eNaBlS

Education and NBS -
bending the curve for biodiversity

DELIVERABLE D2.1

Living Labs for Nature Based Solutions to Biodiversity Regeneration: An Educational Guide

Wageningen University and Research

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Document information

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Project overview

ENaBlS will set the basis of networking and collaboration to promote, embed and unfold Nature-based Solutions (NBS) concepts and approaches within universities and vocational schools, the professional sphere and society at large through transdisciplinary dialogue. ENaBlS envisions the creation of 7 Living Labs (DE, NL, FI, AT, LT, EL, CZ), incorporating all 'voices' and leaving no one behind. The goal is to enable society to bend the curve for biodiversity by mainstreaming both NBS and biodiversity in higher education and Technical and Vocational Education & Training (TVET). The ultimate objective is for ENaBlS to contribute more generally to i) the advancement of a Nature Positive society through the necessary transformative change of communities, business models and lifestyles, and, specifically, ii) put biodiversity and climate on the path to recovery responding to the objectives of the EU biodiversity strategy for 2030 and the EU climate adaptation strategy.

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Abbreviation	Description
D	Deliverable
NBS	Nature Based Solution
WP	Work Package

1   Introduction[1]

Welcome to the educational guide for Living Labs for Nature Based Solutions to biodiversity regeneration. This manual serves as a comprehensive guide for integrating nature based solutions (NBS) into the academic and operational frameworks of higher education institutions. As global environmental challenges intensify, the role of universities in fostering sustainable development and innovative solutions has never been more critical. NBSs, which leverage natural processes and ecosystems to address societal issues, offer a promising path toward resilience and sustainability. Higher and vocational education institutions are uniquely positioned to lead the way in the adoption and implementation of NBS. By incorporating Living Labs — real-world, experimental environments — into their campuses, universities can transform themselves into hubs of innovation and learning. These Living Labs provide an invaluable platform for interdisciplinary research, experiential learning, and community engagement, all centered around sustainable practices.

By embracing NBSs through Living Labs, higher education institutions can play a pivotal role in shaping a sustainable future. This manual is designed to support not only ENABLS educators, researchers, administrators, and students in their journey towards integrating sustainability into every aspect of campus life. Together, we can create vibrant, resilient communities that thrive in harmony with the natural world.

In this manual, you will find a detailed overview of the principles and benefits of NBSs, along with practical guidelines for setting up and managing Living Labs. We refer to various case studies that highlight successful implementations of NBS in (higher) education settings, offering insights and inspiration for your own initiatives. Additionally, the manual provides tools and resources to help you evaluate the impact of your projects and continuously improve their effectiveness. The following chapters set the basic understanding for our ENABLS Living Labs and give important hands-on knowledge gathered from already existing Living Labs, which we consider throughout the implementation of our seven ENABLS Living Labs. The framework seeks to provide answers to the following questions:

i)   What are the key characteristic of a Living Lab?
ii)   How can we identify, invite and actively involve Living Lab stakeholders from different sectors, generations and walks of life?
iii)   How can we create a learning community/ Community of Practice which mobilises different forms of learning and interacting?
iv)   How can we co-define a common NBS-related theme considering multiple perspectives?
v)   How can we brainstorm possible solutions and ways forward in addressing the topic?
vi)   How can we converge towards one possible solution and/or way forward to be operationalized and executed in practice?
vii)   How can we monitor and evaluate progress in terms of capacity-building and joint learning on the one hand and towards the development of a concrete NBS to the topic identified on the other?

The manual is structured as follows: first it explores the basic concept of Living Labs, its phases and participants. Than important educational concerns are discussed, such as practicalities in project management and pedagogical facilitation. The manual ends with a section on evaluation and monitoring, and provides tools for these purposes as well as the facilitation process of the Living Lab.

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[1] Note: some text has been created aided by AI after carefull prompting and probing and has been subsequently modified.

Thus, this document provides a general framework which we further develop for our seven regional Living Labs considering their specific conditions and stakeholders.

2   Living Labs: a lively way to address societal concerns

Living Labs have been effectively used to address a variety of societal issues. Many known examples are:

Urban Development: Creating smart, sustainable cities through innovative infrastructure and services.

Healthcare: Developing patient-centered health solutions and improving public health outcomes.

Environmental Sustainability: Promoting eco-friendly practices and technologies to combat climate change and environmental degradation.

Social Inclusion: Creating inclusive solutions that address inequalities and promote social cohesion.

