NBS EduWORLD

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Nature-Based Solutions Education Network (NBS EduWORLD)

Deliverable D2.2 Assessment Framework and Guidance for the Project

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Abstract	This report provides an overview and analysis of assessment tools for NBS education in the European region. Based on mapping, desk research and interviews, it finds that most of the reviewed student assessment tools constitute authentic assessment. Online NBS courses are more likely to adopt conventional assessment methods, such as formative and/or summative tests, due to the nature of the online learning environment. There is an unequal distribution across education levels, with continuous professional development for teachers and vocational education and training providing very few examples of assessment tools. In institutional assessment, there is a clear lack of incorporation of NBS education, although many NBS evaluation frameworks exist. The report also presents the guiding framework for NBS EduWORLD, built upon a project intervention logic, lessons learnt from previous project tasks and consultations with the Consortium and Advisory Board members. They are structured according to crucial project stages: Strategic vision and leadership; Understanding NBS education; Implementing NBS education, and Building the NBS EduCommunity.
Keywords	NBS, education, assessment, guidance

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1. Introduction

Box 1. Definition of nature-based solutions (NBS)

> Nature-based solutions (NBS) are: “Solutions that are inspired and supported by nature, which are cost-effective, simultaneously provide environmental, social and economic benefits and help build resilience. They bring more, and more diverse, nature and natural features and processes into cities, landscapes and seascapes, through locally adapted, resource-efficient and systemic interventions. Nature-based solutions must benefit biodiversity and support the delivery of a range of ecosystem services.”

Source: European Commission, n.d.

Driven by policy, environmental and economic imperatives, **NBS education** is increasingly emerging across disciplinary boundaries, knowledge silos, and skill sets, to deliver **integrated solutions to address the causes and consequences of climate change through education**. While NBS bring several known benefits, such as the potential to be more affordable to implement than traditional infrastructure (Price, 2021) and environmental and social benefits (Kapos et al., 2019), raising awareness of NBS and its educational potential is crucial, in order to increase the take-up of NBS.

By fostering collaborations between NBS experts and educational institutions, across sectors and forms of education, **the Nature-Based Solutions Education Network (NBS EduWORLD) seeks to foster a society that is NBS-literate, inclusive, and sustainable**. Through its work, communities become more prepared, cohesive, and participatory in engaging with nature and using the benefits of nature to solve local and global challenges.

To ensure that NBS is mainstreamed in educational offers, it is needed to showcase how skills for NBS can be assessed. This way will ensure that NBS are appreciated and taught, given that assessment often gives clear direction for what topics should be prioritised and taught in education. Therefore, **this report summarises and critically assesses the state of play of NBS education assessment tools in Europe** and the lessons one can learn from them.

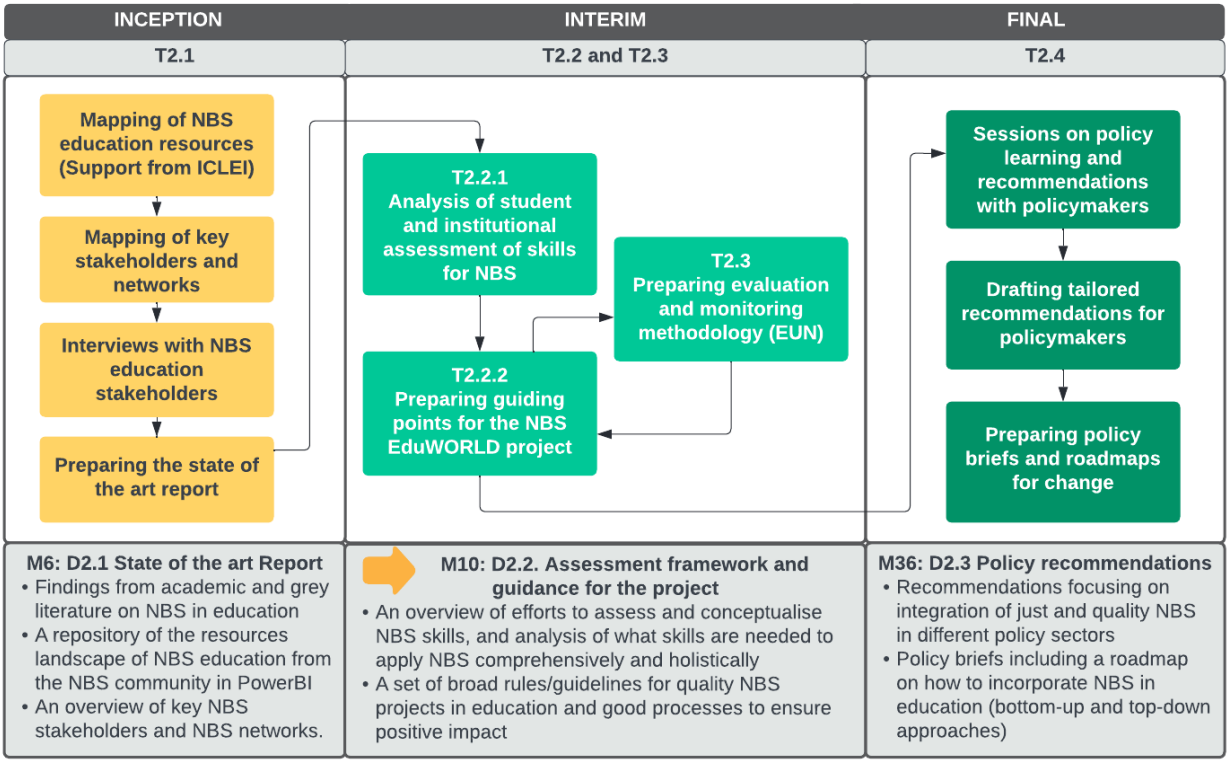
Another core issue, crucial for ensuring mainstreaming of NBS education across Europe, is **purposeful planning around NBS education projects by learning from the examples of prior projects.** Thus, this report provides guidelines for the project partners based on the lessons from the State-of-the-art report on how the key stakeholders in the Consortium can purposefully design and execute their tasks in order to achieve NBS-literate, inclusive and sustainable communities.

The authors of this report hope that it will be a **foundational asset for all Consortium members**. Hopefully, it can help Consortium members finetune their approaches and implement their project tasks better and more coherently, building upon the lessons learnt. This deliverable (D2.2), is the second out of three deliverables from WP2 “Framework and guidance / Evaluation and impact” and an outcome of T2.2 “Developing analytical frameworks for NBS EduWORLD”.

2. Methodology

This chapter describes the methods used under each strand of the research tasks underpinning the deliverable (T2.2.1 and T2.2.2). The tasks take place in the interim period of WP2 and concern the 'developing analytical frameworks for NBS EduWORLD' based on two strands of parallel work (Analysis of student and institutional assessment of skills for NBS and guiding points for the NBS EduWORLD project). Figure 1 shows where the research tasks (T2.2) and deliverable (D2.2) are situated in the wider work of Work Package 2.

Figure 1. Methodological overview of Work Package 2 tasks



Source: compiled by PPMI

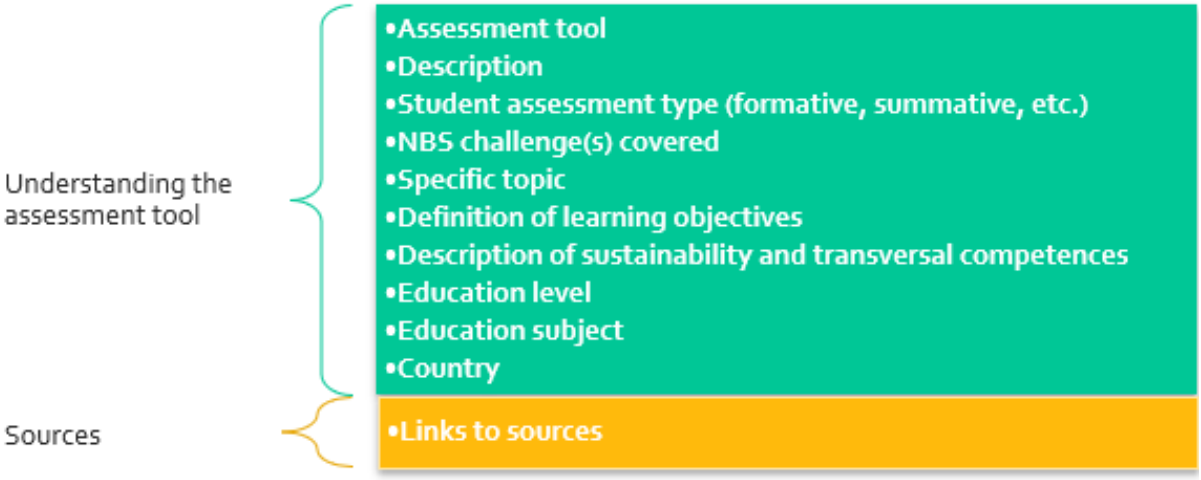
2.1. Assessment framework for NBS in education portfolio

In order to identify the kinds of abilities required and how they relate to NBS, the research team mapped the best practice assessment tools by desk research and analysed the methods used. The assessment covered two levels: student assessment and institutional assessment (often also understood as 'evaluation'). The mapping should not be considered exhaustive, as individual teachers are likely to use a variety of different forms of student assessment and school leaders may apply institutional assessment frameworks that are not described and available online. The research was limited to resources available online and in English.

The assessment mapping was done in Excel and in a template that covered elements, such as: education level, country applied, learning outcomes to be tested, and specific tools and approaches used to test students' learning outcomes around NBS or to test how institutions fare with supporting NBS education. Importantly, the mapping template covered reflection on which types of competences and transversal skills were assessed and how they link to NBS,

and how institutional assessment evaluates the institutions' contribution to skill building around NBS. **Figure 2** visualises all modalities covered by the mapping template. The items are those covered in the mapping of institutional assessment – some of the elements covered in student assessment were not relevant to the institutional level.

Figure 2. Modalities of the mapping template of NBS assessment tools



Sources: compiled by PPMI

The filled-out mapping templates covered 37 student assessment tools and 15 institutional assessment tools. Thereby, the research team analysed the trends across the types of assessment tools and described the main trends and findings across them in this report. The analysis was supplemented with findings from interviews conducted under D2.1 (State-of-the-art report), in which subjects were also asked about assessment tools. For the full assessment mapping, see: https://nbseduworld.eu/nbs-education-inventory.

2.2. Guiding frameworks for all parts of the project

To help the project partners design tools that may overcome the difficulties of bringing NBS into education and be most effective, WP2 researchers produced guidelines for each step of the project. This assignment first defined the project's operational and analytical framework for influencing and mainstreaming NBS education and skills for NBS (the intervention logic). This section will present the analytical underpinning of the guidelines and the intervention logic for the overall project, as well as the methods used for preparing the guidelines.

The **intervention logic** follows a comprehensive approach and is largely in line with the expectations for intervention logics for evaluations within the European Commission. The main focus of the intervention logic is on how the project can help foster and improve skills, but it also looks into and connects to impact pathways and the higher-level objectives of the project. The intervention logic visualizes and describes the contextual factors, as well as key aspects of the project and how these dimensions (the project's main outputs and tasks) link and lead to the positive impacts envisaged at the proposal stage. In line with the structure below, we present here our narrative and visual intervention logic for NBS EduWORLD.

Figure 3. Structure of the intervention logic

Source: compiled by PPMI

Context

The 2030 Agenda for Sustainable Development and the European Green Deal (EGD) reflect the urgency to embed the principles of the green transition and sustainable development into competence development and all levels of education. NBS has been highlighted as crucial in contributing to all the main policy strategies related to the EGD, in particular to biodiversity restoration, climate change mitigation and adaptation, and socially just and green economic transitions. Learners should be empowered to act in complex situations in a sustainable manner, which may require them to take new directions, participate in socio-political processes and attain sustainability competences. NBS can be one such new direction for learners that strengthens nature and participatory inclusive problem-solving, leading to long-term solutions for society and climate. If done right, engaging in NBS can be a great way for students to acquire tangible skills for the green transition and sustainability mindsets.

Needs

In this context, NBS education can be understood as an important part of learning for the green transition and sustainable development (hereafter LfS). It relates to the strongly emerging societal and political needs to strengthen the sustainability dimension of education and bring it into line with the EU Green Deal Policy objectives, especially in supporting biodiversity, and with the Sustainable Development Goals. Furthermore, there is a need for clear and concise information about NBS, how the concept links to the wider public discourse around climate change, biodiversity, health and well-being, and the local economy (answering the question: why should I care about NBS?), as this is currently not well understood in society. Thus, there is also a need to provide resources and accessible educational opportunities for citizens on how to participate and take action about NBS and NBS education.

Objectives

The overall objective of NBS EduWORLD is to nurture an NBS-literate society, supporting a just transition to a sustainable future. This implies a society/community, where nature is embedded in citizens' daily lives and a part of formal, informal, and non-formal education streams, in turn creating green jobs and supporting social inclusion and cohesion through NBS practices, technology, and digitalization. Some highlights regarding other sub-objectives:

- The project will enhance knowledge of NBS at all education levels and for different age groups, and across three different geographic areas: urban, rural, and coastal;

- The project will put an emphasis on including a variety of voices when engaging with NBS education;
- The project will support integrated STEM teaching, inquiry-based science education, real-world applications of NBS, new dissemination and mobilisation strategies suited for 21st-century technologies and transversal skill development;
- The project will explore synergies between the field of NBS, biodiversity education, and learning for sustainability.

Preconditions

Preconditions concern elements that must be in place to ensure that the interventions of NBS EduWORLD can take place. In the context of NBS EduWORLD, this would be the signing of the grant agreement and the receiving of funding from the Horizon Europe programme of the European Union. In addition, without the proposed plan for activities, agreed upon in the grant agreement, no activities could occur.

