NBS EduWORLD

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NBS EduWORLD Knowledge Stream:

Guidelines on Implementation of Nature-Based Solutions Activities in Education for Starters

Deliverable D5.1: NBS Knowledge Stream Guidelines

Version: 1.0

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Abstract	The guidelines have been designed to address the requirements of educators with little to no prior knowledge of nature-based solutions (NBS). They provide a step-by-step framework for understanding, implementing, and integrating NBS concepts into different education settings, covering formal, non-formal and even informal education. The guidelines incorporate hands-on activities, recommendations, and practical examples to facilitate educators in effectively conveying NBS-related content to their students. By considering the needs and limitations of the Knowledge Stream, the guidelines aim to build a solid foundation of NBS knowledge among educators and empower them to unlock the potential of NBS education.
Keywords	NBS, education, guidelines
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Abbreviations

ECEC	Early Childhood Education and Care
EFDN	The European Football for Development Network
ETS	Education Through Sport
EU	European Union
LfS	Learning for the Green Transition and Sustainable Development
LS	Learning Scenario
MOOC	Massive Open Online Course
MoYS	Ministry of Youth and Sports
NBS	Nature-based solutions
SDC	STEM Discovery Campaign
SSL	STEM School Label
STEM	Science, Technology, Engineering and Mathematics
STE(A)M	STEM + Arts
TBVT	The Big Van Theory
WSA	Whole-school approach

Executive summary

In response to the growing need for integrating the topic of nature-based solutions (NBS) in education, these guidelines have been developed to cater to educators with limited to no prior exposure to NBS concepts. This document outlines examples and recommendations to bridge the knowledge gap by equipping educators with diverse ideas, activities, and initiatives, enabling them to seamlessly integrate NBS concepts across various education settings.

The guidelines cover formal, non-formal, and informal education settings, ensuring their applicability across diverse learning environments. By incorporating hands-on activities, expert recommendations and practical examples, the guidelines empower educators to confidently explore NBS-related content with their students. Educators will be equipped with the right tools to instil a solid foundation of NBS understanding. Moreover, they will be able to address the topic of NBS throughout diverse pedagogical approaches, according to the needs of the learners and the curriculum and setting demands.

By empowering educators to nurture a generation that comprehends and appreciates NBS, this document lays the groundwork for a sustainable future where NBS principles are seamlessly integrated into education. Through these guidelines, educators will harness the potential of NBS education, fostering informed and engaged citizens who contribute positively to the well-being of our planet.

1. Introduction

Educators face a significant challenge in effectively integrating the topic of NBS in education, due to the complexity and novelty of the subject matter. Traditional teaching methods often fall short in conveying the interdisciplinary nature of NBS and their role in sustainable development.

These guidelines aim to serve as a valuable resource for educators interested in integrating NBS topics in their settings. The goal of the guidelines is to provide concrete guidance, support, and hands-on approaches, rather than principles or strict rules, to those new to teaching NBS, whether in formal, non-formal, or informal settings.

UNESCO has issued a global call to all countries to incorporate Learning for the Green Transition and Sustainable Development (LfS) as an essential element of their core curriculum by 2025[1]. At the European Union level, policies also emphasize the importance of LfS. For example, the European Commission's Biodiversity Strategy for 2030[2], emphasizes the need to enhance knowledge and awareness regarding biodiversity conservation. Considering these developments, NBS have emerged as a promising approach to foster global biodiversity in collaboration with local communities.

In their 2020 paper, Fronza & Gras-Velázquez emphasized and illustrated the fundamental connection between education and sustainability. At the core of these guidelines is the belief that education plays a crucial role in enhancing literacy and awareness, not only about sustainability, but specifically about NBS. At the same time, the topic of NBS can foster comprehensive approaches, critical thinking, and the integration of various subjects or topics, due to its transdisciplinary nature. However, despite the great potential of this topic, there is a lack of resources and training opportunities available for educators on how to integrate NBS in education settings (Utkarsh, 2023). To address these needs, these guidelines are therefore intended for teachers and educators with little to no knowledge about the topic of NBS. Where possible, the guidelines make distinctions in terms of what is advised, while striving to avoid being prescriptive, as they have been designed with flexibility at their core.

In many cases, you might need to adjust the guidance to your personal circumstances, and to your students' and settings' needs. To enable the universal applicability of the guidelines, we intentionally use the terms "educators", "students" and "setting" in a broad way. Some of the content might therefore also be useful to other educational stakeholders, such as policymakers, teacher trainers, or families interested in learning how to support young learners and the youth's journey in learning about NBS.

Following the recommendation from the report Data collection and analysis of Erasmus+ projects (European Commission, 2022) on "how to move from awareness to taking action", the guidelines focus on providing: 1) hands-on initiatives and activities that yield tangible results, 2) positive communication, 3) ideas for peer-to-peer teaching, 4) whole-school approaches.

[1] UNESCO press release on environmental education: https://www.unesco.org/en/articles/unesco-urges-making-environmental-education-core-curriculum-component-all-countries-2025
[2] Biodiversity strategy for 2030: https://environment.ec.europa.eu/strategy/biodiversity-strategy-2030_en#:~:text=The%20EU's%20biodiversity%20strategy%20for,contains%20specific%20actions%20and%20commitments

These guidelines form Deliverable D5.1 NBS Knowledge Stream Guidelines, the first of two deliverables from Work Package 5 of NBS EduWORLD, which focuses on education for NBS Starters, and in particular: the Knowledge and Connections Streams.

2. Objectives

The guidelines aim to serve as a practical resource, offering clear and comprehensive **guidance** to teachers and educators, but may also be found useful by other education stakeholders on integrating NBS into the education sector. An important objective of the guidelines is to **raise awareness about NBS** among educators, students, and the wider community. By emphasizing the benefits and potential of NBS in addressing environmental challenges, the guidelines seek to inspire a greater understanding and appreciation for nature-based approaches.

The guidelines recognize the role of education in promoting sustainable development and the transition to a greener future. By incorporating NBS into education, the guidelines aim to **foster** LfS, as well as to encourage educators to adopt **inquiry-based methods** when teaching about NBS (e.g., through experiments, hands-on activities, research projects, etc.). This holistic approach capitalizes on students‘ innate curiosity, promotes critical thinking, and empowers them to become agents of positive change by translating knowledge into actionable solutions for complex environmental challenges.

NBS often involve collaboration with local communities and stakeholders. The guidelines aim to facilitate **community engagement** by encouraging educators to involve community members in NBS projects, promoting partnerships with local organizations, and fostering a sense of shared responsibility for environmental issues. In this direction, the guidelines emphasize the importance of a **whole-school approach**[3] (WSA), which according to the European Commission (2022) seeks to embed LfS across the institution and “adopts a systemic view of education creating opportunities for living and learning sustainability across the education environment”. In a WSA, NBS principles are integrated across the entire educational institution. This approach involves aligning curriculum, policies, and practices to promote NBS, fostering a culture of sustainability throughout the school community. NBS EduWORLD aims to further explore the WSA in detail with expert teachers as part of its Network Stream activities.

Evaluation is essential to measure the effectiveness and impact of NBS programs in education. The guidelines provide support and advice on **evaluating NBS activities**, including the development of evaluation frameworks, data collection methods, and analysis techniques. By promoting systematic evaluation, the guidelines aim to ensure continuous improvement and evidence-based decision-making.

Ultimately, the guidelines aim to **inspire action and behaviour change** among students, educators, and the wider community, with relation to NBS. By highlighting successful examples and showcasing the positive outcomes of NBS education, the guidelines seek to motivate and empower educators to take concrete steps towards teaching NBS in their settings.

[3] Whole-school approach definition: https://www.ibe.unesco.org/en/glossary-curriculum-terminology/w/whole-school-approach

By addressing these objectives, the guidelines strive to be a comprehensive and impactful tool in promoting the integration of NBS into education, especially among educators who are new to NBS, their meaning and application.

3. Methodology

The guidelines have been developed based on a thorough literature review, pedagogical expertise, and work carried out during the first year of the NBS EduWORLD project. In this context, the guidelines are intended for the designated “Knowledge Stream”, namely educators without any prior, or with very little, knowledge on the topic of NBS. The following were critical components of the methodology:

- **Conducting a literature review**: to gather and analyze existing scholarly articles, research papers, case studies, and relevant educational resources related to NBS. The literature review provided a foundation of knowledge and insights into the various aspects of NBS, such as its definition, benefits for teachers and students, and implementation strategies in education settings.
- **Working with experts**: the development of the guidelines also benefited from the input and expertise of **pedagogical experts** with extensive experience in educational practices, curriculum development, and instructional design. Their knowledge and insights were instrumental in shaping the guidelines to ensure they meet the real needs of educators.
- **A collaborative approach**: throughout the first year of the NBS EduWORLD project, regular meetings and exchange of feedback among partners in the Consortium helped to gather **good practices**, map challenges and opportunities and translate them into practical advice for educators.

By leveraging these approaches, these guidelines have been tailored to meet the specific needs of educators within the Knowledge Stream of NBS EduWORLD, and any other educators or members of the society with little to no knowledge of NBS.

4. Resources and concepts enriching NBS education

This chapter is based on a literature review, and summarizes the relevant resources, reports, concepts and research studies that support the content of the guidelines, enriching their credibility and foundation. Key concepts, frameworks and definitions related to NBS are included, contributing to a comprehensive understanding of the topic, and providing more information for those educators who wish to dive deeper into the state of the art of NBS in education.

