literally "crops that cover the soil" and one of their first uses was to reduce soil erosion during fallow periods in annual cropping systems. Cover crops are also known as "green manures," "catch crops," or "living mulch." Green manure cover crops are usually legumes that fi x N and are grown to provide N to the following cash crop. Catch crops are cover crops that are grown during fallow periods in cropping systems to take up nutrients, especially N, that would be lost if plants are not present. Lastly, living mulches are cover crops that are grown both during and after the cash crop growing season and are suppressed or managed to reduce their competition with the cash crop when it is growing. In terms of soil management, the basic premise for using cover crops is to reduce fallow periods and spaces in cropping systems.
Use soil conservation measures - wind breaks	Windbreaks are rows of trees or shrubs that reduce the force of the wind. They can reduce soil erosion, increase crop yields and protect livestock from heat and cold. Windbreaks can shield buildings and roads from drifting snow. They beautify the landscape and provide travel routes and habitat for wildlife. Windbreaks can also be sources of wood and food .
Use soil conservation measures - Deep-rooted plants and minimum or conservation tillage	Conventional tillage, such as moldboard plowing, leaves the soil surface bare and loosens soil particles, making them susceptible to the erosive forces of wind and water. Conservation tillage practices reduce erosion by protecting the soil surface and allowing water to infiltrate instead of running off. Also, deep roots create tunnels for air and water to enter the soil.
Promote agroforestry	Agroforestry is a term created from the words agriculture and forestry, and refers to the grazing of livestock and cultivation of crops between planting trees. Agroforestry systems, which integrate trees in agricultural landscapes, have been recognised by scientists for their role in mitigating climate change by acting as a carbon sink: trees sequester atmospheric carbon in their biomass. Agroforestry practices can also enhance soil organic carbon, which is a component of soil organic matter and is the largest carbon stock in terrestrial ecosystems.
Encourage development of early successional sand dune habitats (dry dunes and wet slacks) where carbon sequestration rates are high.	Dunes are formed from sand blown inland from the beach by onshore winds, and trapped by debris or plants. Accumulating sand makes a good habitat for tough beach grasses such as sand couch and lyme grass, whose strong horizontal roots stabilize the collected sand, encouraging more to settle.
Enhance or facilitate habitat expansion, including the facilitated range expansion of mangroves, as warming conditions and changes in storm occurrence permit.	The purpose of ecological enhancement is to increase and/or improve the habitat for biodiversity while also protecting human health and the environment. This NBS facilitates the expansion of habitat that will enhance and promote biodiversity

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Integrated coastal zone management	Integrated coastal management aims for the coordinated application of the different policies affecting the coastal zone and related to activities such as nature protection, aquaculture, fisheries, agriculture, industry, off shore wind energy, shipping, tourism, development of infrastructure and mitigation and adaptation to climate change. It will contribute to sustainable development of coastal zones by the application of an approach that respects the limits of natural resources and ecosystems, the so-called ecosystem-based approach. Integrated coastal management covers the full cycle of information collection, planning, decision-making, management and monitoring of implementation. It is important to involve all stakeholders across the different sectors to ensure broad support for the implementation of management strategies.
Quarry restoration	The extraction of minerals is a temporary land use. Once quarrying has finished the land can be 'recycled' or reused through restoration. In many cases, restoration involves returning the land to its original use. However, this is not always feasible or desirable. Through creative restoration planning, mineral extraction offers the opportunity to improve the environment in and around quarry sites or to create new land uses. The type of restoration will depend on the desired land use or after use and the type of mineral that has been quarried. Examples include: - Landfill - Agriculture - Habitat creation - Social amenities - Combined wildlife and social amenities - Housing - Flood storage - Business or commercial properties
Phytoremediation	Phytoremediation is a plant-based approach, which involves the use of plants to extract and remove elemental pollutants or lower their bioavailability in soil (Berti and Cunningham, 2000). Plants have the abilities to absorb ionic compounds in the soil even at low concentrations through their root system. Plants extend their root system into the soil matrix and establish rhizosphere ecosystem to accumulate heavy metals and modulate their bioavailability, thereby reclaiming the polluted soil and stabilizing soil fertility. There are advantages of using phytoremediation, which include: (i) economically feasible—phytoremediation is an autotrophic system powered by solar energy, therefore, simple to manage, and the cost of installation and maintenance is low, (ii) environment and eco-friendly—it can reduce exposure of the pollutants to the environment and ecosystem, (iii) applicability—it can be applied over a large-scale field and can easily be disposed, (iv) it prevents erosion and metal leaching through stabilizing heavy metals, reducing the risk of spreading of contaminants, (v) it can also improve soil fertility by releasing various organic matters to the soil (Aken et al., 2009; Wuana and Okieimen, 2011; Jacob et al., 2018).