Assumptions

In order to increase the take-up and know-how around NBS across communities, holistic implementation is needed. Action is needed both vertically (from individual to organisations to system/policy-level change) and horizontally – all stakeholders to be acting in synergy for the promotion of NBS. In order to understand change in the context of education, WP2 researchers need to consider both system- and organisational-level approaches and practices and interlinkages between them. The system level can be understood as related to the development of long-term political visions at national, regional and local levels, as well as changes to formal education (e.g., curricula, teacher education, assessment and recognition, among others).

The organisational level relates more to the actions taken at educational institutions by school leaders, board members and individual teachers, regarding their own effort to strengthen Whole-School Approaches (WSA) around NBS, engaging with and innovating in content and methodology, improving facilities and cooperating with NBS experts and the broader NBS edu-community. Thus, the organisational level relates more to non-formal education, as both education and expert institutions can design and provide their own learning on NBS both in physical and virtual spaces. Institution-level and non-formal practices are an important dimension of education on NBS, as well as families, friends, and the community outside immediate learning environments, which play a key role in informal learning around NBS.

Hence, WSA around NBS refers to a holistic, systemic, co-creative and reflexive effort by all stakeholders involved in education to meaningfully engage students in complex NBS challenges. “Holistic” highlights the attempt to explore and address sustainability issues from multiple perspectives in an integrated and relational way. “Systemic” refers to considering key aspects of the education system simultaneously (formal, non-formal and informal education, curriculum, pedagogy and learning, professional development, school-community relationships, school practices, ethos, vision and leadership). Finally, “co-creative” refers to the inclusion of multiple voices and multiple stakeholders in the development of the approach within a given context (Mathie and Wals, 2022).

A critical outcome of learning about NBS is in-depth understanding and appreciation of NBS, accompanied by practical skills around the implementation of various types of NBS to tackle different NBS challenges (see the State-of-the-art report). Given the risk of greenwashing around NBS, it is important to pay attention to NBS being integrated into the learning environment, learning content and pedagogy in a comprehensive manner. It is crucial that innovations are inspired and supported by nature and provide not only environmental, but also social and economic benefits, thus not being superficially implemented or, eventually, abandoned due to lack of support. The EU supports a variety of projects and research to increase the knowledge on what high-quality NBS entail and how it can be supported to address different types of challenges. The mainstreaming of these resources through the creation of engaging education is one way, in which NBS EduWORLD can help ensure comprehensive learning around NBS.

It is assumed that for NBS to be mainstreamed more broadly, so that its positive effect on nature and communities can be strengthened, NBS education should be applied holistically and comprehensively through key supporting pillars of education at the national level and through the Whole-School Approach at institutional levels. Financial mechanisms supporting each pillar, are crucial for optimal results:

- **Policy and visions around NBS:** The visions and applicability of NBS at national, local and regional levels could be recognised and integrated into key long-term education strategies shaping the education delivery system, as well as into other relevant policy areas (e.g., agriculture, fisheries, environment). **Integrated policymaking** *('*Articulated policies concerning complex issues and interventions and that transcend the boundaries of established and dissociated policy fields' (Albuquerque, 2019)) is thus crucial for strengthening NBS education and providing ecosystem benefits throughout society and across policy fields.

- **Assessment:** Clear competence frameworks and learning objectives on NBS should be created, along with assessment systems mirroring these frameworks. In this way, one will ensure that NBS is consistently integrated with teaching, given that assessment often gives clear direction for what topics should be prioritised and taught. To this end, it is crucial to create strategies and programs along with evidence-based knowledge and policy recommendations for promoting and integrating the key features of sustainability citizenship through NBS.

- **Learning content:** Critical issues around NBS, such as the different NBS Societal challenge areas, need to be integrated into curricula, competence frameworks and education materials for all education levels in relevant classes and, to the extent possible, in interdisciplinary ways.

- **Pedagogy:** Engaging pedagogy can be very advantageous to strengthen the effectiveness of learning and making sure learners also acquire action competences around NBS. Examples are interactive, learner-centred teaching and learning settings, and designing action-oriented, transformative pedagogy, which supports self-directed learning, participation and collaboration, problem-orientation, inter- and transdisciplinarity, and the linking of formal and informal learning to the development of competences around NBS.

- **Physical learning environment:** Positive whole-school learning environments are crucial for strengthening the effectiveness of learning. The focus can be on relational aspects and ensuring overall wellbeing and positive learning cultures of the education institution, but also on the physical aspects. In terms of NBS implementation, the latter is indeed one of the key ingredients, and using NBS actively in the learning environment can be a great way to demonstrate NBS (e.g., school garden for food production and classroom plants to increase air quality). It will be important that NBS demonstrators are not just passively there but used actively in the teaching and learning around NBS.

The supporting pillars of education form the capacities of the education system delivery and are impacted by external drivers and challenges, as well as by the underlying motivations and capacities of key actors (e.g., teachers, school management leaders, policy makers). These factors need to come together to strengthen NBS education.

Activities
The scope of activities of NBS EduWORLD can be broken into four main fields:

- Strategic vision and leadership (coordination, monitoring and evaluation)
- Understanding NBS education
- Implementing NBS education
- Building the NBS EduCommunity (outreach, dissemination and exploitation efforts)

Outputs
Considering that the preconditions are fulfilled, and the activities are implemented, the first elements of the intervention logic concern outputs. The outputs reflect the direct (short-term) results of implemented activities. Namely, if an activity under implementing NBS education is the delivery of training for teachers, then the output is the number of teachers that received the training. Below one can find examples of such outputs for each of the main types of activities:

- Strategic vision and leadership (coordination, monitoring and evaluation):
  - Number of meetings within the Consortium and Work Package leaders
  - List of relevant reports and guidelines and their topics
- Understanding NBS education:
  - List of relevant reports and guidelines and their topics
  - Number of dissemination events that focuses on the understanding of NBS
- Implementing NBS education
  - Number of learners at different levels and educational institutions, NGOs, etc that participated in NBS education
  - Number of participants in the dissemination events that spread awareness of NBS (e.g., policy learning sessions, NBS workshops)
- Building the NBS EduCommunity (outreach, dissemination and exploitation efforts)
  - Number of dissemination events and their topics
  - Numbers of associated networks and organisations
  - List of dissemination products and their topics

Results

Results can typically be measured in the short and medium-term, and show the first steps towards achieving the objectives of NBS EduWORLD.

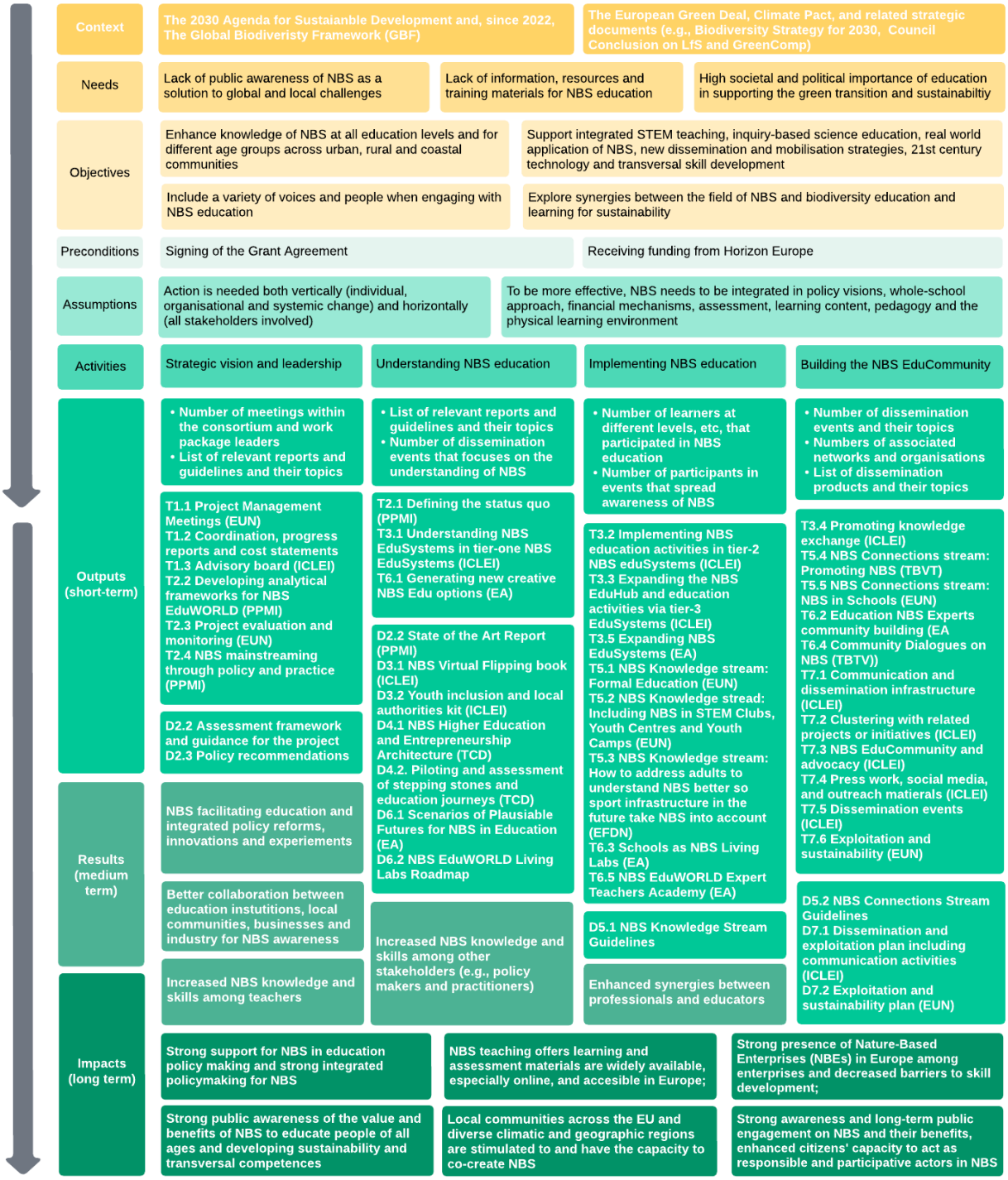
- Enhance synergies between professionals and educators, and make NBS resources widely and easily available to interested stakeholders and the civil society: effectively create an 'NBS EduCommunity';
- A complete set of guidelines, relevant for every key stakeholder in education, to outline different paths to support education institutions and communities to implement NBS;
- Improve education policy and reinforce the importance and relevance of NBS at all education and community levels (across urban, rural and coastal), as well as increase the relevance of education in non-education policy areas (e.g., agriculture, fisheries, environment);
- Initiate and trigger nature-positive and NBS-facilitating policy reforms, innovation, or experiments in NBS education at local, regional and national levels;
- Help bring education institutions closer to their local communities, business, and industry to raise awareness and uptake of NBS in educational institutions' learning ecosystems;
- Strengthen teachers' knowledge of NBS – which is expected to trickle down to other learners, as education providers serve as an entry point to disseminating knowledge of NBS and its benefits to citizens.

Impacts

Impact measures' progress towards the objectives. The causality between the initial outputs and impact is often less clear, as more external factors and assumptions play a role. The impact is visible in the longer term after the results of this intervention have interacted with other interventions (e.g., the inclusion of NBS in the curriculum).

- Strong awareness about the value and benefits of NBS to educate people of all ages in an innovative and holistic way by developing sustainability and transversal competences, values, and attitudes through an active and engaging pedagogy, and from a lifelong learning perspective;
- NBS teaching programmes, learning and assessment materials are widely available, especially online, and more frequently accessed across the EU;
- Local communities across the EU and diverse climatic and geographic regions are stimulated to co-create NBS (e.g., engaging in NBS citizen science and NBS community design and co-creation), thus contributing to greater upscaling and impact of these solutions and promoting climate resilience;
- Strong awareness about and long-term public engagement with NBS and their benefits, enhancing citizens' capacity to act as responsible and participative actors in a knowledge-based society, as well as a better understanding of the value and impact of NBS due to participation in the co-creation of NBS;
- Increased presence of Nature-Based Enterprises (NBEs) in Europe among enterprises and decreased barriers to their development due to skill gaps;
- Increased support for NBS and NBS education in policy making and strong integrated policymaking for NBS (e.g. funding, inclusion in curricula, national guidelines on institution infrastructure).

Figure 4. Intervention logic for NBS EduWORLD



Sources: compiled by PPMI.

The **guidelines** are based on three key strands of resources. They are partially based on desk research and analysis by the project, and co-created among the Consortium using participatory research methods. Feedback from partners and the NBS EduWORLD Advisory Board on the development of the guidelines was crucial to ensure their relevance. Thus, the guidelines were discussed in project meetings, in a co-creation workshop, as well as with the project's Advisory Board. To sum up, the guidelines entail:

- Lessons learnt from State-of-the-art report and institutional-level assessment mapping;
- Insights from a co-creation workshop with the Consortium held in June 2023;
- Feedback from the NBS EduWORLD Advisory Board.

3. Assessment and NBS education

This section provides an overview of the trends and lessons learnt from the mapping of NBS assessment tools. Section 3.1 reflects on student assessment: the main trends in the database, types of assessment used at different levels, what the literature says about the relevance and quality of the different tools discovered and how trends differ based on educational level and type. It also discusses what competences and skills the student assessment tools aim to reflect, and how well that aligns with broader green transition goals. Section 3.2 reflects on institutional-level assessment and on the extent to which existing NBS evaluation frameworks align with, or can be helpful in, monitoring progress on NBS education.