4.1. Nature-based solutions definition

NBS offer comprehensive and versatile approaches to addressing pressing societal issues. They are "solutions that are inspired and supported by nature, which are cost-effective, simultaneously provide environmental, social, and economic benefits and help build resilience. Such solutions bring more, and more diverse, nature and natural features and processes into cities, landscapes, and seascapes, through locally adapted, resource efficient and systemic interventions. NBS must therefore benefit biodiversity and support the delivery of a range of ecosystem services" (European Commission).[4]

Figure 1: Benefits of nature-based solutions – The European Commission

The Final Report of the Horizon 2020 Expert Group on 'Nature-Based Solutions and Re-Naturing Cities by the European Commission (2015) states that NBS include working "beyond silos and engaging with others across disciplines and sectors", as well as involving all stakeholders, including education players.

NBS are a core element of the European Green Deal and recent major European policy initiatives, such as the EU Biodiversity Strategy for 2030.

[4] Nature-Based Solutions definition: https://research-and-innovation.ec.europa.eu/research-area/environment/nature-based-solutions_en

4.2. Green Deal

The European Commission unveiled in 2019 a set of proposals to overcome climate change and environmental degradation, known as the European Green Deal[5], which highlights "the crucial role of education and training in empowering and engaging people for environmental sustainability and boosting the skills and competences needed for the green transition" (European Commission, 2022).

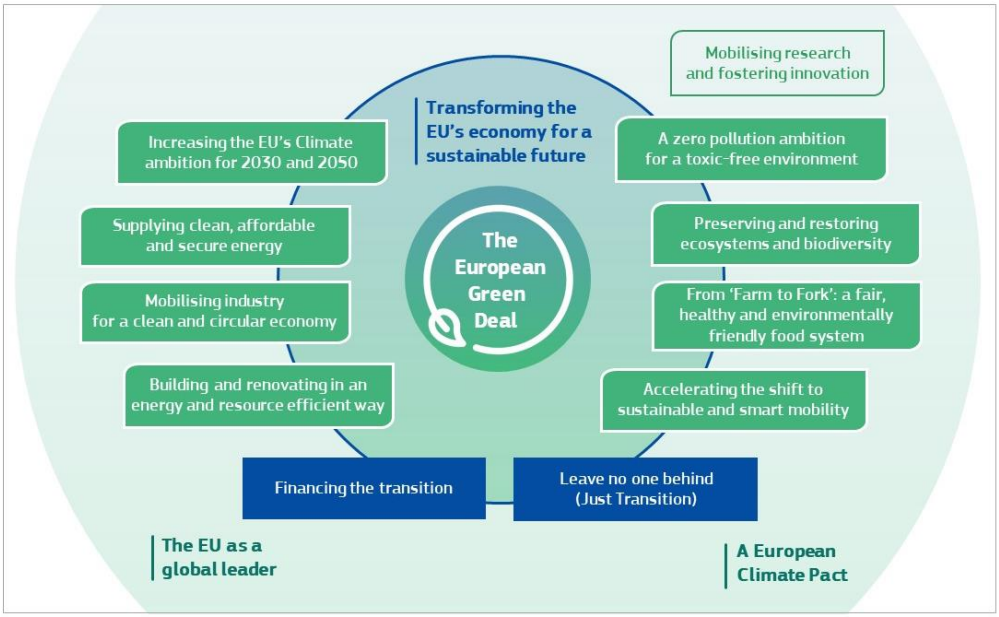

Figure 2: The European Green Deal – The European Commission

In line with the Education for environmental sustainability (European Commission, 2021), every level of education, from Early Childhood Education and Care (ECEC) to tertiary and adult education, has a role in the European Green Deal. Yet, research suggests that especially young learners experience a sense of helplessness in the face of the overwhelming nature of climate change (ALLEA, 2020). This can be addressed through NBS initiatives focusing on steps forward and collective actions, not only decreasing eco-anxiety, but also fostering a sense of agency. Moreover, treasuring experiences in nature from an early age benefits not only people, but also the environment (Molina Ascanio & Tasiopoulou, 2023), as this early connection and care translates into positive environmental attitudes in adulthood (Well & Lekies, 2006). The European Green Deal includes the development of a European sustainability competence framework as a policy action to promote environmental sustainability learning in the EU, which is explained in the next subsection.

4.3. GreenComp Framework

This above-mentioned framework, known as GreenComp[6] and developed by the Joint Research Centre of the European Commission, identifies a set of sustainability competences that can be integrated into educational programs. The goal is to help learners acquire knowledge, skills, and attitudes that encourage empathetic, responsible, and caring thinking, planning, and action

[5] European Green Deal: https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal_en
[6] GreenComp Framework: https://publications.jrc.ec.europa.eu/repository/handle/JRC128040

towards the planet and public health. GreenComp consists of 4 interconnected competence areas[7]: "Embodying sustainability values," "Embracing complexity in sustainability," "Envisioning sustainable futures," and "Acting for sustainability", whereby each encompasses three interlinked and equally important competences. GreenComp is designed to serve as a flexible reference for learning programs and educators fostering sustainability as a competence, without being overly prescriptive.

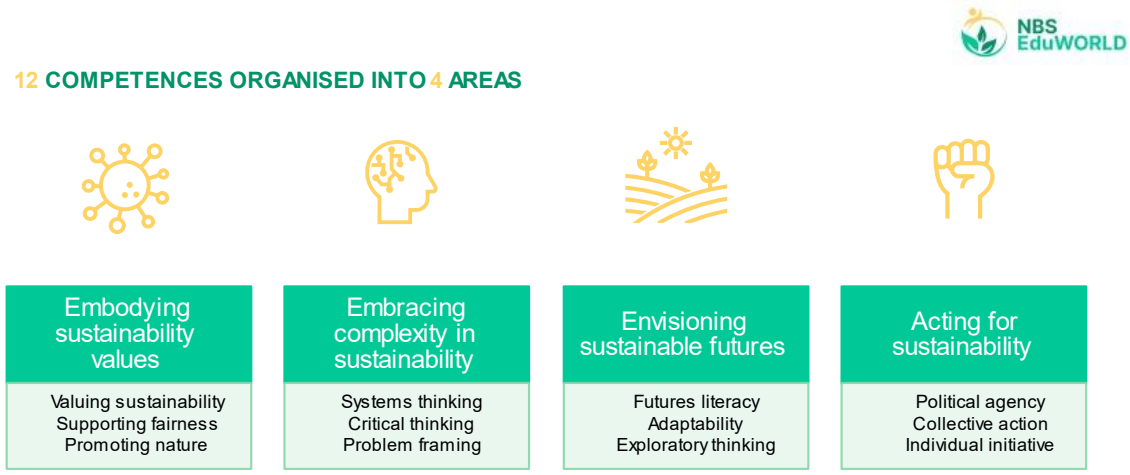

Figure 3: The GreenComp Competences– a visual representation by European Schoolnet

The present guidelines refer to and include GreenComp in several activities (e.g., resources for teaching NBS in different education settings, professional development materials and opportunities for educators, etc.) to support the European Green Deal and the idea highlighted by Bilgin et. Al (2022) that "the shared understanding of sustainability competences can support education and training institutions to develop comparable practices and facilitate the sharing of knowledge and expertise".

4.4. Council Recommendation on learning for the green transition and sustainable development

The European Union is taking significant steps to address climate change and promote sustainable development, education and training. For example, in June 2022, the Council of the European Union adopted a Recommendation on Learning for Environmental Sustainability (LfS)[8]. The policy aims to integrate sustainability into all aspects of education and training and calls for prioritizing green and sustainable learning in formal and non-formal education. Through GreenComp, LfS aims to equip learners of all ages with the knowledge, skills, and attitudes necessary to lead sustainable lives, adopt greener consumption and production patterns, embrace healthier lifestyles, and actively contribute to a sustainable economy and society (European Commission, 2022). Additionally, LfS fosters an understanding of the interconnected global challenges, e.g., the climate crisis, environmental degradation and biodiversity loss, encompassing environmental, socio-economic and cultural dimensions.

[7] GreenComp 12 competence areas: https://joint-research-centre.ec.europa.eu/greencomp-european-sustainability-competence-framework/greencomp-conceptual-reference-model_en

[8] Article by the European Commission on the Recommendation: https://education.ec.europa.eu/news/learning-for-the-green-transition-and-sustainable-development

The European Commission is also conducting research on green education, including studies on teacher professional development, learning approaches for sustainability, synergies between green and digital agendas, and sustainable learning environments and infrastructure.

In addition, the Erasmus+ Teacher Academies initiative[9] aims to enhance the European and international dimensions of teacher education in Europe. Several academies[10] specifically focus on sustainability, creating learning pathways for teachers to develop and demonstrate their sustainability education competences, producing resources for schools and teacher education, and helping teachers understand climate change and its mitigation options.

4.5. 12 NBS Societal Challenge Areas

The 12 NBS Societal Challenge Areas[11] offer a comprehensive approach to addressing pressing environmental and social issues, promoting sustainability in formal, non-formal, and informal education settings. Their importance lies in their ability to address interconnected global challenges, e.g., climate change, environmental degradation, and biodiversity loss, while fostering sustainable living, economic growth, and social cohesion. These 12 areas fit easily into a range of topics or subjects, which are included in these guidelines.