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Systems for erosion control	Erosion control systems may be a single or group of practices that prevent detachment and interrupt the transport of soil by rainfall, runoff, melting snow or ice and irrigation water. Since phosphorus is often attached to sediment particles, erosion control systems serve to decrease phosphorus delivery from agricultural areas. Erosion control practices are available to reduce the amount of soil particles and attached phosphorus from leaving the site. Keeping soil particles and nutrients on site can enhance soil properties and maintain productivity.
Soil and slope revegetation	Slope revegetation is one of the widely used technique for controlling erosion and stabilization of dump slope and thereby maintaining ecological equilibrium in the area. Soil revegetation is a vital step in facilitating a successful soil restoration in disturbed lands. It can occur naturally through plant succession and colonization or accelerated human-driven land changes meant to repair damage caused by severe events like floods, wildfire, or mining. The original technique involved applying fertilizer and seeds to vulnerable lands.
Strong slope revegetation	Revegetation is one of the widely used technique for controlling erosion and stabilization of dump slope and thereby maintaining ecological equilibrium in the area. With respect to the role of vegetation growth upon dump slope, it can be described as hydrogeological and mechanical actions; with respect to the hydrogeological action, roots of vegetation play an important role to enhance dump stability by controlling interception of rain water and evapotranspiration and the resulting pore pressure reduction, whereas mechanical action, in turn, reinforced the dump material by roots and enhanced the shear strength of the dump material.
Replace hard engineered river stabilisation with softer alternatives (e.g. willow-based)	Traditionally, shore stabilizations have been constructed using hard engineering methods with materials such as steel and concrete to protect developments from erosion due to flooding. Soft engineering is a natural form of flood mitigation that builds along shorelines to protect areas from flooding. Often referred to as riparian zones, this technique establishes local vegetation along water banks to create shore stabilization through complex root structures. Applied to water systems, soft engineering is proven to reduce erosion while at the same time protecting local habitats along river, lake and ocean shorelines.
Plant trees/ hedges/perennial grass strips to intercept surface run-off	Buffer strips are designed to intercept runoff using permanent vegetation. Other erosion-control practices are usually employed in association with buffer strips. As an integral part of a planned conservation system, buffer strips may be located at a variety of locations within a landscape. To maintain buffer-strip performance, periodic maintenance is required. Contour buffer strips, filter strips, and grassed waterways are frequently used types of buffer strips.
Use of pre-existing vegetation	This NBS can preserve a part of pre-existing ecosystems and vegetation. The use of preexisting vegetation (remnant vegetation) provides elements to integrate vegetation present on the site prior to NBS design and implementation. This approach has many advantages (Florgård, 2000):