3.1. Student assessment in NBS education

3.1.1. Trends in student assessment in the European region

Student assessment serves multiple objectives –as a reflection of the knowledge and skill level of the learner and their preparation to advance to the next education phase or the professional world, or a tool to track progress and efficiently address the needs of the learner by improving the teaching process. It can also serve as an indication of the education system's performance, as well as establish and encourage the development of competences necessary in the future.

Box 2 describes the most common forms of assessment and their differences, in general.

Summative assessment focuses on students' knowledge and skills attained after a period of teaching. It is usually conducted through standardized testing and examination, and results in a grade.

Formative assessment – assessment of student understanding and progress which aims to adapt the learning process to the student's needs in the process. As such, it focuses on improving the learning experience rather than providing a standardized grade. Conducting formative assessment requires more effort than summative as it caters to individual needs.

Authentic assessment requires students to critically think to apply their newly learnt knowledge and skills to real-world-based situations. It usually entails open-ended tasks and it embraces complexity, demanding learners to be creative, critical and to draw from different sources of information. They also require more time and effort to assess and grade.

Box 2. Main types of student assessments

Source: Tilbury, 2023

Recent literature on education assessment methods tends to favour employing authentic assessment, as well as advocating for a mixed approach where both formative and summative assessment play a role in assessing a learner's knowledge and skills and effectively preparing them for professional life (Koh, 2017; Villarroel et al., 2018). Authentic assessment (which can be both formative and/or summative) caters to each specific case of teaching, entails use and analysis of complex real-world situations, may often replicate the tasks performed in professional settings, requires learners to utilise multiple sources of information and critically engage with them, and is overall cognitively challenging (Villarroel et al., 2018).

In contrast, conventional or traditional assessment, referring to tests and examination that focus on learning fact-based content, is increasingly seen as failing to correspond to the needs for future competencies when used by itself. For instance, literature on learning for sustainability advocates for authentic assessment techniques as opposed to conventional assessment (Tilbury, 2023). This is based on the idea that to teach sustainability, which in itself is a multifaceted and complex concept that requires solving interconnected real-world problems, requires similarly complex and messy assessment methods that foster skills necessary for addressing various social, economic, and environmental issues.

A recent report on the future of assessment in primary and secondary education within the EU identified several notable trends in assessment leading up to 2030, including a shift towards competence-oriented education, with problem-solving, critical and analytical thinking skills as the key taught and assessed competences (Dumčius et al., 2019). The report also finds that assessment may be expected to be increasingly personalized and digitalized, with the latter helping to facilitate and support innovative methods and the use of such tools as game-based and online learning. There is also an observed continued shift to self- and peer-assessment away from the more conventional practice of the teacher as the primary assessor, and assessment may be expected to be increasingly less about comparison and ranking (summative approach), and more about enhancing and informing students' learning (formative approach). The following section on assessment for NBS learning reflects these general trends.

3.1.2. Trends in student assessment for learning for NBS

The **student assessment mapping resulted in 37 cases** consisting of diverse approaches on how to assess learners' competences necessary to understand, critically analyse, design or develop NBS. The mapping covers examples from different parts of Europe: UK (6), Italy (5), Poland (3), Austria (2), Netherlands (2), Sweden (2), Spain (2), an example each from Belgium, Denmark, France, Germany, Ireland, Lithuania, Slovakia, Portugal and 7 EU/Global assessment methods or tools that are not attributable to one country. The distribution of the described methods across different levels of education was as follows: primary education (5), secondary education (11), higher education (13), adult learning (3), continuing professional development (CPD) (3), vocational education and training (VET) (1) and 2 cases applicable to various levels of education. Of all the assessments mapped, 18 are summative, 14 formative, and another 5 examples use both types of methods for student assessment.

Despite increasing examples of publicly available NBS teaching methods, they rarely include discussion of assessment methodology or tools. This confirms the findings of other studies on

assessment methods of learning for sustainability, which point to the same gaps in the field (Mulvik et al., 2021). Similarly, there are few examples of literature and theory on NBS education assessment methods. Some of the resources that discuss assessment include a study on digital tool use for NBS learning (Læssøe et al., 2021), as well as a collection of case studies on using NBS to enhance environmental education (Vasconcelos and Calheiros, 2022). Overall, there is a lack of well-developed methodology for NBS learning assessment that is designed to be transferable.

Several of the mapped assessment methods were merely listed as part of an NBS education case without providing a more in-depth description or methodology of how the assessment is carried out. In cases of online courses, in which the assessment method is limited to conventional testing, lack of detailed information may not present an issue. However, with courses that employ projects that rely on development or evaluation of NBS, the lack of detailed accessible information on the assessment methodology presents a limitation for inferring the real quality of the mapped assessment tools in question.

Although it should be acknowledged that developing transferable assessment materials and methodology may be challenging due to the complex nature of NBS education that often requires a place-based and context specific approach, this gap presents a challenge for educators to find helpful resources in developing their own assessment methods. One interview respondent claimed to not assess students' NBS learning in any structured way apart from observing whether the students seemed to be enjoying the class or hearing their informal feedback (Interview with secondary school teacher for SOTA report).

This example brings up the broader debate on the topic of sustainability competences assessment, which points to the issue that there is still no explicit consensus on what exactly is being assessed (Redman, Wiek, and Barth, 2021) and whether assessment – at least in terms of traditional and standardized assessment – is effective. As mentioned above, since learning for sustainability requires a high degree of complexity and development of such competences as critical, systems and futures thinking, standardized assessments, such as exams and conventional testing, are increasingly seen as not apt for the job (Tilbury, 2023).

This shift in thinking is reflected in the mapped assessments, the majority of which include authentic approaches. Of the 37 mapped cases, 27 employ authentic assessment in the form of rubrics, designing posters, complex project work, quality of performance in teamwork, working with case studies, and engaging in reflective exercises. With regards to longer courses or study programmes in HE and CPD, they use a combination of authentic assessment along with more conventional assessment methods (e.g., examination).

Courses and study programmes conducted solely online (8), in all but two cases, primarily use traditional assessment methods, such as tests and multiple-choice quizzes. Considering that online courses are often unlimited in their number of participants, assessment needs to be streamlined and automatized which excludes the option of more complex authentic assessment that requires oversight from instructors and teachers. In one case of online NBS teaching with great number of participants, this was resolved using peer assessment.

A study on current practices of assessing student sustainability competencies conducted a systematic review of relevant studies which produced a typology of 8 different tools (Redman, Wiek, and Barth, 2021). In order of most to least frequently mentioned assessment tool types,

this typology consists of scaled self-assessment, reflective writing, scenario/case test, focus group/interview, performance observation, concept mapping, conventional test, and regular course work. Of these categories, only concept mapping and focus group/interview were *not* identified in the 37 cases, with all other assessment types represented in the mapping. **Table 1** provides an overview of some examples of specific assessment tools from the assessment mapping files, and in which courses and at what education levels they are most often applied.

Table 1. Common assessment tools of skill for NBS by course type and educational level

Assessment Method	Course Type	Education Level
Quizzes	Micro, Module, Short	Adult learning, CPD
Multiple Choice	Micro, Module, Short	Primary, Secondary, Higher Education, Adult learning
Report / Case Study	Module, Undergraduate, Postgraduate	Secondary, Higher education, Adult Learning
Exam	Short, Module, Undergraduate, Postgraduate	Secondary, Higher education, Adult Learning
Project assessment (rubric, panel evaluation, etc.)	Short, Module, Undergraduate, Postgraduate	Primary, Secondary, Higher education, Adult Learning
Skills development / test	Training	Adult Learning, Community Based, CPD
Participation / Learning by doing assessment	Experiential/Practice, Undergraduate	Adult Learning, Community Based, CPD
Action-based assessment	Community, Short, Living labs	Adult Learning, Community based
Online assessment/ Videos/ Lectures/Games	Short, CPD, Certification	Higher Education, Adult learning
Team Collaboration / Group Learning assessment	Short, Module, Community Undergraduate, Postgraduate.	Primary, Secondary, Higher Education, Adult Learning, Community Based, CPD
Self-assessment (Questionnaires, Survey Methods)	Short, Module, Community	Adult Learning, Community based, CPD

Source: compiled by PPMI based on the assessment mapping.

Place-based teaching and assessment of NBS

Literature on learning for sustainability indicates that to increase the effectiveness of teaching, the learning process should preferably take place within the studied environment and include its observation and active engagement of the student in practice rather than being conducted solely in the classroom (Vasconcelos and Calheiros, 2022; Ontong and Le Grange, 2014). When teaching employs **place-based pedagogies**, students tend to not only participate more actively in the learning process, but such an approach also fosters learner awareness and

understanding of ecosystems, concern for the environment, and systems thinking, all essential for sustainability competences. Half of the mapped NBS teaching cases (18) involved some form of nature/place-based learning assessment, which was grounded in practical engagement with the environment, e.g., through fieldtrips to existing NBS, site visits or exploration for potential locations to develop NBS, or other outdoor class exercises. **Box 3** presents one such example. There is also a notable intersection between digital tools, and nature/place-based learning and assessment. For example, the use of digital maps and citizen science platforms can empower a closer engagement with the environment through technology. The other half of the mapped cases were either fully conducted online (8), or completely taught in a classroom setting (10).

Box 3. Group case study work: urban fieldtrip with analysis and design of NBS

This three-day training short course on nature-based solutions in urban planning organized by the ReNature project aims to upskill participants in understanding the ecological foundations of NBS, assessing their impacts on ecosystem services and their socio-economic implications, identifying planning barriers and opportunities, and applying key principles for NBS design. It includes a fieldtrip and practical engagement with a case study in which the theoretical knowledge is applied, and then is presented in front of experts.

Source: NetworkNature, 2019.

Assessment in the context of action-oriented approaches to NBS education

There can be a distinction between two lines of teaching NBS – education delivery that is based on learning through praxis, or that exclusively relies on delivering and assessing theoretical content. In the first case – teaching NBS is part of the broader trend of **action-oriented pedagogies** to learning for sustainability, which focuses on fostering student engagement with actions that contribute to sustainable development and address environmental and social challenges (Sinakou, Donche, and Van Petegem, 2022; Fitzsimmons, Uusiautti, and Suoranta, 2013). The majority of the mapped assessment tool examples at least in part rely on the action-oriented approach which includes project-based learning, practical participation and increasing student engagement, rather than being based on information delivery. For these examples, methods for assessing student's attainment of learning outcomes are usually formative, and most often include self-assessment, quizzes, peer feedback, end-of-course evaluations, questionnaires, and teacher-student feedback.

Across all levels of education, WP2 researchers identified assessment cases that relied on **project-based learning**, often in the form of designing and building NBS and attempting to offer practical application and outcome versus learning about NBS in theory. Such cases tend to involve teaching by experts on the ground, as well as the participation of relevant stakeholders (e.g., municipality or local community). Expert involvement was part of the assessment process in two cases in higher education, and one each in VET, Adult Learning and CPD education (e.g., in the form of a panel in front of which learners must present their projects). Project-based learning assessment also tends to be based on team collaboration rather than individual work, as such projects may require a lot of input and time to be carried

out, and also offer the opportunity to develop collaboration skills that are relevant to sustainability competence building. **Box 4** presents a project-based learning approach for which the teacher chose an authentic assessment method – an assessment grid that evaluates a wide range of learner skills and makes room for the complexity of learning for sustainability.

Box 4. Assessment method: Project assessment grid

Through a project-based learning approach, high school students build a prototype of a constructed wetland. The teacher can assess their competences based on the students' performance using an assessment grid. The teacher provides a description of criteria to students about what is expected from them as part of that particular activity; for example, usage of scientific language, knowledge on wetlands and some levels of competences they were expected to acquire. The assessment is translated into a grade and is reflected in the final evaluation at the end of the academic year.

Source: Urschitz, 2021.

Research on developing sustainability competences in **primary school** children emphasizes the importance of using action-oriented approaches in teaching and assessment, and to that end suggests using such methods as motivational games, collaboration, life observation, visual exercises, research projects, utilising multimedia, and making learning grounded, interdisciplinary (e.g., combining art and science) and situated in place (Vesterinen and Ratinen, 2023). The 5 primary education assessment methods presented in the mapping quite closely align with these recommendations: they include games, interdisciplinary approaches of merging social and environmental themes with creative expression and art (**Box 5**), engaging with the environment, use of photo materials and discussion, as well as the creation of field e-books (**Box 7**). In such cases, the teacher's role with regards to assessment tends to fulfil a mediating function to assist learners and spark interest in the student rather than only provide information. Overall, exclusively content-based teaching appears quite rarely in the mapped cases, and in most cases comes in the form of a short online course. In these cases, the assessment tends to rely on conventional methods of testing and examination.

Box 5. Assessment method: Contribution to teamwork, memory game, test, and questionnaire

Primary school students debate the construction of a green wall inside and outside the school using recycled materials. They come up with a design and employ the best solution in collaboration with the city municipality. The assessment aims to help students take greater responsibility for content and language learning. The main assessment concerns students' contribution during teamwork which reveals their level of participation and understanding. The memory game and the matching photosynthesis test are used to verify the acquisition of new scientific knowledge and of the other disciplines involved in the project. A questionnaire can also be used to assess students' knowledge after the activity.

Source: Ardissino, 2021.