While in principle, the ENABLS Living Labs can connect with all these issues, the main focus lies on finding NBS in responding to them while simultaneously enhancing biodiversity. Since these issues are highly interconnected and complex, they cannot be addressed from a single discipline or perspective. Instead, they require boundary crossing between sectors (water, soil, energy, nature, food, health & well-being), disciplines (sociology, philosophy, ethics, biology, chemistry, the arts & humanities) and functions (education, research, innovation, community engagement. Living Labs epitomize an integrative approach that includes many 'voices' and perspectives. Living Labs provide a safe space or learning environment where people from the world of education, research, civic society, governance and business jointly address an issue that they all consider important, but they may not have the same understanding of the issue or the same idea about how to resolve it. Living Labs provide a space where people can try things out, make mistakes and through a process of co-learning, test innovative ideas.

2.1   What are important elements of a Living Lab?

Living Labs play a crucial role in addressing complex societal issues through their innovative, collaborative, and user-centered approaches. They have become quite popular in recent years. However, the concept is subject to inflation since there is a tendency to call any place where different stakeholders come together to learn something a Living Lab. While we do not wish to fix the meaning of a Living Labs, since it is still an evolving concept, we believe it is important to provide some characteristics or criteria.

Living Labs are alive, meaning they are situated in the real and often messy world, center on real challenges, and involve real people. Important elements of a Living Lab that contribute to the learning and innovation process are the following:

Real-World Testing and Experimentation: Living Labs provide an environment where new technologies, services, processes and solutions can be tested and refined in real-world settings. This ensures that innovations are not only theoretically sound but also practically viable and effective in addressing societal issues.

Space and Time-bound: Living Labs or relatively open but are not without limits in terms of geographical boundaries, scale and life-span. Typically they operate at the scale of a campus with connections to the local community, a neighborhood or district and sometimes at the level of a region. In terms of live span, they do not last forever but rather anywhere between a few months until a view years.

User-Centric Design: At the heart of Living Labs is the involvement of end-users in the development process. By incorporating feedback and insights from the actual users, the

solutions are tailored to meet the real needs and preferences of the community, leading to higher acceptance and more effective outcomes.

Multi-Stakeholder Collaboration: Living Labs bring together various stakeholders, including citizens, researchers, businesses, and government entities. This collaborative approach fosters diverse perspectives, shared knowledge, and collective problem-solving, which are essential for addressing the multifaceted nature of societal issues.

Sustainability and Scalability: Through continuous iteration and co-creation, Living Labs help develop sustainable and scalable solutions. They provide a platform for long-term monitoring and evaluation, ensuring that the solutions can be adapted and scaled to different contexts and communities.

Social Innovation: Living Labs promote social innovation by addressing societal challenges through creative and participatory methods. This includes developing new social practices, policies, and business models that can lead to systemic change.

Enhanced Community Engagement: By actively involving the community in the innovation process, Living Labs enhance civic engagement and empowerment. This leads to a greater sense of ownership and responsibility among citizens towards the implemented solutions and societal well-being.

Data-Driven Decision Making: Living Labs generate valuable, often but not exclusively, science-informed data and insights through their real-world experiments. This data can be used by policymakers and stakeholders to make informed decisions, creating a more responsive and adaptive governance framework.

Bridging the Gap between Theory and Practice: Living Labs act as a bridge between theoretical research and practical application. They provide a space where academic knowledge can be applied to real-world problems, fostering a dynamic interaction between theory and practice.

Living Labs are highly relevant in addressing complex, even so-called ´wicked´issues due to their holistic, participatory, and adaptive approach. By fostering innovation through real-life experimentation, user involvement, and multi-stakeholder collaboration, they create sustainable and impactful solutions to some of the most pressing challenges faced by society today.

3   Processes and stakeholders: a lively ecosystem

3.1   Phases in a Living Lab

Living Labs are typically temporary arrangements within a limited geographical location from very local to regional, that last until the energy is gone, support and/or funding dwindles or ends, or ideally, the issue addresses, has been dealt with in a satisfying manner. A Living Lab does have certain stages:

1) an initiation phase where the topic is discussed initially, stakeholders are identified, agreement on the Living Lab way of working is agreed upon, and commitment to the process is expressed by all involved;

2) exploration and planning phase, where ideas about addressing the topic are gathered and discussed, other perspectives are invited, the knowledge needed is identified and brought in;

3) a co-creation phase where specific actions are decided upon and stakeholders agree and commit to implement them;

4) a monitoring and evaluation phase, where stakeholders reflect on progress or lack there-off to determine whether and how actions need to be adjusted (although reflection should also be a part of the preceding phases and not be limited to this phase), and, lastly

5) a refinement and dissemination phase, where all involved celebrate successes and capture the lessons learnt, and improve the product or solution for further use.