	- Vegetation in parks, etc. is already mature when the first occupants move in. This is a great advantage especially in areas with low growth potential. - Preserved areas will differ from 'traditional' gardens and parks and be of interest to everyone, particularly as an exciting playground for children. - Costs for construction and maintenance of green areas are minimized - Essential habitats for plants and animals can be preserved.
Restore wetlands in areas of groundwater recharge	Groundwater recharge is one of the most important functions of wetlands. Water that infiltrates and recharges groundwater contributes to the local and regional groundwater flow net, thus contributing to higher base flows and improved distribution of seasonal flows. Recharge is important for replenishing aquifers used for water supply.
Reconnect rivers with floodplains to enhance natural water storage	Reconnecting rivers with their floodplains is a green infrastructure approach that focuses on removing barriers along the edges of the river. This allows the river to re-establish its natural course over time, eventually connecting it to its historical floodplain, or creating a new one. It can include removal or setting back of levees, raising of a deeply engraved riverbed, or expanding a river's bank. Faster solutions include manually restoring (by digging) the river close to its original form, and establish human made connections between the river and its original floodplain wetlands.
Re-vegetation of riverbanks	The root systems of trees, shrubs, and grasses bind and hold the banks together much in the same way that reinforcement improves the strength of concrete. After heavy rain, when creeks and rivers are flowing fast, vegetation helps absorb the force of the flow and reduce the water's capacity to erode the banks. Trees and shrubs on the banks and within the stream provide shade and shelter for aquatic and terrestrial fauna. Fish and other aquatic organisms need moderate temperatures to live and breed successfully.
Re-meander rivers (where they have been artificially straightened) to help reduce speed and height of flood peaks	Re-meandering increases the length of a river channel and decreases flow conveyance and speed, allowing more water to be stored in-channel and helping to decrease flood risk downstream. Having a more natural river channel condition can also help with biodiversity.
Restore grassland/low input arable in drinking water catchments	Grasslands that have a combination of both desired native species and invasive perennial weeds may be restored to reduce the coverage of invasive species and promote the health of the native prairie community.
Use engineered reedbeds/wetlands for tertiary treatment of effluent	Engineered wetlands are artificially created wetlands designed for the treatment of wastewaters, habitat creation or both. Constructed wetlands, though simple, can provide all the mechanisms for effluent treatment and achieve similar reductions in the concentrations of contaminants removed by more complex mechanical equipment or structures. One of the main benefits of installing a wetland is that it does not need power and the running costs are much lower (up to 10-50% cheaper than conventional treatments) and have low maintenance

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	requirements. They offer minimal visual impact and provide a sustainable alternative to mechanical based wastewater treatments.
Target ponds/wetland creation to trap sediment/pollution runoff in farmed landscape	The creation of ponds and wetlands has the potential to alleviate stream water quality impairment in catchments affected by diffuse agricultural pollution.
Constructed wetlands and built structures for water management	Constructed wetlands make use of the natural purification processes of vegetation, soils and microbes to remove contaminants from discharge. Uses of constructed wetlands for water purification include applications in industrial wastewater and municipal wastewater and storm water treatment. This relatively low-cost technology improves water security and access, making it important for climate change adaptation.
Rivers or streams, including remeandering, re-opening Blue corridors	A river is a natural flow of running water that follows a well-defined, permanent path, usually within a valley. A stream is a natural flow of water that follows a more temporary path that is usually not in a valley. The term stream is often used to mean any natural flow of water, including rivers. Although some rivers are larger than some streams, size is not a distinguishing factor.
Floodplain restoration and management	A floodplain is the area bordering a river that naturally provides space for the retention of flood and rainwater. Floodplain soils are generally very fertile and they have often been dried-out to be used as agricultural land. Floodplains in many places have also been separated from the river by dikes, berms or other structures designed to control the flow of the river. They have also been covered by legacy sediments. Major floodplains roles have thus been lost, due to land drainage, intensive urbanization and river channelization. The objective is to restore them, their retention capacity and ecosystem functions, by reconnecting them to the river.
Create new intertidal habitat through afforestation, or planting of saltmarsh or seagrass at appropriate elevations in the tidal frame	Seagrass are the only true plant that can live completely submerged under water. A salt marsh or saltmarsh, also known as a coastal salt marsh or a tidal marsh, is a coastal ecosystem in the upper coastal intertidal zone between land and open saltwater or brackish water that is regularly flooded by the tides. It is dominated by dense stands of salt-tolerant plants such as herbs, grasses, or low shrubs.
Restore micro-topography, creek networks, sediment inputs, and nutrient exchange in abandoned aquaculture ponds.	Micro-topography, loosely defined as topographic variability on the scale of individual plants, describes soil surface variation within an elevation range from roughly one centimeter to as much as one meter, encompassing both vertical relief and surface roughness. When it comes to fine sediment inputs to rivers, they come from bank erosion of fine floodplain sediments and erosion of the soil surface. The latter is strongly affected by land use and management, and increases for the same soil and land use with increases in topographic slope.
Re-establish and restore previous intertidal habitat by de-poldering or coastal realignment	Replacing coastal habitats where they are eroded, inundated or otherwise impacted upon is particularly important given the high level of ecosystem service they provide. Afforestation is a process where new