Technical NBS skill set and content-based assessment

Higher education courses that focus on specific types of nature-based solutions (e.g., courses on water management or a particular ecosystem restoration method) aim to provide students with highly specialized skills necessary for designing and constructing NBS. In such cases, traditional and summative assessment was more common: exams, short answer questions, and multiple-choice quizzes. Nevertheless, these methods were usually employed as supplementary assessment to project-based learning, and only partly contributed to the overall grading of the course. This is in line with the literature on assessment that advocates for the effectiveness of using a combination of methods that correspond to different learning objectives. In three cases, courses on NBS integrated already existing frameworks for evaluating NBS effectiveness into the students' assessment. For example, students were expected to use these frameworks to evaluate an NBS case study, and then were graded accordingly. Such an approach directly links taught knowledge to future professional skills and competences for working in the field of NBS design, development, maintenance, and evaluation.

Box 6. Assessment method: Quizzes for online course

The online course about assessment methods for NBS teaches what NBS can achieve in cities and how they can help respond to climate change and sustainability challenges. Anyone can take the course online for free, which includes 7 videos, 3 readings and 2 quizzes. The course also involves digital tools for learning, such as podcasts and films.

Source: Coursera, 2020.

Integration of digital materials and tools in assessment of NBS education

All cases of student assessment included a level of digital tools or technology use. Examples include online quizzes and questionnaires, self-assessment conducted online, podcasts, films, creative platforms, NBS-related games, interactive digital maps, and citizen science empowering platforms. The medium of technology can also enable educators to gather information on learners' abilities during the learning process in real time, and to communicate instant feedback to the learner, as such empowering formative assessment methods. Other benefits come from access to creative platforms (e.g., Canva for making posters, and Book Creator for making e-books (**Box 7**), which empower interdisciplinary and complex thinking and foster creativity.

Box 7. Assessment method: Field E-books

In this study case, Field E-books for Eco- and Climate Explorers were used as teaching material for middle-school children. The course material draws on virtual e-books using Book Creator in group work, and follows three stages: exploring the local environment, working with the material in groupwork to make e-books in English, and Friendship classes where classes from Velika Gorica, Croatia, and Aarhus, Denmark, exchange e-books and discuss similarities and differences. The material is accessible to other educators.

Source: Anderson et al., 2021.

As mentioned in the place-based approach section above, in several instances digital tools also served to increase the learner's connection with the environment and were the basis for the assessment methods. Although the literature on the benefits of nature-based learning in combination with the use of technology is still sparse (Holloway and Mahan, 2012; LaBate, 2019), the overall trend in digitalisation of teaching methods extends to place-based approaches as seen, for example, in three assessment mapping cases in which learners were expected to use interactive digital maps. Such integration of digital resources promotes learner spatial and environmental awareness and corresponds well with the competences necessary for the development of NBS knowledge and skills (**Box 8**). Another mapped case included the use of a citizen science platform as a tool for NBS learning in primary and secondary education. Such a platform requires active engagement and study of the local ecosystem while on the ground, while simultaneously contributing to the local knowledge, and as such is a form of authentic assessment that corresponds to real world-based learning.

Box 8. Assessment method: NBS online game and interactive map

In this secondary education class, students reflect on how their future jobs can be based on NBS to transform their cities. The students must choose their role and decide the way to develop a green job and consider how it would be possible. For the assessment, the teacher used an NBS online game (http://game.think-nature.eu/), and an interactive map, created beforehand by the teacher. The High School is identified on the map and the students can search for examples of NBS in the proximity and mark newfound places, by adding a website and a picture.

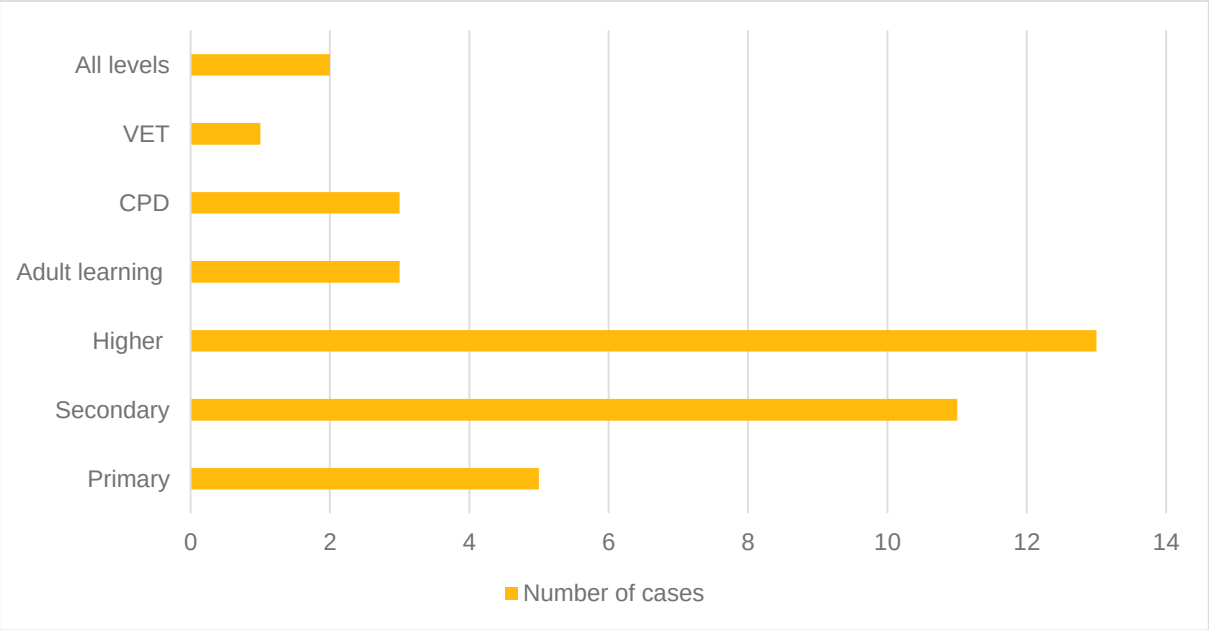
Source: Martínez, 2021.

Assessment methods and tools are not equally available across education levels

The assessment mapping resulted in an unequal distribution of the methods across different levels of education, with higher education (13) and secondary education (11) leading in examples, and primary education (5), adult learning (3), CPD (3), and VET (1) providing few cases. Only 2 cases, in the form of digital tools rather than instances of assessment methods used in specific courses or classes, can be considered applicable to various levels of education (**Figure 5**). The single example of how NBS skills and competences are assessed in VET is in line with the gap in NBS education in VET overall, as established in the State-of-the-Art report.

The dominant number in higher education assessment method examples can be explained by the fact that most university courses or module descriptions and syllabi contain requisite descriptions on how the student is assessed and graded. As such, examples from this education level tend to be more detailed and informative.

Figure 5. Assessment mapping across education levels



Source: compiled by PPMI based on the assessment mapping.

3.1.3. Competences and skills that student assessment tools aim to capture

This section analyses how skills for NBS are conceptualised in the existing assessment frameworks at the classroom level. It aims to answer the questions: Which competences are connected to learning objectives around NBS in the assessment tools? What are the key skills that NBS education fosters? The goal here is not to define an assessment methodology, but to foster more clarity on which competences learning for NBS can foster based on existing evidence, which will help the development of the analytical and guiding frameworks.

Before reflecting on how skills for NBS can be understood looking at the assessment frameworks, it is important to contextualise skills for NBS in the context of learning for sustainability and sustainability competences. As noted in the State-of-the-art report, there are no clear competence frameworks on nature-based solutions and only some which mention NBS competences implicitly. Yet, there have been numerous other efforts to define specific competences for sustainability in academia (Waltner, Rieß, and Mischo, 2019; Barth et al., 2007, Vare et al., 2019). The 17 SDGs closely link to the challenges NBS aim to address, and thus UNESCO's learning objectives for achieving the SDGs are very relevant (UNESCO, 2017). Several sustainability competences or SDG learning objectives may be relevant to teaching and learning NBS due to their relevance for NBS implementation (e.g., participatory processes, dialogue, innovation, and ability to take action).

To assist in understanding, consistency and integration of sustainability, the European Sustainability Competence Framework (GreenComp) can be used in education and training

programmes in formal, non-formal and informal settings and for learners of any age (Bianchi, Pisiotis, and Cabrera Giraldez, 2022). It identifies the competences for sustainability across four competence areas (values, embracing complexity, envisioning, and acting) (Bianchi, Pisiotis, and Cabrera Giraldez, 2022) – see **Figure 6**.

Figure 6. Sustainability competences (GreenComp)

In the GreenComp, 'promotion of nature' is recognised as a competence. 'Promotion' can be understood as with an aim to increase the amount of a product (in this case nature) and thus being in line with the logic of a nature-positive economy as opposed to a climate neutral economy. Nature-positive goals can been defined as the halting of nature/biodiversity loss and increase of the health, abundance, diversity and resilience of species, populations and ecosystems so that by 2030 nature is visibly and measurably on the path of recovery compared with 2020 (Nature Positive, n.d.). From this viewpoint, the phrasing of the GreenComp is inherently action-focused and nature-positive.

Source: Green Competences Framework, Joint Research Centre.

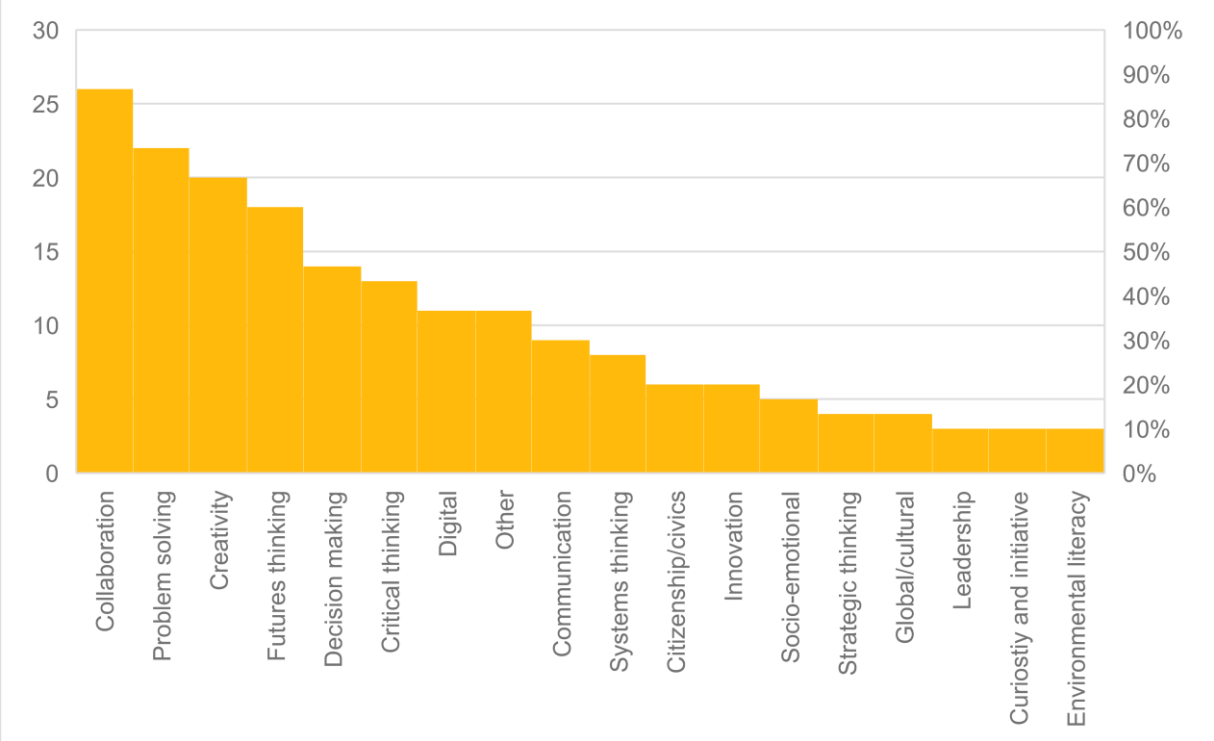
As highlighted in the State-of-the-art report, despite nuances in terminology used, all existing competence frameworks emphasize related knowledge and skills needed to grasp, analyse and act upon sustainability issues. Bearing in mind the complexity of environmental issues spread across different domains, people need to be enabled to think in a systemic way. Learners need good analytical skills and critical thinking to be able to assess the current state, past developments, and future trajectories of the environment, as well as identify false information. Finally, people need competences to initiate action, take leadership in promoting sustainability, engage, cooperate and effectively communicate with others, as well as enable others to act – it all calls for strong interpersonal competences. This is closely in line with the literature, claiming that the most common competences are critical thinking, participation and connection-building competence (Corres et al., 2020).

With regards to NBS, there are no explicit linkages or mention of NBS in any of the reviewed sustainability competences. Other observed potential points for linkages could go through the emphasis on participation and connectedness in sustainability, which is also a crucial part of NBS. Another link is that NBS can contribute to innovation, creativity, and critical thinking in sustainability education. Furthermore, thinking more broadly, NBS underpin the SDGs by, for example, supporting vital ecosystem services, biodiversity, access to fresh water, improved livelihoods, healthy diets and food security. Improving biodiversity through NBS helps mitigate climate change and create healthy ecosystems for all species. The link between NBS and

sustainability competences, and in particular to the GreenComp Framework of the JRC (Bianchi, Pisiotis, and Cabrera Giraldez, 2022) is being explored in detail throughout other tasks and deliverables of NBS EduWORLD (e.g., MOOC for teachers on teaching NBS in the classroom, learning scenario templates, workshops in Work Package 5; focus groups in Work Package 6, etc), and thus this report will not explore this topic more in depth.

We analysed the type of sustainability and transversal competences that the tools aimed to capture as outcomes of the learning. In most cases, this was indicated in the tool itself, though in some cases additional analysis of the most relevant and obvious transversal/sustainability competences was inferred.

Figure 7. Most common competences measured with the NBS assessment tools



Source: compiled by PPMI based on the assessment mapping.

