**L**earning, **E**ngagement, and **A**ction **F**ramework

# GREEN LEAF

*Comprehensive Greening Curriculum Framework*

Co-funded by the European Union

# List of Authors

Chiavarino, Claudia

Cittadini, Silvia

Duchateau, Jana

Fantasia, Antonio

Ianoș, Grațiela

Ioniță, Ruxandra

Manasia, Loredana

Mercan, Gamze

Merlin, Francesca

Panayi, Nicholas

Pârvan, Andrei

Tornariti, Elena

Varol Selçuk, Zümrüt

Yaşar Akyar, Özgür

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# Executive Summary

Higher education stands at a critical juncture. Climate change, biodiversity loss, resource scarcity, and widening social inequalities are reshaping economies, societies, and the conditions of life on Earth. Universities are increasingly expected to prepare learners not only to understand these challenges but also to contribute actively to the transitions required to address them. Yet across many institutions, sustainability remains unevenly integrated into curricula and institutional practices. Initiatives are often fragmented, dependent on individual champions, or confined to specialised programmes. What is needed is a coherent framework capable of connecting **curriculum transformation, institutional engagement, and practical implementation**.

The **GREEN LEAF Framework** responds to this need. Developed within the GREENUS project, it provides a structured yet adaptable approach to embedding sustainability across higher education systems. The framework does not treat sustainability as an additional topic or discipline. Instead, it positions sustainability as a **guiding principle for learning design, institutional collaboration, and systemic change**, enabling universities to prepare learners for the complex realities of the twenty-first century.

The framework is organised around **three mutually reinforcing pillars: Learning, Engagement, and Action**. Together, these pillars provide both a conceptual foundation and a practical pathway for institutions seeking to move from isolated initiatives toward comprehensive transformation.

The **Learning pillar** addresses the core question of how sustainability can be embedded meaningfully within curricula. It focuses on transforming what students learn, how they learn, and where learning takes place. This pillar promotes the integration of sustainability metaconcepts across disciplines, encouraging fields as diverse as engineering, economics, health sciences, education, and design to engage with shared environmental and societal challenges. It also emphasises the importance of transformative pedagogies—approaches that combine systems thinking, experiential learning, collaboration, and critical reflection. Within this pillar, learning extends beyond traditional classrooms to include community engagement, place-based experiences, and digital environments that support immersive and interdisciplinary exploration.

The **Engagement pillar** recognises that curriculum transformation cannot occur through curriculum design alone. Sustainable change depends on people, relationships, and partnerships. This pillar focuses on empowering educators, mobilising students, and building collaborative networks with external stakeholders such as local communities, civil society organisations, and public institutions. Through initiatives such as educator development programmes, stakeholder partnerships, and Green Learning Ambassador networks, the framework strengthens the human and institutional capacity required to sustain sustainability initiatives over time.

The **Action pillar** ensures that sustainability commitments translate into concrete and measurable outcomes. It provides mechanisms for implementing, monitoring, and continuously improving sustainability initiatives within higher education institutions. Through tools for evidence-based practice, institutional governance, and quality assurance, this pillar supports universities in embedding sustainability within strategic planning, curriculum evaluation, and organisational processes. By doing so, it helps institutions move beyond experimentation toward systemic and durable change.

A distinctive feature of the GREEN LEAF Framework is its emphasis on **integration across people, places, and futures**. Learning connects conceptual knowledge with lived experiences in communities and ecosystems. Engagement brings together diverse actors to co-create solutions. Action ensures that these efforts lead to lasting institutional

transformation. The result is a dynamic learning ecosystem in which education becomes a catalyst for societal change.

The GREEN LEAF Framework provides universities with a coherent architecture for integrating sustainability into the core functions of higher education. Through its three pillars—Learning, Engagement, and Action—it connects curriculum transformation, collaborative engagement, and institutional implementation into a single pathway for change. In this way, the framework supports higher education institutions in preparing learners not only to understand sustainability challenges, but also to participate in shaping more sustainable and just futures.

# Introduction

## Aims

The Learning, Engagement, Action, Framework (GREEN LEAF) aims to provide a structured, adaptable, and participatory model to support higher education institutions and other learning organizations in embedding sustainability and climate action across curricula. Building on international frameworks such as UNESCO's Greening Curriculum Guidance (2024) and the EU's GreenComp (2022), the LEAF pursues six strategic aims and introduces a **living component** to ensure its continued relevance and impact.

**1. Integrate Sustainability Systemically**. Establish conceptual and operational foundations for embedding sustainability across all disciplines, institutions, and educational levels.

**2. Align Learning Outcomes with Green Competencies**. Define sustainability learning outcomes aligned with cognitive, socio-emotional, and behavioral domains to empower active global citizenship.

**3. Support Transformative Pedagogies**. Promote pedagogical strategies—experiential, collaborative, systems-thinking, place-based, and value-oriented—that foster transformative learning.

**4. Contextualize Greening Practices**. Encourage adaptation to local contexts, ecosystems, and cultural realities to ensure inclusivity and authenticity in sustainability learning.

**5. Foster Multi-Stakeholder Collaboration**. Integrate the roles of educators, students, NGOs, policy-makers, and community partners as co-creators of green learning ecosystems.

**6. Activate a Living Framework through a Network of Green Learning Ambassadors**. Establish an international **Network of Green Learning Ambassadors**—students, educators, researchers, and community leaders—who act as facilitators, innovators, and connectors of sustainability initiatives.

This network will:

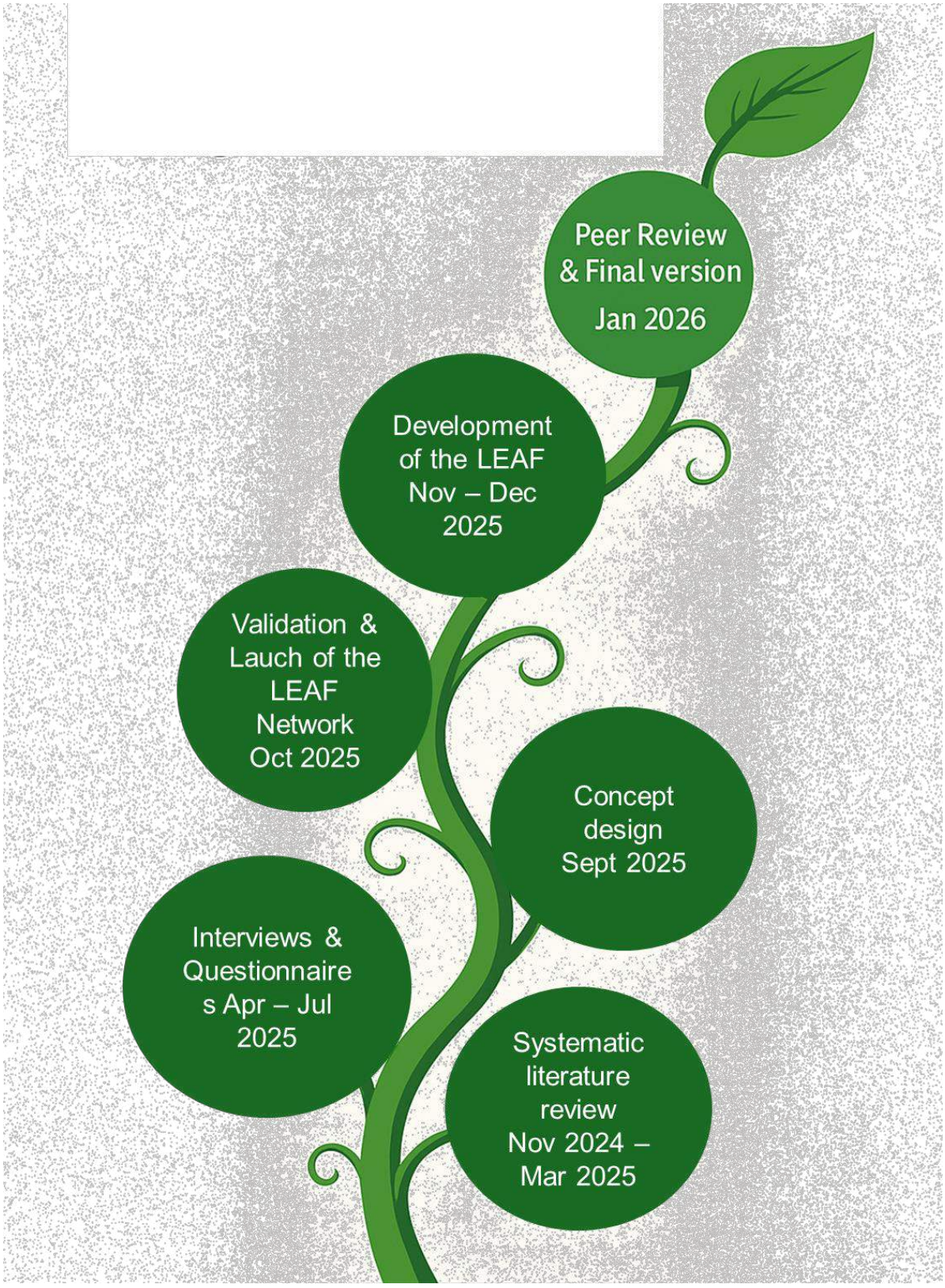
- Serve as a community of practice for exchanging ideas and resources.
- Promote **peer-to-peer learning and advocacy.**
- Keep the framework **"alive," adaptive, and responsive** to emerging sustainability challenges.

## Methodology

The *LEAF* was developed through a **multi-phase, evidence-based and participatory process**, combining empirical research with collaborative co-design. The methodology

includes the establishment of the *Green Learning Ambassadors Network* as a participatory, ongoing validation mechanism.

**Figure 1 Phases in the LEAF development**



**Phase 1 – Evidence Synthesis**

A systematic literature review mapped global trends in greening education, sustainability competencies, and pedagogical innovations, guided by the PRISMA protocol and informed by international frameworks (UNESCO, UNEP, OECD, EU).

**Phase 2 – Stakeholder Consultation**

Semi-structured interviews with academics, NGO representatives, and practitioners captured diverse institutional and regional perspectives on sustainability integration.

**Phase 3 – Learner Perspectives**

A multi-institutional student survey explored perceptions, motivations, and expectations regarding sustainability education, grounding the framework in learner realities.

**Phase 4 – Data Integration and Framework Design**

Thematic and cross-case analysis synthesized findings into five key framework dimensions:

1. Stakeholder Roles
2. Learning Outcomes
3. Contextual Factors
4. Pedagogical Strategies
5. Learning Environments

**Phase 5 – Validation through Co-Creation**

The emerging framework was refined through workshops and focus groups with experts, educators, and civil society actors, ensuring coherence, practicality, and inclusivity.

**Phase 6 – Establishment of the Green Learning Ambassadors Network (Living Component)**

To ensure the framework remains dynamic and practice-driven, a **Network of Green Learning Ambassadors** was established as a *living component*. This network functions as:

- A **feedback mechanism** to test and adapt the framework in real contexts;
- A **capacity-building platform** to train educators and students as sustainability multipliers;
- A **community of practice** linking academia, NGOs, and local communities;
- A **monitoring channel** that gathers evidence of good practices and challenges for ongoing refinement of the framework.

Ambassadors will be selected from pilot institutions, NGOs, and youth organizations, supported through mentorship, peer learning, and digital collaboration platforms. Their role will be both academic and activist—bridging policy, pedagogy, and community transformation.

**Phase 7 – Continuous Learning and Evolution**

The *Green Learning Ambassadors Network* ensures the LEAF evolves through continuous dialogue, evaluation, and cross-institutional collaboration. This living dimension transforms the

framework from a prescriptive document into an active, iterative system of practice and reflection.

## Structure of the document

This document is organised to guide readers from the **conceptual foundations of curriculum greening** to the **practical use of the GREEN LEAF Framework** and its living implementation mechanisms. It can be read sequentially, but it is also designed for selective navigation, allowing different audiences to move directly to the sections most relevant to their roles and needs.

The document opens with an **Introduction**, which presents the aims of the framework, explains the methodology used in its development, and situates the document within the wider objectives of the GREENUS project. This section is particularly useful for readers seeking to understand the evidence base, development process, and overall purpose of the framework.

It then moves to **What Is a Green Curriculum?**, which establishes the conceptual grounding of the report. This section clarifies what is meant by a green curriculum, outlines its defining characteristics, explains what is distinctive about greening curricula in higher education, and sets out the rationale for why curriculum greening is necessary. Readers new to the topic may wish to begin here before engaging with the framework itself.

The next major part, **The GREENUS Framework for Greening HE**, introduces the LEAF framework in full. It explains why the framework is needed, presents its three pillars—**Learning, Engagement, and Action**—and details the steps within each pillar. This section forms the structural core of the document. Readers interested in institutional design, implementation pathways, and the overall architecture of the framework should focus especially on this part.

A dedicated section, **How to Use the Framework?**, then translates the framework into pedagogical and curriculum-design questions. It addresses what learners should achieve, what they should learn, how sustainability content can be organised through metaconcepts, how teaching can be approached through different pedagogical clusters, and where meaningful learning happens best. This is the most directly practice-oriented section for educators, curriculum developers, and programme teams.

The document then presents **The Living Component: Network of Green Ambassadors**, which extends the framework beyond static guidance and into ongoing institutional and community practice. This section explains how ambassadors can be identified, recruited, supported, trained, and mobilised, and how the LEAF Network can sustain engagement and innovation over time. Readers interested in leadership, participation, and long-term institutional activation may wish to turn directly to this section.

The report closes with a **Conclusion**, which reflects on the broader significance of the framework, and a **References** section, which documents the research and policy sources that inform the framework.

To support navigation, the document also includes **figures, tables, and text boxes** throughout. These elements highlight models, key actions, illustrative cases, and practical examples. Readers looking for quick orientation may use the table of contents, list of figures, list of tables, and list of boxes to locate either conceptual explanations or concrete practices more efficiently.

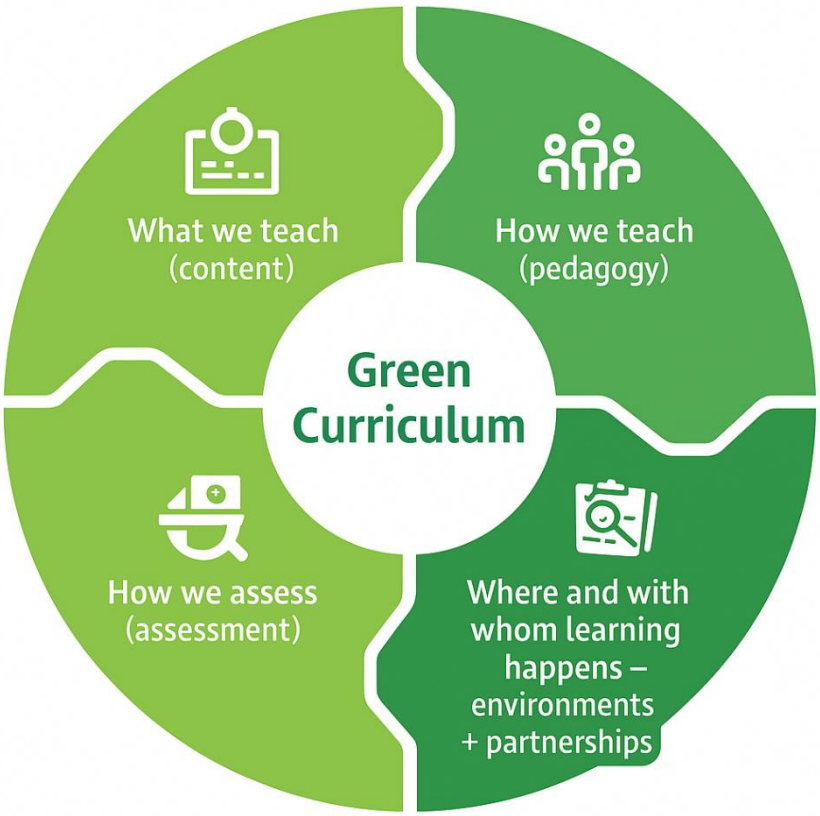
# What Is a Green Curriculum?

## Designing a Green Curriculum: What Do We Actually Mean by "Green"?

A **green curriculum** is a way of designing teaching and learning that helps learners understand the world's sustainability challenges and feel empowered to take meaningful action. Rather than simply adding environmental topics into existing courses, a green curriculum reshapes the whole learning experience—what we teach, how we teach, how we assess, and how we connect with our communities (see Figure 2). It brings together knowledge, skills, values, and real-world action so that learners can contribute to fairer, more sustainable futures.