Figure 4: The 12 NBS Societal Challenge Areas – European Commission

[9] Erasmus+ Teacher Academies: https://education.ec.europa.eu/education-levels/school-education/erasmus-teacher-academies

[10] Article by the European Commission on 16 new Erasmus+ Teacher Academies: https://education.ec.europa.eu/news/16-new-erasmus-teacher-academies-to-promote-excellence-in-teacher-education-in-europe

[11] The 12 Nature-Based Solutions Societal Challenge Areas mapped by the European Commission: https://op.europa.eu/en/publication-detail/-/publication/d7d496b5-ad4e-11eb-9767-01aa75ed71a1#:~:text=The%20Handbook%20aims%20to%20provide,Climate%20Hazards%3B%20Green%20Space%20Management%3B

4.6. NBS concepts from D2.1 State of the Art report of NBS EduWORLD

The concept of NBS is relatively new to most educators, and as an innovative and complex topic, it might seem difficult to implement in different education settings. Based on the State-of-the-Art report developed by NBS EduWORLD, to understand the concept of NBS, and successfully integrate it in their activities, educators should follow three key recommendations as listed below.

- **Use the European Commission's NBS definition**: as an emerging research topic, organisations differ in their definition of what NBS are. While the European Commission definition remains constant, there is flexibility in selecting NBS examples, allowing for tailored cases based on the interests and prior knowledge of students, schools and the wider community.
- **Interdisciplinary approach**: collaboration between professionals from different fields, and pedagogies, such as project-based learning and integrated STEM learning, among others, should be utilized to address real-world challenges and enhance transformative learning.
- **Suitable pedagogies and learning environments**: Educators and designers of education materials are advised to broaden their pedagogical approach, using outdoor, nature-based learning spaces and strategies, such as citizen science and team-oriented approaches for teaching NBS.

These recommendations are integrated in the guidelines, offering useful tips, examples and suggestions for educators that wish to integrate the topic of NBS into formal, non-formal and informal education settings.

5. Introducing nature-based solutions in formal education

This chapter provides an overview of strategies for integrating NBS in formal education settings, such as: how to integrate and adapt ready to use materials in the curriculum (e.g., via Learning Scenarios), teacher training and professional development for educators and teacher trainers with little to no-knowledge about NBS (e.g., Massive Open Online Courses, workshops, hands-on activities, etc.), showcasing examples and sharing best practices through competitions, and strategies for a WSA (e.g., School Label Accreditation, collaboration with the wider community, etc.). We agree with Fronza & Gras-Velázquez's (2020) statement that "when teachers are trained, innovative pedagogies used, students engaged and there is a willingness to take the challenge, (…) no topic is too complex to address in the classroom".

5.1. Learning Scenarios

As a teacher, you might not have the knowledge (yet), neither the time, nor the resources to create NBS teaching materials. The NBS EduWORLD project provides educators with a repository of ready-to-use and clearly structured materials[12], such as Learning Scenarios (LS)[13] specifically designed to integrate NBS into the curriculum, which can guide you in incorporating NBS concepts, activities, and assessments into existing subjects like science, geography, environmental studies, STE(A)M and, why not, also language subjects. The LS have been (co-) created by teachers and/or pedagogy experts within the Nature-Based Solutions in Education Phase II Pilot and NBS EduWORLD, and some have even been tested in the classroom. All LS are easily adaptable to different grade levels and learning objectives, which allows you to tailor the content to your specific classroom and curriculum context. When using a LS, you can either follow it as it is, or select some of the activities, modifying them or creating your own lessons based on the overall topic of the LS.

> "**Learning Scenarios** complement national curricula by facilitating the incorporation of NBS topics into a diverse range of subjects. They serve as an excellent means of introducing complex and interdisciplinary topics in the classroom, as they provide the necessary resources and effectively enhance both theoretical comprehension and practical application" (Fronza & Gras-Velázquez, 2020).

Box 1: Tips for working with a Learning Scenario (1)

- **Review your curriculum or learning objectives** to find connections between NBS and subject(s) you teach. Look for opportunities to integrate the topic into existing lessons and choose activities that align with your class planning. Mix and match the activities that work for you and your students! Do not be afraid of transforming an online activity into an in-person session, and vice versa.
- **Adapt the LS to the age and interest of your students**. You might come across a LS that explores NBS in a brilliant way but does not target the age group you teach. That is still alright! LSs offer much flexibility, and you might want to adapt them, or a specific activity, for your classroom.
- Take advantage of **technology** and available (teaching) resources at school to enhance the learning experience. Choose technologies that fit you, your students and school the most, and use online platforms, interactive tools, or virtual field trips to explore NBS beyond the classroom walls.

[12] NBS EduWORLD repository: https://nbseduworld.eu/resources
[13] Definition of Learning Scenario: https://www.tel-thesaurus.net/wiki/index.php/Learning_scenario#:~:text=Definition,of%20knowledge%2C%20competences%20or%20skills.

Box 2: Tips for working with a Learning Scenario (2)

- Incorporate **hands-on activities** allowing students to directly engage with NBS principles. For example, organize (when possible) field trips to local green spaces or natural areas, where students can observe and study ecosystems, analyse environmental challenges, and propose NBS solutions. Provide opportunities for students to actively participate in NBS-related projects, such as creating school gardens*, constructing green infrastructure on school premises, or designing sustainable energy systems. NBS encourages experiential learning outside of the classroom, take advantage of that!
- Integrate **NBS into broader environmental literacy and citizenship education** initiatives. Help students understand the connections between their local environments, global sustainability challenges, and the potential of NBS in addressing these issues. Foster critical thinking, ethical decision-making, and civic engagement by encouraging students to analyse environmental problems, evaluate NBS solutions, and advocate for sustainable practices within their communities.
- Develop assessment strategies to evaluate students' understanding of NBS. LS include varied **formative and summative evaluation methods** (e.g., rubrics, quizzes, presentations, research projects, reflections, etc.) to help you assess students' progress. Choose and adapt methods to ensure a personalised learning and encourage learners to reflect on their own progress.
- **Seek collaboration** with other teachers (or even schools) interested in integrating NBS into their classrooms. NBS is a broad topic that can be studied through different subjects – have fun finding out the links with other educators in their fields of expertise! You can collaborate in person or online, e.g., via eTwinning** . Together, you can share ideas, resources, and best practices.

* Resources for building a school garden: https://www.nature.org/en-us/about-us/who-we-are/how-we-work/youth-engagement/nature-lab/school-garden-resources/

** eTwinning platform: https://school-education.ec.europa.eu/en/etwinning

You can find examples for these tips for working with a Learning Scenario, in **Annex 1**.

5.2. MOOCs

Teacher training and professional development for educators and teacher trainers is a must for educators who are "NBS starters", to be able integrate the topic of NBS in their classrooms. Teachers are encouraged to follow training and professional development opportunities to build and expand their knowledge and understanding of NBS. Massive Open Online Courses (MOOCs)[14] address the challenges faced by teachers, such as conflicting schedules, lack of incentives, and financial constraints, as highlighted by Fronza & Gras-Velázquez in 2020.

[14] MOOC definition: https://www.mooc.org/

By participating in MOOCs, teachers can conveniently access valuable resources and expand their understanding of NBS even at a distance. One such example can be found in the MOOC[15] “Exploring Nature-Based Solutions in Your Classroom" by NBS EduWORLD, focused on NBS concepts, methodologies, practical implementation strategies, as well as guidance for creating an NBS LS, and enabling peer-review and exchange of best practices. By incorporating hands-on activities, case studies, and collaborative learning experiences, this MOOC offers a flexible, freely accessible, and self-paced learning environment for educators to learn about NBS and/or implement the topic in their lessons.

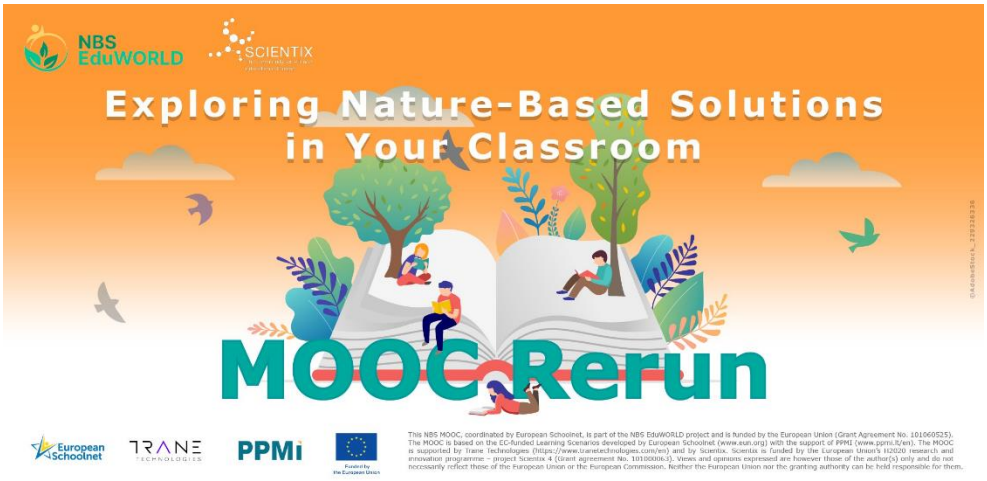

Figure 5: Exploring Nature-Based Solutions in Your Classroom MOOC – NBS EduWORLD

Some tips to make the most of following a MOOC to deepen your understanding and equip yourself with the necessary skills to effectively teach NBS can be found in **Box 3** below.