The most common competences were collaboration (and teamwork) followed by problem-solving, creativity and futures thinking. The most commonly listed competences were mostly transversal, rather than specific sustainability competences, though futures and systems thinking are exceptions more commonly framed as sustainability competences. This can likely be explained by the fact that the majority of the assessment tools analysed relate to problem-based NBS projects which often revolve around team-work and specific problem-focused tasks. Another potential reason is that NBS, due to its framing around specific challenges, is very suitable for problem-based and collaborative pedagogies. Finally, several of the competences to be assessed can be considered as transversal skills, and some key competences for lifelong learning (e.g., 'learning to learn' and 'civic competences'). This finding is in line with the findings of the preliminary study on NBS education, which also found that the NBS learning scenarios by EUN created under the Integrating Nature Based Solutions Pilot, provided a great opportunity for nurturing all key competences for lifelong learning and in particular the civic competences.

To conclude, NBS education fosters both crucial transversal competences, depending on the pedagogical approach taken, and sustainability competences, through its focus on addressing global and local environmental, social and economic challenges. An inherent principle within the concept of NBS is the pro-active approach towards nature and society, as opposed to more conservation-based approaches or infrastructure-based approaches, such as green/blue infrastructure. More recent competence frameworks in the area of sustainability (e.g., the GreenComp), which strongly incorporate action competences, systems thinking, and problem framing, are thus more in line with the inherent visions of NBS.

3.2. Institutional assessment of NBS education

The goal within the EU is to deliver NBS-related skills and competencies across the union through a variety of education modes and teaching methodologies that will establish a pathway that will deliver a cohort of skilled cross-disciplinary individuals, teams and businesses that will drive the implementation of the New Green Deal (NGD) while underpinning a nature positive recovery of the economy and deliver on climate change initiatives. This process should also project NBS as a viable career prospect for European citizens of all ages, creating an NBS literate society and supporting a just transition to a sustainable future. There is a growing realisation that achieving meaningful change across the board, in all levels of education and training, may require changing the operation and culture of learning at educational institutions. While this means that several approaches to assessing NBS exist as shown in Table 2, the focus on education around NBS is missing. Most of the reviewed studies do not reflect on NBS assessments used for educational institutions or educative purposes.

Table 2. Overview of institutional assessment studies and their educational component.

Institutional sustainability assessment	Used for educational institutions or purposes	Source
A holistic framework for assessing co-benefits (and costs) of NBS across elements of socio-cultural and socio-economic systems, biodiversity, ecosystems and climate	X	(Raymond et al., 2017)
Step-wise framework for designing user-oriented NBS assessments and real-world lessons learned from successes and challenges in working with NBS assessment	Increased number of visits to an environmental education centre as a result of regional development	(Giannini, 2021)
NBS impact assessment framework, and a robust set of indicators and methodologies to assess the impacts of NBS across 12 societal challenges	Highlighting the importance of stakeholder and citizen education Environmental education opportunities are envisioned as a significant indicator of urban resources for NBS	(Directorate-General for Research and Innovation, 2021)
Practical five-step action framework to guide inclusive participation across different stages	X	(van der Jagt et al., 2021)

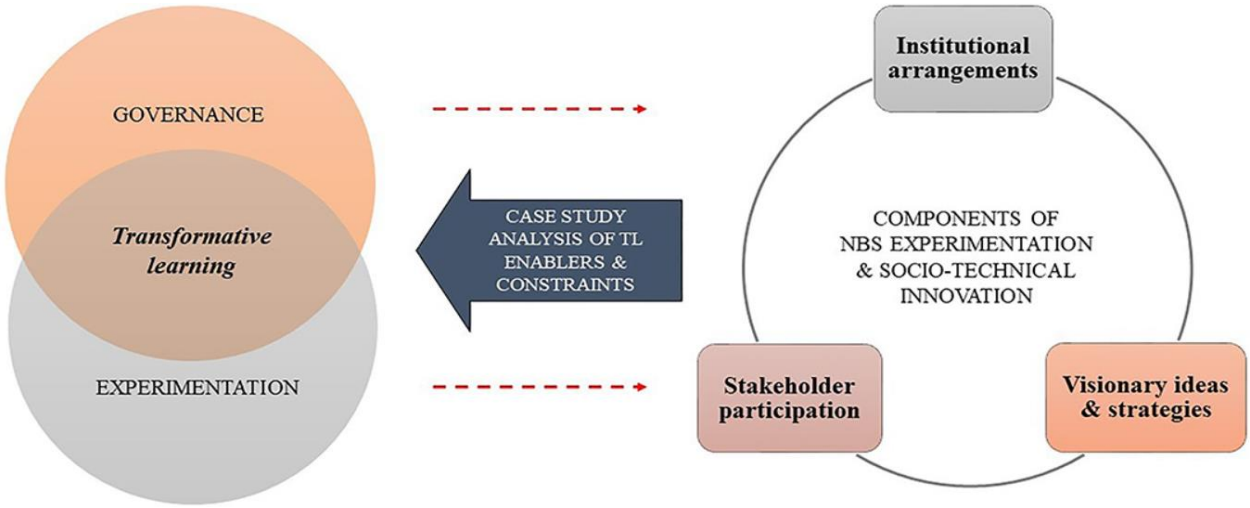
Institutional sustainability assessment	Used for educational institutions or purposes	Source
of monitoring and assessment of urban NBS including indicator selection		
An innovative framework that can be applied to both NBS project planning and evaluation for several water-based challenges	The social dimension encompasses indicators related to educational values in project implementation	(de Lima et al., 2022)
An innovative approach based on the ecosystem services concept to solve multifunctionality that could be adapted for the Life-cycle assessment of NBS	X	(Larrey-Lassalle et al., 2022)
Ecological/physical, social, and technological NBS intervention, defined ecological domains, and 12 NBS domains	X	(Hanson et al., 2017)
Assessment of NBS and smart city against the SDG indicator framework	Participation of children in educational activities	(Wendling et al., 2018)
A systematic review to indicate the main concepts related to the issue of NBS effectiveness	X	(Sowińska-Świerkosz and García, 2021)
A 'dynamic' assessment framework that explicitly accounts for the impact of climate change on the effectiveness of the proposed NBS	X	(Calliari, Staccione, and Mysiak, 2019)
NBS impact evaluation	X	(Scharf et al., 2021)
Engaging stakeholders in the assessment of NBS effectiveness in flood risk reduction	There are generic, rather than targeted strategies, for example, the promotion of education	(Pagano et al., 2019)
Explores what enables transformative learning	Transformative learning has been developed through adult learning	(Wickenberg et al., 2022)
Economic, ecological, social, and political cost-benefit analysis of NBS	Education is one of the possible benefits of the assessment	(UNDP, 2021)
Hierarchical classification of NBS	X	(Castellar et al., 2021)
NBS performance assessment	X	(Oppla, n.d.)

Institutional sustainability assessment	Used for educational institutions or purposes	Source
Assessment instruments	X	(Global Water Partnership, 2023)

Source: compiled by PPMI based on assessment mapping.

A few examples include children's education (Wendling et al., 2018), and dissemination of knowledge through an educational centre (Giannini, 2021). While the education of citizens is considered part of the evaluation process (de Lima et al., 2022), there is also criticism that education as a goal or element of the evaluation per se is too generic. The educational aspects of the NBS interventions included in the assessment, such as for example audience, ought to be more specific in order to direct transformative action (Pagano et al., 2019).

Figure 8. Framework to analyse conditions and activities which enable and constrain transformative learning in processes of NBS implementation.

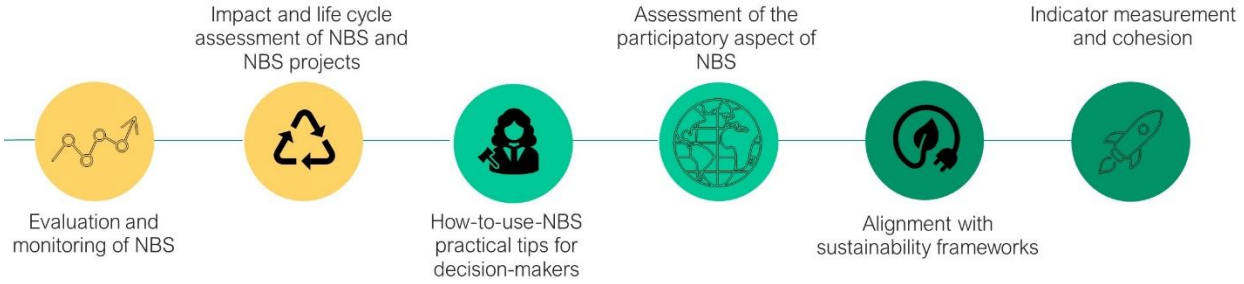


Source: Wickenberg et al., 2022.

In fact, the research found only one study focused on transformative learning (Wickenberg et al., 2022). Transformative learning, defined as the process of using a prior interpretation to construe a new or revised interpretation of the meaning of one's experience in order to guide future action, can be an important part of NBS implementation (Wickenberg et al., 2022). **Figure 8** shows conditions and activities which enable and constrain transformative learning in processes of NBS implementation.

The studies were, however, very informative about the broader assessment of sustainability. **Figure 9** provides an overview of the core aspects on which these studies focused.

Figure 9. Overview of key trends in institutional level assessment of NBS



Source: compiled by PPMI based on the assessment mapping.

Evaluation and monitoring of NBS

A vast majority of NBS studies aim to propose ways to monitor and evaluate NBS. Some sources provide various types of NBS assessments based on the type of challenge or service (Oppla, n.d.), or depending on their function, there can be a process, impact, response, and integrated assessments (Global Water Partnership, 2023). The assessment has to have the attributes of relevance, legitimacy, and credibility, as well as it can be used to support interventions (Global Water Partnership, 2023). Cost-benefit analysis is another methodology to assess NBS and it needs to include all costs and benefits, including economic, ecological, social, and political (UNDP, 2021). This tool can identify trade-offs and synergies between climate and biodiversity goals and other goals (UNDP, 2021). On the other hand, there are also assessments of the impact of climate change on the effectiveness of the proposed NBS that involves system analysis and backcasting (Calliari, Staccione, and Mysiak, 2019). It is to be applied ex-ante to support the choice between innovative NBS and it accounts for the multifunctional character of NBS to capture associated direct benefits/ costs and co-benefits/costs (Calliari, Staccione, and Mysiak, 2019).

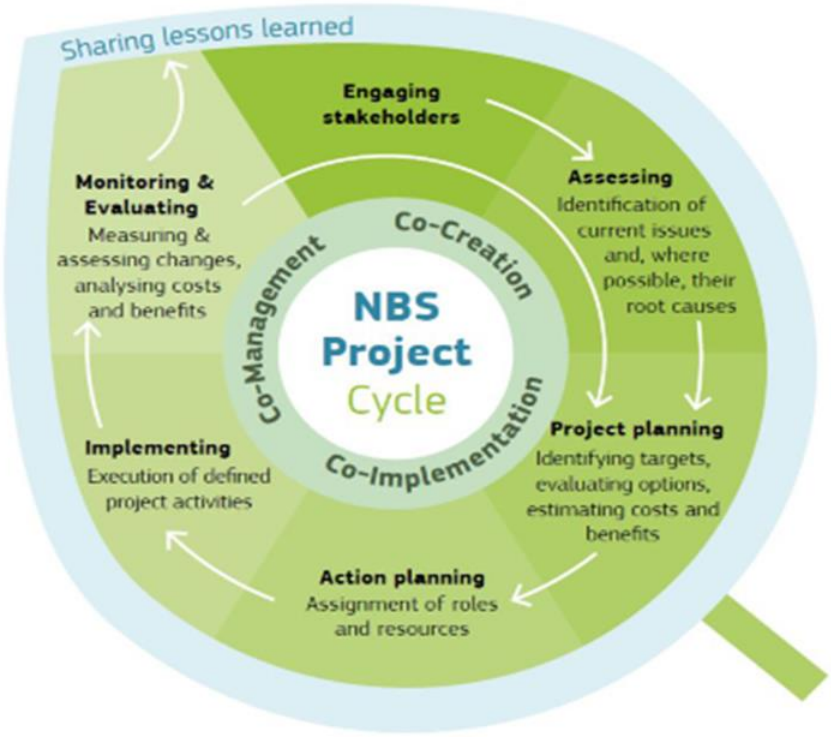
Impact and life cycle assessment of NBS

One particular aspect of assessment refers to NBS effectiveness assessment. One study proposes assessing the effectiveness of NBS based on whether NBS leads to enhanced climate resilience in the urban area, environmental benefits, social benefits, economic benefits, and biodiversity benefits (Directorate-General for Research and Innovation, 2021). Another study uses the following concepts to assess NBS effectiveness: (1) stakeholders' participation, (2) policy and management capability, (3) economic efficiency, (4) analysis of synergies and trade-offs, (5) adaptation to local conditions, (6) adequate spatial scale and (7) performance in the long term (Sowińska-Świerkosz and García, 2021). Another form of assessment involves life cycle assessment which goes beyond the traditional scope of NBS to encompass environmental impacts generated over the entire life cycle of the NBS, starting with the extraction of raw materials up to end-of-life management (Larrey-Lassalle et al., 2022). The scale of the assessment can be adjusted to the needs of the decision-maker, and be at the level of an object or a city (Larrey-Lassalle et al., 2022).