**Figure 2**

Key structural elements that underpin the design of a green curriculum in higher education




## Characteristics of a green curriculum

Across international frameworks and the GREENUS review, several defining characteristics of a green curriculum emerge:

**Table 1**

*Defining Features of a Green Curriculum Integrating Competence-Based, Transformative, and Contextualized Approaches to Sustainability Learning*

| Characteristics | Description | Supporting Evidence |
|---|---|---|
| Holistic, Interdisciplinary & Systems-Oriented | Integrates ecological, social, cultural, ethical, and economic | UNESCO. (2024). Greening curriculum guidance. • |

| Characteristics | Description | Supporting Evidence |
|---|---|---|
| | dimensions; emphasizes complexity and interconnected systems. | Bianchi, G., Pisiotis, U., & Cabrera, M. (2022). GreenComp: The European sustainability competence framework. • Yu, T. (2024). Sustainability and systems navigation in entrepreneurship education. • Köhler, J. et al. (2013). Embedding sustainability across disciplines in HE. |
| Competence-Based & Future-Oriented | Uses sustainability competencies (systems thinking, futures literacy, adaptability, political agency) to shape learning outcomes and assessments. | Bianchi, G., Pisiotis, U., & Cabrera, M. (2022). GreenComp. • Anapey, G. M. (2024). Competence-based model in HE in the Global South. • Brundiers, K., & Wiek, A. (2013). Competence-based sustainability education. |
| Transformative & Values-Centred | Builds ethical reasoning, climate justice, fairness, care for nature, intergenerational responsibility; fosters identity development and worldview change. | UNESCO. (2024). Greening curriculum guidance. • Jeronen, E. (2022). Transformative pedagogies in sustainability learning. • Martínez-Valdivia, E. et al. (2021). Critical and justice-oriented sustainability learning. |
| Experiential, Action-Oriented & Community-Engaged | Uses hands-on, embodied, real-world, and place-based learning; engages communities, NGOs, and stakeholders; emphasizes learner agency. | UNESCO. (2024). Green School Quality Standard. • Ashford, T., Kuzich, S., & Gomez, F. G. (2024). Service learning and sustainability. • Zainal-Abidin, Z. et al. (2024). Urban ecological design-based experiential learning. • Xu, L. (2024). Hybrid field-based sustainability learning. |
| Contextualized & Culturally Relevant | Draws from local realities, Indigenous and traditional knowledge systems; connects learning to place, culture, and community needs. | UNESCO. (2024). Greening curriculum guidance. • Anderson, E. (2025). Indigenous/local epistemologies in HE. • Ameli, K. (2022). Nature-based learning and multispecies perspectives in HE. |
| Integrated Across the Institution (Whole-Institution Approach) | Sustainability embedded in governance, operations, curriculum design, assessment, and campus culture. | UNESCO. (2024). Green School Quality Standard. • Wilson, G., & von der Heidt, T. (2013). Barriers to |

| Characteristics | Description | Supporting Evidence |
|---|---|---|
| | | institutional sustainability reform. • Holdsworth, S., & Thomas, I. (2016). HE organizational culture and sustainability. |
| Continuously Evolving, Adaptive & Participatory | Treated as a living, adaptive process; co-designed with students, faculty, and communities; continuously evaluated and improved. | UNESCO. (2024). Greening curriculum guidance. • Ade-Ojo, G. O. (2011). Policy–practice gaps and participatory co-design. • Biancardi, C. et al. (2023). HEIs as community sustainability engines. |

## What is distinctive about a green curriculum in higher education?

While the idea of a green curriculum can apply to any learning context, higher education brings a set of unique characteristics that shape how sustainability is understood, taught, and lived within institutions.

Higher education is built around **strong disciplinary identities**, each with its own theories, methods, and traditions. This means that greening the curriculum often requires thoughtful work both within and across disciplines, finding ways to honour disciplinary depth while encouraging interdisciplinary collaboration. The GreenUS review highlights how these disciplinary cultures strongly influence how sustainability is framed and integrated.

Universities also **combine teaching with active research**. A green curriculum in academia often draws directly on emerging sustainability research, allowing students to work with real data, explore real-world problems, and participate in knowledge creation. This dual role positions higher education institutions as important drivers of sustainability innovation and community transformation.

Another defining feature is **academic freedom**. Faculty members have significant autonomy in how and what they teach, which creates space for creativity and experimentation but can also lead to uneven implementation. Studies show that faculty confidence, preparedness, incentives, and institutional support play major roles in shaping the extent of curriculum greening.

Universities are also complex institutions with **layers of governance**—departments, faculties, committees, and senate structures. This complexity can slow change, but when sustainability becomes a shared institutional priority, it enables powerful whole-institution approaches. Many studies highlight how siloed governance structures can be a barrier, underscoring the need for more cross-campus coordination.

Higher education also offers rich opportunities for **experiential and community-based learning**. University partnerships with municipalities, NGOs, industry, and civil society enable living labs, sustainability studios, field-based research, and community-engaged projects, which are widely recognized as some of the most impactful green curriculum practices. Because universities prepare future professionals—engineers, teachers, business leaders, policymakers, health practitioners—green curricula have a direct influence on **societal transitions**. The literature shows strong growth in discipline-specific sustainability skill frameworks, highlighting the workforce relevance of HE-based greening efforts.

Finally, universities are themselves large, **complex environments**—often comparable to small cities. When campuses adopt sustainable operations and use them as

learning opportunities, they model sustainability for thousands of students and staff. UNESCO's whole-institution approach has strong relevance in this context.

## Why Green the Curriculum?

Greening the curriculum is a necessary response to the **environmental**, **social**, and **economic** challenges that shape the world students are entering. Higher education plays a unique role in preparing graduates who can understand complex problems, navigate uncertainty, and act responsibly within their professions and communities. A green curriculum helps universities fulfil this mission by embedding sustainability thinking and action into the core of learning.

Students increasingly expect their education to reflect the realities of the climate crisis and to prepare them to contribute to solutions. International evidence shows that learners value courses that feel meaningful, relevant, and connected to real-world challenges. Greening the curriculum strengthens motivation, deepens engagement, and empowers students with the agency and confidence to act.

For educators, a green curriculum enriches teaching by offering opportunities for interdisciplinary collaboration, creative pedagogy, experiential learning, and stronger connections with communities and external partners. For institutions, it supports strategic priorities such as graduate employability, innovation, equity, community engagement, and global citizenship.

Ultimately, greening the curriculum ensures that universities remain responsive, future-focused, and socially responsible—helping learners not only succeed in their careers, but also contribute to shaping a more sustainable and just world.

# The GREENUS Framework for Greening HE

## What is the LEAF Framework and why do we need it?

The LEAF (**L**earning • **E**ngagement • **A**ction **F**ramework) is a pivotal outcome of the GreenUS project. It offers a structured, evidence-based model to guide higher education institutions in embedding sustainability and climate action across curricula. The framework translates the insights of the systematic literature review, stakeholder interviews, learner surveys, and co-design workshops into a practical, adaptable blueprint for curriculum transformation.

The need for the LEAF arises from a clear challenge: while many universities recognize the importance of sustainability, they lack an integrated, actionable approach that connects learning outcomes, pedagogical strategies, institutional collaboration, and real-world impact. Existing efforts are often fragmented—limited to individual courses, motivated educators, or isolated initiatives—without a holistic structure to support systemic change.

The LEAF addresses this gap by offering:

- **A shared conceptual foundation** for understanding what green learning entails.
- **A practical operational model** that connects learning, engagement, and action.
- **A flexible framework** that institutions can adapt to their context, culture, and resources.
- **A living component**, the Network of Green Learning Ambassadors, ensuring ongoing refinement, relevance, and collective learning.

## Three pillars of the LEAF

The **LEAF** provides the conceptual and operational foundation for greening higher education curricula. It connects **what** we learn (**Learning**), **who** drives and collaborates (**Engagement**), and **how** change happens (**Action**), forming a dynamic ecosystem that supports sustainability transformation – see Figure 3.

**Figure 3**
*The Green LEAF Wheel. A Holistic Framework for Greening Higher Education*


### 🍃 1. Learning Pillar

Focus: *Transforming learning through green competencies, pedagogies, and environments.*

Includes:

- **Green learning outcomes** aligned with sustainability competencies (knowledge, values, skills, and agency).
- **Content integration**: embedding sustainability themes across disciplines.
- **Pedagogies**: experiential, systems-thinking, place-based, transformative.
- **Learning environments**: physical, digital, and community spaces that model sustainable practices.

The *Learning Pillar* informs:

- The **Guidebook/Manual**, by outlining *how to design, teach, and assess* for sustainability.
- The **Tools and Resources for Faculty**, providing *teaching templates, pedagogical models, and learning environment examples.*

### 🌎 2. Engagement Pillar

Focus: *Empowering people and partnerships to co-create sustainable education.*

Includes:

- **Educators** as facilitators of transformation.
- **Stakeholders** (NGOs, policymakers, institutions, communities) as co-implementers.
- **Green Learning Ambassadors** as the *living network* sustaining collaboration and innovation.

The *Engagement Pillar* drives:

- The **Online Digital Catalogue**, which captures and disseminates best practices from diverse contexts.
- The **Ambassadors Network**, ensuring ongoing knowledge exchange and adaptation.

### 🌾 3. Action Pillar

Focus: *Translating knowledge and collaboration into real-world impact.*

Includes:

- **Models and Practices** demonstrating effective curriculum greening.
- **Resources** and *instruments* for implementation and evaluation.
- **Monitoring tools** for continuous improvement and evidence-based practice.

The *Action Pillar* materializes through:

- The **Guidebook/Manual**, providing *practical steps, frameworks, and evaluation tools.*
- The **Digital Catalogue**, showcasing *case studies and models in action.*
- The **Faculty Tools**, equipping educators and leaders to act effectively.

## Learning

The **Learning Pillar of the LEAF Framework** positions learning design—rather than isolated sustainability content—as the central lever for greening higher education. Evidence from the GREENUS systematic review indicates that curriculum greening is most effective when sustainability is embedded systematically across learning outcomes, disciplinary structures, pedagogical approaches, and learning environments, rather than addressed through stand-alone courses or ad hoc initiatives.

The Learning Pillar frames sustainability learning as a **competence-based and developmental process**, integrating cognitive, socio-emotional, and behavioural dimensions. It recognises that higher education institutions play a critical role in equipping learners not only with disciplinary expertise, but also with the capacities required to understand complexity, exercise ethical judgment, and contribute to sustainable transitions within professional and societal contexts.

To translate these principles into practice, the LEAF Framework proposes a structured learning pathway built around four **Learning Steps (ISTEPS)**. These steps provide a practical sequence for designing, implementing, and sustaining green learning across curricula and learning environments. Each **ISTEP** identifies core curriculum and pedagogical actions—what institutions must put in place—and learning practices—how these actions are realised in concrete educational settings.

The four ISTEPS guide higher education institutions in addressing four interconnected dimensions of learning transformation within the GreenUS Framework: **Learning Outcomes • Curriculum Integration • Pedagogical Practice • Learning Environments**

They also support institutions in aligning teaching, assessment, and educational spaces with sustainability goals as part of a whole-institution approach.

**The four ISTEPS are:**

1. **ISTEP 1 — Define and Systemise Green Learning Outcomes.** Align programmes and courses with sustainability competencies across cognitive, socio-emotional, and behavioural domains.
2. **ISTEP 2 — Integrate Sustainability Across Disciplines.** Embed sustainability coherently across all fields of study using interdisciplinary and spiral curriculum approaches.
3. **ISTEP 3 — Apply Transformative and Experiential Pedagogies.** Use learner-centred, experiential, and reflective teaching approaches to foster critical thinking, ethical reasoning, and learner agency.
4. **ISTEP 4 — Activate Diverse and Sustainable Learning Environments.** Leverage physical, digital, and community-based spaces as living environments that support applied sustainability learning.

To operationalise each of these Learning Steps, the following sections outline core actions that higher education institutions can undertake, alongside concrete key practices illustrating how learning transformation can be implemented across diverse institutional contexts. Complementary example boxes highlight illustrative practices that demonstrate these approaches in action.

## ISTEP 1 — Define and Systemise Green Content and Learning Outcomes

**Goal:** *Align learning outcomes with green competencies and global greening indicators.*

Innovation in content involves moving beyond adding isolated topics to reshaping the entire curriculum through a **"spiral curriculum"** approach, where key concepts are revisited with increasing complexity (UNESCO, 2024b).

This step initiates the holistic transformation of higher education by transitioning from the fragmented insertion of environmental topics to a systematic restructuring of the educational experience. Innovation in content centres on the "spiral curriculum" approach,

ensuring that core concepts—such as climate science, resilience, and post-carbon economics—are revisited across all levels of study with increasing depth and complexity.

The **Global Greening Curriculum Indicator** (SDG 4.7.1) supports institutions with moving beyond subjective reporting to objective, **evidence-based mainstreaming** of green themes in the official intended curriculum. The following table outlines core actions and innovative practices recommended to achieve alignment.

**Table 2**

*Actions and practices to systemise green content*

| Core actions | Key practices |
|---|---|
| Align with Greening Indicators | • Map syllabi against representative keywords for Environment, Sustainability, Climate Change, and Biodiversity to ensure objective integration (Antoninis et al., 2025).<br>• Ensure content balances the environmental, social, and economic pillars of sustainability |
| Integrate Systems Thinking | • Move beyond linear knowledge to teach causal feedback loops and multi-scalar interactions across ecological and social systems<br>• Use "metaconcepts" like planetary boundaries and complexity as starting points for inquiry |
| Infuse Climate Justice | • Embed content that addresses the historic responsibility of global actors and the unequal burden of climate impacts on marginalised groups<br>• Target underlying social structures, such as power relations and systems of discrimination |
| Leverage Indigenous and under-represented Knowledge | • Incorporate land-based learning and traditional ecological knowledge as central epistemological lenses (GEM Report UNESCO, 2024; UNESCO, 2024b).<br>• Use storytelling and ancestral connections to nature as valid scientific and cultural inputs |

The actions and practices outlined in Table 2 gain further legitimacy when considered alongside initiatives such as EDINSOST (see ) and GATE (see ), which demonstrate how competence-based sustainability integration can be operationalised at scale. The EDINSOST project illustrates how universities can move beyond isolated course reform by systematically mapping sustainability competencies across degree programmes, aligning teaching strategies with defined learning outcomes, and strengthening faculty capacity. Its coordinated, multi-university structure reflects the kind of structured alignment and institutional coherence required for effective curriculum transformation.

**Box 1. The EDINSOST Project: Improving Sustainability Education**

The EDINSOST R+D+i project strengthens sustainability education in Spanish higher education. Funded by national research programs, it brings together ten universities to develop common frameworks for integrating sustainability competencies into curricula.
The project maps sustainability skills across degrees, validates innovative teaching strategies, assesses faculty training needs, and evaluates student learning outcomes. Special focus is given to Education and technological degrees due to their long-term societal impact.
EDINSOST promotes a coordinated, holistic approach to embedding environmental, social, and economic sustainability into university education.

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Similarly, the Erasmus+ GATE initiative translates the GreenComp framework into practice through self-evaluation tools, leadership training and certification mechanisms that embed sustainability into governance, pedagogy and school culture. Both examples reinforce the principle that greening education must be measurable, competence-driven and institution-wide. They demonstrate that aligning curricula with recognised sustainability frameworks is a practical pathway for embedding systems thinking, justice-oriented perspectives and participatory approaches across educational levels, consistent with European policy ambitions for a climate-ready education system.

**Box 2. GreenComp Assessment for Trans-for-ma-tive Education**

GATE is a three-year Erasmus+ project (2025–2028) that helps secondary schools across Europe place sustainability at the heart of everyday school life. Rather than treating sustainability as just another subject, GATE encourages schools to live it — in the classroom, in decision-making, and in their relationship with the wider community.
Inspired by the European GreenComp framework, the project develops practical self-evaluation tools, training for teachers and school leaders, and a Sustainability School Certification Model that recognises meaningful progress. Students are active contributors in shaping more sustainable school environments.

Learn more

## ISTEP 2 — Implement Transformative and Applied Pedagogies

**Goal:** *Shift from passive transmission to learner-centred, action-oriented experiences.*

The transition from knowledge acquisition to the cultivation of sustainable agency requires a fundamental shift in **how** learning occurs. This second step of the Learning Pillar focuses on moving beyond the passive transmission of climate facts toward **learner-centred, action-oriented experiences** (UNESCO, 2024b). By adopting transformative pedagogies, higher education institutions empower students to evolve from recipients of information into active **agents of change** capable of navigating complex, real-world socio-ecological challenges.

Innovation in this step addresses the socio-emotional and behavioural dimensions of learning, ensuring that climate knowledge serves as a catalyst for positive attitudinal shifts and

collective resilience rather than inducing eco-anxiety or powerlessness (GEM Report UNESCO, 2024) see **Table 3**.

**Table 3**

*Actions and practices for transformative green pedagogies*

| Core Actions | Key Practices |
|---|---|
| Adopt Experiential Pedagogies | • Connect theory with practice through environmental audits, site visits, and community projects<br>• Implement project-based learning linked directly to the Sustainable Development Goals (SDGs) |
| Utilise Digital Innovations | • Integrate AI-driven personalization for ethical learning paths and Metaverse/XR environments for risk-free simulation of complex sustainability scenarios.<br>• Employ AI-driven personalisation for adaptive and ethical learning paths |
| Foster Co-Creation | • Use participatory methods like Photovoice, where students collaboratively construct meaning through visual narratives of local sustainability challenges.<br>• Implement "dialogic gatherings" where students and teachers co-design learning priorities |
| Practice Reflexive Inquiry | • Create "safe spaces" for existential reflection, allowing students to process climate anxiety and develop personal agency (UNESCO, 2024b).<br>• Use critical pedagogy to challenge prevailing norms and political decisions |

The shift towards transformative and applied pedagogies represents a necessary evolution from knowledge transmission to competence formation and agency development. In line with international guidance on Education for Sustainable Development, this step recognises that sustainability learning must engage cognitive, socio-emotional and behavioural dimensions simultaneously. Experiential and project-based approaches link theory to real-world challenges, enabling learners to apply systems thinking and problem-solving skills in authentic contexts. Digital innovations, including AI-supported personalisation and immersive simulations, further extend these possibilities by creating adaptive and ethically guided learning pathways that allow students to explore complex sustainability scenarios without real-world risk.