Box 3: How to benefit from a MOOC (1)

- **Define your learning objectives** before starting the MOOC. What aspects of NBS do you want to understand or master? Clear goals will help you stay focused and motivated throughout the course.
- MOOCs offer flexibility, but it is crucial to **allocate dedicated time** for learning. Create a routine that suits your schedule and stick to it.
- **Participate** in discussion forums, engage with fellow learners, and ask questions. Actively engaging with the course material and community can deepen your understanding and provide additional perspectives. When in doubt – ask; you never know how much you can learn from your peers! Connecting with other teachers might also open doors for future collaborations for both you and your students.

[15] Exploring Nature-Based Solutions in Your Classroom MOOC (2023): https://www.europeanschoolnetacademy.eu/courses/course-v1:Scientix+NBS+2023/about

Box 4: How to benefit from a MOOC (2)

- MOOCs often provide **additional resources**, e.g., LS, quizzes, and audio-visual materials. Use these resources to reinforce key concepts, and you might also be able to adapt it for your students!
- **Seek feedback** from your peers. that can help you identify areas for improvement and refine your understanding of NBS concepts and pedagogical practices.
- Regularly **reflect** on what you have learned and consider how you can apply it to your classroom. MOOCs are, by nature, a source you can revisit to refresh your knowledge, or take inspiration from to use in your teaching practice.

5.3. NBS Competition

To mainstream the integration of complex topics, such as NBS, in the classroom, teachers' competitions serve as a great tool (Fronza & Gras-Velázquez's, 2020). There are many competitions or showcase events, where educators and students can both present their NBS projects and ideas. Teachers are encouraged, together with their students, to develop innovative visions to discover practical applications of NBS in solving environmental challenges. This is also a great way to find out how educators in other countries are teaching NBS, thus contributing to sharing best practices and collaboration.

Figure 6: Nature-Based Solutions in Educatiopn Competition – European Schoolnet

The STEM Discovery Campaign (SDC)[16] is an annual campaign organised by Scientix[17] from Februar[y] 1st until April [3]0th with the support of partner organisations that recognizes and rewards outstanding projects, highlighting best practices, and promoting further integration of Science, Technology, Engineering and Mathematics (STEM) and NBS in formal education. The **SDC** is

[16] STEM Discovery Campaign: http://www.eun.org/stem-discovery-campaign-2023
[17] Scientix, the community for science education in Europe: https://www.scientix.eu/

an opportunity for educators to enhance professional development, access valuable resources, and foster a vibrant NBS and STEM learning environment for your students.

In your classroom, you can organise challenges or exhibitions for students to share their work, learn from one another, and inspire others to adopt NBS approaches. In this way, students can showcase and reflect on their own learning experiences, while also engaging their peers, families and even the wider community.

Box 5: How to make the most of joining the SDC

- **Visit the Scientix website*** ** or SDC **app**** ** and explore the resources and activities.
- The campaign often hosts **webinars and workshops** led by experts in NBS and STEM education. Participate in these events to gain valuable insights, learn new teaching strategies, and adapt them to your classroom needs.
- **Connect with other educators** in the campaign. Share ideas, experiences, and resources with each other. Collaborative projects and discussions can enrich your teaching practice and provide new perspectives.
- Use the campaign as an opportunity to **organize NBS events or activities** in your school. Why not plan a science fair, a NBS workshop, or nature-themed days? Involve students, parents, and the wider community for more impact.
- Encourage your students to **participate in challenges or competitions** part of the campaign. These challenges can inspire creativity, problem-solving skills, and teamwork. Provide guidance and support to students throughout the process.
- If you develop innovative NBS activities or lessons as part of the campaign or one of its competitions, e.g. NBS competition[1] organised by NBS EduWORLD, **share your experiences** through blogs, social media, or the Scientix online community.
- **Keep an eye on the latest updates** related to the campaign, e.g., by subscribing to the Scientix newsletter, following social media channels, and regularly checking the campaign website or app for new resources and opportunities.

*** Scientix website: https://www.scientix.eu/home

**** SDC app: https://www.scientix.eu/events/campaigns/sdc23/download

5.4. Workshops

Attending online or in-person workshops for teachers can be highly valuable in figuring out how to integrate NBS concepts into your classroom and where to start. Usually, workshops around the topic of NBS integrate some of the following elements into their programmes (**Box 6**).

Box 6: Tips for creating an NBS workshop

- **Understanding NBS**, including their principles, benefits, and applications. This will help you grasp the importance of NBS in addressing environmental challenges and promoting sustainability.
- Facilitating the **sharing of knowledge and experiences**. You can learn from other teachers about successful NBS projects, case studies, and best practices, fostering a collaborative learning environment.
- In the workshops, you can also explore different **pedagogical approaches**, (such as, outdoor learning) teaching methods, and resources to effectively incorporate NBS into your curriculum.
- You can **identify opportunities to incorporate NBS principles** across subjects and learn how other educators are collaborating (for example, how teachers are engaging the wider community or how a school is greenifying their playground).
- Usually workshops include many **hands-on activities,** where you can engage in NBS-related tasks and role-play situations. These enable you to envision how to translate these experiences into your lessons.
- Some workshops could even help you develop your **own NBS-focused LSs** and activities. You can learn how to design engaging lessons that highlight the importance of ecosystems, biodiversity, sustainable practices, and nature conservation or even just feel inspired about a topic for one of your lessons.

5.5. School Label Recognition

A WSA is needed to integrate sustainable practices and NBS principles into a school's culture and curriculum. To support this approach, during its second year, NBS EduWORLD will develop a NBS school recognition pathway in collaboration with the STEM School Label (SSL) initiative under Scientix[18], implementing a recognition for schools to signify the school's commitment to sustainability and the successful integration of NBS into its operations, curriculum, and campus. To be recognised as an NBS school, a school would need to meet specific standards, aimed at encouraging continuous improvement in NBS implementation.

The NBS school recognition will also encourage collaboration between different subject areas, fostering interdisciplinary learning and highlighting the interconnectedness of NBS with various topics. It will also foster partnerships with the wider community, including local environmental organizations, industry, or research institutions, to support NBS initiatives, provide expertise, and create authentic learning opportunities.

For educators, there are many advantages of working towards being recognised as a NBS school, e.g., **Box 7**.

[18] The Scientix STEM School Label: https://www.stemschoollabel.eu/home

Box 7: How to benefit from a NBS school certification

- Schools with a NBS certification will prove to have developed or updated their curriculum to incorporate key NBS principles and practices for the benefit of their students and staff. Your own best stories of implementation and examples of activities organised for your students or with your school will serve as examples for all schools in the SSL community.
- Accreditation may foster **collaboration** among teachers within and across schools. You can connect with colleagues who share an interest in NBS, exchange ideas, and learn together.
- As a teacher associated with a certified NBS school, you may enjoy a sense of pride and **recognition** for your efforts to incorporate sustainability into your teaching practice. Your commitment to enriching your school's curriculum with NBS activities, as well as helping your school achieve a NBS School certification, might in turn lead to more **training and professional development** opportunities for teachers with the support of your school administration.
- You also may encounter new opportunities for your **career growth**, such as presenting at conferences, participating in research projects, or contributing to curriculum development initiatives.

6. Introducing nature-based solutions in non-formal education

This chapter provides an overview of strategies for educators to integrate NBS in non-formal education settings. For example, activities to introduce NBS to children and youth following an inquiry-based learning approach in STEM clubs, youth centers and camps, the use of audio-visual materials created through participatory processes based on performing-arts, and the need for creative collaboration with organisations, such as football clubs, to transform their installations in resilient buildings.

6.1. STEM Clubs

STEM clubs are out-of-timetable sessions[19] that enrich and broaden the curriculum at school, or any regular attendance of young learners to STEM programmes developed by other organisations, such as sports clubs. For instance, more and more football clubs are implementing STEM into their foundation. The European Football for Development Network (EFDN)[20] which has created a network of football clubs across Europe, created the STEM Football & Education Programme to promote STEM education among youngsters[21]. Through

[19] STEM Clubs definition: https://www.stem.org.uk/secondary/enrichment/stem-clubs
[20] The European Football for Development Network (EFDN): https://www.efdn.org/
[21] EFDN STEM Football & Education Programme: https://www.efdn.org/blog/project/efdn-stem-education-programme/

this programme, EFDN aims to use the power of football to keep children engaged and committed to learning by developing a programme for education about STEM through football activities in primary and secondary education.

Sports can create an inclusive environment that benefits children in various ways. For example, Žnidarec Čučković argues in the “Good practice handbook for the sports movements" (2018) that sports offer possibilities of new knowledge, including skills and competences that will transfer to everyday life, such as social competences that include gender equality, cultural pluralism, and religious tolerance. These activities might lead to social change. Additionally, when teaching children and youngsters through their favourite sports, they can find extra motivation and enjoy a fun learning experience. This philosophy of using sports as a tool is defined as Education Through Sport (ETS)[22], and it has been implemented in European projects, e.g., Soring for Health[23]. Moreover, sports organizations can play a significant role in using sports as tool for fostering positive development in children. In this context, STEM clubs provide an excellent platform for introducing NBS concepts to children and youth, e.g. some football clubs have their own garden and host regular visits, so young learners can take care of it.