The life-cycle approach can also be taken in the assessment of NBS projects **(Figure 10)**. It is widely acknowledged that NBS integrate knowledge and practices of other related concepts (e.g. EbA, Eco-DRR, LID, GI, SuDs, and WSUD) linked with extensive stakeholder engagement using co-creation, co-implementation, and co-management actions as shown in the NBS lifecycle (Dumitru and Wendling, 2021; Dumitru and Wendling, 2021; Directorate-

General for Research and Innovation, 2021). Taken together, a broad range of skills and knowledge is required to design and successfully implement NBS, thus education institutions are likewise required to reform, re-design or adapt their approaches to delivering cross-disciplinary education that covers a wider range of fields, in either formal or informal settings. In this way, education can foster a cultural change towards environmental inclusiveness in societal understanding (Tagulao, 2022) rather than just a greening of the economy.

Figure 10. Schematic diagram showing full life-cycle of NBS projects



Source: Dumitru & Wendling, 2021.

However, at educational institutions, owing to conventional structures, policies, teaching methods, etc., in education, this form of evaluation of NBS projects remains largely unexplored. Where resources, contents and supportive programmes are missing from formal and informal education programmes at different educational levels, access is required to the requisite tools, courses and other frameworks (Vasconcelos and Calheiros, 2022).

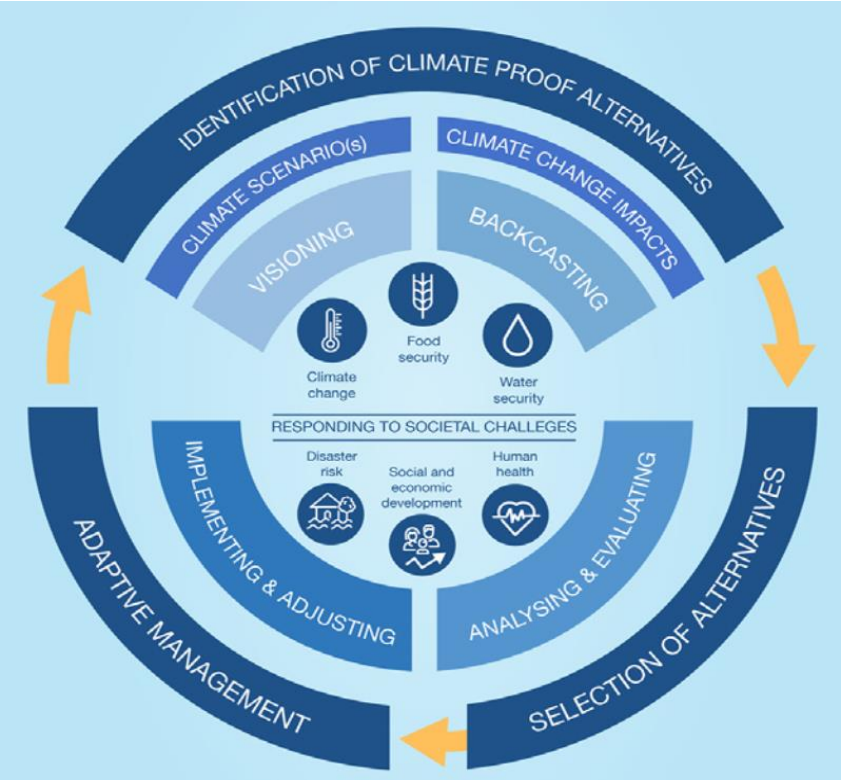
How-to-use-NBS practical tips for decision-makers

Some of the NBS institutional assessment resources are aimed at facilitating the use of NBS by decision-makers. Therefore, the purpose is to inform and evaluate policies about NBS use for addressing climate change and other challenges (Giannini, 2021). One example of a user-oriented NBS assessment includes 4 steps: Step 1: Identifying NBS assessment purposes and goals, Step 2: Defining assessment characteristics, Step 3: Selection of elements to be included in the assessment, and Step 4: Choice of the assessment approach (Giannini, 2021). Other examples involve developing a toolbox that provides tools for different project stages (Scharf et al., 2021). However, this approach does also not focus on education.

Additionally, attempts to organise NBS principles and qualities into a uniformly applicable framework have proven difficult. Calliari et al (2018) have suggested that the framework should

not demonstrate the superior performance of 'working with nature' but should be inclusive of the changing climatic conditions and settings in which the proposed NBS operate. A framework suggested by Calliari, Staccione, and Mysiak (2019) utilises the performance-based approach that makes it possible to assess NBS suitability across most societal challenges identified in the EU Research and Innovation (R&I) agenda on the environment (EC, 2015). The design explicitly accounts for the constitutive elements of NBS, including: multifunctionality; simultaneous delivery of economic, environmental and social benefits; multi-stakeholder engagement (**Figure 11**).

Figure 11. Proposed assessment framework for climate-resilient NBS



Source: Calliari, Staccione, and Mysiak, 2019.

In understanding this approach to applying NBS and utilising the performance assessment framework, then educational materials and courses aimed at understanding what an NBS is, and what is its purpose (i.e., design criteria, cost effectiveness, long-term benefits, etc.) can be refined and delivered, either holistically or in iterative steps within an educational institution or curriculum. The framework supports the choice among NBS, hybrid or traditional solutions to societal challenges by considering their effectiveness, benefits and costs under future climate conditions. The framework builds on the integration between a system analytical and a visioning-back casting approach.

Besides, in co-creating and designing NBS it is important to ensure that the proposed project or programme is inclusive from the beginning of the target audience and desired outcomes based on agreed measures of success. The evaluation design should utilise trans-disciplinary approach, align with policy principles and deliver on expected reporting obligation. One approach to determining a teaching methodology that connects with the Key Principles, is using an S. M. A. R.T. framing (i.e., Specific, Measurable, Achievable, Relevant, and Time-

Bound) that can be mapped onto the key evaluation principles to understanding successful performance criteria, but forms the basis for creating the framing for education delivery of. Understanding the form and function of NBS is as important as determining the method of education, teaching or instruction. By initially determining the type, purpose, scale and expected result from an NBS, the appropriate level of knowledge is deciphered, and the appropriate education level or training methodology is determined.

Table 3. Key principles in robust impact assessment of NBS

Key principles	Definition
Scientifically sound	Impact evaluations measure the change in an outcome that is attributable to a defined intervention, so requires a credible and rigorously defined study design to control for factors other than the intervention to establish cause and effect relationships.
Practical and straight forward	Since every nature-based solution project is unique, measuring of impact/outcome needs to be adjusted to the specific project and context.
Use reference conditions and baseline assessment	Baseline data are important for measuring pre-intervention outcomes (reference conditions) to be used in the assessment process for before-and-after comparison.
Align with policy principles and reporting obligations	To assure relevance and cost-effectiveness, it is important to seek alignment with key policy objectives. This can be done through a strategic review of policy alignment between local/regional/national strategic objectives and potential benefits of nature-based solutions.
Use a transdisciplinary approach	Monitoring and evaluation plans should be co-produced in collaborative actions to achieve the best balance between local needs, values and knowledge, and interdisciplinary scientific knowledge.

Source: European, Directorate-General for, Innovation, et al., 2021.

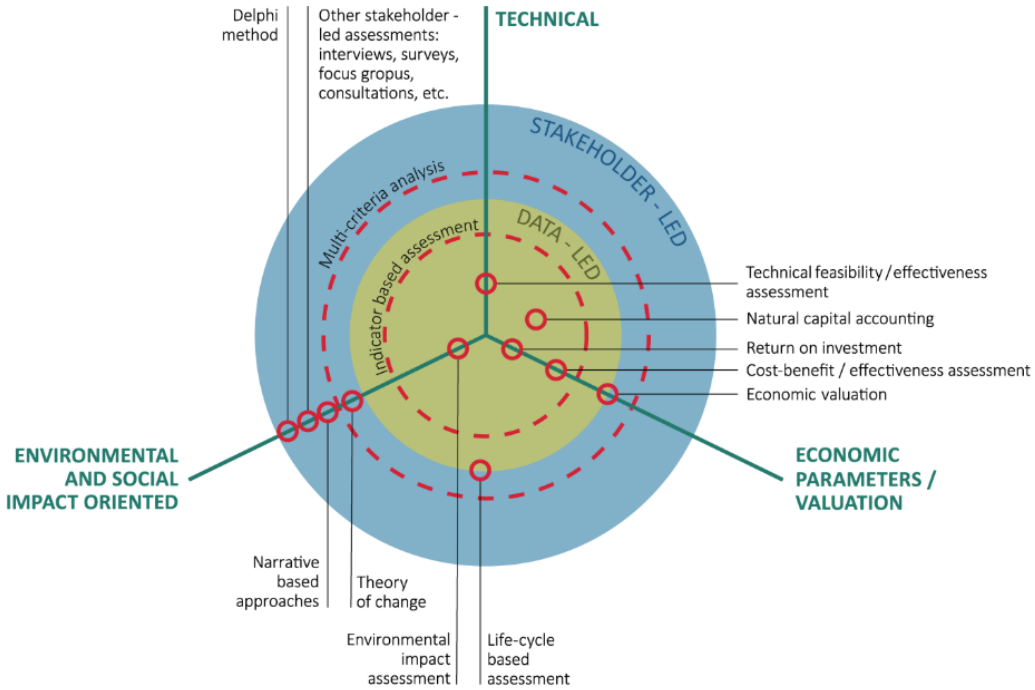
This approach is useful for determining a subject, project or institutional level implementation. From an education point of view, there is an expectation that a basic level of understanding is delivered initially, with successive years building on that knowledge and comprehension that is qualitative and quantitative. Educational aspects can be delivered as steppingstones or using a zone of proximal development (ZPD) pathway to understanding the implementation of NBS in multiple settings (i.e., rural, urban, coastal, marine). For example, a broad multi-disciplinary knowledge base is required if NBS are used to address societal challenges through the protection, sustainable management and restoration of natural and modified ecosystems, that deliver benefits for biodiversity and human well-being (IUCN, 2023).

Assessment of the participatory aspect of NBS

One of the crucial elements of NBS is stakeholder involvement and participation. A set of studies include mechanisms for involving participation and participation-based methods. A study argues that NBS assessment cannot take place in isolation from specific political and socio-cultural contexts as it limits their long-term uptake and impact on decision-making (van der Jagt et al., 2021). Thus, all stages of monitoring and assessment should be participatory (van der Jagt et al., 2021). Furthermore, there can be primarily data-led or stakeholder-led assessment elements that correspond to collecting data on various impacts - technical,

economic, environmental, and social, as shown in **Figure 12** (Giannini, 2021). The intention is to inform, communicate and promote the involvement of different stakeholders, including civil society, towards engagement with NBS (de Lima et al., 2022). To review the participatory process, (Pagano et al., 2019) propose a qualitative modelling phase which includes interviews and a stakeholders' workshop, and a quantitative modelling phase, made of stakeholder and experts' meetings and a stakeholders' workshop.

Figure 12. Primarily data-led or stakeholder-led approaches and the corresponding impacts.



Source: Giannini, 2021.

Alignment with sustainability frameworks

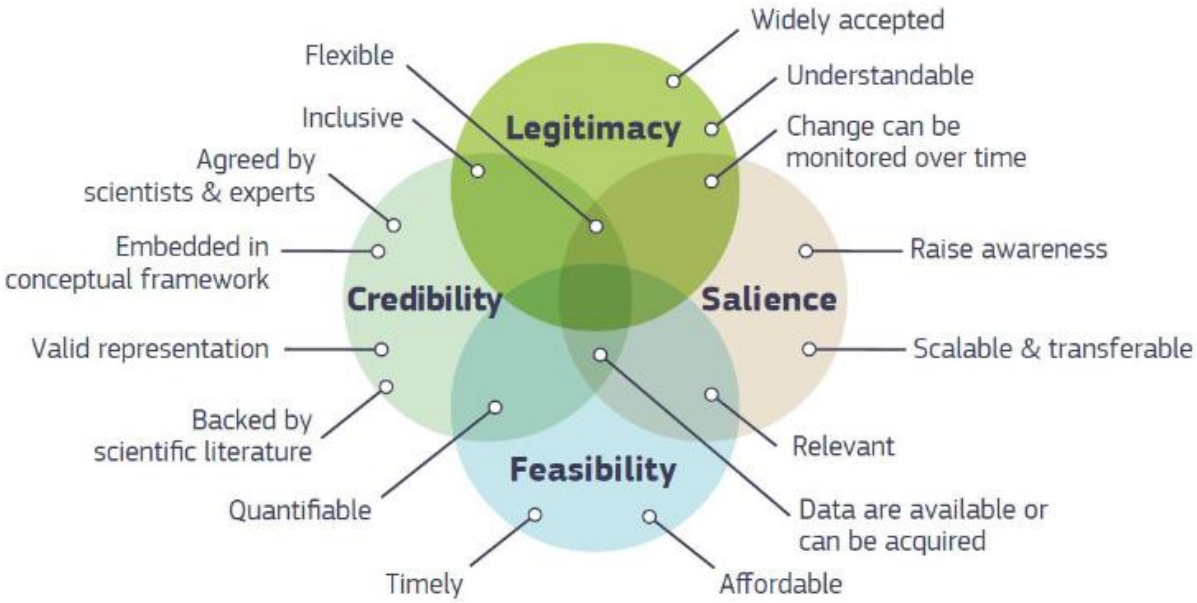
A few studies explore how to ensure that NBS is aligned with sustainability goals. An innovative framework evaluates whether NBS projects are aligned with sustainability dimensions through a set of sustainability indicators (de Lima et al., 2022). This approach is applied to the key stages of an NBS project made of context assessment, NBS implementation and adaptation process, and NBS results (de Lima et al., 2022). In some cases, the assessment of NBS is against the SDG indicator framework (Wendling et al., 2018). One study shows that the strategic selection of an NBS assessment scheme that closely aligns with one or more sub-objectives within SDG 11 (make cities inclusive, safe, resilient and sustainable), can maximize operational efficiency by exploiting synergies between evaluation schemes (Wendling et al., 2018).