Equally critical is the emphasis on co-creation and reflexive inquiry. Participatory methods such as dialogic gatherings reposition learners and educators as partners in knowledge construction, fostering shared responsibility and democratic engagement. The

Jornadas Pedagógicas at the University of Lisbon (see ) exemplify how structured, institution-wide dialogue can catalyse pedagogical renewal by creating horizontal spaces for reflection and exchange across the academic community. Such practices operationalise transformative learning principles, embedding sustainability not only in curriculum content but also in institutional culture.

**Box 3. Example of dialogic gatherings to navigate pedagogical innovation**

The **Jornadas Pedagógicas**, established by the University of Lisbon (ULisboa) in 2022, exemplify the use of dialogic gatherings to foster institutional transformation and pedagogical innovation. These events are structured as regular cycles of sharing and reflection that bring together the entire academic community—including students, teachers, researchers, and technical-administrative staff—to discuss themes of common interest and reinforce cooperation.

By focusing on a specific annual theme, the Jornadas promote a horizontal space for discussion and the exchange of experiences regarding pedagogical methodologies. This approach directly aligns with transformative learning principles, which shift the educational paradigm from one-way information transmission to dialogue and negotiation among egalitarian partners. Within the GREEN LEAF Framework, such gatherings serve as a critical mechanism for co-constructing knowledge, allowing stakeholders to become active co-creators of their learning environments.

Learn more

## ISTEP 3 — Model Practices through Green Learning Environments

**Goal:** *Transform campuses and digital platforms into living laboratories.*

The environment must model the sustainability principles being taught, bridging the gap between classroom knowledge and civic life (UNESCO, 2024b). Thus, the third step of the Learning Pillar shifts the focus from pedagogy to the **physical, digital, and community-based settings** where learning occurs. Consistent with the **Whole-Institution Approach (WIA)**, this step recognizes that the learning environment is not a neutral backdrop but an **active mediator of educational experience – see** Table 4. To get every learner "climate-ready," the institution must "walk the talk" by transforming its own operations and platforms into **living laboratories** for sustainability. Transitioning to green learning environments requires **cross-sectoral collaboration** between academic departments and facilities management. This integrated model provides high-impact outcomes by allowing students to acquire hands-on skills in **real-world systems**, such as biodiversity mapping or lifecycle assessments of campus buildings. As highlighted by the **Greening Education Partnership**, these environments foster a culture of inquiry and responsibility, preparing graduates to navigate the complexities of the Anthropocene with **humility and critical reflexivity.**

**Table 4**

*Actions and practices for transforming the learning environment*

| Core Actions | Key Practices |
|---|---|
| Establish Campus-as-Lab | • Use university operations (e.g., **waste audits, energy monitoring**, green building design) as direct educational resources for student research<br>• Involve students in institutional planning using frameworks like STARS for benchmarking |
| Enhance Place-Based Settings (UNESCO, 2024a) | • Dissolve boundaries between campus and community through **service-learning** and partnerships with local NGOs for justice-oriented projects<br>• Anchor learning in local geographic and cultural contexts to make sustainability tangible |
| Adopt Embodied Learning | • Implement **outdoor and multisensory settings** (e.g., eco-rituals, land stewardship) to foster ecological empathy and kinship with nature |

| Core Actions | Key Practices |
|---|---|
| Ensure Digital Sustainability | • Use nature observation and "contemplative walks" as methods for investigating ecological ethics<br>• Design hybrid environments that use **low-bandwidth solutions** and open resources to reduce the ecological footprint of the technology used<br>• Critically reflect on the material and energy use of the digital infrastructures used for learning |

The third learning step consolidates the Whole-Institution Approach by positioning the campus and its ecosystem as active pedagogical actors. In line with international guidance that calls on institutions to “walk the talk,” green learning environments operationalise sustainability through institutional practice, ensuring coherence between what is taught and what is lived. The Campus-as-Lab model exemplifies this integration: by embedding student research within operational systems—energy monitoring, waste audits, biodiversity mapping or lifecycle assessments—institutions convert infrastructure into educational capital. This approach strengthens applied competences and also institutional accountability, as benchmarking tools and participatory planning frameworks connect learning outcomes with measurable sustainability performance.

The Living Laboratory Seed Fund at University College Cork (see ) demonstrates how structured funding mechanisms can catalyse this model by linking cross-disciplinary research with campus operations and open knowledge sharing.

**Box 4. Sustainability & Climate-Action Living Lab Seed Fund**

The University College Cork (UCC) Living Laboratory Seed Fund, established by UCC Green Campus and funded by the HEA, empowers students and staff to use their research capabilities to solve real-world sustainability issues related to institutional infrastructure and practices. By using the university itself as a "testbed," the programme bridges the gap between academic theory and operational reality.
Core Objectives of the Programme:
• *Real-Life Problem Solving*: Projects are designed to address tangible challenges within the campus or local community.
• *Cross-Boundary Partnerships*: Initiatives must be based on collaborations that cross disciplinary or sectoral boundaries.
• *Iterative Testing*: Ideas are trialled in real-life settings to allow for the continuous refinement of solutions.
• *Open Knowledge Sharing*: Data and findings generated by funded projects are shared openly to foster collective learning.
Launched in 2019, the programme is now in its third funding round (as of July 2023), specifically supporting UCC’s **Sustainability and Climate Action Plan (2023–2028)**. Notable projects include **"Re-UCC,"** which focuses on campus waste prevention through re-use, the **UCC Open Arboretum**, and **"Plastics Free UCC,"** which explores social and marketing levers to reduce plastic dependency. This programme exemplifies the "Campus-as-Lab" model, transforming the university into a vital mediator of sustainability experience (UCC Living Laboratory, 2023).

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Similarly, the Åmosen Living Lab coordinated by the University of Copenhagen ( ) extends the concept beyond campus boundaries, transforming landscape restoration

into a co-creative platform that integrates scientific expertise, stakeholder engagement and policy-relevant experimentation. Both initiatives illustrate how universities can act as mediators between knowledge production and territorial transformation, aligning research, teaching and civic responsibility.

**Box 5. Land Use Change for the Green Transition: The Åmosen Living Lab**

Coordinated by the Green Solutions Centre at the **University of Copenhagen (UCPH)**, this Living Lab addresses the complex interests, conflicts, and environmental dilemmas arising from land use changes during the green transition. It serves as a platform to generate and **co-create solutions** with all partners relevant to land use planning and the rewetting of drained wetland areas.

Core Focus and Activities:

- *Geographic Focal Point*: The lab revolves around the drained wetlands and regulated streams of **Åmosen** in Western Zealand.
- *Restoration of Carbon-Rich Soils*: A primary objective is developing specific pathways for the **rewetting of carbon-rich soils**, a critical measure for climate change mitigation.
- *Scalable Lessons*: The findings and strategies developed in Åmosen are designed to be transferable to other geographical sites involving the restoration of carbon-rich ecosystems.

This initiative exemplifies the *"Campus-as-Lab"* model, transforming academic research into an active tool for social and ecological intervention. By involving researchers, students, and external stakeholders, the university acts as a vital mediator of sustainability experience, bridging the gap between theoretical knowledge and real-world landscape transformation.

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Beyond physical infrastructure, place-based and embodied learning practices strengthen ecological literacy and ethical reflection by grounding sustainability in local contexts and lived experience. Ensuring digital sustainability further expands this responsibility, requiring institutions to critically assess the material footprint of educational technologies and design low-impact, open-access systems.

## ISTEP 4 — Design Holistic and Adaptive Assessments

**Goal:** *Measure transformation across cognitive, socio-emotional, and behavioural domains.*

Assessment must evolve beyond simple knowledge testing to evaluate the development of green agency (UNESCO, 2024a, 2024b).

Assessment serves as the final mechanism for validating the transition from theoretical knowledge to demonstrated green agency. In alignment with the OECD's focus on "agency in the Anthropocene" and UNESCO's transformative learning agenda, this step moves beyond traditional testing of scientific facts to evaluate a learner's capacity for complex problem-solving, ethical reasoning, and collective action. Assessment must be holistic, capturing not only intellectual mastery but also the socio-emotional dispositions—such as empathy and resilience—and the behavioural commitment required to navigate climate uncertainties. To ensure high-quality outcomes, assessment practices must transition from a "one-size-fits-all" model to an adaptive framework that recognizes diversity in learner backgrounds and contexts. Actionable implementation requires institutions to move away from "about" learning to "for" sustainable development, using validated, reliable measures to track long-term behavioural shifts.

**Table 5**

*Actions and practices for holistic green assessment |*

| Core Actions | Key Practices |
|---|---|
| Measure Green Competencies | • Use GreenComp-aligned audits to assess skills in future literacy, systems thinking, and political agency<br>• Evaluate learners' capacity to manage complexity and uncertainty in real-world scenarios |
| Utilise Authentic Products (UNESCO, 2024) | • Grade "naturalistic" products, such as action plans, student journals, and project-based portfolios, instead of traditional exams (UNESCO, 2024a).<br>• Use peer-review and group debates to assess "relational agency" and collective problem-solving |
| Implement Digital Badging | • Issue competency-based digital badges for achievements in areas like ecological literacy and systems mapping<br>• Align badges with international accreditation standards to enhance graduate employability |
| Integrate Continuous Feedback | • Establish iterative feedback loops involving educators, peers, and stakeholders to refine learning paths in real-time<br>• Incorporate social-emotional self-assessments to monitor student well-being and resilience over time |

The fourth learning step consolidates curriculum transformation by aligning assessment with the development of green agency. Assessment is, thus, repositioned as a mechanism for evaluating learners' capacity to apply systems thinking, exercise ethical judgment and act collectively in conditions of uncertainty. Measuring sustainability competences therefore requires tools that capture cognitive mastery alongside socio-emotional dispositions—such as empathy and resilience—and observable behavioural commitments. Aligning audits and evaluation criteria with frameworks such as GreenComp strengthens coherence and comparability, while ensuring that learning outcomes are anchored in recognised sustainability competences.

The shift toward authentic and adaptive assessment practices operationalises this ambition. Evaluating portfolios, action plans and project-based outputs moves assessment from abstract testing to situated problem-solving, while peer review and deliberative formats assess relational agency and collaborative capacity. Digital badging and competency-based recognition systems further connect sustainability learning with employability and international standards, reinforcing the workforce relevance of green competences. Continuous feedback loops, including social-emotional self-assessment, support iterative learning and well-being monitoring, ensuring that transformation is sustained rather than episodic.

The experience of TU Dublin's competency mapping initiative ( ) illustrates how structured, evidence-based audits can inform curriculum redesign. Specific sustainability competences are identified and integrated with co-creation practices.

**Box 6. o-Create & NEMOS: Competency Mapping for Evidence-Based Transformation**

TU Dublin's School of Food Science and Environmental Health utilized a custom mapping tool, based on the **AASHE STARS framework**, to systematically audit its BSc Food Innovation degree. This process identified **70 specific sustainability competencies** required to guide a comprehensive curriculum redesign. The initiative uniquely integrates **student co-creation** with continuous professional development for staff, ensuring that learning outcomes remain adaptive and grounded in the complex needs of the global food system (Dunne et al., 2023).

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## Engagement

The **Engagement** pillar of the LEAFs positions *people*—rather than content, tools, or technology—as the driving force of green transformation in higher education. Evidence shows that curriculum greening succeeds when educators, institutional leaders, students, and external partners collaborate as *co-creators* of knowledge and practice, rather than passive recipients of top-down strategies. This approach reflects principles highlighted in UNESCO's *Greening Curriculum Guidance* (2024) and the *Green School Quality Standard* (2024), which emphasise shared responsibility, distributed leadership, and participatory decision-making as foundations for whole-institution transformation.

To operationalise these insights, the LEAF Framework proposes a structured engagement pathway built around **four Engagement Steps (eSTEPS)**. These steps provide an actionable sequence for building, strengthening, and institutionalising the human relationships and collaborative cultures necessary for greening higher education. Each eSTEP identifies **core actions**—the strategic moves institutions must take—and **key practices**—the concrete activities that bring these actions to life.

The four eSTEPS guide higher education institutions in engaging three central human domains of the GreenUS Framework: **Educators • Stakeholders • Ambassadors**
They also enable institutions to embed engagement into governance systems and long-term organisational culture.

The four eSTEPS are:

1. **eSTEP 1 — Engage and Empower Educators**. Build educator capacity, motivation, and collaborative structures for sustainability teaching.
2. **eSTEP 2 — Build Strategic Partnerships with Stakeholders**. Expand sustainability learning beyond the university through inclusive, community-rooted collaborations.
3. **eSTEP 3 — Activate a Network of Green Learning Ambassadors**. Mobilise students, staff, and partners as catalysts of sustainability engagement and innovation.
4. **eSTEP 4 — Institutionalise Engagement through Structures and Governance**. Embed engagement into policies, decision-making, quality assurance, and long-term institutional systems.

To operationalise each of these Engagement Steps, the following sections outline the core actions that higher education institutions can take, alongside concrete key practices that illustrate how these actions can be implemented in real contexts. Complementary example boxes highlight initiatives from diverse institutions that demonstrate these practices in action.

## eSTEP 1 — Engage and Empower Educators. How do we prepare educators to embrace sustainability?

**Goal:** *Build educator capacity, motivation, and collaborative structures*

Educators are the primary catalysts of sustainability learning. This step focuses on enabling them to **teach differently, collaborate meaningfully, and innovate confidently** (Table 6).

**Table 6**
*Actions and practices to engage and empower educators*

| Core actions | Key practices |
|---|---|
| Provide training in transformative and sustainability pedagogies (UNESCO, 2024) | • Deliver workshops on systems thinking, futures literacy, and critical pedagogy<br>• Train educators in experiential, place-based, and project-based methods<br>• Include social–emotional aspects (climate emotions, agency, hope)<br>• Offer micro-credentials or CPD certificates in sustainability teaching<br>• Use model lessons and exemplars aligned with GreenComp competencies |
| Create cross-disciplinary teaching teams | • Form curriculum teams including experts from diverse faculties<br>• Implement paired or co-teaching models around sustainability themes<br>• Organize interdisciplinary design sprints for new modules<br>• Use shared problem-based learning challenges to bridge disciplines<br>• Facilitate regular cross-faculty meetings to align learning outcomes |
| Offer incentives (time, recognition, micro-grants) | • Provide teaching relief or workload points for curriculum greening<br>• Introduce sustainability teaching awards / recognition schemes<br>• Allocate micro-grants for innovative teaching pilots<br>• Include sustainability teaching contributions in promotion criteria<br>• Fund travel or dissemination for educators presenting green teaching innovations |
| Establish educator communities of practice | • Create monthly peer-learning circles focused on sustainability pedagogy<br>• Establish online hubs for sharing resources and teaching materials<br>• Invite external experts (NGOs, municipalities, industry) into sessions<br>• Host interdisciplinary “brown bag” seminars around green teaching problems |

| Core actions | Key practices |
|---|---|
| Encourage co-design of modules and assessment | • Run co-design workshops including educators, students, and stakeholders<br>• Map modules against GreenComp competencies for alignment<br>• Develop authentic assessments linked to real sustainability challenges<br>• Use backward design approaches for clarity of outcomes and impact<br>• Pilot assessments with student ambassadors for feedback and refinement |

The core actions proposed in eSTEP 1 reflect the complementary conditions required to build educator engagement as a foundation for curriculum greening. Providing structured **training** in transformative and sustainability pedagogies is essential for equipping educators with the epistemic, methodological and affective capacities demanded by sustainability learning. Yet pedagogical upskilling alone is insufficient without organisational arrangements

that support collective work. Cross-disciplinary **teaching teams** (see **Box** ), for example, respond to the inherently systemic and transdisciplinary nature of sustainability challenges, enabling educators to transcend disciplinary silos and co-construct integrative learning experiences. **Incentive structures**—including time allocation, recognition and micro-grants—further signal institutional commitment, addressing well-documented barriers related to workload, legitimacy and competing academic priorities.

### Box 7. EELISA Communities as catalysts for cross-disciplinary teaching teams

The EELISA Communities are mission-driven collaboration platforms that play a central role in reshaping higher education across the European Engineering Learning Innovation and Science Alliance (EELISA). These Communities bring together students, educators, researchers, professional staff and external stakeholders — including public institutions, companies and civil society actors — to address real-world societal and environmental challenges from interdisciplinary perspectives.
Hosted and coordinated through the EELISA Digital Campus, the Communities serve as dynamic hubs where cross-disciplinary teaching teams can form, grow and thrive. They go beyond traditional academic silos, enabling educators from diverse fields to design and deliver learning experiences that integrate knowledge from multiple disciplines, such as engineering, social sciences, arts and environmental studies.
Key features of EELISA Communities as boosters of cross-disciplinary teaching teams:

- Shared Mission and Real-World Focus: Each Community is oriented toward pressing global challenges and the Sustainable Development Goals (SDGs). This mission-driven approach naturally encourages educators to combine expertise from different disciplines to co-design curricula, project-based learning activities, and challenge-based learning experiences rooted in real problems.
- Collaborative Team Formation: By bringing together educators with varied backgrounds alongside students and external partners, EELISA Communities foster cross-disciplinary teaching teams whose collective strengths enrich the learning journey and expand educational impact.
- Experiential and Impact-Oriented Learning: Activities within Communities — from collaborative workshops and think tanks to joint research and SDG-oriented projects — create fertile ground for educators to embed active, participatory and transdisciplinary pedagogies into their teaching practice.