From here the Living Lab can continue to explore and develop or decide to end because outcomes have (not) been achieved and there is no need or energy for further collaboration. This is not to say that lessons learnt, also from failures and setback won´t travel further and can inform future Living Labs and NBS.
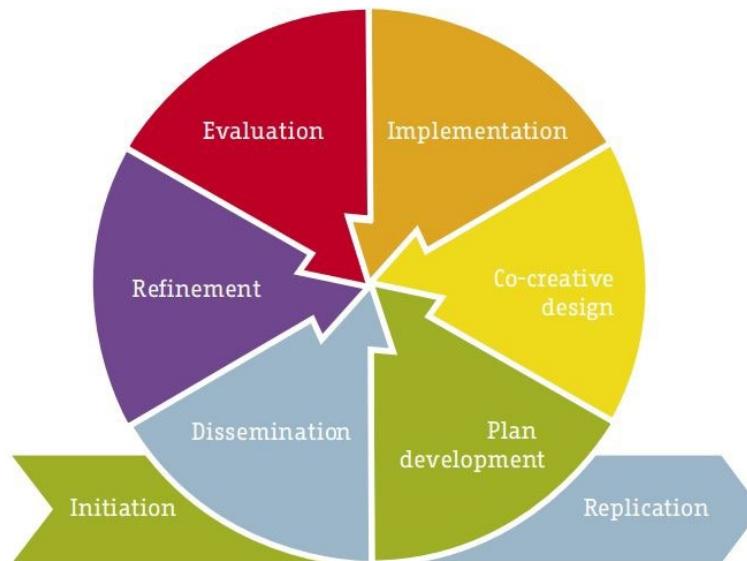

Figure 1: Phases in a Living Lab (Steen and van Beunen, 2017)

There are many figures available showing stages of a Living Lab that follow the sequence depicted here (e.g. Figure 1 and 2). In this model one can recognize the phases described above: from initiation

towards plan development, co-creative design and implementation, to evaluation, refinement and dissemination.

Below is another way of depicting important stages in the process of Living Labs (Figure 2). This model stresses the importance of understanding the stakeholder's requirements and values, of doing collaborative ideation and co-creation in the implementation phase and evaluating throughout the process. In this model, these stages do not necessarily occur in a perfectly linear fashion. In practice, the processes of understanding, ideation, co-creation and evaluation of the product or process can interlink and support each other. The importance of the Living Lab leader is to ensure these processes take place when needed.

Figure 2: Stages in a Living Lab (Source: Lupp et al., 2021)

Despite having distinctive stages, Living Labs are challenging to plan due to their open-ended nature. Their success relies heavily on several factors: the quality of the facilitation and support, the commitment of the participants, the mandate the participants have to implement change within their institutional environment, and the resources available to support the Living Lab.

Hence, it is crucial to invest in stakeholder engagement and collaboration. Trust and motivation to address a common need are the most important drivers in Living Labs (Steen and van Bueren, 2017)). Living Labs won´t succeed with strict top-down management, but rather by fostering collaboration from the ground up. Maintaining transparency and balancing stakeholders' diverse interests are crucial for achieving project goals. It's essential to manage stakeholder engagement effectively through well-defined communication channels.