Indicator measurement and cohesion

Research finds that assessment of more than one ecosystem service is lacking (Hanson et al., 2017). Therefore, a portion of the assessment attempts to consolidate various indicators to embody the complex nature of NBS. **Figure 13** shows the conceptual and more specific approach to developing ecosystem service indicators. Another study tries to assess NBS by developing their hierarchical classification which involves the division of NBS units into spatial

and technological, each to be divided into more specific sub-units (Castellar et al., 2021). The same approach refers to NBS interventions following the purpose of intervention to be divided into river, soil, and biodiversity interventions (Castellar et al., 2021). Some indicators for NBS include net carbon sequestration for urban forests; the economic benefit of reduction of stormwater to be treated in public sewage systems; area remaining for erosion protection; species richness of indigenous vegetation; the annual amount of pollutants captured by vegetation, index of ecological connectivity, and similar (Raymond et al., 2017).

Figure 13. Criteria for developing ecosystem service indicators



Source: Directorate-General for Research and Innovation, 2021

Overall, NBS assessment is well-developed and embedded in sustainability frameworks, and a range of evaluation frameworks exist, but education plays a minor role, if any, in these. One way to extract education, is to establish ways to disseminate, study, and practice the developed body of knowledge around applying and assessing NBS, or to integrate explicitly education in NBS assessment frameworks at the institutional level.

4. Guiding frameworks for all parts of the project

The following sections are structured using common project stages across the project's Work Packages as highlighted in the intervention logic. Rather than structuring by Work Packages, each section refers to partners, for whom the guiding information is most relevant. A more universal framing (with examples and directions for whom the guidance is most relevant) allows the guidelines to not be too detailed and prescriptive – which would not have been in line with the nature of this project. Overall, the guidelines provide essential elements that project partners can keep in mind when designing, implementing and evaluating their work. The guidelines aim to answer key questions, such as:

- How can the project's work be implemented to ensure high-quality NBS education delivery and the achievement of the project's intended impacts?
- How can the project's work be implemented to reach more people? How can its outputs be better tailored for different groups and learning communities?

4.1. Strategic vision and leadership

This section provides guiding points for the coordination, monitoring and evaluation aspects of the project.

- **Alignment of strategic vision with existing sustainability frameworks**

  ***Most relevant for**: Partners engaged in project coordination, monitoring and evaluation tasks – all Work Package (WP) leaders.*

  - **Guidance:** Among the existing examples of assessment tools in NBS or NBS education, the tools concerning the alignment of NBS with sustainability frameworks are particularly relevant. WP leaders could consider framing the project's goals and visions within the logic of existing NBS or sustainability frameworks and, in particular, GreenComp for the educational aspects (Bianchi, Pisiotis, and Cabrera Giraldez, 2022). Another approach is to keep using the distinction between the 12 NBS Societal challenge areas, as developed by the Horizon 2020 NBS Expert Group (European Commission, 2021), as part of the vision for the project's focus areas and targeted impact.
  - **Logic**: As highlighted by Consortium partners, it is easier to introduce people to NBS as a notion related to the terms they are already familiar with. Besides, as it stands, there are very few existing tools specifically designed around competences for NBS or institutional assessment of NBS education, and these are not available in all languages. The GreenComp incorporates competences that are very much in line with the underlying philosophy of NBS (action competences, problem framing, nature promotion and nature positivity). Besides, NBS could be related to many of the SDGs, given that the 12 NBS Societal challenge areas are quite close to the 17 SDGs, which in turn fosters global cooperation in the field of NBS in the education sector and beyond.

- **Integrating NBS into whole-school approach for sustainability**

  ***Most relevant for**: Partners involved in the strategic vision of educational institutions, or partners who work in close collaboration with schools*

  - **Guidance**: Leaders of formal educational institutions could integrate NBS into their whole-school learning for sustainability strategies and operations, whereby NBS could be an excellent tool. Rather than only teaching theoretical knowledge on NBS, institutions could encourage NBS principles in their operations and real NBS case study use in the curricula and teaching materials. The partners could also encourage this approach by reaching out to whole-school approach communities and networks, disseminating information about the project, and pitching the idea of having a collaboration event or paper on the link of NBS, and the whole-school approach for sustainability.

  - **Logic:** The State-of-the-art report reflects that to ensure that learners adopt and change behaviours, it is not enough either to simply learn about NBS, or to experience it without pedagogical approaches (e.g., walking in a park). The whole-school approach, which revolves around bringing sustainability into operational, educational and cultural activities of educational institutions, is one of the crucial aspects of learning for sustainability which helps build sustainability competences. It is also one of the immediate logical linkages between NBS and learning for sustainability, given that NBS could help innovate the physical learning environment and help education institutions achieve its WSA sustainability goals.

- **Promoting integrated policy making for NBS education**

  ***Most relevant for:** Partners who are policy-makers working in fields related to NBS education (e.g., environment, education, agriculture, fisheries and employment policy areas, etc.)*

  - **Guidance:** Project partners working in the field of policy making or with policy makers could try to improve the mapping of the various relevant policy fields for NBS. Project partners could bring these different agendas and stakeholders together, either through dissemination and panel events on strengthening education capacity building, or through project implementations and exemplary NBS initiatives. It will be important to also include education policy makers or specialists in this field, to ensure that the discussions have a transformative education agenda. Policy learning sessions by the project could provide integrated policy making for NBS education as one of its topics, to discover and discuss with policy makers how to ensure a more integrated policy development – and identify potential challenges – in practice.

  - **Logic:** The State-of-the-art report reflects that currently EU-level and national level policy documents rarely cover both the topics of NBS and education. NBS and education are usually addressed in a siloed manner in the different policy fields. Policymakers' understanding of the cross-disciplinary and integrative performance capacity of NBS is a necessity in promoting the adoption of NBS,

but also in providing a policy framework for educational institutions, training organisations, business and entrepreneurs. Integrative policy-making has been highlighted as one of the key factors to mainstream NBS within policy circles given NBS' multi-faceted nature.

- **Ensuring stakeholder engagement from the get-go, around common visions**

  ***Most relevant for**: Partners engaged in project monitoring and evaluation tasks*

  - **Guidance:** Consortium partners working on monitoring and evaluation tasks could consider applying the 'Practical five-step action framework to guide inclusive participation' across different stages of monitoring and evaluation of the project, including indicator selection. Besides, they could take inspiration from the **'**Holistic framework for assessing co-benefits (and costs) of NBS across elements of socio-cultural and socio-economic systems, biodiversity, ecosystems and climate cost-benefit', as this may also help understand who is benefiting from the project. Furthermore, indicators on outputs and outcomes could consider break-down by various stakeholders and future tasks could be targeted to those groups benefitting least from the ongoing tasks (e.g., rural and coastal communities). Consortium partners coordinating consultations could also map the different stakeholders and integrate them, in particular those less often included in NBS education. Finally, it will also be important to use stakeholder engagement actively internally in the coordination of the project, to avoid project partners working in silos, and instead have the opportunity to learn from each other and work towards a common vision.

  - **Logic:** Ensuring the voice of different types of stakeholders is integral to the objectives and goals of the project. As highlighted in the State-of-the-art report, participatory approaches can improve the depth of the learning around NBS, and some groups are more often left out of NBS education (e.g., rural and coastal communities, formal education groups and learners in VET).

- **Take a careful approach to quantifying success, staying true to NBS values**

- ***Most relevant for**: Partners engaged in project monitoring and evaluation tasks*

  - **Guidance**: Consortium partners responsible for monitoring and evaluation could prepare a monitoring framework that caters to specific contexts, situations, knowledge requirements and success metrics with nuanced examples and use of both qualitative and quantitative measures and equally cover social, environmental and economic dimensions. For instance, concerning measuring the environmental impact of specific NBS interventions, it will be important to avoid greenwashing. This could be done by building upon approaches and measurements for the drivers of biodiversity loss, to ensure that the focus is on interventions that achieve a measurable overall net gain in biodiversity, rather than merely any action that benefits nature, regardless of its origin. Similarly, it will be important to track, to the extent possible, whether groups across various background factors are benefiting from the educational opportunities provided by the project.

- **Logic:** Effective performance evaluation can be the basis for designing and implementing NBS that support evidence-based policy. Additionally, it will support policy learning and facilitate flexible decision-making, via adaptive management. In this way, it is possible to ensure the sustainable performance of NBS over time. To this end a robust assessment process is required that is scientifically sound, practical and straightforward, using reference conditions and baseline assessment to measure change. However, as highlighted in the State-of-the-art report, quantifying success in the field of NBS and sustainability more broadly, can be challenging. Due to their constituent components and scale, NBS often require time to realise the adaptive, mitigative or resilient co-benefits, and are very context specific, which makes their effectiveness difficult to quantify (in either monetary or non-monetary returns) (Kapos et al. 2019), and their benefit-cost ratios may vary over time to accrue benefits.

- **Beyond intended impacts: monitoring and evaluation as a learning opportunity**

  ***Most relevant for**: Work Package leaders engaged in project monitoring and evaluation tasks*

  - **Guidance:** Work Package leaders could take a reflexive approach to monitoring project impact, as well as could map the causal pathways to allow for early detection of risk and opportunity for intervention and/or learning. The monitoring and evaluation framework could build upon the intervention logic of the guidance framework, but also try to map additional factors that may influence the outcomes given the local and time period and well as the interlinking relationship between the actions and outcomes. As these factors will be evolving throughout the project, they could not be considered comprehensively at the time when the initial intervention logic was prepared. Project partners could reflect together upon intended and unintended impacts and trade-off across causal pathways throughout the project timeline. Overall, WP leaders could take inspiration from existing tools for reflexive monitoring (e.g., Connective Nature Cities project, see Lodder et al, 2020 or Vani Mierlo et al, 2020).

  - **Logic:** The mapping of institutional-level assessment finds that NBS assessment often lacks educational aspects and education, and skills building is not integral to the logical frameworks. At the same time, monitoring and evaluations could be seen as an educational undertaking, due to the possibility to learn from mistakes and successes. A careful and continuous assessment of assumptions, considering also unintended impacts, synergies and trade-offs, throughout the project timeline can make the monitoring and evaluation effort more useful and a learning exercise that benefits the whole Consortium.

- **Ensuring the long-term positive impact of the NBS EduWORLD**

  ***Most relevant for**: Partners working in the field of civil society, non-governmental organizations or institutes, education and policy-making*

- **Guidance:** Consortium partners could engage and train additional partners (e.g., local communities) that are not limited by finance and time-frame considerations to continue using the resources and materials provided by the project. The partners could upload lessons learnt from the project to existing online repositories, to maximise their availability to professional teaching and learning communities. Consortium partners could also search for additional funding , in order to ensure the continuation of project activities beyond the end of the project. Existing networks (e.g., Oppla, Scientix, NetworkNature, etc.) either specific to NBS, teaching, or education that are concerned with sustainability across multiple age groups, could be utilised to create support groups, teaching activities or community programmes that will deliver a consistent message on NBS education after the project ends.

- **Logic:** The State-of-the-art report finds that the long-term nature of NBS requires projects to be oriented at a longer timeframe, which often presents difficulties with regards to funding, maintenance and continuous oversight. In order to increase the effectiveness of the NBS, as well as to have a strong impact on the learning and skill development of communities, there is a need to ensure that these elements are addressed in the planning and development phases for long-term projects, or to ensure a degree of self-sufficiency is incorporated to ensure a long-lasting impact.

4.2. Understanding NBS education

This section provides guiding points for the parts of the project concerning research and analysis of the state of the art, the types of actors, resources and the conceptual understanding of NBS education.

- **Use the European Commission's definition of NBS consistently**

  Relevant for all project partners

  - **Guidance:** It is recommended to use and promote the European Commission's definition of NBS (**Box 1**) consistently throughout the project. Whereas the definition is fixed, there is flexibility in which NBS to choose as examples. Selecting appropriate cases across different dissemination activities and events could appeal to the diverse interests and prior knowledge of various local partners and communities. Rather than always employing the same set of illustrating cases, NBS examples could be attuned to the specific needs of each audience to maximise the outreach and appeal of the target group (e.g., commonly used examples regarding urban regeneration and green space management may not be relevant to a rural community, and so on).

  - **Logic:** To achieve efficient implementation, there is a need to provide consistency in the adoption of NBS principles within each project and provide certainty in regard to skills development and understanding at different levels for all Consortium members. Using the European Commission's definition of

NBS and aligning with the EU approach to NBS can contribute towards that aim.

- **Relying on NBS experts if uncertainty about NBS examples arises**

  Relevant for all project partners

  - **Guidance:** In determining whether an instance qualifies as a NBS, it helps to consider if the NBS in question addresses social and economic issues through nature and contributes to biodiversity and ecosystem health. If the NBS does not contribute to strengthening/increasing biodiversity, or addressing socio-economic issues, it may not be considered a NBS. If there is still doubt, project partners should not hesitate to reach out to the NBS experts involved in the project, and the Advisory Board. Besides, other partners with an in-depth understanding of NBS, could put together a list of NBS examples for all project partners to rely on as practical examples that help key stakeholders better understand NBS. This list could also be shared with schools to inspire them to implement NBS in their teaching and learning activities, fostering better awareness and mainstreaming of NBS.
  - **Logic:** In some Consortium consultations, there were ongoing discussions about what NBS or high quality NBS entail. Besides, when introducing a small quiz at the start of external events about the definition of NBS, many participants answered wrong. This indicates that NBS is not that straight-forward to understand and that there is a need to, throughout the project, emphasise the comprehensive meaning of NBS often, clearly and with enriching examples.