Learn more

Equally important are **communities of practice** (see Box ), which provide the social infrastructure for sustained professional learning, enabling educators to share practices, negotiate meaning and normalise innovation in a supportive environment.

### Box 8. The GlobeCOP – an international community of practice for sustainability and STEAMSS

**GlobeCOP** (Global Learning Opportunities for Green and Sustainability Education in STEAM and Social Sciences *Community of Practice*) is an international, collaborative network developed under the **GLOBE-STEAMSS** project. It brings together educators, researchers, students and professionals across Europe who are engaged in advancing sustainability, digital transformation and inclusive education in STEAMSS (Science, Technology, Engineering, Arts, Mathematics and Social Sciences). The community serves as a dynamic **space for shared learning, co-creation and professional** growth, enabling members to:

- Exchange experiences and best practices in innovative teaching, curriculum design and sustainability education.
- Develop green, digital and entrepreneurial competencies that are crucial for future-oriented education.
- Collaborate on real-world challenges through joint projects, design challenges and hackathons that connect theory with practical action.
- Access a dedicated digital platform offering resources, tools, teaching materials and a shared educational ecosystem to support inclusive and open learning.

GlobeCOP is designed as a supportive, interdisciplinary network that strengthens community-driven innovation in education, fosters global knowledge exchange, and empowers educators to shape the future of teaching and learning in a rapidly changing global landscape.

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Finally, **co-design processes** ensure that sustainability teaching is not developed in isolation but emerges through participatory collaboration with students, colleagues and external stakeholders, enhancing relevance, ownership and pedagogical coherence ( ).

### Box 9 The Social Tech Hub at UCLL as a co-design space

The Social Tech Hub serves as a collaborative space for students, startups, and local communities to co-create tech-driven solutions to societal challenges. It will focus on developing and implementing innovation action plans, delivering entrepreneurship programs, and providing mentorship for aspiring tech entrepreneurs. By building strong partnerships with industry leaders, startups, and other academic institutions, the hub will support technology **transfer and help bridge the gap between academic research and real-world applications.**

Learn more

## eSTEP 2 — Build Strategic Partnerships with Stakeholders. How do we work with society to make sustainability learning real and relevant?

**Goal:** *Expand green learning beyond the university walls*

Sustainability becomes transformative when HEIs collaborate with the community and external partners. UNESCO stresses that greening education must be **inclusive, participatory, and community rooted**.

eSTEP 2 focuses on strengthening the role of higher education institutions as **anchoring actors within regional sustainability ecosystems**. Moving beyond internal capacity-building, this step addresses how universities deliberately engage with municipalities, civil society organisations, industry, and other external partners to co-create meaningful sustainability learning opportunities. The core actions defined in eSTEP 2 reflect a shift from episodic collaboration toward structured, long-term, and pedagogically embedded partnerships. This approach aligns with international policy frameworks that emphasise community-rooted, participatory, and action-oriented education for sustainable development. UNESCO's Greening Curriculum Guidance highlights that sustainability learning becomes transformative when learners engage with real-world actors, contexts, and challenges, while GreenComp underscores the importance of collective action, political agency, and systems thinking as key sustainability competencies.

**Table 7**

*Actions and practices to boost the learning ecosystem*

| Core actions | Key practices |
|---|---|
| Identify and map relevant stakeholders | • Conduct a campus-wide stakeholder mapping exercise<br>• Include municipalities, NGOs, industry, and civil society<br>• Prioritize partners aligned with local sustainability challenges<br>• Establish long-term collaboration agreements (MOUs) |
| Co-create sustainability projects with partners | • Involve partners in defining real-world project briefs<br>• Use living labs or challenge-based learning formats<br>• Invite partners to co-supervise student research or capstone projects<br>• Connect projects to regional climate or SDG strategies |
| Integrate stakeholder expertise into teaching | • Invite practitioners for guest lectures and masterclasses<br>• Use practitioner case studies as core teaching materials<br>• Offer joint seminars taught by educators + stakeholders<br>• Create stakeholder-in-residence or mentor roles |
| Facilitate experiential, community-based learning | • Organize fieldwork, site visits, and service-learning programmes<br>• Use community knowledge (including Indigenous knowledge) to contextualize learning<br>• Develop cross-sector hackathons or design challenges<br>• Embed community data into coursework and assessments |
| Establish stakeholder advisory boards | • Create faculty- or university-level sustainability advisory councils<br>• Include youth, NGOs, policy-makers, and business representatives<br>• Use boards for annual review of sustainability curricula<br>• Align teaching goals with regional sustainability agendas |

The first core action in eSTEP 2—**identifying and mapping relevant stakeholders**—establishes the foundation for effective collaboration. Rather than relying on informal or ad hoc partnerships, institutions are encouraged to adopt a strategic approach that recognises the diversity of actors shaping local and regional sustainability transitions. Systematic stakeholder mapping enables institutions to prioritise partners whose expertise and mandates align with pressing sustainability challenges, while formal collaboration agreements help ensure continuity, clarity of roles, and mutual commitment over time.

The example in illustrates how different institutions have operationalised stakeholder mapping and long-term engagement to support curriculum-relevant collaboration, demonstrating the value of intentional partnership design.

**Box 10. Academic-driven stakeholder mapping in the NEXTFOOD project**

**NEXTFOOD** is a European-funded project aimed at transforming education and training for sustainable agrifood and forestry systems. It promotes a shift from top-down knowledge transfer toward learner-centric, action-based approaches where students, researchers, farmers, and other stakeholders collaborate on real sustainability challenges.

The project built a research and education-driven partnership of 19 organisations across 13 countries and 3 continents. The consortium was anchored by universities and specialised training institutions, ensuring that stakeholder engagement remained pedagogically grounded.

To complement this academic core, the project established a Stakeholders' Advisory Board (SAB) bringing in agricultural cooperatives, regional governments, foundations, and industry actors. Critically, SAB members were engaged throughout the project's lifetime, enabling sustained, curriculum-relevant collaboration rather than one-off consultations. This intentional two-tier structure enabled partners to co-develop case-based action learning grounded in real sustainability challenges.

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Furthermore, the stakeholders become co-designers of learning. Involving partners in defining project briefs and supervising student work ensures that learning activities respond to real-world needs and policy priorities, while formats such as living labs and challenge-based learning provide structured environments for collaboration. This practice supports learners in developing applied sustainability competencies by engaging with complexity, uncertainty, and competing interests. It also reinforces the role of higher education institutions as contributors to regional climate strategies and SDG implementation, as illustrated in the accompanying box

( ) showcasing co-created projects linked to urban resilience, education innovation, and regional development agendas.

### Box 11. Example of co-creation practices in response to the need to build resilient and sustainable cities

Faced with demographic growth, climate change and the digital revolution, the question of how to build sustainable, resilient and welcoming cities for all has become one of the defining challenges of the 21st century. Meeting this challenge requires a coordinated effort from the academic world, businesses, local authorities and society at large.

To remain at the forefront of innovative research, to train the future professionals who will shape tomorrow's cities, and to strengthen its capacity to transfer knowledge to industry, the École nationale des ponts et chaussées is investing in a new co-creation space: the Co-Innovation Lab.

This laboratory is designed as a multidisciplinary hub where researchers, students and companies can work together to accelerate innovation. It responds simultaneously to three key needs:

- Advancing research and innovation through state-of-the-art facilities that foster cross-fertilisation of knowledge, data analysis, experimentation and large-scale prototyping.
- Boosting the competitiveness of companies by enabling them to co-innovate with École des Ponts researchers, laboratories and scientific equipment through collaborative research partnerships.
- Enriching education and training by opening innovation spaces to professors and students and integrating experimental insights directly into teaching.

Through the Co-Innovation Lab, the École des Ponts positions itself as a catalyst for new ideas, new methods and new professions dedicated to building the cities of the future.

Learn more

A further core action in eSTEP 2 is the **integration of stakeholder expertise into teaching**. This goes beyond occasional guest lectures to encompass sustained pedagogical involvement through joint seminars, practitioner-led case studies, and stakeholder-in-residence or mentoring roles. Such practices diversify epistemic perspectives within the curriculum and expose learners to applied knowledge, professional practices, and lived experience (see ).

### Box 12. Integrating Stakeholder Expertise Through the LEARNathon and Challenge-Based Learning

The **LEARNathon** (Learning, Engagement and Research Nexus Hackathon), developed at National University of Science and Technology POLITEHNICA Bucharest, offers an example of how stakeholder expertise can be meaningfully integrated into teaching through **challenge-based learning** (CBL) and hybrid university–school partnerships. Designed within Initial Teacher Education programmes, the LEARNathon connects **pre-service teachers, schoolteachers, pupils, and university educators** to collaboratively address real challenges linked to the Sustainable Development Goals (SDGs).

**A Two-Stage Collaborative Learning Ecosystem**

The initiative is structured as a **multi-actor learning environment** composed of two interlinked stages:

**1. The LEARNathon — University-Based Co-Design with Stakeholders.** Pre-service teachers work in mixed teams to address authentic educational challenges presented by instructors and school partners. They draw on **stakeholder expertise**—including school practitioners and educational researchers—to develop prototypes such as serious games; interactive teaching materials; apps and digital tools; workshops and training programmes

**2. EduFest — School-Based Implementation and Testing.** The most promising designs are implemented with pupils in local schools during *EduFest*, a festival-style collaborative event. Schoolteachers, pupils, and university mentors participate in testing, evaluating, and refining the learning experiences. This step ensures **real-world applicability, iterative improvement**, and mutual learning across educational levels.

Moreover, **facilitating experiential, community-based learning**—recognises that sustainability learning is deeply contextual. Fieldwork, service-learning, site visits, and community-based challenges allow learners to engage directly with local sustainability dynamics, including social, environmental, and cultural dimensions. Importantly, this action also foregrounds the role of community and Indigenous knowledge in contextualising academic learning, thereby promoting epistemic plurality and social justice.

### Box 13. Example of community-based learning

An illustrative example of community-based learning is the development of a transnational online educator learning community within an Erasmus+ cooperation project (https://includeup.eu/) focused on inclusive digital entrepreneurship for adults with migrant backgrounds. The community was created in response to concrete societal challenges related to social inclusion, employability, and unequal access to entrepreneurial opportunities, particularly in digitally driven economies. Adult educators from higher education institutions, NGOs, and adult education centres across multiple European countries engaged in a shared learning space where professional learning emerged through peer exchange, co-creation of teaching resources, and reflection on real-world educational practice. Grounded in the everyday realities of working with migrants and vulnerable adult learners, the community enabled educators to connect theory with practice, adapt pedagogical approaches to diverse local contexts, and collectively develop more inclusive and responsive learning strategies. Rather than functioning as a static platform, the community operated as a living learning ecosystem in which continuous interaction, feedback loops, and shared responsibility supported community-based learning, professional agency, and sustainable educational innovation.

The final core action in eSTEP 2—**establishing stakeholder advisory boards**—supports the long-term alignment of teaching and learning with societal needs. Advisory boards create structured spaces for dialogue between universities and external actors, enabling regular reflection on curriculum relevance, responsiveness, and impact. Including diverse representatives—such as youth, NGOs, policymakers, and industry—ensures plural perspectives and strengthens accountability.

### Box 14. PROMEnhance Booklet

Cooperation with local authorities, CSOs and HEI for certifying competences on territorial development (PROMEnhance Booklet) - as a result of the work done within the project, the Erasmus+ PROMEnhance partnership released a Booklet with 11 practical recommendations for Higher Education Institutions on how to improve and institutionalise cooperation with external stakeholders in the provision of certified programs.

Learn more

## eSTEP 3 — Activate a Network of Green Learning Ambassadors. Who within and around the institution drives sustainability engagement?

**Goal:** *Mobilise students, staff, and partners as catalysts of sustainability engagement and innovation*

eSTEP 3 focuses on **mobilising people as agents of change** by activating a Network of Green Learning Ambassadors across the institution and its partner ecosystems. While eSTEP 2 establishes structured partnerships with external stakeholders, eSTEP 3 concentrates on **human agency, leadership, and peer-driven innovation**, recognising that sustainability transformation depends not only on formal structures but on empowered individuals who can catalyse change from within.

This step reflects growing evidence that student and staff leadership, when meaningfully supported, plays a critical role in embedding sustainability across teaching, learning, and campus life. International frameworks such as GreenComp or the Learning Compass emphasise competences related to political agency, collective action, and individual initiative, highlighting the importance of enabling learners and educators to move from awareness to action eSTEP 3 operationalises these competences by creating formal pathways for participation, leadership, and recognition.

**Table 8**

*Actions and practices to develop a network of Green Ambassadors*

| Core actions | Key practices |
|---|---|
| Identify and recruit ambassadors | • Set open calls for students, staff, educators, and community partners<br>• Use nomination pathways to recognize emerging sustainability leaders<br>• Apply transparent, inclusive selection criteria (diversity, motivation, leadership potential)<br>• Align ambassador roles with GreenComp competencies (agency, collective action) |
| Train ambassadors in sustainability leadership | • Provide training in communication, facilitation, and project design<br>• Offer learning modules on political agency, climate justice, and systems thinking<br>• Use mentorship from senior staff or external sustainability practitioners<br>• Develop ambassador toolkits for projects and outreach |
| Enable ambassadors to lead initiatives | • Empower ambassadors to design and manage sustainability campaigns<br>• Allow them to co-create events, workshops, and student engagement programmes<br>• Integrate ambassador-led micro-projects into curriculum or campus operations<br>• Provide seed funding for ambassador innovations |
| Embed ambassadors into institutional structures | • Include ambassadors in teaching committees and sustainability councils<br>• Involve them in curriculum review or pilot course evaluations<br>• Assign them roles in new student orientation or community outreach<br>• Formalise roles through badges, credits, or paid positions |

| Core actions | Key practices |
|---|---|
| Recognize and showcase ambassador contributions | • Highlight ambassadors in university publications and events<br>• Award certificates or leadership recognition<br>• Offer pathways for ambassadors to present at conferences or HE networks<br>• Maintain an online portfolio of ambassador-led practices (for digital catalogue use) |

The following section, **The Living Component: Network of Green Learning Ambassadors**, operationalises eSTEP 3 by detailing the core actions, key practices, and illustrative examples through which such networks can be established, supported, and sustained.

## eSTEP 4 — Institutionalise Engagement through Structures and Governance. How do we ensure this engagement endures beyond projects and people?

**Goal:** *Embed engagement into policies, decision-making, quality assurance, and long-term institutional systems.*

eSTEP 4 represents the transition from **activation to institutional permanence**. While earlier steps focus on building partnerships (eSTEP 2) and mobilising people as change agents (eSTEP 3), eSTEP 4 addresses the conditions required to ensure that sustainability engagement becomes **embedded, sustained, and resilient beyond individual projects, champions, or funding cycles**.

At this stage, sustainability engagement is no longer treated as an add-on or an experimental initiative. Instead, it is integrated into the **formal systems that shape how the institution plans, governs, evaluates, and allocates resources**. This reflects a core insight from international frameworks on education for sustainable development: transformative change in higher education requires alignment between pedagogical innovation and institutional governance.

The core purpose of eSTEP 4 is to translate the momentum generated through educator engagement, stakeholder collaboration, and ambassador networks into **durable institutional arrangements**. This includes embedding sustainability engagement within strategic plans, policy frameworks, and key performance indicators, thereby signalling long-term institutional commitment and accountability. Alignment with broader policy agendas—such as the Sustainable Development Goals, the EU Green Deal, and national climate education strategies—further situates institutional action within wider societal transformations. Unlike eSTEP 2, where external stakeholders are primarily engaged as co-creators of learning, eSTEP 4 positions stakeholders, students, and ambassadors within **governance and oversight roles**. Sustainability councils, steering committees, and advisory bodies provide structured spaces where diverse perspectives inform decision-making, curriculum priorities, and institutional direction. This shift from collaboration to governance is a defining feature of eSTEP 4.

**Table 9**
*Actions and practices to institutionalise engagement*

| Core actions | Key practices |
|---|---|
| Embed sustainability engagement in institutional policy | • Insert sustainability teaching and partnership commitments into strategic plans<br>• Define institutional KPIs for curriculum greening<br>• Align governance with SDG, EU Green Deal, and national climate education frameworks |
| Establish sustainability governance bodies | • Create university-wide sustainability councils or steering committees<br>• Ensure representation from students, faculty, staff, NGOs, and local partners<br>• Integrate ambassador participation into formal governance roles |
| Align curriculum governance with sustainability goals | • Require sustainability mapping of all programmes (GreenComp-aligned audits)<br>• Include sustainability criteria in programme approval and reviews<br>• Develop quality assurance indicators for green learning |
| Support engagement through institutional infrastructure | • Provide administrative staff to coordinate partnerships and ambassador networks<br>• Allocate budget for collaboration activities and professional learning<br>• Create shared physical and digital spaces for co-creation (e.g., Green Hubs, Green Offices) |
| Monitor, evaluate, and report engagement progress | • Use annual sustainability reporting aligned with UNESCO recommendations<br>• Apply feedback loops between educators, ambassadors, and stakeholders<br>• Showcase progress publicly to reinforce legitimacy and motivation<br>• Integrate evaluation into continuous curriculum design cycles |

A central dimension of institutionalisation concerns **curriculum governance**. eSTEP 4 emphasises the need to systematically align programme approval, review, and quality assurance processes with sustainability goals. Tools such as sustainability mapping, GreenComp-aligned audits, and dedicated quality indicators enable institutions to move from isolated examples of good practice toward **coherent, institution-wide curriculum transformation**.