3.2 Participants in a Living Lab

There are usually four types of stakeholders involved in a Living Lab: citizens or 'users', private actors, knowledge institutes and public actors such as governmental departments (Figure 3). Living Labs can arise from any of these four stakeholder categories. In Urban Living Labs, citizens are often invited to co-create a Living Lab to address an issue in their neighborhood or city (Menny et al., 2018; Hansen et al., 2021). Sometimes the government takes the initiative and creates the opportunity for private citizens and knowledge stakeholders to resolve a common issue together through a Living Lab project.
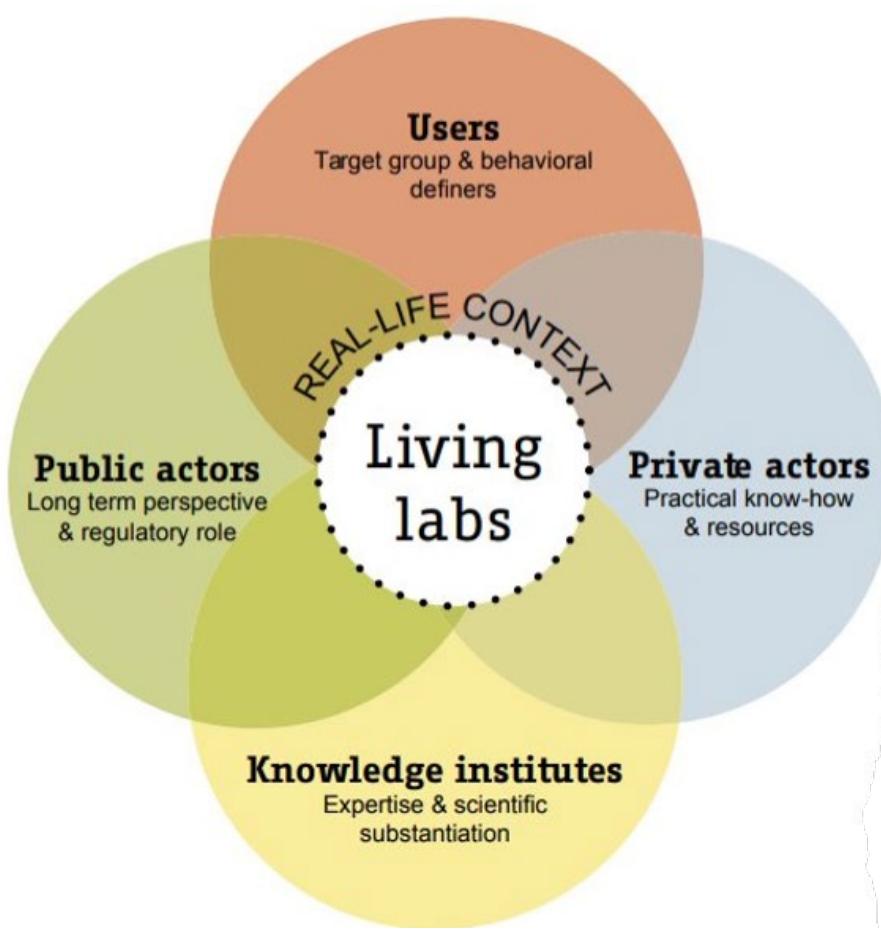
Figure 3: Stakeholders in a Living Lab (Source: Steen and van Beunen, 2017)

When citizens take the initiative to create a Living Lab, they usually have a leading role and demonstrate a high level of engagement. The projects initiated by private and public actors, or knowledge institutes, must carefully consider how to involve citizens. Many projects called (or labelled) Living Labs, however, do not effectively engage citizens in the process.

Citizens in the Living Lab process can be involved in the Living Lab process at various levels and scales (Juujärvi & Pesso, 2013). These levels of involvement have been described into six main categories (Ives & Olson, 1984):

No engagement: No engagement is when stakeholders are unwilling or not invited to be engaged in the NBS development.

Symbolic engagement: Symbolic engagement is when input from the citizens is requested but not used.

Engagement by advice: Engagement by advice is when citizens' advice is asked with the help of interviews or questionnaires.

Engagement by weak control: Engagement by weak control is when citizens have more responsibility to be a part of solution development, however, they can "sign off" at any stage of the solution development process.

Engagement by doing: Citizens are active participants in the solution development process and influence it in all stages.

Engagement by strong control: Engagement by strong control is when citizens have the power of decision making on the solution development process in an Urban Living Lab and the outcome will be highly affected by the citizens' ideas, needs and expectations.

When initiating a Living Lab, it is important to recognize various levels of engagement, not only of citizens but also of other involved stakeholders, and to make clear and transparent agreements on the way everyone is engaged throughout different phases of the process.

4   Lively Learning: Living Labs in education

4.1   Benefits of Living Labs in education

Including Living Labs in higher education offers numerous benefits, aligning with both educational goals and societal needs. Integrating Living Labs into higher education provides a multifaceted platform for experiential learning, interdisciplinary collaboration, and real-world problem-solving. This approach not only enhances the educational experience but also prepares students to be innovative, socially responsible, and skilled professionals ready to tackle the complex challenges of the modern world. Based on reviews of Living Labs in the context of education (van der Wee-Bedeker, 2024; McCrory wt al. 2020) some important learning goals that can be achieved through Living Labs that can be achieved through Living Labs are the following:

Experiential Learning: Living Labs provide hands-on, real-world learning experiences for students and other citizens. This discovery-oriented experiential learning approach helps students apply theoretical knowledge to practical problems, enhancing their understanding and retention of academic concepts.

Interdisciplinary Collaboration: Living Labs encourage interdisciplinary collaboration by bringing together students, faculty, and external partners from various fields. This fosters a comprehensive learning environment where students can tackle complex problems that require diverse skill sets and perspectives.

Innovation and Creativity: By working in Living Labs, students are exposed to innovative processes and creative problem-solving methods. This environment nurtures their ability to think outside the box, develop original solutions, and cultivate an entrepreneurial mindset.