Box 8: Tips on combining STEM clubs and NBS

- As an educator working for/with a sports organisation, you can peak the learners’ interest in the topic by designing **multidisciplinary activities that foster inquiry-based learning**, where participants can explore, investigate, and problem-solve using key NBS principles and STEM knowledge. You could **conduct experiments** related to ecological restoration, energy efficiency, or sustainable agriculture, to encourage critical thinking, creativity, and collaboration as learners explore the scientific and technological aspects of NBS.
- Conduct **workshops and training sessions** to provide learners with the necessary knowledge and skills to understand and implement NBS. These sessions can cover topics, such as sustainable land and water management, green infrastructure, and ecosystem services, among other. Facilitate interactive discussions, practical exercises and demonstrations to enhance understanding and application of NBS principles.

6.2. Audio-visual materials

Utilize the power of audio-visual materials to engage and educate learners about NBS. Encourage children and youth to **create their own audio-visual materials**, such as short films, documentaries, or animations to highlight environmental problems caused by humans, and their solution through NBS concepts. Enable them to participate in the entire process, from scripting and filming to editing and sharing their creations. This **participatory approach** empowers

[22] Education Through Sport: https://sportlearning.eu/education-through-sport/
[23] https://www.feyenoord.nl/maatschappelijk/projecten/onderwijs/schoolsport-plus

participants to express their understanding of NBS through the performing arts, effectively conveying their messages to wider audiences.

These **audio-visual materials can be used in every setting**, as an introduction to the topic of NBS in the classroom, as an opportunity for children and the youth to reflect and discuss during non-formal activities, or as a topic of reflection in informal settings. By providing a unique look at the latest science concepts and trends in an understandable and fun way, taking to the stage, radio and television for creative performance art appearances, writing non-scientific books on science, or holding performance-art-led training workshops. organisations such as The Big Van Theory (TBVT)[24], can promote scientific culture, STEM vocations and NBS, with special dedication to (female) scientific vocations and in areas at greater risk of social exclusion.

6.3. Outdoor learning

Organize **outdoor expeditions and field trips** that immerse participants in natural environments to enable firsthand interactions with ecosystems, fostering a deep appreciation for nature and its potential in addressing environmental challenges. During these trips, incorporate guided discussions and hands-on activities to introduce NBS concepts for problem-solving of environmental issues, such as the role of wetlands in water purification or the importance of biodiversity in ecosystem resilience, etc. Encourage young learners to reflect on their experiences and discuss potential NBS applications in their local communities. These outdoor expeditions could be documented by recording videos of the students, or of the natural environment. If you record only the sound, you can use this audio later in class to help recollect their own emotions during the visit and solidify their bond with nature.

6.4. Organisations

Expand your network by collaborating with non-formal organizations, such as football clubs, to integrate NBS in sports activities, and benefit both their knowledge and well-being. Work with these organizations to **raise awareness** about sustainability among the learners, and explore opportunities to **transform school facilities or buildings into resilient ones,** following the examples of actions taken by these clubs. Together, you could discuss the benefits of rainwater harvesting through NBS, how to improve green infrastructure in and around stadiums while keeping in mind biodiversity, what benefits sustainable facilities and buildings will bring to our school, sports or living environment, etc. For example, EFDN aims to host regular STEM conferences, such as the one held in Glasgow in 2023[25], to use the power of football to foster educational opportunities for children and create a positive impact in the club's network of football clubs and communities.

Engage youth in planning and implementing these initiatives, showcasing the integration of NBS principles with sports and community development. In this regard, the WSA could be transformed into a "whole-organisation approach", where community involvement is key to integrate NBS education.

[24] The Big Van Theory (TBVT): https://www.bigvanciencia.com/eng/big-van-scientists-on-wheels
[25] EFDN STEM Conference in Glasgow: https://www.efdn.org/blog/news/recap-efdn-stem-conference-in-glasgow/

Collaboration with industry is key to making your students acquainted with NBS careers. Green jobs are “growing more quickly than other jobs globally”, according to a 2021 report on Global Guidance for Education on Green Jobs, published by United Nations Environment Programme. NBS development, implementation and advocacy require a new workforce, and offer fresh opportunities for future professionals. For instance, the Youth Offices: in Turkish universities, are run by young volunteers and focused on peer-to-peer training and learning.

When partnering with environmental organizations, you can facilitate **collaborative projects** with children and youth. These projects can involve hands-on activities like habitat restoration, urban greening initiatives, or citizen science projects. By working together, participants gain exposure to NBS implementation in real-world contexts and develop a sense of ownership and responsibility for environmental issues. Collaboration with experts and organizations also provides opportunities for mentorship and knowledge-sharing.

6.5. Youth Centers and Youth Clubs

By working with youth centers and youth clubs, as an educator you can bring the topic of NBS to a larger and more diverse group of learners, in terms of age, social status, origin, and other key demographic markers. For instance, in Türkiye, the Ministry of Youth and Sports (MoYS) has a key role in offering non-formal education opportunities for youth through Youth Centres, project grants and implementation of educational-cultural projects[26].

The 474 Youth Centers run all year long in the different regions of the country, often in underdeveloped areas, targeting mostly disadvantaged youth. The Youth Centers are run by volunteers - former members who became Youth Leaders and then professionals working for the MoYS. These Youth Centers offer a variety of activities and initiatives through the Youth Clubs. At the Science and Technology Clubs in particular, youth engage in innovative programs, competitions, and hands-on projects.

A STE(A)M approach offers many opportunities to creatively introduce the topic of NBS, while also making sure that links among different subjects are created. MoYS coordinates a variety of clubs within the Youth Centers, and NBS can also be integrated in clubs focused on other topics, such as the Art Club.

In **Box 9** and **Box 10** below, you can find some tips to get started with NBS in youth organisations.

[26] Youth Policy in Türkiye: https://national-policies.eacea.ec.europa.eu/youthwiki/chapters/turkey/overview

Box 9: Tips for introducing NBS to Youth organisations (1)

- **Raise awareness**: Begin by introducing the concept of NBS to the members of the clubs or centers. Explain the importance of NBS in addressing environmental challenges and promoting sustainability. To introduce the topic, you could show audio-visual material to support the experience and as an invitation to discuss, ask questions and encourage youngsters to elaborate on their thoughts and feelings on the topic.
- **Discuss relevance**: Engage your audience in a discussion about how NBS intersects with science and technology or other subjects. Highlight the role of innovation, engineering, creativity and scientific principles in developing nature-inspired solutions for environmental problems.
- **Explore NBS examples**: Share real-life examples of NBS projects and initiatives. Discuss how NBS integrates STEM, and environmental stewardship. Explore case studies demonstrating NBS effectiveness in various contexts.
- **NBS projects**: Encourage your audience to propose and develop their own NBS projects. Provide guidance and resources for them to design and plan projects that address local environmental challenges using NBS principles. For example, they could create projects related to reforestation, sustainable water management, biodiversity conservation, or sustainable energy solutions, etc.

As an educator involved with youth organisations, there could also be opportunities to explore for collaboration with international or large-scale organisations for the advancing of youth engagement and further organisation of activities. For instance, UNICEF, in collaboration with the Türkiye Ministry of Environment, Urbanization and Climate Change, as well as civil society organizations and youth associations support the engagement of young people (including the Youth Climate Envoys[27]) in climate policy dialogue, which serves as a platform to involve the youth as climate ambassadors, in NBS awareness and actions. [28]

Another example can be found in projects focusing on green skills development through the vocational education system, e.g., the Green Skills[29] project, which could inspire your work with youth in youth organisations.

[27] Young Climate Envoys in Türkiye: https://turkiye.un.org/en/173104-turkey%E2%80%99s-young-climate-envoys-are-forefront-tackling-climate-change
[28] Collaboration between the government of Türkiye and UNICEF: https://www.unicef.org/turkiye/en/copy-young-people-and-climate-action
[29] Green Skills project: https://epale.ec.europa.eu/sites/default/files/io3-comparative-report-about-the-curricula-for-construction-workers-on-green-skillseng_1.pdf

Box 10: Tips for introducing NBS to Youth organisations (2)

- **Hands-on experiments**: Organize hands-on experiments and demonstrations that illustrate NBS concepts. For instance, at STE(A)M clubs, members could conduct experiments, where they study natural systems or biodiversity, and develop solutions inspired by nature.
- **Plan field trips to expose club members to natural environments**. Encourage them to observe and analyse natural systems, biodiversity, and ecosystem services. During these outings, facilitate discussions on how NBS can be applied to protect and restore these ecosystems.
- **Guest speakers**: Invite guest speakers from environmental organizations, research institutions, or NBS practitioners to share their expertise and experiences, providing insights into the science behind NBS. Discuss ongoing projects that the club members can get involved in. Furthermore, the speakers could offer insights into their daily jobs, inspiring the future generation of scientists. The talks could be organised either in person or through an online meeting tool, such as Microsoft Teams, Google Meet or Zoom, for maximum convenience for the guest speakers as well.
- **Collaborative projects**: Encourage collaboration between science and technology clubs and other clubs or organizations that focus on environmental issues. This could include joint projects, competitions, or workshops that combine scientific and technological expertise with NBS principles.
- **Public awareness events**: Organize events, e.g., exhibitions, mini-competitions, or talks where youth club or centre members can showcase their NBS projects to the community. This provides an opportunity for them to communicate the importance of NBS and inspire others to adopt sustainable practices.