### Box 15. Green Office Model

One practical mechanism for institutionalising sustainability engagement in higher education is the **Green Office model**, developed through the international Green Office Movement. A Green Office is a formal university unit—often student-led and staff-supported—dedicated to advancing sustainability across the institution's education, research, operations, and community engagement activities. Unlike temporary initiatives or student clubs, Green Offices are embedded within the institutional structure and receive official recognition, resources, and a mandate to coordinate sustainability action across campus.

Typically located within university governance structures, Green Offices function as **bridging organisations** between students, staff, administrators, and external partners. Their role is to translate institutional sustainability commitments into concrete initiatives, while also ensuring that the voices of

students and the wider campus community are represented in decision-making processes. In this way, they help integrate grassroots engagement with formal governance structures.
Examples such as the **Green Office Wageningen** and the **Maastricht University Green Office** demonstrate how these units can support long-term institutional change. Their activities include coordinating sustainability strategies, facilitating interdisciplinary projects, organising training and awareness campaigns, supporting curriculum greening initiatives, and advising university leadership on sustainability policy. By combining operational support with participatory governance, Green Offices provide a stable platform for experimentation, collaboration, and institutional learning.

# Action

The **Action Pillar** constitutes the operational core of the GREEN LEAF. While the Learning and Engagement pillars establish conceptual foundations and collaborative ecosystems, the Action Pillar ensures that these commitments translate into measurable institutional change. It shifts the focus from intention to implementation, embedding sustainability within governance procedures, resource allocation, quality assurance systems and institutional performance metrics. In line with international guidance on greening education systems, this pillar positions higher education institutions as knowledge producers and accountable actors in the green transition.

The Action Pillar therefore emphasises implementation fidelity, scalability and impact verification. It requires institutions to adopt evidence-based models, deploy structured tools, monitor competence development systematically and align improvement cycles with accreditation and reporting mechanisms. Consequently, the pillar establishes sustainability as a managed, auditable and continuously improving institutional process.

To operationalise this ambition, the Action Pillar is structured through four interlinked Action Steps (aSTEPS):

- **aSTEP 1** — Implement Evidence-Based Models and Practices. *Adopting verified curriculum greening models to ensure scientific and pedagogical rigor.*
- **aSTEP 2** — Deploy Practical Resources and Implementation Instruments
- **aSTEP 3** — Establish Robust Monitoring and Evaluation Systems
- **aSTEP 4** — Drive Continuous Improvement and Scaling

## aSTEP 1 — Implement Evidence-Based Models and Practices

**Goal**: *Adopting verified curriculum greening models to ensure scientific and pedagogical rigor.*

The first Action Step consolidates transformation by replacing ad hoc sustainability initiatives with validated, transferable models. Institutions are encouraged to embed proven approaches—such as Campus-as-Lab or structured service-learning partnerships—within formal curricula, assessment systems and governance mandates. Establishing measurable learning outcomes, operational key performance indicators, and stakeholder responsibilities at the outset ensures pedagogical rigor and operational accountability.

The use of structured replication protocols and cross-functional implementation teams strengthens scalability and institutional coherence. Moreover, leveraging shared repositories such as the GREENUS Digital Catalogue enhances strategic learning across institutions. The use of structured replication protocols and cross-functional implementation teams strengthens scalability and institutional coherence. Moreover, leveraging shared repositories such as the GREENUS Digital Catalogue enhances strategic learning across institutions. Table 10 operationalises aSTEP 1, specifying the core actions required to embed validated greening models and the corresponding practices that ensure their consistent, scalable, and quality-assured implementation across the institution.

**Table 10**
*Actions and practices to implement greening models*

| Core actions | Key practices |
|---|---|
| Apply Validated Greening Models | • Integrate Campus-as-Lab projects into formal assessment schemes (graded credits, capstones, theses), not only extracurricular activities.<br>• Require each Campus-as-Lab initiative to define measurable learning outcomes, operational KPIs, and stakeholder roles upfront.<br>• Establish cross-functional implementation teams (academic staff, facilities management, sustainability officers, students) with formal mandates.<br>• Use pilot-to-scale protocols that specify criteria for replication (cost, staffing, governance, scalability thresholds).<br>• Embed service-learning projects into multi-year partnerships with municipalities or NGOs, rather than one-off collaborations. |
| Utilise the GREENUS Digital Catalogue | • Introduce internal peer-review processes before uploading practices to ensure quality and transferability.<br>• Tag catalogue entries using standardised metadata (discipline, level, SDGs, competencies, institutional type) to enable strategic reuse.<br>• Use catalogue cases as reference points in curriculum redesign committees.<br>• Benchmark institutional practices against catalogue exemplars during internal audits and programme reviews. |

aSTEP 1 makes explicit that greening models only become effective when they are **institutionally anchored and operationally defined**. Integrating approaches such as Campus-as-Lab into formal assessment, governance structures, and partnership frameworks shifts them from optional innovation to core academic practice. The emphasis on KPIs, defined roles, and cross-functional teams reflects a move toward **managed implementation**, where sustainability is treated as a performance domain rather than an experimental add-on.

The inclusion of pilot-to-scale protocols further signals a change in logic: successful initiatives are not only evaluated for impact, but for their **capacity to be replicated and sustained across the institution**. In parallel, the GREENUS Digital Catalogue introduces a shared reference system that enables benchmarking, comparability, and strategic reuse, reducing fragmentation and duplication of effort.

illustrates how this logic operates in practice. The TU Delft model shows how Campus-as-Lab initiatives can be embedded within institutional processes, supported by governance mechanisms, and tested at scale. It demonstrates that the value of such models lies not only in the innovation itself, but in the **conditions that make it transferable, accountable, and scalable**.

### Box 16. Campus as a Living Lab: TU Delft Green Campus Initiative

The **Delft University of Technology (TU Delft)** operationalises the Campus-as-Lab approach through a structured **Campus Innovation Model**, positioning the campus as a real-scale testing environment for sustainability solutions. The initiative supports the university's transition toward carbon neutrality, circularity, and climate adaptation by embedding innovation within both campus operations and formal learning processes (Herth et al., 2025).

Projects are integrated into **research-led teaching formats**, including design studios, capstone projects, and graduate theses, ensuring that student participation contributes to formal assessment. Each initiative is developed through a **proposal-based innovation process**, led by academic staff and aligned with clearly defined learning outcomes and operational KPIs linked to campus performance (e.g., energy systems, material reuse, climate adaptation measures).

Implementation is coordinated through **formal governance structures**, including the Campus Innovation Committee, which selects, supports, and partially funds projects. Cross-functional teams—bringing together researchers, facilities management, sustainability units, and external partners—ensure alignment between educational objectives and institutional priorities.

The model emphasises **scalability and real-world validation**. Projects are selected once they move beyond experimental field labs and are tested at full scale on campus infrastructure. Replication and scale-up are supported through feasibility studies, performance monitoring, and partnerships with industry and public actors, ensuring that innovations can extend beyond the university context.

Examples such as circular construction projects, off-grid energy systems, and climate-adaptive infrastructure demonstrate how Campus-as-Lab approaches can be embedded as **structured, assessable, and scalable institutional practices**, linking curriculum, campus operations, and societal impact.

## aSTEP 2 — Deploy Practical Resources and Implementation Instruments

**Goal:** *Institutionalise sustainability reform by embedding structured tools, guidance frameworks and digital instruments into routine academic processes*.

The second Action Step translates strategic commitment into operational capability by equipping institutions with concrete instruments that support consistent implementation. While evidence-based models provide direction, practical resources ensure that reform is feasible, scalable and embedded within everyday academic work. This step recognises that sustainable transformation depends not only on vision but on accessible tools, clear procedures and aligned incentives.

Deploying faculty toolkits enables discipline-sensitive integration, moving sustainability beyond generic thematic inclusion toward alignment with core epistemologies and assessment standards. Embedding the LEAF Guidebook within programme validation, accreditation and reporting cycles anchors sustainability within quality assurance systems rather than voluntary initiatives. At the same time, digital personalisation tools strengthen learner-centred implementation by tracking competence development, supporting advising structures and connecting sustainability skills with employability pathways. Table 2 operationalises aSTEP 2. It defines the instruments through which sustainability reform is embedded in routine academic processes, linking institutional actions with practical tools that support consistent, discipline-sensitive, and scalable implementation.

**Table 11**
*Actions and practices to embed structured tools, guidance frameworks*

| Core actions | Key practices |
|---|---|
| Distribute Faculty Toolkits | • Develop discipline-specific "entry points" showing how sustainability aligns with core disciplinary concepts, not just thematic add-ons.<br>• Include assessment exemplars (rubrics, grading descriptors, sample assignments) aligned with green competencies.<br>• Offer modular toolkit components that can be adopted incrementally by time-constrained staff.<br>• Link toolkit usage to professional development recognition or promotion criteria. |
| Operationalise the LEAF Guidebook / Manual | • Embed the Manual into programme validation and re-accreditation procedures.<br>• Require new programmes to explicitly document alignment with LEAF learning and action steps.<br>• Assign institutional ownership of the Manual (e.g. curriculum office, teaching and learning centre) with update responsibilities.<br>• Integrate Manual-based self-assessment into annual departmental reporting. |
| Leverage Digital Personalisation Tools | • Integrate personal learning dashboards into student advising and mentoring systems.<br>• Allow students to export green skill profiles for employability portfolios and career services.<br>• Use learning analytics to identify gaps between intended and attained green competencies.<br>• Ensure digital tools comply with data protection, accessibility, and ethical AI standards. |

Sustainability integration depends on the availability and institutional positioning of implementation instruments. Toolkits, guidebooks, and digital systems are not neutral supports; they determine how consistently sustainability is interpreted, applied, and assessed across programmes (see ).

The shift toward discipline-specific toolkits addresses a persistent barrier: the disconnect between sustainability agendas and disciplinary epistemologies. Embedding guidance within accreditation and reporting processes, in turn, situates sustainability within formal institutional accountability structures, rather than optional practice. Furthermore, digital tools introduce a further layer by making competence development visible and traceable. This creates feedback loops between intended and achieved learning outcomes, enabling institutions to identify gaps and adjust implementation accordingly. What emerges is a move from fragmented adoption to standardised yet adaptable practice, where sustainability is carried through aligned instruments rather than individual initiative.

**Box 17. Faculty Toolkits: Embedding ESD in Curriculum Design**

Several European universities have developed **Education for Sustainable Development (ESD) toolkits** to support faculty in integrating sustainability into teaching in a structured and discipline-relevant way. For example, the **University of Liverpool ESD Toolkit** provides a suite of practical resources that guide educators in embedding sustainability within programme and module design. The toolkit includes **programme review tools, example learning outcomes, curriculum mapping instruments, and ready-to-use teaching activities**, enabling educators to align sustainability with disciplinary content and assessment practices. It is structured in modular components, allowing staff to adopt elements incrementally depending on their needs and time constraints.
Similarly, institutional toolkits such as those developed at **University College London** provide guidance applicable across disciplines, supporting educators in designing learning experiences that integrate sustainability competencies while remaining sensitive to disciplinary contexts.

## aSTEP 3 — Establish Robust Monitoring and Evaluation Systems

**Goal:** *Ensure that curriculum greening is measurable, transparent and continuously improved through structured evidence and accountability mechanisms.*

Sustainable transformation cannot rely on implementation alone; it requires systematic verification. The third Action Step embeds monitoring and evaluation as a core governance function, ensuring that progress in sustainability education is demonstrable, comparable and responsive to evidence. This step integrates indicators as strategic instruments for institutional learning.

The Greening Curriculum Indicator provides a quantitative baseline, but its credibility depends on methodological rigour. Combining automated syllabus analysis with expert review mitigates superficial keyword inflation, while longitudinal tracking allows institutions to detect stagnation or regression as well as improvement. Disaggregated data further enables targeted interventions across faculties and programme levels, strengthening precision in reform efforts.

Furthermore, competence-based audits deepen this evaluative layer by examining whether intended learning outcomes translate into graduate capabilities. Involving external stakeholders—employers, alumni and civil society—enhances relevance and legitimacy, while scenario-based assessments test learner judgment under real sustainability trade-offs. Crucially, programmes are required to respond formally to audit findings, embedding improvement planning within quality assurance cycles.

Finally, structured feedback loops ensure that monitoring remains participatory rather than technocratic. Student reflection tools, co-interpretation workshops and wellbeing indicators integrate human experience into evaluation processes. Closing the loop by documenting how feedback informs curriculum revision transforms assessment from a compliance mechanism into a driver of adaptive institutional learning.

Table 12 sets out aSTEP 3. It specifies the actions and evaluation practices through which curriculum greening becomes measurable, transparent, and continuously improved at institutional level.

**Table 12**
*Actions and practices to embed structured tools, guidance frameworks*

| Core actions | Key practices |
|---|---|
| Utilise the Greening Curriculum Indicator | • Combine automated syllabus analysis with qualitative expert review to avoid keyword inflation.<br>• Track indicator results longitudinally to detect regression as well as progress.<br>• Disaggregate results by faculty, programme level, and discipline to guide targeted interventions.<br>• Publish selected indicator results internally to support transparency and accountability. |
| Conduct Competence-Based Audits | • Align competence audits with graduate exit profiles and employability frameworks.<br>• Include external reviewers (employers, civil society, alumni) in competence validation panels.<br>• Use scenario-based assessments to test learner decision-making under sustainability trade-offs.<br>• Require programmes to respond formally to audit findings with improvement plans. |
| Implement Feedback Loops | • Institutionalise structured student reflection mechanisms (learning diaries, reflective briefs).<br>• Use participatory evaluation workshops to co-interpret monitoring data with learners and staff.<br>• Integrate wellbeing and climate-anxiety indicators into student support services.<br>• Close feedback loops by documenting how feedback led to concrete curriculum changes. |

## aSTEP 4 — Drive Continuous Improvement and Scaling

**Goal:** *Embed sustainability reform within institutional quality cycles and extend its impact beyond the single institution to national and international systems.*

The fourth Action Step ensures that curriculum greening is cumulative. It consolidates prior implementation and monitoring efforts by integrating sustainability into accreditation mechanisms, scholarly practice and multi-level policy alignment. In doing so, it transforms sustainability from a project-based initiative into a structural feature of institutional development.

Aligning reform with accreditation standards leverages existing quality assurance cycles as strategic entry points for change. When sustainability evidence becomes a required element of programme self-evaluation and internal review, reform gains regulatory traction rather than remaining dependent on voluntary engagement. Training auditors and reviewers in sustainability criteria further strengthens consistency and credibility.

At the same time, long-term scaling depends on recognising educators as knowledge producers. Valuing curriculum innovation as scholarly output, establishing repositories for teaching cases and funding small-scale action research positions sustainability work within academic reward systems. Cross-institutional comparative studies, particularly through collaborative networks, support diffusion and shared learning. Moreover, scaling requires vertical integration with broader policy agendas. Translating institutional monitoring data into policy-relevant indicators and participating in coordinated reporting initiatives ensures that local practice informs systemic reform. Table 13 defines how aSTEP 4 is enacted. It links

institutional actions with practices that anchor sustainability within accreditation processes, academic recognition, and multi-level policy alignment.

**Table 13**

*Actions and practices for embedding sustainability in quality assurance and system-level scaling*

| Core actions | Key practices |
|---|---|
| Align with Accreditation Standards | • Use accreditation cycles as leverage points to accelerate curriculum reform.<br>• Require sustainability evidence in programme self-evaluation reports.<br>• Train internal auditors and reviewers on sustainability criteria. |
| Foster Practitioner Knowledge Generation | • Recognise curriculum innovation outputs as legitimate scholarly contributions.<br>• Establish institutional repositories for green teaching cases and datasets.<br>• Fund small-scale action research grants for educators testing new approaches.<br>• Promote cross-institutional comparative studies through GREENUS networks. |
| Support Global Target Alignment | • Institutionalise structured student reflection mechanisms (□ Translate institutional monitoring data into policy-relevant indicators.<br>• Participate in coordinated reporting initiatives under the Greening Education Partnership.<br>• Support staff and students in contributing evidence to international consultations.<br>• Use institutional results to inform regional or national curriculum reform processes. |

# How to Use the Framework?

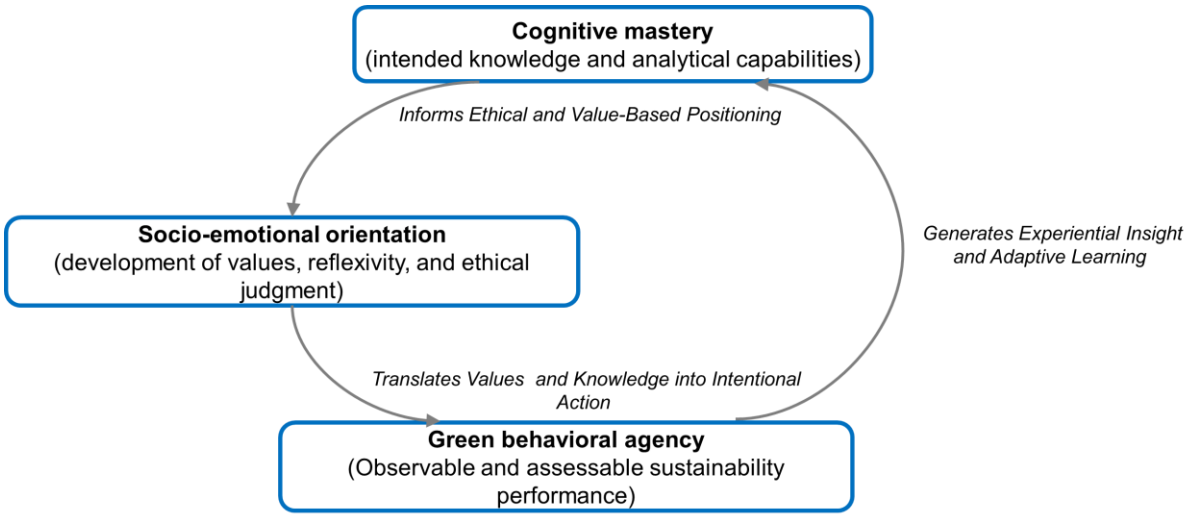
## What do we want learners to achieve?