	forests are planted across land without trees. As a forest grows, it naturally removes CO2 from the atmosphere and stores it in its trees.
Ecological restoration of degraded coastal and marine ecosystems	Restoration is considered an effective strategy to accelerate the recovery of biological communities at local scale. Re-establishing coastal marine ecosystems at large scales will play a key role in supporting human health and wellbeing, achieving the UN Sustainable Development Goals, and adapting to and mitigating global climate change.
Coastal sand engine	The sand engine (also called Sand Motor) is a type of beach nourishment where a large volume of sediment is added to a coast. The natural forces of wind, waves and tides then distribute the sand along the coast over many years, preventing the need for repetitive beach nourishment. The method is expected to be more cost effective and also reduces the repeated ecological disturbances caused by replenishment.
Dune replenishment	Dunes are a protective feature that provide sand buffer and protect the land from waves and flooding. Therefore, they represent a buffer between sea and land, in a similar way to a seawall but are usually of natural origin. A distinct feature of dunes is their dynamic character, with a constantly undergoing change of their shape. Dune rehabilitation refers to the restoration of dunes from a more impaired, to a less impaired or unimpaired state of overall function, in order to gain the greatest coastal protection benefits (Linham & Nicholls 2010).

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Sustainable development goals & Challenges

Table 3: NBS attributes - SDGs, Targets and Indicators

SDG	Target	Indicator
SDG 2 Zero hunger. End hunger, achieve security and improved nutrition and promote sustainable agriculture	Target 2.3 By 2030, double the agricultural productivity and incomes of small-scale food producers, in particular women, indigenous peoples, family farmers, pastoralists and fishers, including through secure and equal access to land, other productive resources and inputs, knowledge, financial services, markets and opportunities for value addition and non-farm employment.	Indicator 2.3.1 Volume of production per labour unit by classes of farming/pastoral/forestry enterprise size
	Target 2.4 By 2030, ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality	Indicator 2.4.1 Proportion of agricultural area under productive and sustainable agriculture
	Target 2.a Increase investment, including through enhanced international cooperation, in rural infrastructure, agricultural research and extension services, technology development and plant and livestock gene banks in order to enhance agricultural productive capacity in developing countries, in particular least developed countries	Indicator 2.a.1 The agriculture orientation index for government expenditures
SDG 6 Clean water and sanitation. Ensure availability and sustainable	Target 6.1 By 2030, achieve universal and equitable access to safe and affordable drinking water for all	Indicator 6.1.1 Proportion of population using safely managed drinking water services

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management of water and sanitation for all.	Target 6.3 By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally	Indicator 6.3.2 Proportion of bodies of water with good ambient water quality
	Target 6.4 By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity	Indicator 6.4.1 Change in water-use efficiency over time
		Indicator 6.4.2 Level of water stress: freshwater withdrawal as a proportion of available freshwater resources
	Target 6.5. By 2030, implement integrated water resources management at all levels, including through transboundary cooperation as appropriate	Indicator 6.5.1 Degree of integrated water resources management implementation (0-100)
		Indicator 6.5.2 Proportion of transboundary basin area with an operational arrangement for water cooperation
	Target 6.6 By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes	Indicator 6.6.1 Change in the extent of water-related ecosystems over time
	Target 6.a By 2030, expand international cooperation and capacity-building support to developing countries in water- and sanitation-related activities and programmes, including water harvesting, desalination, water efficiency, wastewater treatment, recycling and reuse technologies	Indicator 6.a.1. Amount of water- and sanitation-related official development assistance that is part of a government-coordinated spending plan
	Target 6.b Support and strengthen the participation of local communities in improving water and sanitation management	Indicator 6.b.1 Proportion of local administrative units with established and operational policies and procedures for participation of local communities in water and sanitation management
SDG 12 Responsible Consumption and Production. Ensure sustainable	Target 12.8 By 2030, ensure that people everywhere have the relevant information and awareness for sustainable	Indicator 12.8.1 Extent to which (i) global citizenship education and (ii) education for sustainable development (including climate change education) are