You can find examples for these tips for introducing NBS to Youth organisations, in **Annex 2**

6.6. Youth Camps

The summer months provide more opportunities for exchanges with students in a more relaxed, non-formal environment through the youth camps taking place before the start of the next school year. For example, at the Youth Camps of MoYS in Türkiye organised seasonally, young people at the Sea and Forest Camps can create meaningful experiences that connect them to nature and inspire them to become NBS advocates. Camps are ideal moments to design activities and experiences to foster a sense of responsibility, promote sustainable/NBS behaviours in a more relaxing environment, and empower young individuals to contribute to the preservation and restoration of natural ecosystems through NBS.

Box 11: Tips for introducing NBS to Youth Camps

- Begin the camp's activities by **introducing the concept of NBS** (e.g., how NBS addresses environmental challenges and promotes sustainability). If the camp takes place in the forest, you could discuss forest fires or protecting old growth trees and primary forests; if it is by the sea or near a river, the focus could be water management, biodiversity, etc.
- Organize **activities that raise awareness** about the importance of nature and ecosystems. Conduct sessions on biodiversity conservation, sustainable land, and water management, and the role of NBS in addressing these issues.
- Plan **walks in nature,** where the camp is located. During these excursions, highlight the ecosystems, flora, and fauna present in the surroundings. Encourage participants to observe and analyse the environment, emphasizing the potential for NBS applications in preserving these ecosystems.
- Engage participants in **hands-on projects** that apply NBS principles. For example, they could work on projects related to ecological restoration, such as reforestation efforts, beach clean-ups, etc. Allow participants to actively contribute to the implementation of NBS solutions in the camp environment.
- Organize **workshops**. Invite NBS experts or organizations on sustainable agriculture, green infrastructure, renewable energy, etc. Encourage participants to develop and present their own NBS project ideas. If camps have large numbers of participants, use that to your advantage – assign several groups and provide opportunities to hear many opinions and ideas, perhaps even organise a mini competition.
- Create **problem-solving challenges** for youngsters to apply NBS concepts, e.g., developing innovative solutions to reduce pollution in coastal areas or mitigating climate change impact on forests. Encourage teamwork and critical thinking skills during these challenges.
- **Partner with local environmental organizations or experts** working on NBS projects, allowing participants to engage in collaborative projects with them. This provides hands-on experiences and a deeper understanding of the real-world applications of NBS.
- Allocate **time to reflect on** NBS-related **experiences and learnings**. Facilitate group discussions, role-play or storytelling sessions where participants can share their insights, project outcomes, and the impact of their actions. Encourage thinking about how to continue promoting NBS in their daily lives.

You can find examples for these tips for introducing NBS to Youth Camps in **Annex 2.**

7. Introducing nature-based solutions in informal education

This chapter provides an overview of strategies for integrating NBS in informal education settings. The Council of Europe establishes that informal learning "takes place outside schools and colleges and arises from the learner's involvement in activities that are not undertaken with a learning purpose in mind"[30]. Therefore, informal education is part of our daily lives, how a child interacts with their environment, including family, friends, the wider community, as well as with nature. Much of a child's informal learning happens naturally when participating in the family life.

Grønhøj, & Thøgersen highlighted the importance of parenting styles in shaping young people's attitudes and behaviours towards sustainability in their study conducted in 2017. In this regard, teachers could encourage families to support children and youth with learning about NBS naturally, by including some of the following tips in their routines and family life (**Box 12**).

Box 12: Tips for introducing NBS through informal education

- **Spending time together in nature**: Going on a walk or a picnic to the forest, grasslands, coats, etc. and enjoying the local natural areas, observing and learning about the local ecosystems, biodiversity, and the benefits they provide.
- **Joining local initiatives,** such as communal gardening or the creation of green corridors, where neighbours can collectively plant, tend to, and harvest fruits, vegetables, or native plants. These spaces are also ideal to create habitats for wildlife, such as birdhouses, insect hotels, or butterfly gardens.
- **Considering environmental factors:** Families, friends, neighbours and other citizens could explore with the youngsters why a certain type of plan or tree species could or could not be planted in a particular area, keeping in mind the importance of climate, soil, seasons, and biodiversity in that area.
- **Visit science centers,** where you can learn together about NBS and meet experts in particular NBS fields.

You can find examples of these tips for introducing NBS through informal education in **Annex 3.**

Inter-generational community involvement is important for NBS stewardship, such as engagement of people of all ages through community volunteering activities The Conservation

[30] https://www.coe.int/en/web/lang-migrants/formal-non-formal-and-informal-learning

Volunteers (TCV)[31] and Groundwork[32] are examples of what has been done in this regard in the Unted Kingdom, and Natuurpunt[33] is another important volunteer-led initiative in Belgium.

Moreover, as a role model for young people and children, through informal education adults could help further solidify the results achieved through formal and non-formal education methods. As mentioned by the European Commission (2022), “enhancing sustainability skills through informal learning would greatly contribute to the success of comprehensive school approaches and further support NBS initiatives within educational institutions”.

8. Evaluation of nature-based solutions activities

This chapter explores how to evaluate the activities introducing NBS in formal, non-formal and informal education settings, including the development of evaluation frameworks (based on GreenComp), data collection methods, and analysis techniques.

Understanding the relevance of evaluating NBS activities is crucial for educators to ensure the right implementation of the topic, its relevance to learners, and to improve the teaching practise. By assessing the learning progress, educators can identify the strengths and weaknesses of the activities and approaches, allowing for informed improvements and adjustments to enhance the learning experience. The evaluation of NBS activities should encompass various aspects, such as the impact on learners' engagement, knowledge acquisition, problem-solving abilities, and attitudes towards nature and sustainability.

Formal: NBS activities may require different evaluation approaches, compared to traditional educational methods used at school. As NBS often involve experiential and immersive learning in natural settings, the evaluation must consider the unique outcomes and experiences that learners gain from direct engagement with nature. Therefore, educators need to adopt innovative evaluation techniques that capture not only academic progress, but also the holistic benefits of nature-based learning, such as increased environmental awareness, emotional well-being, and a sense of connection to the natural world. Some of the techniques you could implement when assessing NBS topics in your classroom, are presented in **Box 13** below.

To define your learning goals and integrate them in your curriculum, you can also have a look at the GreenComp Framework[34], which will help you evaluate your students’ progress in sustainability knowledge, competences, and attitudes.

[31] The Conservation Volunteers (TCV): https://www.tcv.org.uk/
[32] Groundwork: https://www.groundwork.org.uk/
[33] Case Study developed by Oppla showcasing the collaboration with Natuurpunt in Belgium: https://oppla.eu/casestudy/19380
[34]The GreenComp Framework: https://green-comp.eu/wp-content/uploads/2022/02/jrc128040_greencomp_f2.pdf

Box 13: Tips for assessing NBS topics in the classroom

- Nature journals to stimulate your students to document their experiences and observations during outdoor activities. Depending on the age group you teach, learners can keep a record of their reflections by writing, sketching, drawing, or collecting objects. These journals can be created in either a physical (e.g., notebook) or digital format.
- **Self-assessments** and **peer assessments** to evaluate their progress in different projects, such as designing a school garden or identifying issues and their possible solutions in the natural spaces around school. This approach promotes student ownership and metacognition skills. To support your students, you can create personalised rubrics and discuss these with them before the activities.
- Your students can perform **audits of the school's** NBS, for example by measuring the temperature in different parts of the building and playing areas, which helps students understand the real-world implications of NBS.
- Organise **role-play opportunities** for students to create and perform skits or role-playing scenarios that illustrate NBS. This creative evaluation method assesses their understanding of complex sustainability issues and their ability to communicate and reach solutions effectively.
- Involving students in **citizen science** initiatives, such as collecting data on local wildlife or environmental changes. This provides authentic learning experiences and helps evaluate their contribution to scientific understanding. Moreover, this **data collection** usually involves the use of technology and can offer data-driven insights for evaluation and improvement.

Non-formal: Promote reflection and action planning among students to reinforce their learning and encourage behaviour change. Facilitate discussions on the potential impact of NBS on their communities and personal lives. Encourage participants to develop action plans that incorporate NBS principles, e.g., protecting old-growth trees, creating green corridors or ensuring water retention to prevent deforestation in their schools and neighbourhoods, etc. In the case of youth centers or clubs, you should regularly assess the progress and impact of the NBS projects undertaken by the members. You can also promote citizen science projects and facilitate the use of participatory monitoring tools.

Encourage reflection on the lessons learned, successes, and challenges faced. Use this feedback to improve future NBS activities within the science and technology clubs. Regarding youth summer camps, assess the impact of the NBS activities conducted by gathering feedback from participants to evaluate their understanding, engagement, and interest in NBS. Consider follow-up initiatives, such as forming a NBS youth network or providing resources for participants to continue their exploration of NBS beyond the youth camps, centres or clubs.

Informal: While no specific evaluation mechanism is needed in informal learning, teachers could encourage families to support their children's learning process by helping them reflect on what they experience or feel, through a casual conversation. For example, during a walk together in a natural environment, questions can support children's thinking process and bring joy in discussing about the surroundings. Questions, such as "What sound(s) you can hear?" for a 5-year-old, or "What would happen if there were no trees in this area?" for a 14-year-old can spark their curiosity and engagement.