The starting point of the GREEN LEAF Framework is clarity about intended **learning outcomes**. Curriculum greening begins with defining the demonstrated performances learners should be able to enact upon completion of a programme (Jones, 2008). This reflects a shift toward outcome-based education grounded in constructive alignment, where learning outcomes, teaching activities, and assessment methods are coherently designed to reinforce one another (Biggs, 2003; O'Brien & Sarkis, 2014; Rekalde-Rodríguez et al., 2022, 2024; Wilhelm et al., 2019). Sustainability is therefore treated as an integrated competence expressed through observable abilities (Kauffman, 2014; Micklethwaite, 2022). Consistent with research on deep learning, the framework prioritises meaning-making, systems integration, and application to real-world complexity over memorisation (Budwig, 2015).

**Learning outcomes** within LEAF are structured across three interdependent and developmentally progressive dimensions: **cognitive mastery**, **socio-emotional orientation**, and **green behavioural agency** (see Figure 4). *Cognitive mastery* provides the analytical foundation—enabling learners to interpret the interdependence of environmental systems, social arrangements, and economic models. *Socio-emotional orientation* shapes ethical positioning—fostering reflexivity, responsibility, and normative engagement with sustainability challenges. *Green behavioural agency* represents demonstrable performance—the capacity to translate understanding and values into collaborative, context-sensitive action.

These dimensions are not sequential stages but dynamically reinforcing processes. As illustrated in Figure 4, analytical understanding informs ethical positioning; ethical positioning motivates action; and action, through reflection and feedback, deepens understanding. Sustainability competence thus evolves through iterative cycles of interpretation, responsibility, and practice.

**Figure 4**
*Iterative Sustainability Competence Development Model*




This architecture aligns with major international competence frameworks. It mirrors the structure of the European sustainability competence framework (GreenComp), particularly its integration of complexity, values, and action (European Commission. Joint Research Centre, 2022); resonates with EntreComp's emphasis on initiative and value creation; and reflects UNESCO's Education for Sustainable Development model, which integrates cognitive,

socio-emotional, and behavioural dimensions (UNESCO, 2024b). Alignment with SDG Target 4.7 and indicator 4.7.1 further strengthens policy coherence and enables measurable curriculum integration.

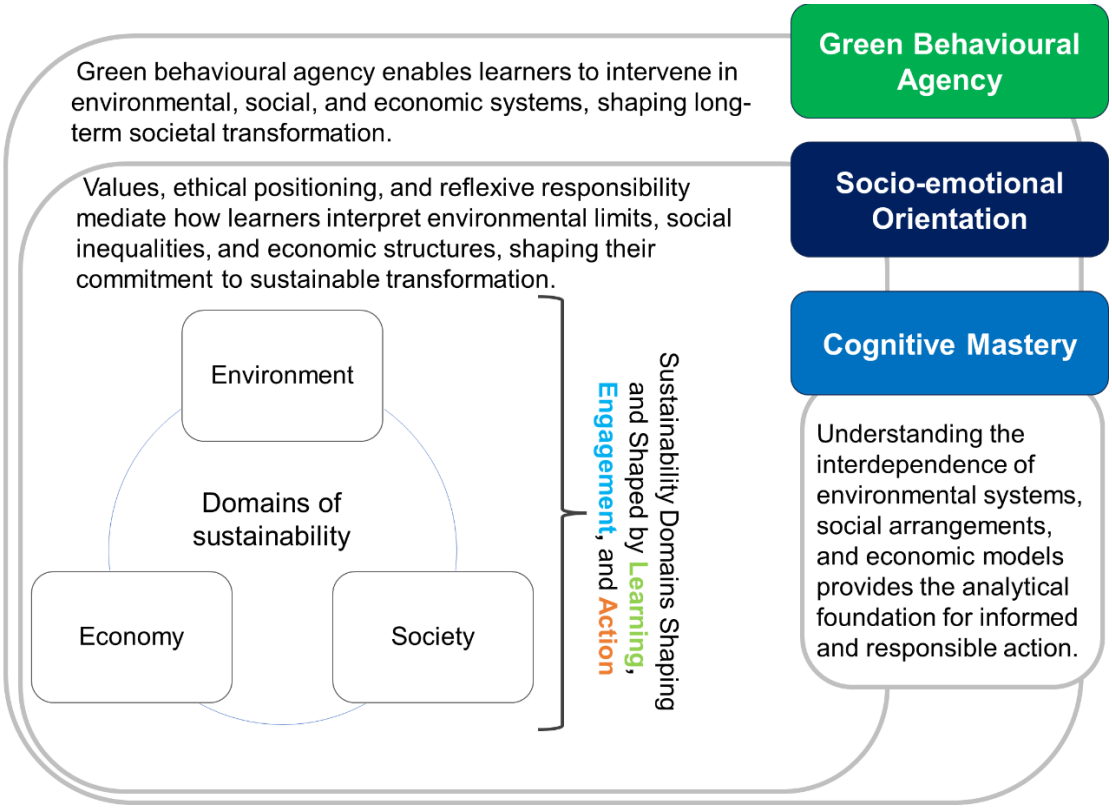
**Constructive alignment** operationalises the vision. Sustainability competences are first articulated at programme level and progressively differentiated across study cycles. Foundational learning emphasises systems awareness and conceptual integration; intermediate stages develop critical evaluation and ethical discernment; advanced levels require applied judgement, leadership, and innovation within complex, uncertain contexts. These competences are translated into course-level outcomes, pedagogical strategies, and authentic assessments (O'Brien & Sarkis, 2014; Rekalde-Rodríguez et al., 2022). Teaching methods are mostly selected for their capacity to enable learners to demonstrate agency in addressing "wicked problems" that lack clear definitions or linear solutions (Micklethwaite, 2022; Moreno-Luna et al., 2021; Wang & Deng, 2024). Assessment evaluates learners' ability to navigate trade-offs, justify decisions, and act responsibly within professional and societal settings (Jones, 2008; Sterling, 2021).

In higher education contexts, these competences are enacted within the interdependent sustainability domains of environment, society, and economy (see Figure 5). The environmental domain foregrounds ecological integrity and biophysical limits; the societal domain emphasises equity, rights, and collective responsibility; and the economic domain addresses production-consumption systems, labour transitions, and sustainable value creation. These domains constitute the structural field within which sustainability competence is formed and exercised. As illustrated in Figure 5, sustainability competence develops within the interdependent domains of environment, society, and economy, which together form the structural context of learning. These domains shape the knowledge learners construct, the values they adopt, and the forms of action they consider legitimate and feasible. Understanding ecological limits and systemic interdependencies grounds cognitive mastery; interpreting issues of equity, rights, and responsibility informs socio-emotional orientation; and designing interventions that are environmentally sound, socially inclusive, and economically viable demonstrates green behavioural agency. Importantly, the relationship is reciprocal: while environmental, social, and economic systems influence learning, graduates equipped with sustainability competence are also positioned to reshape these systems through informed, ethical, and transformative action.

Understanding the interdependence of these domains grounds cognitive mastery. Interpreting their justice implications shapes socio-emotional orientation. Designing interventions that are environmentally sound, socially inclusive, and economically viable demonstrates green behavioural agency. As depicted in Figure 5, learning outcomes are shaped by sustainability domains—but they are also intended to shape them in return. Through sustained action, graduates contribute to environmental integrity, social justice, and sustainable economic transformation.

The purpose of sustainability education, therefore, is to produce systemically responsible actors capable of navigating and transforming complex socio-ecological-economic realities. Framed as lifelong learning, sustainability competence remains an evolving capability. Graduates should leave education equipped to update their knowledge, engage critically with emerging evidence, manage uncertainty, and participate constructively in shaping long-term societal transformation.

**Figure 5**
*Integrated Model Linking Sustainability Domains and Learning Outcomes in the GREEN LEAF Framework*




## What should they be learning?

The LEAF supports the idea that a green curriculum is defined by a **coherent architecture of sustainability knowledge** organized around core metaconcepts that allow learners to interpret, question, and transform the world.

Drawing on UNESCO's *Greening Curriculum Guidance* (UNESCO, 2024b) and the European sustainability competence framework (*GreenComp*) (European Commission. Joint Research Centre, 2022), the LEAF framework organizes sustainability content around six interrelated **metaconcepts**. These metaconcepts function as integrative lenses that cut across disciplines, professional fields, and societal sectors: **systems and interdependence**; **justice, equity, and responsibility**; **futures and anticipation**; **sustainable production and consumption systems**; **human-nature relationships**; **agency, governance, and collective action**; **spiral and developmental structure**.

Rather than adding "green topics," institutions are invited to align disciplinary content with these structuring ideas.

### Systems and Interdependence

Learners should understand that ecological, economic, technological, and social systems are deeply interconnected – see Table 14. The **systems and interdependence** metaconcept establishes a foundational shift in how sustainability is approached within higher education. It reframes disciplinary knowledge by situating it within dynamic, interconnected socio-ecological systems, where environmental, economic, technological, and social

processes are co-constitutive rather than separable domains. This perspective challenges reductionist approaches and requires learners to engage with non-linear dynamics, feedback mechanisms, and cross-scale interactions that characterise contemporary sustainability challenges.

From a curriculum perspective, this metaconcept functions as an organising principle. It enables disciplines to reinterpret their core concepts through a systems lens: engineers analyse lifecycle impacts and infrastructure interdependencies, economists examine externalities and systemic risk, while health sciences connect environmental conditions to population health outcomes. Such integration moves sustainability from peripheral topics to embedded analytical frameworks within disciplinary practice.

This orientation is closely aligned with the systems thinking competence in European Commission Joint Research Centre's GreenComp framework, which emphasises understanding complexity, interconnections, and unintended consequences as essential to sustainability literacy. It also reflects UNESCO's guidance on greening curricula, which highlights complexity literacy as a prerequisite for informed decision-making in uncertain and rapidly changing contexts.

Importantly, systems thinking is cognitive and also epistemological and practical. It requires learners to navigate uncertainty, recognise limits to prediction, and engage with trade-offs across sectors and scales. As such, it supports the development of more reflexive and adaptive forms of professional practice, where decisions are informed by an awareness of interdependence and long-term consequences.

**Table 14**

*Systems and Interdependence as a Cross-Disciplinary Foundation for Sustainability Learning*

| Core content | Across disciplines |
|---|---|
| • Earth systems and planetary boundaries<br>• Socio-ecological systems<br>• Feedback loops and tipping points<br>• Interdependence of local and global processes<br>• Institutional and governance systems | • Engineers explore lifecycle systems.<br>• Economists analyse systemic externalities.<br>• Educators examine institutional ecosystems.<br>• Health sciences study environmental determinants of health. |

## Justice, Equity, and Responsibility

The **justice, equity, and responsibility** metaconcept foregrounds the normative and political dimensions of sustainability. It recognises that environmental challenges are inseparable from questions of **power, distribution, and rights**, and that sustainability transitions inevitably produce uneven impacts across social groups, regions, and generations. As such, this metaconcept shifts the focus from technical problem-solving alone to the **ethical frameworks and governance choices** that shape how sustainability is defined and pursued.

Within curricula, this perspective enables disciplines to interrogate their own roles in reproducing or addressing inequality. Legal studies examine regulatory justice and rights-based approaches to environmental governance; business disciplines engage with corporate responsibility and accountability; social sciences analyse structural inequalities and socio-economic drivers of vulnerability; and STEM fields increasingly confront questions of **ethical design, technological bias, and societal impact**. This cross-disciplinary engagement positions sustainability as a site of contested values rather than a neutral domain – see Table 15.

The emphasis on intergenerational equity, North–South dynamics, and distributional impacts further highlights that sustainability involves negotiating trade-offs and responsibilities across time and space. Learners are required to consider who benefits, who bears the costs, and whose voices are included or excluded in decision-making processes. This orientation supports a more critical and reflexive understanding of sustainability, particularly in the context of climate transitions that may exacerbate existing inequalities if not carefully governed.

This metaconcept aligns with the "Embodying sustainability values" competence area in the European Commission Joint Research Centre's GreenComp framework, which emphasises fairness, responsibility, and respect for diversity as core elements of sustainability competence. It also reflects UNESCO's emphasis on justice-driven approaches to greening curricula, where ethical reasoning and social inclusion are central to educational transformation.

**Table 15**

*Justice, Equity, and Responsibility as a Cross-Disciplinary Foundation for Sustainability Learning*

| Core content | Across disciplines |
|---|---|
| • Climate justice and social inequality<br>• Intergenerational equity<br>• Global North–South dynamics<br>• Human rights and sustainability<br>• Distributional impacts of climate transition | • Law examines regulatory justice.<br>• Business studies explore responsible governance.<br>• Social sciences analyze structural inequality.<br>• STEM fields consider ethical technology design. |

## Futures and Anticipation

The **futures and anticipation** metaconcept positions sustainability as an inherently forward-looking endeavour, requiring learners to engage with uncertainty, complexity, and long-term transformation. It shifts the focus from analysing present conditions to **exploring possible, probable, and desirable futures**, and to understanding how current decisions shape future outcomes. This perspective is particularly relevant in the context of climate change and socio-ecological transitions, where delayed impacts and irreversible thresholds demand anticipatory thinking.

Within curricula, this metaconcept introduces approaches such as scenario building, foresight methods, and transition design, enabling learners to engage with **uncertainty, risk, and systemic change**. Disciplines operationalise this in distinct ways (Table 16): engineers

model future energy and infrastructure systems, economists explore transition pathways and systemic risks, urban planners design resilient cities, and environmental scientists assess ecosystem vulnerability. At the same time, fields such as law, policy, and business engage with governance under uncertainty, regulatory design, and risk management, while design and architecture contribute through innovation in materials, systems, and future-oriented solutions.

Importantly, futures thinking extends beyond prediction. It involves the capacity to critically evaluate assumptions, imagine alternative trajectories, and engage with normative questions about desirable futures. This includes reflecting on trade-offs between adaptation and mitigation, short-term and long-term priorities, and technological and social pathways for transformation. In this sense, the metaconcept supports learners in navigating uncertainty while maintaining agency in shaping outcomes.

This approach aligns with the **"Envisioning sustainable futures" competence area in the European Commission Joint Research Centre's GreenComp framework**, which emphasises imagination, strategic thinking, and anticipation as core sustainability competences. It also reflects **UNESCO's call for future-oriented curriculum reform**, where learners are equipped to engage with emerging challenges and actively contribute to shaping sustainable transitions.

**Table 16**
*Futures-Oriented Sustainability Content*

| Core content | Across disciplines |
|---|---|
| • Futures literacy and scenario building<br>• Risk, uncertainty, and resilience<br>• Adaptation and mitigation pathways<br>• Innovation for sustainability<br>• Transition design | • Engineering: model energy/infrastructure futures<br>Economics: forecast transition scenarios<br>Urban planning: design resilient city pathways<br>Education: develop anticipatory thinking<br>• Health: assess climate-related risks<br>Business: analyse financial and supply-chain risks<br>Environmental science: evaluate ecosystem vulnerability<br>Policy: govern under uncertainty<br>• Law: develop regulatory instruments<br>Agriculture: implement adaptive practices<br>• Architecture: climate-responsive design<br>• STEM: clean technologies<br>Social sciences: social innovation<br>Design: sustainable materials and systems |

## Sustainable Production and Consumption Systems

The **sustainable production and consumption systems** metaconcept directs attention to the material and economic foundations of sustainability. It requires learners to critically examine how goods, services, and resources are produced, distributed, and consumed, and how these systems can be reconfigured to operate within ecological limits. This perspective challenges dominant linear models of growth and encourages engagement with alternative paradigms such as circularity, regeneration, and post-carbon development.

Within curricula, this metaconcept enables disciplines to interrogate their contribution to production systems and their potential for transformation. Engineering and industrial fields address material efficiency, energy systems, and low-carbon infrastructure; architecture and design engage with sustainable materials and climate-responsive solutions; business and economics examine supply chains, value creation, and the implications of shifting beyond

growth-oriented models. At the same time, agricultural sciences and environmental disciplines explore regenerative practices and ecosystem restoration, while social sciences consider the social dimensions of production, including labour conditions, food systems, and rural transformation (Table 17).

A key dimension of this metaconcept lies in making **resource flows and systemic impacts visible**. Tools such as lifecycle assessment, data analytics, and supply chain mapping allow learners to understand how local practices connect to global environmental pressures. This supports a more integrated view of sustainability, where production and consumption are understood as interconnected processes with environmental, social, and economic consequences.

The emphasis on circular economy, decarbonisation, and sustainable mobility reflects broader transitions toward **post-carbon and resource-efficient systems**. These transitions require not only technological innovation but also organisational change, policy alignment, and shifts in consumer behaviour. As such, learners are encouraged to engage with both technical solutions and systemic transformations.