Engagement with Real-World Issues: Living Labs immerse students in addressing real-world societal issues, from urban development to environmental sustainability and social inclusion. This engagement helps students understand the relevance and impact of their studies, motivating them to contribute meaningfully to society.

Skill Development: Participation in Living Labs equips students with a range of valuable skills, including project management, teamwork, communication, and critical thinking. These skills are highly sought after by employers and enhance students' employability.

Research and Innovation Opportunities: Living Labs serve as a dynamic research environment where students and faculty can collaborate on cutting-edge projects. This offers opportunities for groundbreaking research and innovation, often leading to publications, patents, and new ventures.

Enhanced Community Connections: Integrating Living Labs into higher education strengthens the relationship between universities and their surrounding communities. This fosters mutual benefit, with universities contributing to community development and communities providing real-world contexts for academic research. This goal aligns well with the desire of universities to contribute to societal impact and the public good.

Sustainability Education: Living Labs often focus on sustainable solutions, providing students with education on sustainability practices and principles. This prepares students to address global challenges such as climate change and resource management in their future careers.

Policy and Governance Insights: Through Living Labs, students gain insights into policymaking and governance processes by interacting with government and industry stakeholders. This experience is invaluable for those interested in careers in public policy, administration, or civic leadership.

Feedback and Iteration in Learning: Living Labs emphasize the iterative process of feedback and continuous improvement. Students learn the importance of refining ideas based on real-world testing and stakeholder input, which is crucial for both academic and professional success.

Ethical and Social Responsibility: Working in Living Labs instills a sense of ethical and social responsibility in students. They learn to consider the broader implications of their work and strive to create solutions that benefit society.

A challenge in connecting educational institutions to Living Labs often comes from the curriculum structures that often limit more open forms of teaching and learning where the learning taking place cannot always be planned for or measured. Formal education tends to focus on accountability, control and efficiency, whereas **Living Labs seek to develop active engagement, intrinsic learning, co-learning and the blending of cognitive, socio-emotional and embodied forms of learning** that emerge from the relationships that are formed and the multiple settings, often outside of the regular classroom, where learning takes place. It is important to assess the space available for deviating from the standardized curriculum, either within cross-cutting courses, more applied courses, space provided by so-called minors or boundary-crossing projects, but also to identify and recognize alternative forms of assessment to help legitimize and recognize student learning within the formal system.

## 4.2 Pedagogical facilitation in educational Living Labs

As pointed out above, teaching and learning processes in a Living Lab differ from most educational practices in higher education. The image below depicts an important difference between instructive and emancipatory learning in education. Most educational programs focus on instructive learning, where predetermined expert knowledge and skills are conveyed to students. Students learn through reading, doing assignments, presentation and sometimes more applied project work (in groups). There is usually a pre-established direction of thinking and students are supported to understand and adopt this direction.

In a Living Lab context, the instructive way of teaching and learning does not fit because the process is naturally complex, uncertain and ambiguous. Throughout the Living Lab process, different knowledge questions will arise that require also different approaches to answer. There is usually not one correct answer or solution, and the process of knowledge creation needs to include diverse perspectives and values, as well as technical know-how. It is important that the students get to reflect and decide on what is necessary to contribute to the Living Lab solution and process. This empowers students to shape the direction of their collaborative work amid challenges. Such empowerment is an important skill to acquire, also for technical students, to work effectively in their professional life later.

Instructive
- Predetermined expert knowledge and skills
- Support students into a specific pre-established direction

Emancipatory
- Complexity, uncertainty and ambiguity
- Space for reflexivity and choice
- Empower students to shape the direction of their collaborative work in the midst of challenges

Figure 4: Navigating instrumental and emancipatory forms of learning in a Living Lab (Source: Van der Wee-Bedeker et al. 2024)

In practice, both instructive and emancipatory learning contribute to the Living Lab process (Figure 4). It is important for the teaching team involved in the Living Lab project to facilitate these pedagogical pillars in a balanced way. Based on a thorough review of Living Lab-related literature, van der Wee-Bedeker et al. (2014) created the figure below to describe layers of learning in the Living Lab described in literature (Figure 5).