9. Challenges and opportunities

This chapter describes the concrete challenges and opportunities in integrating NBS in education activities for stakeholders with little to no knowledge of NBS, with examples based on the work of the Knowledge Stream and the policy brief authored by Utkarsh in 2023 on unlocking the potential of transformative learning for sustainability. It will also map opportunities for educational synergies between the different focus points of NBS EduWORLD. This chapter will help formal, non-formal and informal educators to evaluate their approach in integrating NBS in their settings.

Introducing the topic of NBS in different settings can bring about several challenges for educators, such as:

- **Curriculum integration**: Integrating NBS into existing formal education curricula may pose challenges, due to the need for aligning with established learning objectives and standards. Furthermore, the lack of flexibility and time in some settings makes the collaboration needed between subjects and educators very difficult. Support by school authorities and policy makers is key to successfully integrating the topic of NBS in schools.

- **Lack of teacher training**: Many educators may need additional training and support to effectively teach about NBS, as NBS is still a relatively new topic for most educators. Currently, there is a lack of training opportunities in NBS education both for teachers and teacher trainers.

- **Resource availability**: Adequate resources, such as literature adapted to the various languages, age groups, teaching materials, and hands-on activities related to NBS are limited or unavailable, making it difficult to incorporate the topic into education settings.

- **Lack of awareness**: Many educators, institutions and families may have limited awareness or understanding of NBS, which could make it challenging to generate interest or support for the topic.

- **Limited access to outdoor learning spaces**: This challenge can contribute to a disconnection between students and the natural world and may reinforce the perception that nature is separate from human activities and undermine the understanding of our dependence on natural systems. By having access to green spaces in or around educational settings, students can develop a deeper appreciation and respect for nature, leading to a more meaningful exploration of NBS concepts, outdoor opportunities, and sensory engagement.

Despite these challenges, there are many opportunities for educators when integrating NBS in their activities or lessons, which are summarised in the following:

- **Interdisciplinary learning**: NBS provides an opportunity for educators to integrate multiple topics or subjects, fostering interdisciplinary learning and critical thinking skills in children and youth from an early age. For educators, this is also a chance for collaboration and professional development with their peers.
- **Experiential learning**: NBS evokes creativity and can be taught through experiential and hands-on approaches, such as field trips, outdoor activities, and community engagement, which can enhance children's and youth's understanding and connection to nature. For educators, this is a chance to integrate new pedagogical approaches into their teaching.
- **Environmental empowerment**: Teaching about NBS can promote sustainable practices among students, empowering them to contribute to positive environmental change. As an educator, teaching about NBS will also give you the knowledge, skills and attitudes to lead a sustainable life as a citizen.
- **Community engagement**: The topic of NBS involves collaboration with local communities, which presents an opportunity to engage youth in real-world problem-solving and community-based initiatives. At the same time, schools, and teachers in particular, benefit from these partnerships, as they offer opportunities to exchange knowledge and expertise.
- **Innovation and creativity**: NBS encourages innovative thinking, as it involves finding nature-inspired solutions to complex environmental challenges. This can stimulate creativity and entrepreneurship among students, but also provide opportunities for educators to expand their teaching methods.
- **Greenifying learning environments**: To advocate for the integration of green or natural spaces in and around educational settings, whether through school gardens, green campuses, nearby parks, or community partnerships. These spaces provide invaluable opportunities for teaching and learning about NBS, fostering environmental awareness, and nurturing a sense of ownership among children and the youth.

To address these challenges and maximize the opportunities, it is essential to involve all educational stakeholders and NBS experts in the process. Teachers require professional development opportunities, access to relevant, engaging and easy-to-adapt educational resources, and opportunities to connect with environmental institutions to overcome challenges and successfully integrate NBS into different education settings.

10. Conclusion

This chapter serves as a summary and reflection on the key findings and recommendations discussed in the guidelines.

Integrating NBS in diverse education settings can provide a unique and engaging learning experience for students while fostering a deeper understanding and appreciation of the environment. Throughout the guidelines, there is a series of recommendations to help you get acquainted with the topic of NBS, including some examples of activities and best practices you could adapt to your students' needs, namely:

- **Familiarize yourself and your students with** the concept of **NBS,** gain knowledge about different NBS approaches, including green infrastructure, ecosystem restoration, sustainable land management, etc.
- **Evaluate** the existing teaching resources, facilities, and natural spaces available in **your education setting**. Identify any opportunities to incorporate NBS into your learning programme, or even the chances to greenify or protect your setting and/or surroundings.
- **Develop hands-on educational activities and projects** that integrate NBS concepts. You can start by using these guidelines and adapting the materials according to the characteristics of your setting, age group and interests of the learners.
- **Support a WSA**, for example by joining the NBS School Label you will benefit from valuable resources, networking opportunities, and professional recognition.
- **Collaborate** with other stakeholders (schools, clubs, youth camps and centers, industry, families, etc) to benefit from each other's expertise and resources, enhance the learning experiences of the children and youth, and provide real-world examples of NBS in action.

Remember to **foster a sense of curiosity, wonder, and connection to nature** throughout the learning process. By integrating NBS into your education setting, you can inspire the next generation to become environmentally conscious and actively contribute to a sustainable future for all.

11. Annex

Annex 1. Examples of resources for integrating NBS in formal settings[35]

1.1. Example for Box 1 "Tips for working with a Learning Scenario (1)"

Link to Learning Scenario: https://www.scientix.eu/resources/details?resourceId=129912

Title of activity: Students create their biodomes

Activity duration: 60 minutes

Description: Students contact the City Municipality to receive a small amount of fresh soil to refresh their existing soil.

Students learn about the life cycle of a plant and watch 2 short videos:

- Plant Life Cycle For Kids - Plant Life Cycle Stages-SmartClass4Kids[36]
- Biodomes Engineering Design Project Lessons 2-6[37]

Then the teacher supplies students with plastic bottles, small pebbles, water, thread, scissors, soil for planting, seeds of carrot, marigolds, celosia and Passiflora.

Students create their biodomes, which develop their roots after a week.

Note: the seeds and root development may vary depending on the soil.

1.2. Example for Box 2 "Tips for working with a Learning Scenario (2)"

Link to Learning Scenario: https://www.scientix.eu/resources/details?resourceId=129910

Title of activity: Smart building 3D/2Ddesign

Activity duration: 120 minutes

Description: Students, in teams, create a 3D design of a smart building based on their research and following sustainable development concepts, using an online 3D design tool (such as Tinkercad[38], Vectary[39], SketchUp[40], etc.).

[35] This list is non-exhaustive.
[36] https://smartclass4kids.com/science/plants-facts/plant-life-cycle/
[37] https://youtu.be/L_UuuP3aW2E
[38] https://www.tinkercad.com/
[39] https://www.vectary.com/
[40] https://www.sketchup.com/

Younger students can create a simple design using an online tool, Paint 3D or drawing on a piece of paper.

Older students use more advanced options for modelling their creation, mainly using an online tool.

They then show their designs in front of the class.

A peer review session follows – exchange of ideas for improving design solutions before making a building brick prototype.

1.3. General Resources for Teachers

- **NBS EduWORLD**: repository on NBS in education resources, NBS projects and organisations
- **Exploring Nature-Based Solutions in Your Classroom MOOC (2023)**: Massive Open Online Course (MOOC) to learn how to integrate NBS into your classroom
- **Scientix**: NBS learning scenarios, chats with NBS experts, career sheets, podcast, and video interviews with NBS experts
- **Greenopolis:** creative exercises to explore NBS
- **Formation en ligne à Vigie-Nature Ecole**: Participatory science course, addressing teachers and educators. It presents the principle of participatory science and how to implement it in classes.

1.4. Games

- **Think Nature NBS game**: simulation game where students are the mayors of Greentown and are asked to address environmental challenges using NBS
- **Urban Nature Explorer:** students need to design an NBS plan for an urban area considering budget, impact, and stakeholder satisfaction

1.5. Related resources

- **Nature Lab**: created by the Nature Conservancy + 550 scientists to show students how nature works
- **City of Trees**: created by the Clearing House H2020 project to learn about the importance of trees
- **Oasis School Yard**: Guidelines to transform schoolyards to encourage activities such as playing, learning, discovering and socializing not only during school and extracurricular time but also during the periods with open access to the local residents of all ages

1.6. Portals

- **Oppla:** EU Repository of Nature-Based Solutions
- **NetworkNature**
- **Think Nature**
- **Urban Nature Atlas:** 1,000+ NBS case studies across Europe

1.7. Publications

- **Nature-based solutions – Publications Office of the EU**

1.8. Other Resources to Integrate Environmental Topics in your Lessons

- **GreenComp: the European sustainability competence framework**
- **Education for Climate Coalition:** platform to connect with other teacher and initiatives, as well as find learning materials

Annex 2. Examples of resources for integrating NBS in non-formal settings[41]

2.1. Example for Box 9 "Tips for introducing NBS to Youth organisations (1)":

Link to Learning Scenario: https://www.scientix.eu/resources/details?resourceId=129919

Title of activity: Noise reduction scavenger hunt outside the classroom (Technology Education)

Activity duration: 120 minutes

Description: In this outdoor game, students would be divided into teams and given a list of noise sources commonly found in their school or community, such as air conditioners, traffic, or construction. The teams would then be tasked with finding and documenting these noise sources using the app for noise evaluation used before (GIS app).