- **Including resources from various types of sources and languages**

  Relevant for all project partners

  - **Guidance:** Where possible, partners could look into compiling resource banks for NBS education resources with information from other languages. Potential support: through the Education for Climate platform to help locate resources in other languages.
  - **Logic:** Currently, the focus of desk research in the project has been English-language sources. In the long term, if the goal is to reach out to a wider community and mainstream NBS more broadly, the project could expand to also gathering resources in different languages.

4.3. Implementing NBS education

This section provides guiding points for the parts of the project concerning the implementation of NBS education and awareness raising initiatives.

- **Interdisciplinary approach to NBS education**

  ***Most relevant for**: Partners with the responsibility of implementing NBS education*

  - **Guidance:** Project partners could actively promote collaboration between professionals of different fields, cross-sectoral engagement, co-construction of NBS, and integrating multi-disciplinal approaches to NBS education, training and policy development. Furthermore, they could use pedagogies that allow for interdisciplinary approaches to more easily be applied (e.g., project-based learning or integrated STEM learning, cross-disciplinary curricula development) that focus on real-world challenges, complex system thinking and the integration of diverse knowledge and reflexivity to enhance transformative learning and curricula development.

  - **Logic:** The State-of-the-art report found that NBS education will benefit from being approached through interdisciplinary learning, activities or projects, and along with a diverse group of actors in its design and implementation. Given the multi-faceted nature of NBS, and the challenges it can address across social, economic and environmental dimensions, this is not a surprise.

- **Addressing a variety of NBS types and challenges**

  Relevant for all parts of the community

  - **Guidance:** When initiating new teaching activities or presenting project results, Consortium partners can implement a varied selection of NBS and NBS challenge areas or focus simply on those among them that are rarely considered, following the 12 Societal challenge areas as an example (as defined by the European Commission, 2021). This can help increase the quality of learning around NBS and provide a greater understanding of the potential role/benefits of NBS in society comprehensively.

  - **Logic:** The State-of-the-art report found that within NBS education, there is a lack of diversity in the type of NBS and challenges addressed. The majority of NBS focused on education concerns urban gardens, green management and urban regeneration projects. While some of these were comprehensively implemented, they do not help to raise awareness around different forms of NBS and forms that are suitable across climates, landscape settings and communities.

- **Employing the most suitable pedagogies and space for NBS learning**

  ***Most relevant for**: Educators and designers of education material*

  - **Guidance:** Educators and designers of education materials could consider broadening their pedagogical approach and the use of available space in and/or outside of the school, for more impactful teaching of NBS.

  - **Logic:** The State-of-the-art report recommended several suitable pedagogies for NBS education, which vary depending on education level. Some examples

were playful pedagogies, citizen science, project-based learning and action and team-oriented approaches. Following best practices of learning for sustainability, teaching NBS could utilise spaces outside of the traditional classroom, given that few classrooms have integrated NBS. This includes outdoor, nature-based learning, strategies that encourage environmental and local exploration, the use of urban gardens and green spaces, and digital space.

- **Actively linking to the assessment frameworks and methods**

  Most relevant for: *Educators and designers of education material*

  - **Guidance:** Consortium partners could actively promote the transferability of methodology and open access to NBS student assessment tools (e.g., the assessment framework on the project's website) through online platforms. Consortium partners could also contribute to advancing the assessment framework by including assessment in their own implementation of NBS education and providing a description of the lessons learnt as an example for the assessment repository. In order to prioritise, partners can pay particular attention to VET, where there currently seems to be very few practices or capacity for delivering (apart from formal HE short course) on NBS, and where there is an identified need for bringing in NBS to change practices and professions.

  - **Logic:** As discussed in the State-of-the-art report, delivering NBS education across the EU is often derived from sustainability initiatives associated with the SDGs and from a teachers' perspective relies on individual knowledge and availability of a competence framework on which to base assessment. However, while sustainability competence frameworks for educators exist both at the conceptual level in academia and at institutions that teach topics related to sustainability, there are no clear competence frameworks for teachers on NBS and only some mention NBS competences implicitly (Mulvik et al 2023). To date, there is limited evidence of NBS being incorporated directly into the curricula associated with a defined assessment framework, with learning scenarios nominally focussed on the NBS societal challenges and key sustainability issues. High-quality assessment methods should be recognized as an essential element for mainstreaming NBS at institutions and promoting sustainability competences.

- **Collaboration with actors outside of educational institutions and the project**

  Most relevant for: *Leaders of formal educational institutions; Civil society, non-governmental organizations or institutes working in the field of NBS or NBS non-formal education*

  - **Guidance:** Consortium partners working on implementing NBS could consider broadening their collaborations with actors outside of educational institutions or across formal/non-formal divide. By cooperating with actors outside the schools (e.g., NGOs and local communities) the Consortium could provide avenues for consistency in using NBS, terminologies and impact within communities and

schools. Consortium partners and external parties could promote the inclusion of NBS terminologies in revised curricula as information or project data utilising NBS projects throughout the EU, and relevant teaching networks to develop consistent interrelated curricula and institutional policies.

- **Logic:** Following action-oriented pedagogies, involving experts and communities working with NBS on the ground in the teaching process can be an effective way to increase student engagement and delivery of applicable sustainability competences. Educational institution collaboration with NBS specialists and environmental centres increases the quality of the lessons around NBS, reduces the burden on teachers, and promotes student contribution to real-life projects and development of NBS. Similarly, working with local communities can support student place-based learning of NBS, and be an effective way to mainstream NBS knowledge, e.g., through the involvement of family members in educational activities.

- **Fostering intergenerational relationships around NBS**

  Most relevant for: *Parents and the broader community engaging in informal education of NBS; leaders of educational institutions; civil society, non-governmental organizations or institutes working in the field of NBS or NBS non-formal education.*

  - **Guidance:** Consortium partners are encouraged to promote intergenerational collaboration with equity considerations in their planning and organisation stage and in the design of suitable spaces for engaging NBS across different physical abilities. Outreach activities could make an active effort towards various local groups that may be likely to be reached less often, e.g., senior, youth and family associations, and include parents and the local community in place-based education opportunities for NBS.

  - **Logic:** The State-of-the-art report points to projects and education initiatives that promote intergenerational relationships and inclusion of seniors and children as good practice for mainstreaming learning on NBS more widely in society and making communities more resilient and cohesive.

- **Inclusion of local community for place-based education opportunities**

  Most relevant for: *Parents and the broader community engaging in in-formal education of NBS; leaders of educational institutions; civil society, non-governmental organizations or institutes working in the field of NBS or NBS non-formal education.*

  - **Guidance:** Consortium partners working with/alongside educational institutions could encourage the inclusion of the local community through on-site events and more long term-engagement initiatives, which also contribute to intergenerational collaboration. Place-based NBS education targeting specific groups of learners could benefit from a level of openness to local communities interested in partaking. With such initiatives, as highlighted by the State-of-the-art report, it is important to also bring in education experts to maximise the educational value of outdoor learning on NBS.

- **Logic:** Community-based learning (e.g., communal management and education schemes through local green space management) is crucial for the development of sustainability and active citizenship competences. It increases a sense of shared responsibility for the local place and encourages a sense of empowerment for action and responding to global issues (UIL, 2017).

4.4. Building the NBS EduCommunity

This section provides guiding points for the parts of the project concerning outreach, dissemination and exploitation of research results to the wider community. It encompasses networking tasks and events organised by the project, as well.

- **Do not avoid referring to related terms, but be transparent about the links**

  Relevant for all project partners

  - **Guidance:** Project partners can use other relevant terms that align with the green transition agenda for mainstreaming NBS, as that could help foster a broader understanding of the policy context and specific NBS challenges (e.g., nature positive economy, circular economy, bioeconomy, and other actions; transformative change; climate neutral; biodiversity). The important point is to clarify the relation between the terms to avoid potential confusion during stakeholder consultations, mapping, or desk research, as well as to still use the European Commission's NBS definition as the main starting point. That would ensure transparency, even when these terms often overlap in meaning in many ways.

  - **Logic:** Literature suggests that NBS is an outcome of an evolution of different terms that express similar ideas (e.g., ecosystem services, green and blue infrastructure, low-impact development, etc). According to the European Commission, these terms can be understood as sub-dimension of NBS across strategic, spatial planning, soft engineering and performance dimensions (European Commission, 2021). During consultations with the Consortium, it became clear that many communities are still actively using these or other terms, and that these communities are logical partners and colleagues of NBS EduWORLD because they often apply great examples of NBS – despite not using the term NBS explicitly. Finding an open dialogue, co-creating with and finding a way to engage these communities within NBS EduWORLD (e.g., inviting for events, co-writing articles, etc), could be a great way to learn and expand the outreach of the project, and can be seen as an opportunity rather than a challenge.

- **Paying attention to language and translation issues**

  Relevant for all project partners

  - **Guidance:** The European Commission's definition of NBS should be used in all instances of dissemination or exploitation of outputs from the NBS EduWORLD project. Translation of definitions and terminologies should be consistent where

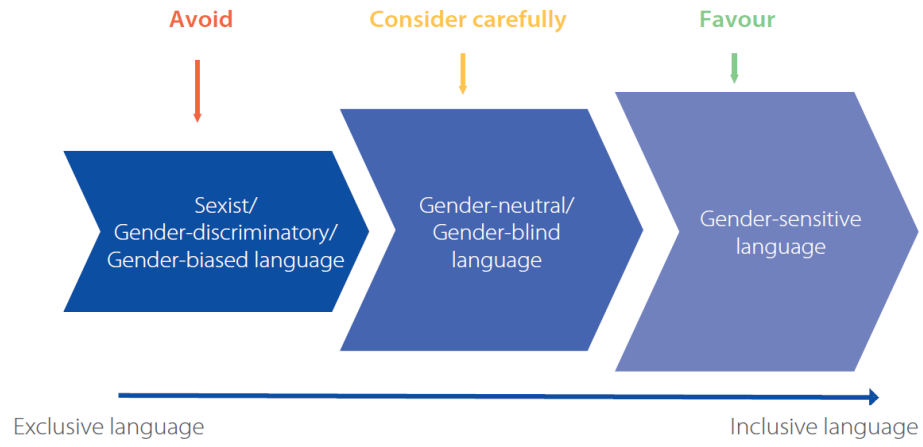
possible, to avoid confusion and misinterpretation. When the terms do not translate, the inherent meaning of the term can still be communicated or, in case that is not possible, the English term can be used instead to avoid confusion until an established and better translation has been achieved.

- **Logic:** Consortium partners have noted that when working with communities and providing support, education materials or training about the implementation, design or benefits of NBS, there is a need to understand the audience, their terminology and their perception of NBS to help deliver the message consistently. Different languages add complexities to this, as noticed by several Consortium partners already about NBS not having a proper translation in all European languages.

- **Gender-sensitive language**

Relevant for all project partners

- **Guidance:** Involving citizens and diverse groups of stakeholders throughout the implementation cycle means including economic, cultural, gender, disability, generational and other considerations when determining how to organise and carry out NBS education initiatives. This also entails the consistent use of respectful and inclusive language that avoids discrimination based on gender, ability, age, ethnicity, race, or socio-economic status. In providing educational materials, delivering education courses, training or capacity-building workshops, there is a need to be mindful of the language used in the delivery. There are some key terms that should be used in all circumstances to make the language more inclusive and gender-sensitive, and we recommend using the most inclusive form of language: gender-sensitive language. We advise project partners to follow the guidelines by the European Commission's Gender Institute to ensure gender-sensitive communications. Examples of three types of language fall on an 'inclusivity scale' and should be deployed as suggested in the figure below.



Source: EIGE, 2019.

- **Logic:** Inclusion is an integral value of NBS and using exclusive language is thus counterintuitive to the agenda of NBS and its social, just objectives.

- **Intentional use of keywords in dissemination efforts**

  Relevant for all project partners

  - **Guidance:** Strategically using keywords will serve to increase the number of individuals finding and reading project publications. This will also very likely lead to more citations of project publications and reported outcomes. Consortium partners could draw attention to keywords, definitions, and use of metrics and indicators when discussing NBS (projects, activities, pedagogies, practices, etc) and using them in discussions with other partners, when preparing and disseminating materials, activities or events for the project.

  - **Logic:** As noted in the WP7 Deliverable D7.1 Dissemination and Exploitation Plan including Communication Activities, the intentional use of keywords enables indexers and search engines to identify relevant publications. This is important to ensuring that publications reach the relevant audience.

- **Targeted dissemination towards communities less often involved in NBS**

  Relevant for all project partners

  - **Guidelines:** Partners could actively target communities and collaborative partners from rural and coastal areas where possible in their dissemination and exploitation events, as well as less affluent areas and VET institutions. Further, they could consider preparing a design that is attractive to learners from these communities, target them strategically, and make an additional effort to build bridges with networks and organisations specialising in challenges affecting these. Partners could pay particular attention to VET, where there currently seem to be very few practices or capacity for delivering (apart from formal HE short course) on NBS, and where there is an identified need for bringing in NBS to change practices and professions.

  - **Logic:** The State-of-the art report found rural and coastal areas to be underrepresented as targeted stakeholders or realised NBS benefits or NBS education. Similarly, VET institutions were the least often covered institutions in NBS education. NBS examples evaluated in non-formal settings tended to be in urban areas, which suggests that students from disadvantaged backgrounds and/or in rural and coastal areas are underrepresented in NBS education activities. While it found that there are examples of NBS initiatives that address social justice issues at the school level, the majority do not, or are not clear about how an NBS education initiative contributes to social justice and social cohesion and this is a key area for the development of NBS educational options.

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