This metaconcept aligns with **UNESCO's key sustainability themes**, including sustainable lifestyles, circular economy, and post-carbon development, which position production and consumption systems at the centre of curriculum reform.

**Table 17**

*Contents for Transforming Production and Economic Systems Across Discipline*

| Core content | Across disciplines |
|---|---|
| • Circular economy<br>• Energy systems and decarbonization<br>• Sustainable mobility<br>• Regenerative agriculture<br>• Supply chains and resource efficiency<br>• Post-carbon economies | • Engineers design low-carbon infrastructures.<br>• Architects develop climate-responsive buildings.<br>• Business leaders rethink growth paradigms.<br>• Designers explore sustainable materials.<br>• Agricultural sciences implement soil regeneration practices<br>• Environmental sciences evaluate ecosystem restoration<br>• Economics assess food system resilience<br>• Sociology studies rural transformation and food justice<br>• Operations management optimizes sustainable logistics<br>• Industrial engineering improves material efficiency<br>• Business ethics addresses responsible sourcing<br>• Data science supports lifecycle tracking |

## Human–Nature Relationships

The **human–nature relationships** metaconcept shifts the focus from understanding systems to **reconsidering how humans relate to the natural world**. It introduces a reflective dimension into sustainability learning, inviting learners to question dominant assumptions about nature as a resource and to explore alternative ways of knowing, valuing, and interacting with the more-than-human world.

This perspective brings together ecological knowledge with cultural, ethical, and experiential dimensions. Across disciplines, it opens space for diverse interpretations:

environmental sciences examine ecosystem functions and conservation strategies, while economics engages with the valuation—and limitations—of ecosystem services. Fields such as anthropology, education, and development studies highlight the importance of **plural knowledge systems**, including Indigenous and traditional ecological knowledge, in shaping more relational and context-sensitive approaches to sustainability (Table 18).

In applied fields, this metaconcept translates into design and practice choices. Urban planning and architecture integrate biodiversity and biophilic principles into built environments; agriculture explores biodiversity-based and regenerative practices; engineering develops green infrastructure that works with, rather than against, natural systems. At the same time, policy and legal perspectives address land rights, environmental justice, and the governance of nature-based solutions.

Beyond disciplinary applications, this metaconcept engages with **questions of identity, ethics, and wellbeing**. It encourages learners to reflect on their own relationship with nature, recognising that sustainability involves not only external change but also shifts in values, attitudes, and ways of being. Concepts such as ecological identity and wellbeing highlight the interdependence between human flourishing and the health of ecosystems.

This orientation aligns with the **"Promoting nature" competence in the European Commission Joint Research Centre's GreenComp framework**, which emphasises care, respect, and responsibility toward the natural world. It also reflects **UNESCO's emphasis on reconnecting education with nature**, recognising this as a key dimension of transformative sustainability learning.

**Table 18**
*Content to Support Human-Nature Relationships*

| Core content | Across disciplines |
|---|---|
| • Biodiversity and ecosystem services<br>• Indigenous and traditional ecological knowledge<br>• Nature-based solutions<br>• Ethical relationships with the more-than-human world<br>• Wellbeing and ecological identity | • Environmental sciences assess ecosystem functions and conservation strategies<br>• Economics evaluate ecosystem service valuation<br>• Urban planning integrate biodiversity into city design<br>• Agriculture apply biodiversity-based farming systems<br>• Anthropology study cultural–ecological relationships<br>• Education integrate plural knowledge systems<br>• Law examine land rights and environmental justice<br>• Development studies explore community-led sustainability models<br>• Engineering design green infrastructure<br>• Architecture incorporate biophilic design principles<br>• Climate science evaluate ecosystem-based adaptation<br>• Public policy develop nature-based climate strategies |

## Agency, Governance, and Collective Action

Finally, learners must understand **how change happens**. The *agency, governance, and collective action* metaconcept brings sustainability learning into the realm of **decision-making, power, and change processes**. It focuses on how transformations are initiated, negotiated, and sustained across institutional, societal, and global levels. Understanding sustainability, in this sense, requires not only analysing systems and envisioning futures, but also engaging with the mechanisms through which change becomes possible.

Across disciplines (Table 19), this metaconcept highlights the diversity of pathways through which agency is exercised. Political science and international relations examine governance architectures and global negotiations; law engages with regulatory frameworks and rights-based approaches; public administration focuses on implementation systems and policy delivery. At the same time, sociology and social sciences explore collective action, social movements, and patterns of citizen engagement, while economics addresses cooperation, incentives, and public goods.

In more applied domains, agency takes the form of **leadership, participation, and organisational change**. Business and management education engage with sustainable leadership and corporate transformation; communication studies explore advocacy and public engagement strategies; education itself becomes a space for fostering participatory practices and empowering learners as active contributors to change. Community development and local initiatives further illustrate how agency is distributed and enacted in context-specific ways.

This metaconcept also foregrounds the importance of **collective rather than individual action**. Sustainability challenges cannot be addressed through isolated efforts; they require coordinated responses across actors, sectors, and scales. Learners are therefore encouraged to understand how alliances are built, how conflicts are negotiated, and how institutional change unfolds over time.

The emphasis on governance and agency aligns with the **"Acting for sustainability" competence area in the European Commission Joint Research Centre's GreenComp framework**, which highlights the capacity to engage, collaborate, and take responsibility for change. It also reflects **UNESCO's action-oriented approach to sustainability education**, where learners are positioned not only as knowledge recipients but as active participants in societal transformation.

**Table 19**

*Governance, Agency, and Collective Action Contents*

| Core content | Across disciplines |
|---|---|
| • Policy processes and climate governance<br>• Collective action mechanisms<br>• Institutional transformation<br>• Civic participation and political agency<br>• Organizational change and leadership | • Political science analyse multilevel governance systems<br>• Law develop and interpret climate legislation<br>• Public administration design implementation frameworks<br>• International relations study global climate negotiations<br>• Sociology examine social movements and mobilization<br>• Economics analyse cooperation and public goods<br>• Communication studies explore advocacy strategies<br>• Education foster participatory learning models<br>• Social sciences analyse citizen engagement models<br>• Community development facilitate local empowerment initiatives<br>• Business schools develop sustainable leadership models |

## Spiral and Developmental Structure

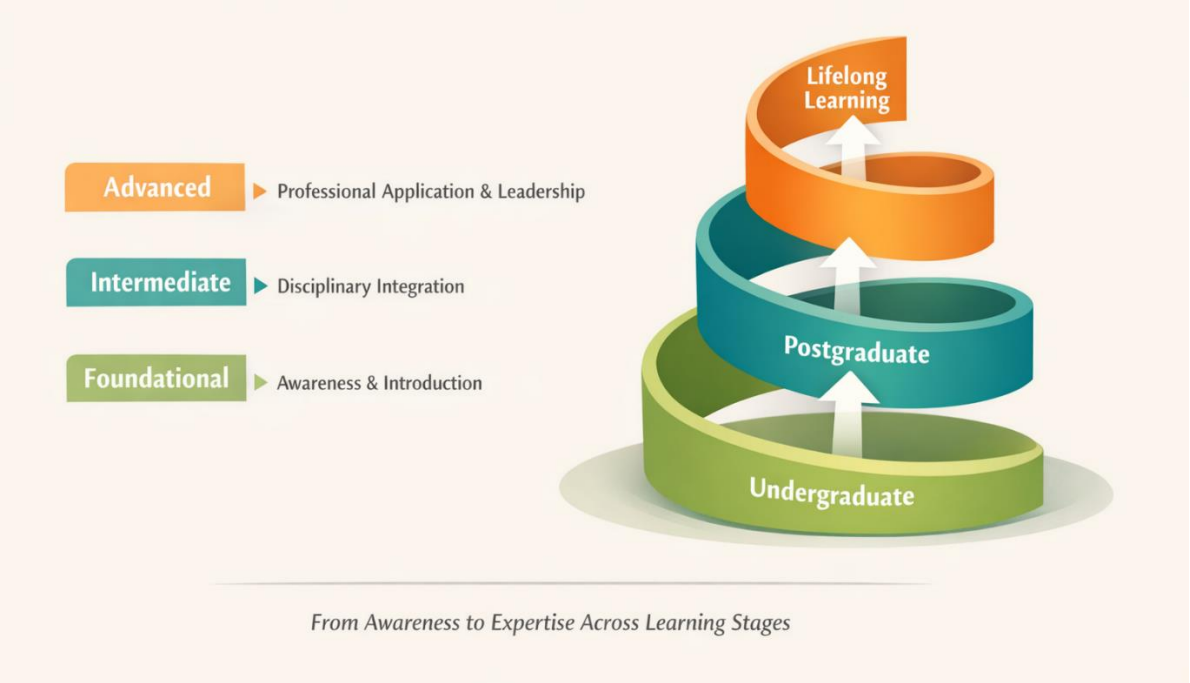
These metaconcepts should not be treated as isolated modules. Instead, they are structured through a **developmental spiral** (Figure 6), where learning deepens and expands across stages of education.

At early stages, learners develop **foundational awareness**, gaining initial exposure to key sustainability concepts and recognising their relevance across contexts. At intermediate levels, these concepts are progressively **integrated within disciplines**, allowing learners to apply sustainability lenses to domain-specific knowledge and problem-solving. At advanced stages, learning evolves into **professional application and leadership**, where learners engage with real-world challenges, navigate complexity, and contribute to transformative practices within their fields.

This spiral progression ensures that sustainability is not confined to introductory courses but is **revisited with increasing depth, complexity, and responsibility**. It supports continuity across undergraduate, postgraduate, and lifelong learning pathways, enabling learners to move from understanding sustainability to actively shaping it in professional and societal contexts.

**Figure 6**

*Spiral and Developmental Structure of Green Learning*




## How can we teach most effectively?

Greening the curriculum requires more than adding new sustainability topics to existing courses. It requires rethinking how learning experiences are designed so that students develop not only knowledge about sustainability but also the ability to engage with complex societal challenges. Climate change, biodiversity loss, resource depletion, and social inequality are interconnected problems that cannot be understood through fragmented disciplinary approaches or passive learning methods. Effective sustainability education therefore relies on pedagogical approaches that foster active participation, interdisciplinary thinking, ethical reflection, and engagement with real-world contexts.

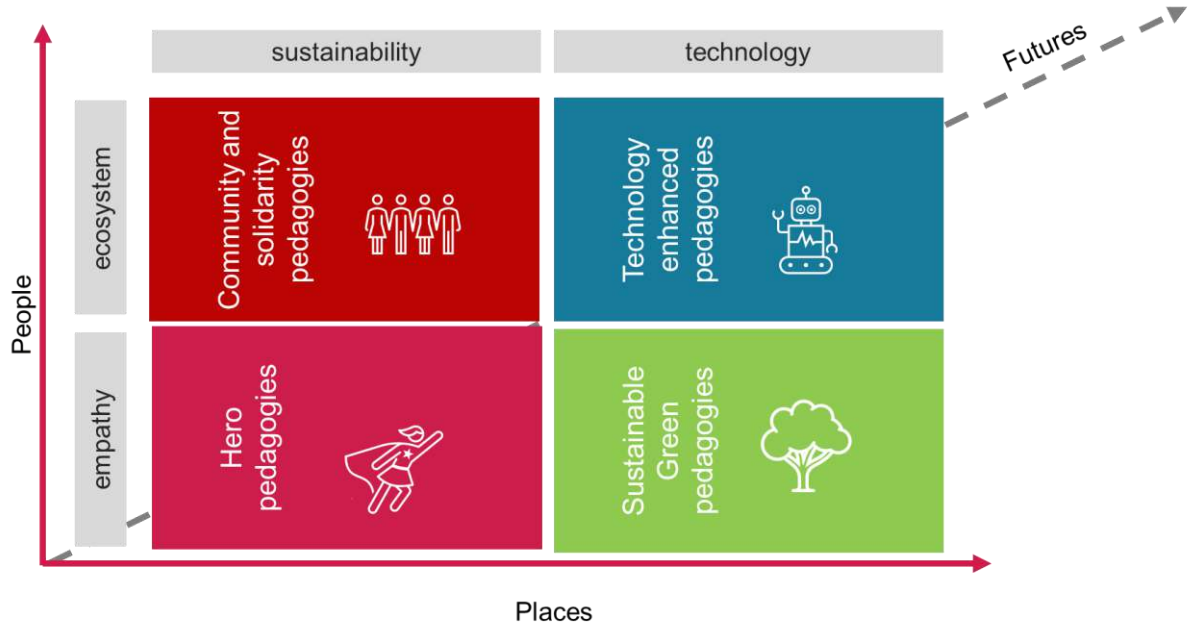
Within the LEAF framework, effective teaching is grounded in a model of innovative pedagogies organized around three interconnected dimensions: **people**, **places**, **and futures** (Ciolan & Manasia, 2024; Culcasi et al., 2023). These dimensions reflect the multidimensional nature of sustainability challenges. The **people** dimension emphasizes empathy, values, and human relationships, recognising that sustainability transformations depend on ethical

awareness, collaboration, and social responsibility. The **places** dimension highlights the importance of learning within real social and ecological contexts, connecting education to communities, institutions, and ecosystems. The **futures** dimension focuses on anticipation, innovation, and technological change, encouraging learners to explore alternative pathways and design solutions for sustainable transitions. Together, these dimensions support pedagogical approaches that combine personal engagement, contextual learning, and future-oriented thinking.

The intersection of these dimensions generates four complementary clusters of pedagogical approaches: **Hero Pedagogies**, **Community and Solidarity Pedagogies**, **Sustainable Green Pedagogies**, and **Technology-Enhanced Pedagogies**. Each cluster represents a distinct orientation toward learning while contributing to the broader goal of transformative sustainability education.

**Figure 7**

*Innovative pedagogy clusters for sustainability-oriented higher education*




**Source.** Ciolan and Manasia (2024)

## Hero Pedagogies: Cultivating Empathy, Meaning, and Personal Engagement

**Hero pedagogies** emphasize the human dimension of learning by fostering emotional engagement, reflection, and a sense of purpose. In these learning environments, educators act not only as instructors but also as mentors and role models who inspire curiosity, responsibility, and ethical awareness (Moriña, 2022). These pedagogies recognize that meaningful learning often begins with personal connection. When students understand how sustainability challenges relate to their own lives, values, and identities, they are more likely to develop intrinsic motivation and long-term commitment to change. Teaching strategies such as storytelling, narrative inquiry, reflective dialogue, experiential exercises, and creative expression can help students explore ethical dilemmas, imagine alternative futures, and

develop empathy for both human and non-human communities (see – as a reference).

Hero pedagogies therefore play a crucial role in cultivating the **socio-emotional foundations of sustainability learning**. They encourage learners to reflect on their own roles within social and ecological systems and to develop a sense of agency and responsibility. These approaches frame it as a deeply human challenge that requires compassion, imagination, and moral engagement (Kukulska-Hulme et al., 2023; Motta & Bennett, 2018).

### Box 18. Velfies as Hero pedagogies

Velfies—short, self-recorded video reflections—illustrate how hero pedagogies can cultivate empathy, ethical awareness, and personal engagement in sustainability and justice-oriented education (Ciolan & Manasia, 2025; Manasia et al., 2026; Sterling-Fox et al., 2020). Unlike traditional written reflection, velfies combine **voice, gesture, facial expression, and spatial context**, enabling learners to express their thinking in multimodal and embodied ways.

In teacher education contexts, velfies invite students to reflect on complex social issues such as inequality, recognition, and responsibility through personal storytelling and narrative exploration. By recording short video-selfies, learners articulate their evolving professional identities and ethical commitments while engaging with the emotional dimensions of teaching and social change.

Because they integrate cognitive reflection with affective expression, velfies help make visible aspects of learning that often remain implicit—such as uncertainty, empathy, and moral positioning. The multimodal nature of video reflection allows students to externalize embodied experiences and develop deeper self-awareness, strengthening their capacity to connect theoretical concepts with lived realities.

## Community and Solidarity Pedagogies: Learning within Social Ecosystems

While hero pedagogies focus on personal engagement, **community and solidarity pedagogies** expand the learning process into the broader social ecosystem in which universities operate. Sustainability challenges are collective problems that require collaboration among multiple actors, including communities, public institutions, businesses, and civil society organizations. Educational approaches that emphasize cooperation and civic engagement help students understand sustainability as a shared societal endeavour (Aramburuzabala Higuera et al., 2019; Culcasi et al., 2023; UNESCO, 2021).

Community-based pedagogies often involve service-learning, community-engaged research, participatory projects, and partnerships with local stakeholders (Istance & Paniagua, 2019; Kukulska-Hulme et al., 2023; UNESCO, 2021). Through these experiences, students apply disciplinary knowledge to real-world challenges while interacting with practitioners, community members, and policymakers. This interaction creates opportunities for reciprocal learning: students contribute ideas and energy, while community partners share practical knowledge and lived experience.

Such pedagogical approaches strengthen learners' sense of belonging and social responsibility. They also help universities position themselves as active contributors to local and regional sustainability transitions. By integrating academic learning with civic engagement, community and solidarity pedagogies foster the development of **collaborative competencies, ethical awareness, and democratic participation**.