- **Context**: Living Lab as a learning environment

- **Intervention**: pedagogical interventions applied by supervisor/teachers

- **Mechanism**: learning processes students engage in
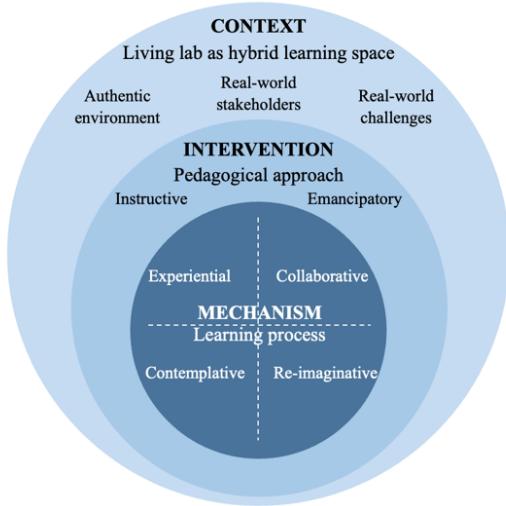
Figure 5: Living Labs as hybrid learning spaces (Source: Van der Wee-Bedeker et al., 2024)

This model distinguished three layers of learning:

1.   The Living Lab as a learning environment: a hybrid learning space where school and the real world come together. This makes the learning environment authentic with real-world stakeholders and challenges. Students will be challenged in their pre-conceived ideas and learn to deal with complexity, ambiguity and diversity.

2.   Within this context, supervisors and teachers also affect the learning process through interventions. Instructive or emancipatory learning can be facilitated actively in the appropriate time and place of the project. In some moments, students will need tools to be able to bring focus in their tasks and knowledge questions, while in other moments they will need to be given clear assignments to acquire a certain skill, technique or piece of knowledge.

3.   Within context and intervention, students go through four important learning processes typical in Living Labs: experiential (trying things out, testing ideas, learning by doing), collaborative (working together with peers but also with other stakeholders), contemplative (reflecting frequently on what is working, what not, what is working with the process, what against, how are we feeling? etc.) and re-imaginative (not just focusing on problems and on what is, but also imagining possibilities, alternative futures and pathways that energize and provide hope).

4.3 Important considerations when setting up a Living Lab in education

In addition to finding the spaces in curricula and educational programs, setting up a Living Lab in higher and vocational education involves careful consideration of objectives, stakeholder engagement, infrastructure, sustainability, and more. By addressing these factors, institutions can create effective and impactful Living Labs that enhance education, foster innovation, and contribute to solving real-world societal issues. Here are some considerations to keep in mind.

1. Clear Objectives and Goals
Define Purpose: Clearly outline the goals and objectives of the Living Lab. Determine what societal issues or educational outcomes the lab aims to address.
Alignment with Curriculum: Ensure that the Living Lab's objectives align with the academic programs and curriculum, enhancing the educational experience for students.

2. Stakeholder Engagement
Identify Stakeholders: Involve a diverse group of stakeholders, including students, faculty, community members, industry partners, and government entities.
Foster Collaboration: Create mechanisms for regular communication and collaboration among stakeholders to ensure their engagement and commitment. Social cohesion and joint motivation are often pivotal in fostering collaboration (Wals et al., 2009).

3. Interdisciplinary Approach
Promote Interdisciplinary Projects: Encourage projects that require the collaboration of multiple disciplines to address complex problems.
Diverse Expertise: Ensure that the Living Lab has access to a wide range of expertise and knowledge areas to support interdisciplinary learning.

4. Infrastructure and Resources
Physical Space: Provide a dedicated physical space for the Living Lab, equipped with necessary facilities and technologies. Sometimes these spaces can also be natural areas, like parks, riverbanks, lakes and nature preserves.
Financial Resources: Secure funding and financial resources to support the lab's activities, including grants, sponsorships, and institutional support.

5. Real-World Integration
Community Involvement: Engage with local communities to integrate real-world problems and solutions into the Living Lab's projects.
Practical Applications: Ensure that the projects undertaken have practical applications and can create tangible benefits for the community and nature.

6. Educational Integration
Curricular Integration: Embed the Living Lab activities into the academic curriculum through courses, projects, trainings and internships.
Assessment and Evaluation: Develop assessment methods to evaluate students' learning outcomes and the impact of Living Lab projects.

7. Sustainability and Scalability
Sustainable Practices: Incorporate sustainability principles in the operation and projects of the Living Lab.
Scalability Plans: Design projects and initiatives that can be scaled or replicated in other contexts or institutions. National and international education networking between the universities and educators is important for scalability and impact.

8. Innovation and Flexibility

Foster Innovation: Encourage innovative thinking and the development of creative solutions to societal issues.

Adaptability: Create a flexible environment that can adapt to changing needs, technologies, and societal challenges.

9. Ethical and Social Considerations

Ethical Guidelines: Establish ethical guidelines to govern the activities and projects of the Living Lab, ensuring responsible conduct.

Social Impact: Focus on projects that have a positive social impact and address the needs and challenges of marginalized or underserved communities.

10. Monitoring and Evaluation

Performance Metrics: Develop metrics and indicators to monitor and evaluate the performance and impact of the Living Lab.