Once the teams have documented all the noise sources on their list, they would then be challenged to come up with creative solutions to reduce the noise, such as planting trees or installing sound barriers. The team with the most creative and effective solutions would win the scavenger hunt.

Students are expected to submit a written report outlining their sound measurement data analysis and design proposal recommendations.

2.2. Example for Box 10 "Tips for introducing NBS to Youth organisations (2)":

Link to Learning Scenario: https://www.scientix.eu/resources/details?resourceId=129913

Title of activity: Meet the expert! (a marine scientist visits the school)

Activity duration: 45 minutes

Description: An expert from an organization that preserves aquatic habitats or a marine scientist is invited to the school (e.g., the Greek NGO "iSea"[42], an environmental organization with the goal to preserve the aquatic habitats and responsible for the *#Zeroplastic* school program).

If this is not possible, students will explore online resources about the protection of aquatic ecosystems, for example:

- iSea informative materials[43]
- The handbook for management and restoration of aquatic ecosystems in river and lake basins (International Network of Basin Organizations - INBO)[44].

[41] This list is non-exhaustive.
[42] https://isea.com.gr/?lang=en
[43] https://isea.com.gr/?lang=en
[44] https://www.gwp.org/globalassets/global/toolbox/references/aquatic-ecosystems.pdf

Students learn about aquatic ecosystems, aquatic litter, and ways to reduce microplastics in our daily life.

2.3. Example for Box 11 “Tips for introducing NBS to Youth Camps”:

Link to Learning Scenario: https://www.scientix.eu/resources/details?resourceId=129911

Title of activity: Out-of-school activity

Activity duration: 100 minutes

Description: Students are encouraged to read the following articles about climate change and disaster risk analytics:

- Climate change impacts in Europe
- Disaster Risk Analytics

An outdoor activity will take place to examine a local area that has been affected by climate change.

The effects of climate change on local Cultural Heritage will be analysed through a comparison between past and present (extreme weather conditions, natural disasters etc.). Teachers will raise awareness among students about the importance of protecting the legacy for future generations.

Students are given one hour to take photos and videos of the area they are exploring to try and understand what is being done and could be done to preserve it.

When they go back to the classroom, students are asked to write down either on a notebook or on online tools, such as Padlet or Miro: what do we need to do to pass on a liveable world and to preserve our heritage for future generations?

2.4. General Resources for Educators:

- **Ecobalade**: A website with interpretation trails, educational trails or discovery trails for heritage interpretation, aiming to promote ecotourism.
- **Nature-based Solutions Education Flipbook**: A user-friendly NBS education resource with a major focus on place-based non-formal education.
- **REGREEN podcasts**: podcasts that explore the concept of nature-based solutions, and how these solutions can help accelerate the transition towards equitable, green, and healthy cities in Europe and in China.

2.5. Games:

- **Photovoice**: “participatory photography” that uses photos to make people aware of a reality or topic, as nature-based solutions or inclusive urban regeneration.

Annex 3. Examples of resources for integrating NBS in informal settings[45]

3.1. Example for Box 12 “Tips for introducing NBS through informal education”:

Link to Learning Scenario: https://www.scientix.eu/resources/details?resourceId=129907

Title of activity: Preparing a real smart garden in theschool yard

Activity duration: 240 minutes

Description: Students prepare a plan for a smart garden to create in their schoolyard. They make a field study to find the perfect spot to place it in their schoolyard.

They search the Internet, specifically in Oppla.eu[46] and Naturvation.eu[47], to find ideas. They look for herbs and vegetables to be planted. They do research about garden designs and about the sensors to be incorporated for automated humidity. They are also encouraged to produce compost using food waste.

3.2. General Resources for Educators:

- **Groundwork**: Federation of charities mobilising practical community action on poverty and the environment across the UK.
- **The Conservation Volunteers**: Organisation bringing people together to create, improve and care for green spaces.

[45] This list is non-exhaustive.
[46] https://oppla.eu/
[47] https://naturvation.eu/

References

ALLEA (2020). A snapshot of Climate Change Education Initiatives in Europe: Some initial findings and implications for future Climate Change Education research. Lead authors: Cliona Murphy, Gabriela Martínez Sainz, Maija Aksela, Gerd Bergman, Michael Jones, Pierre Léna, David Wilgenbus. Berlin. DOI: 10.26356/climateeducation

Bianchi, G., Pisiotis, U., Cabrera Giraldez, M. (2022). GreenComp – The European sustainability competence framework. Bacigalupo, M., Punie, Y. (editors), EUR 30955 EN, Publications Office of the European Union, Luxembourg, ISBN 978-92-76-46485-3, doi:10.2760/13286, JRC128040

Bilgin, A. S., Molina Ascanio, M., Milanovic, I., Kirsch, M., Beernaert, Y., Sotiriou, S., Gregori Montaner, A., Cornakov, S., Velner, G., Axisa, J. , Wellens, T., Muscat, M., Vaidelis, G., Messaritou, M., Goździk, A., Castilla Mora, L., Ivanova, I., Dariou, E., Yuste, A., Preda, E., Quarta, B., B. Domínguez, X., Kesting, F., Katikas, L., Mitic-Radulovic, A., Gras-Velazquez, A. (2022), STEM in the future: Transforming education for sustainability, Scientix Observatory, October, http://files.eun.org/scientix/Bilgin_et_al_2022_STEM_in_the_Future_Final-to-publish-2.pdf

Council of the European Union (2022). Proposal for a Council Recommendation on learning for environmental sustainability. https://data.consilium.europa.eu/doc/document/ST-9242-2022-INIT/en/pdf

European Commission, Directorate-General for Education, Youth, Sport and Culture (2022). Data collection and analysis of Erasmus+ projects – Focus on education for environmental sustainability: final report, Publications Office of the European Union, 2022, https://data.europa.eu/doi/10.2766/29038 European Commission, Directorate-General for Education, Youth, Sport and Culture. Input paper: A whole school approach to learning for environmental sustainability

European Commission, Directorate-General for Education, Youth, Sport and Culture, Tasiopoulou, E., Billon, N., Finlayson, A.et al., (2022). Education for environmental sustainability – Policies and approaches in European Union Member States: final report, Tasiopoulou, E.(editor), Billon, N.(editor), Finlayson, A.(editor), Siarova, H.(editor), Pribuišis, K.(editor), Gras-Velazquez, A.(editor), Mulvik, I.(editor), Bajorinaitė, M.(editor), Sabaliauskas, E.(editor), Fronza, V.(editor), Vežikauskaitė, J.(editor), Disterheft, A.(editor), Publications Office of the European Union, https://data.europa.eu/doi/10.2766/391

European Commission, Directorate-General for Education, Youth, Sport and Culture (2022). Learning for the Green Transition and Sustainable Development – Accompanying the proposal for a Council Recommendation on Learning for Environmental Sustainability, doi: 10.2766/02392

European Commission, Directorate-General for Education, Youth, Sport and Culture (2022). The green deal highlights the crucial role of education and training in empowering and engaging people for environmental sustainability and boosting the skills and competences needed for the green transition –, Publications Office of the European Union https://data.europa.eu/doi/10.2766/615529

European Commission, Directorate-General for Education, Youth, Sport and Culture (2022). Whole school approaches to sustainability – Key messages, Publications Office of the European Union, https://data.europa.eu/doi/10.2766/775485

European Commission, Directorate-General for Research and Innovation (2021). Evaluating the impact of nature-based solutions – A summary for policy makers, Publications Office, https://data.europa.eu/doi/10.2777/521937

European Commission (2015). Towards an EU Research and Innovation policy agenda for Nature-Based Solutions & Re-Naturing Cities. Office for Official Publication of the European Union, Luxembourg, https://ec.europa.eu/newsroom/horizon2020/document.cfm?doc_id=10195

Fronza, V. & Gras-Velazquez, A. (2020). Sustainability in formal Education: ways to integrate it now. Scientix Observatory, December 2020, DOI: https://doi.org/10.57568/iulres.v1i2.84

Grønhøj, Alice & Thøgersen, John. (2017). Why young people do things for the environment: The role of parenting for adolescents' motivation to engage in pro-environmental behaviour. Journal of Environmental Psychology. 54. 10.1016/j.jenvp.2017.09.005

Molina Ascanio. M., & Tasiopoulou. E. (2023). Outdoor Learning in ECEC using EdTech and the STE(A)M approach. Scientix Observatory, https://www.scientix.eu/documents/10137/121801/Molina_Ascanio_2023_ECEC_Outdoor_Technology_Final.pdf/240647f3-363b-a510-3754-f5e83637a6e2?t=1678963185658

Naumann, S., Burgos Cuevas, N., Davies, C., Bradley, S., Mahmoud. I.H., Arlati, A. (2023). Harnessing the power of collaboration for nature-based solutions: New ideas and insights for local decision-makers. Publications Office of the European Union, 2020, https://data.europa.eu/doi/10.2777/954370

UNEP (2021). Global Guidance for Education on Green Jobs Connecting Higher Education and Green Opportunities for Planetary Health

Utkarsh, S. (2023). Integrating Nature in Education: Unlocking the Potential of Transformative Learning for Sustainability

Wells, N.M., & Lekies, K.S. (2006). Nature and the Life Course: Pathways from Childhood Nature Experiences to Adult Environmentalism. Children Youth and Environments. 16(1), 1–24

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