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consumption and production patterns	development and lifestyles in harmony with nature	mainstreamed in (a) national education policies; (b) curricula; (c) teacher education; and (d) student assessment
SDG 13 Climate Action. Take urgent action to combat climate change and its impacts	Target 13.3. Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning	Indicator 13.3.1 Number of countries that have integrated mitigation, adaptation, impact reduction and early warning into primary, secondary and tertiary curricula
		Indicator 13.3.2 Number of countries that have communicated the strengthening of institutional, systemic and individual capacity-building to implement adaptation, mitigation and technology transfer, and development actions
	Target 13.b Promote mechanisms for raising capacity for effective climate change-related planning and management in least developed countries and small island developing States, including focusing on women, youth and local and marginalized communities	Indicator 13.b.1 Number of least developed countries and small island developing States that are receiving specialized support, and amount of support, including finance, technology and capacity-building, for mechanisms for raising capacities for effective climate change-related planning and management, including focusing on women, youth and local and marginalized communities
SDG 14 Life below water. Conserve and sustainably use the oceans, sea and marine resources for sustainable development	Target 14.c Enhance the conservation and sustainable use of oceans and their resources by implementing international law as reflected in UNCLOS, which provides the legal framework for the conservation and sustainable use of oceans and their resources, as recalled in paragraph 158 of The Future We Want	Indicator 14.c.1 Number of countries making progress in ratifying, accepting and implementing through legal, policy and institutional frameworks, ocean-related instruments that implement international law, as reflected in the United Nation Convention on the Law of the Sea, for the conservation and sustainable use of the oceans and their resources
SDG 15 Life on land. Protect, restore and promote sustainable use of terrestrial ecosystems, sustainable manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss	Target 15.2 By 2020, promote the implementation of sustainable management of all types of forests, halt deforestation, restore degraded forests and substantially increase afforestation and reforestation globally	Indicator 15.2.1 Progress towards sustainable forest management
	Target 15.3 By 2030, combat desertification, restore degraded land and soil, including land affected by desertification, drought and floods, and strive to	Indicator 15.3.1 Proportion of land that is degraded over total land area

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	achieve a land degradation-neutral world	
	Target 15.5 Take urgent and significant action to reduce the degradation of natural habitats, halt the loss of biodiversity and, by 2020, protect and prevent the extinction of threatened species	Indicator 15.5.1 Red List Index
	Target 15.9 By 2020, integrate ecosystem and biodiversity values into national and local planning, development processes, poverty reduction strategies and accounts	Indicator 15.9.1 Progress towards national targets established in accordance with Aichi Biodiversity Target 2 of the Strategic Plan for Biodiversity 2011-2020
	Target 15.a Mobilize and significantly increase financial resources from all sources to conserve and sustainably use biodiversity and ecosystems	Indicator 15.a.1 Official development assistance and public expenditure on conservation and sustainable use of biodiversity and ecosystems
	Target 15.b Mobilize significant resources from all sources and at all levels to finance sustainable forest management and provide adequate incentives to developing countries to advance such management, including for conservation and reforestation	Indicator 15.b.1 Official development assistance and public expenditure on conservation and sustainable use of biodiversity and ecosystems

Table 4: NBS attributes - SDGs per Challenge

Challenges	Sustainable Development Goals (SDGs)						
	SDG2	SDG3	SDG6	SDG12	SDG13	SDG14	SDG15
Climate Resilience	+	+			+		+
Water Management	+	+	+	+	+	+	+
Natural and Climate Hazards	+	+	+		+		+
Green Space Management	+	+	+	+	+		+
Biodiversity	+	+	+		+	+	+
Air Quality	+	+			+		+
Place Regeneration	+	+			+		+
Knowledge and Social Capacity Building for Sustainable Rural Transformation	+	+	+	+	+		+

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Participatory Planning and Governance	+	+	+	+	+	+	+
Social Justice and Social Cohesion	+	+	+	+	+	+	+
Health and Well-being	+	+	+	+	+	+	+
New Economic Opportunities and Green Jobs	+	+			+	+	+

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