Continuous Improvement: Use feedback and evaluation results to continuously improve the Living Lab's processes, projects, and outcomes.

11. Communication and Dissemination

Share Results: Regularly share the results and findings of Living Lab projects with the broader academic community and stakeholders.

Public Awareness: Increase public awareness of the Living Lab's activities and successes through various communication channels.

Participants in a Living Lab often engage in a process of social learning. Social learning involves the building of social cohesion, trust and a joint commitment among all actors, seeks to include a plurality of values, knowledge and perspectives, and brings together a wide range of competences. Through social learning participants collectively spiral towards a solution or an improvement (Wals et. al, 2009).

Living Labs do have a specific focus, but the focus is co-defined by the participants in the lab to enhance ownership and commitment to the process and its outcomes. In ᴇɴᴀʙʟꜱ the overall goal is to mainstream biodiversity and NBS in higher education and TVET (Technical and Vocational Education & Training) by developing and upscaling new forms of teaching, learning and capacity-building that are more relational, systems-oriented and applied. A key characteristic is that the university and vocational schools collaborate with societal stakeholders who also have a stake and common motivation in working on NBS and the enhancement of biodiversity.

5 Monitoring and evaluation of a Living Lab within the context of a NBS

Evaluating Living Labs for nature based solutions (NBS) involves assessing various dimensions to ensure that the projects are effective, sustainable, and beneficial to both the environment and the community. Here are key aspects and methods for evaluating such Living Labs:

1. Environmental Impact
- **Biodiversity Metrics:** Assess changes in local biodiversity, such as species richness and abundance, before and after the implementation of NBS.
- **Ecosystem Services:** Measure improvements in ecosystem services, such as water purification, air quality, soil health, and carbon sequestration.
- **Habitat Restoration:** Evaluate the success of habitat restoration efforts by monitoring vegetation cover, soil stability, and wildlife habitation.

2. Social and Community Benefits
- **Public Health:** Assess improvements in public health outcomes, such as reductions in heat stress, respiratory conditions, and mental health benefits due to increased green spaces.
- **Community Engagement:** Measure the level of community involvement and engagement in the planning, implementation, and maintenance of NBS projects.
- **Social Cohesion:** Evaluate enhancements in social cohesion, community pride, and local identity through surveys and social indicators.

3. Economic Viability
- **Cost-Benefit Analysis:** Conduct a cost-benefit analysis to compare the economic costs of implementing NBS with the financial benefits, such as reduced healthcare costs, increased property values, and job creation.
- **Funding and Investment:** Assess the sustainability of funding sources and the ability to attract investments for scaling and maintaining NBS projects.

4. Technical Feasibility
- **Implementation Success:** Evaluate the success of the technical implementation of NBS, including the quality of construction, integration with existing infrastructure, and adaptability to local conditions.
- **Maintenance Requirements:** Assess the maintenance needs and costs over time to ensure long-term sustainability.

5. Policy and Governance
- **Regulatory Compliance:** Ensure that NBS projects comply with local, regional, national and international regulations and policies.
- **Governance Structures:** Evaluate the effectiveness of governance structures in managing, overseeing, and adapting NBS projects, including stakeholder collaboration and decision-making processes.

6. Educational and Research Outcomes
- **Knowledge Generation:** Assess the contribution of the Living Lab to scientific knowledge and innovation in NBS through publications, research projects, and technological advancements.
- **Educational Impact:** Evaluate the educational outcomes for students and community members, including skills development, awareness, and capacity building in NBS.

7. Monitoring and Evaluation (M&E) Framework
- **Baseline Data:** Establish baseline data for all relevant metrics before the implementation of NBS projects.
- **Continuous Monitoring:** Implement continuous monitoring using sensors, surveys, and field observations to track changes and impacts over time.

- **Adaptive Management:** Use the data collected to adapt and improve NBS projects through an iterative process, ensuring that they remain effective and relevant.

8. Stakeholder Feedback

- **Surveys and Interviews:** Collect feedback from stakeholders, including community members, project partners, and local authorities, through surveys and interviews to gauge satisfaction and identify areas for improvement.
- **Participatory Evaluation:** Involve stakeholders in the evaluation process to ensure that their perspectives and insights are considered.

Take home message

Evaluating Living Labs for NBS requires a comprehensive approach that considers environmental, social, economic, technical, policy, and educational dimensions. By using a mix of qualitative and quantitative methods, continuous monitoring, and adaptive management, stakeholders can ensure that NBS projects are effective, sustainable, and beneficial for both the environment and the community.

5.1 Suggested resources related to visioning, leadership and system innovations

- European Network of Living Labs (ENoLL) - TRANSIT - openresearch.amsterdam
- Living Labs in Nederland: onderzoek en innovatie mét steden | Rathenau Instituut
- UNESCO Handbook (SET4HEI)
- Inner Development Goals (website, toolbox)
- Systems Innovation guides:
- GIZ's Leadership development for global responsibility Methods and instruments (https://www.giz.de/en/downloads/giz2012-en-leadership-development-global-responsibility.pdf)
- Self-study Guide for Regenerative Leadership for System Transitions https://www.indigenousandmodern.com/wp-content/uploads/2024/01/Self-Study-Guide-Regenerative-Leadership-for-Systems-Transformation.pdf
- Transformational Leadership for Sustainability (course, book)
- Theory U (website, resources, toolbox, courses)
- Sociocracy (toolbox, website, book)
- Wageningen University – CDI Reflection Guide: https://www.wur.nl/en/research-results/research-institutes/centre-for-development-innovation/publications-guides/reflection-guide.htm
- UNESCO's Key Competences: *Learning to Transform the World: Key Competencies for Education in Sustainable Development.*
- A Rounder Sense of Purpose – Sustainability Education Tools: https://aroundersenseofpurpose.eu/
- Designing Transformative Learning Resources: https://www.designingtransformativelearning.com/resources
- Transdisciplinary Research Field Guide - https://www.uu.nl/en/research/transdisciplinary-field-guide/get-started
- Principles of Transformative Research for Sustainability: https://www.eur.nl/en/media/2021-11-dit-working-paper-1dit-platformerasmus-university-rotterdam2021
- The Responsible Research and Innovation Toolkit - https://rri-tools.eu/
- Wageningen University's Citizen Science MOOC - https://www.wur.nl/en/show/transformative-citizen-science-for-sustainability.htm
- AMS LivingLab Guide - https://www.ams-institute.org/documents/28/AMS_Living_Lab_Way_of_Working-ed4.pdf
- Community Based Participatory Research and Sustainable Development Goals - https://unescochair-cbrsr.org/pdf/resource/BHALL_Community_Based_Research_ENG_Dec13.pdf
- Durham University's guide on the ethical principles and practices of Community-based

- participatory research - https://www.durham.ac.uk/media/durham-university/departments-/sociology/Community-Based-Participatory-Research-A-Guide-to-Ethical-Principles,-2nd-edition-(2022)-.pdf
- Cornell's Staff and Sustainability Platform - https://sustainablecampus.cornell.edu/take-action/employee-resources/staff-sustainability-training
- University of Bedfordshire Staff Development for Sustainability Scheme - https://www.beds.ac.uk/sustainability/education/staff-professional-development-opportunities/
- Advance Higher Education ESD Resources and Tools - https://www.advance-he.ac.uk/teaching-and-learning/education-sustainable-development-higher-education#reports
- Practical guide to social learning in the context of sustainability. *The Acoustics of Social Learning: Designing learning processes that contribute to a more sustainable world.* Wageningen/Utrecht: Wageningen Academic Publishers Accessible via: https://core.ac.uk/download/pdf/29248373.pdf

6   Conclusions

This Living Lab Manual on Nature Based Solutions in Higher Education aims to empower not only our ᴇNᴀBʟS institutions to harness the full potential of NBS for sustainable development. By integrating NBS into their academic and operational strategies, universities in general can become pioneers in addressing environmental challenges while enriching their educational offerings.

The guidelines and resources provided in this manual serve as a foundation for launching and nurturing successful Living Labs. These labs not only facilitate cutting-edge research and experiential learning but also foster a culture of sustainability that extends beyond the campus boundaries. The collaborative efforts of educators, students, researchers, and community partners are crucial in driving the transformative change needed to achieve environmental resilience and social well-being.

As you embark on your journey to implement and expand NBSs within your institution, remember that the impact of these efforts is far-reaching. By cultivating green spaces, enhancing biodiversity, and promoting ecological stewardship, you contribute to the health and vitality of both local and global ecosystems. Moreover, you prepare the next generation of leaders to think critically, act sustainably, and innovate responsibly.

We encourage you to continually share your experiences, challenges, and successes with the broader academic and environmental communities. Through collective learning and collaboration, we can refine our approaches, inspire new initiatives, and amplify the positive impact of NBSs in higher education.

Thank you for your commitment to sustainability and for making a difference through your Living Lab initiatives. Together, we can build a more sustainable and resilient future for all.

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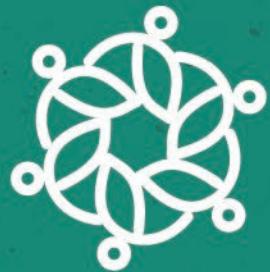
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