### Box 19. Walk & Talk: Community and Solidarity Pedagogies in Urban Learning

Walk & Talk initiatives illustrate how community and solidarity pedagogies connect academic learning with the lived realities of local communities. Inspired by the *Jane's Walk* movement, these guided urban walks combine observation, dialogue, and community engagement to explore social and environmental challenges directly within the spaces where they unfold.
During Walk & Talk activities, students walk through neighbourhoods alongside local residents, community associations, and civic organizations. Through shared observation and conversation, participants examine issues such as gentrification, housing affordability, urban sustainability, and waste management. These encounters allow learners to understand how public policies, economic dynamics, and social practices shape everyday life in cities.
By bringing the university into dialogue with neighbourhood actors, Walk & Talk pedagogies transform the city into a living classroom. Students engage with community knowledge, learn from civic actors advocating for social and environmental justice, and reflect on how urban spaces can be designed to support inclusive and sustainable living.

Learn more

## Sustainable Green Pedagogies: Learning for Systems Change

**Sustainable green pedagogies** focus directly on the environmental and systemic dimensions of sustainability. They aim to develop learners' capacity to understand complex socio-ecological systems and to design innovative responses to sustainability challenges.

These approaches emphasize interdisciplinary inquiry, systems thinking, and problem-solving. Instead of learning about sustainability only through theoretical instruction, students are encouraged to investigate real-world problems and experiment with potential solutions. Methods such as challenge-based learning, project-based learning, living laboratories, and design thinking allow learners to explore issues such as renewable energy transitions, circular economies, sustainable cities, or regenerative agriculture.

In these learning environments, the role of the educator shifts toward facilitating inquiry and guiding collaborative problem-solving processes. Students often work in multidisciplinary teams and interact with external experts or stakeholders, allowing them to integrate scientific knowledge with social and economic considerations.

Sustainable green pedagogies therefore support the development of transformative competencies, including systems thinking, anticipatory thinking, and innovation capacity. They encourage learners to move from understanding sustainability challenges to actively participating in the design of sustainable solutions.

### Box 20. Learning Planet Youth Design Challenge: Green Pedagogies in Action

The **Learning Planet Youth Design Challenge** illustrates how sustainable green pedagogies engage learners in designing solutions to real-world sustainability challenges. The initiative supports young people in transforming their ideas for environmental and social change into concrete projects with tangible impact.
Through design-based and challenge-driven learning, participants identify pressing sustainability issues within their communities and develop innovative responses. The programme provides mentorship, collaborative networks, and opportunities to refine project ideas while connecting learners with experts, organisations, and peers working toward sustainable development.
This pedagogical approach encourages learners to move beyond theoretical understanding toward **active problem-solving and systems thinking**. Thus, participants gain experience in project design,

collaboration, and sustainability innovation, while reflecting on the broader social, environmental, and economic systems shaping their projects.

Learn more

## Technology-Enhanced Pedagogies: Expanding the Learning Ecosystem

**Digital technologies** provide powerful opportunities to enhance sustainability learning by enabling new forms of interaction, experimentation, and collaboration. Technology-enhanced pedagogies integrate digital tools and platforms to create dynamic learning environments that extend beyond the traditional classroom.

Simulations, virtual laboratories, digital storytelling, augmented reality or extended reality (XR) environments, and collaborative online platforms allow students to explore complex systems and scenarios that would otherwise be difficult to experience directly. For example, climate simulations can help learners visualize the long-term consequences of policy decisions, while virtual laboratories enable experimentation with environmental systems in safe and controlled conditions.

Technology also enables global collaboration and access to open data, allowing students to work with international peers and engage with real-world datasets. These digital environments support personalized and flexible learning pathways while fostering digital literacy and adaptability. When used thoughtfully, technology-enhanced pedagogies do not replace human interaction but rather **expand the educational ecosystem**, creating new opportunities for collaborative exploration, experimentation, and knowledge creation.

### Box 21. Escaping the Climate Crisis: Immersive Games for Sustainability Learning

Escape rooms and XR experiences show how digital technologies can transform sustainability education into immersive and collaborative learning experiences. These game-based pedagogies place learners inside interactive narratives where they investigate environmental challenges, analyse complex systems, and work together to solve sustainability-related problems.

Digital escape rooms have been used to explore topics such as sustainable production and consumption, waste prevention, and the economic dimensions of sustainability. For example, the **ZeroWaste escape room**, created within the European ELMET project, invites participants to address urban waste and consumption challenges through a fictional scenario set in Venice. Players act as members of a sustainability task force competing for funding by analysing ecological footprints, identifying industries associated with over-consumption, and exploring circular-economy solutions.

Immersive narratives can also encourage learners to think about long-term sustainability futures. In **Back for the Future**, an escape room developed by Trinity College Dublin and the BiOrbic Research Centre, participants play the role of travellers from a dystopian future who return to the present to prevent climate catastrophe. Through collaborative challenges related to biodiversity restoration, emissions reduction, and bio-based circular solutions, players explore how present decisions shape environmental outcomes.

## Integrating Pedagogical Approaches for Transformative Learning

Although each pedagogical cluster highlights a distinct orientation, their greatest value emerges when they are combined in coherent learning designs. Hero pedagogies strengthen emotional engagement and ethical reflection; community-based pedagogies connect learning

with societal contexts; sustainable green pedagogies develop systems thinking and problem-solving capacities; and technology-enhanced pedagogies expand opportunities for experimentation and collaboration.

Together, these approaches create learning environments that address the cognitive, emotional, social, and practical dimensions of sustainability education. In such environments, learners do not simply acquire knowledge about sustainability but develop the capacity to **think critically, collaborate effectively, and act responsibly in complex socio-ecological systems**.

## Where does meaningful learning happen best?

Sustainability learning emerges in **connected learning environments that link knowledge, experience, and action**. Climate change, biodiversity loss, resource depletion, and social inequality unfold within complex social and ecological systems. Understanding these challenges requires learning experiences that extend beyond lecture halls and disciplinary boundaries.

Current global education debates highlight the importance of **learning ecosystems**—networks of institutions, communities, and digital platforms that support lifelong and collaborative learning. The Brookings Institution's *New Green Learning Agenda* emphasizes that education systems must connect formal learning with community engagement, real-world problem solving, and digital collaboration in order to prepare learners for sustainability transitions.

Within the LEAF framework, meaningful green learning unfolds across **four complementary environments: classrooms, communities, places, and digital spaces**. Together, these environments form an integrated ecosystem that connects conceptual knowledge with lived experience and collective action.

### Classrooms: Foundations for Critical and Systems Thinking

Classrooms provide structured spaces for exploring sustainability concepts, analytical frameworks, and interdisciplinary perspectives. Through dialogue, inquiry, and collaborative exploration, learners develop the intellectual tools needed to understand complex socio-ecological systems.

Active pedagogies strengthen this role. Challenge-based learning, project-based learning, and collaborative problem solving encourage students to investigate real sustainability challenges while developing systems thinking, anticipatory thinking, and ethical reasoning. These approaches transform classrooms into spaces for **critical inquiry and intellectual exploration**, preparing learners to engage with sustainability issues beyond the university.

### Communities: Learning Through Collective Engagement

Communities offer opportunities to connect academic learning with the social realities of sustainability transitions. Cities, neighbourhoods, civil society organizations, businesses, and public institutions all shape the contexts in which sustainability challenges unfold.

Community-engaged learning approaches—such as service learning, participatory research, living labs, and stakeholder partnerships—bring students into direct dialogue with those working on sustainability challenges. Through collaboration with practitioners and

community members, learners develop civic awareness, collaborative problem-solving skills, and a deeper understanding of the social dimensions of sustainability.

These interactions position universities as **active contributors to regional sustainability ecosystems**, while allowing students to learn from community expertise and lived experience.

## Places: Learning from Real Environments

Real environments provide powerful contexts for experiential learning. Natural landscapes, urban neighbourhoods, industrial sites, and community infrastructures reveal how global sustainability challenges take shape in specific locations.

Place-based learning activities—such as fieldwork, urban observation, environmental monitoring, and site visits—allow students to investigate sustainability challenges directly within the environments where they occur. These experiences help learners connect global issues with local realities and understand how ecological processes, social systems, and cultural practices interact.

Engaging with places strengthens learners' relational understanding of sustainability and fosters a sense of responsibility toward the environments and communities they inhabit.

## Digital Spaces: Expanding the Learning Ecosystem

Digital environments expand the reach of sustainability education by connecting learners with global knowledge networks, data resources, and collaborative platforms. Online tools enable students to explore complex sustainability systems through simulations, interactive datasets, and virtual collaboration.

Digital platforms also facilitate international cooperation. Students can collaborate with peers, researchers, and practitioners across institutions and regions, gaining access to diverse perspectives and experiences. These connections support interdisciplinary learning and global dialogue around sustainability challenges.

Integrated thoughtfully, digital tools enhance sustainability education by **extending learning across physical and institutional boundaries** while enabling new forms of experimentation and collaboration.

## Learning Across People, Places, and Futures

Effective sustainability education connects **people, places, and futures**. Learners engage emotionally and ethically with sustainability challenges, investigate the social and ecological contexts in which these challenges emerge, and explore pathways for future transformation.

By linking classrooms, communities, places, and digital environments, higher education institutions can create **dynamic learning ecosystems** that connect knowledge with action. Within such ecosystems, students develop the capacity to analyze complex challenges, collaborate across sectors, and contribute to more sustainable and equitable futures.

# The Living Component: Network of Green Ambassadors

The Network of Green Learning Ambassadors is the living, participatory heart of the GREEN LEAF Framework. While the Learning, Engagement, and Action pillars provide the structural foundation for greening higher education curricula, the Ambassadors bring the framework to life through continuous dialogue, experimentation, and collaboration. They ensure the LEAF remains dynamic, context-responsive, and rooted in real institutional and community practice.

Green Learning Ambassadors are students, educators, researchers, community partners, and practitioners who champion sustainability learning within their institutions and regions. They act as facilitators, connectors, innovators, and storytellers—bridging academic, civic, and professional spaces to advance meaningful climate action and curriculum transformation.

## How to identify potential Green Ambassadors?

The journey towards establishing an effective Network of Green Learning Ambassadors starts with identifying the right individuals—those who are passionate about sustainability, climate action, and transforming how learning happens in higher education. Potential Green Learning Ambassadors can come from many backgrounds: students, lecturers, researchers, professional and administrative staff, and community partners. These individuals are not defined only by their formal roles, but by their desire to cultivate a culture of sustainability learning within and beyond the university.

Across Europe and globally, universities have experimented with sustainability champions, green offices, student climate leaders, and similar initiatives. Their experiences offer valuable insights into how institutions can identify and support ambassadors who can genuinely advance curriculum greening and institutional transformation.

### Commitment to Sustainability

At the heart of every effective Green Learning Ambassador lies a genuine commitment to sustainability and curriculum greening. This commitment is often visible long before any formal ambassador role exists. It can be seen in the choices people make, the questions they raise, and the ways they shape learning experiences for others.

Potential ambassadors are often already weaving sustainability into their everyday work. Educators may redesign assignments to address real-world environmental or social challenges, invite community partners into the classroom, or encourage students to reflect on the ethical dimensions of their discipline. Students may seek learning opportunities beyond their formal curriculum, participate in sustainability initiatives, or bring climate and justice perspectives into group projects and student-led activities. Professional and administrative staff may contribute by improving sustainable practices in learning environments, supporting green initiatives, or connecting institutional operations with educational goals.

What matters most is not a person's job title or disciplinary background, but the way sustainability has become part of how they think, teach, learn, and act. Green Ambassadors frequently come from a wide range of fields, including those not traditionally associated with environmental studies. Their strength lies in their ability to make sustainability meaningful within their own context and to help others see how it connects to their studies, professions, and everyday lives.

Because this commitment grows organically from personal values and lived practice, the ambassador role feels natural rather than imposed. These individuals tend to engage with curiosity and care, sustain their involvement over time, and communicate with authenticity. Their motivation is rooted in purpose rather than obligation, which makes them trusted peers and credible facilitators of change.

**Box 22. Creating spaces for engagement: the Green Office as an incubator for Green Ambassadors**

Creating dedicated spaces for sustainability engagement can help Green Learning Ambassadors emerge naturally within an institution. The Green Office at **Wageningen University & Research** illustrates how this can work in practice.
Established in 2012 following a student initiative, the Green Office provides a structured yet open platform where students and staff can engage with sustainability through practical projects linked to campus life, education, and everyday work practices. A small team of student employees, supported by a staff coordinator and volunteers, creates accessible entry points for involvement at different levels of commitment.
By offering opportunities to collaborate, experiment, and take responsibility, the Green Office enables participants to gradually develop confidence, sustainability literacy, and leadership skills. Many grow into informal ambassadors within their peer groups and departments, connecting sustainability ideas with learning and institutional practice.

## Leadership Potential and Ability to Inspire Others

In addition to demonstrated commitment to sustainability, potential Green Learning Ambassadors should show leadership potential and the capacity to positively influence others. In this context, leadership is not defined by formal authority or managerial roles, but by the ability to mobilise participation, facilitate collaboration, and sustain engagement around sustainability learning.

Such individuals are often effective communicators who can translate sustainability concepts into forms that are meaningful within specific disciplinary, professional, or community contexts. They are able to convene diverse actors, support peer learning, and encourage collective ownership of initiatives. Their leadership is typically expressed through facilitation, coordination, mentoring, and knowledge sharing rather than directive decision-making.

In educational settings, this form of distributed and relational leadership is particularly important. Curriculum greening and sustainability engagement rely on voluntary participation, trust, and peer influence. Green Ambassadors with leadership capacity help bridge institutional goals and everyday practice, enabling sustainability initiatives to scale beyond individual projects and endure over time.

### Box 23. Leadership through practice: Florence and the VIS project

A clear example of leadership potential and the ability to inspire others can be found in the case of Florence, a master's student and practicing schoolteacher who initiated and led the project *Sustainable Future* (*ro. Viitor sustenabil – VIS – the acronym translates dream).*

*Scan with your phone or tablet to visit the project's Instagram page.*

The VIS project emerged from a curricular analysis aligned with the Sustainable Development Goals, identifying the need to develop green and transformative competences among lower secondary students (grades V–VIII), particularly in relation to responsible resource use and sustainability-oriented decision-making. Florence designed the project as part of her didactic master's programme at POLITEHNICA Bucharest and implemented it at the "Ion Iorgulescu" School in Argeș County.

Initiated during the COVID-19 pandemic, the project integrated an e-service-learning component, combining classroom-based and online activities. Within technology education classes, students created useful household objects from reused materials available in their homes, linking curricular objectives with principles of circular economy and sustainable consumption. Learning activities were action-oriented and inquiry-based, supported using photovoice as a method for reflection, dissemination, and advocacy. Students documented their work and learning processes through images and narratives shared via the project's public communication channels.

Florence's leadership was expressed through the design and coordination of an innovative educational intervention rather than through formal authority. She facilitated collaboration among students, connected school learning with family and community contexts, and translated abstract sustainability concepts into concrete, age-appropriate learning experiences. The project has continued beyond its initial implementation, demonstrating its capacity to generate sustained engagement and transferable practice.

**Source**: Manasia et al. (2023)

## Expertise

In addition to commitment and leadership capacity, Green Learning Ambassadors should demonstrate relevant expertise that enables them to contribute meaningfully to sustainability learning and curriculum greening. Expertise in this context should be understood broadly and inclusively, encompassing disciplinary knowledge, pedagogical competence, practical experience, or contextual understanding related to sustainability challenges.

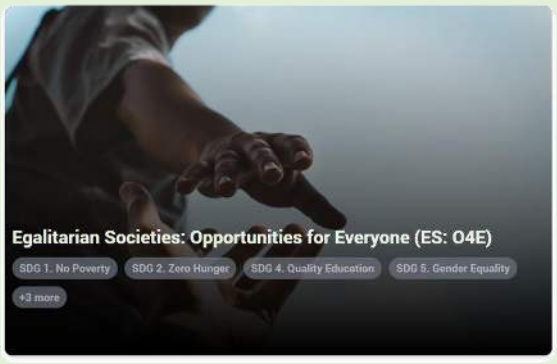
Potential ambassadors may possess subject-specific expertise relevant to environmental, social, economic, or technological dimensions of sustainability. This can include formal academic training, professional experience, applied research, or sustained engagement with sustainability-related practice. Equally important is pedagogical or facilitation expertise, particularly the ability to design, adapt, and support learning experiences that foster green and transformative competences.

Expertise does not need to be exhaustive or specialist in all areas of sustainability. Rather, effective Green Ambassadors typically have a solid knowledge base within their own domain and the capacity to connect this expertise to broader sustainability frameworks, such as curriculum goals, competence frameworks, or institutional priorities. Their credibility often stems from the practical application of knowledge in real educational or professional contexts.

Recognising diverse forms of expertise is essential. Educators, students, researchers, and professional staff may each contribute different but complementary knowledge and skills. By valuing disciplinary, pedagogical, and practice-based expertise, institutions can build ambassador networks that are both robust and context-sensitive, supporting meaningful and scalable curriculum greening.

### Box 24. EELISA Communities as hubs of distributed expertise

Within the **EELISA European University** alliance, EELISA Communities provide an institutional framework for mobilising and applying expertise around major societal challenges, including sustainability, social inclusion, and responsible innovation.
These Communities bring together students, educators, researchers, and professional staff from different disciplines and partner institutions to work on shared thematic areas such as sustainable food systems, zero waste, health and well-being, or social equity. Participation is based on demonstrated knowledge, interest, and experience, allowing individuals to contribute domain-specific, pedagogical, or practice-based expertise.
Through challenge-based activities, research–education integration, and collaboration with external stakeholders, EELISA Communities enable participants to apply their expertise in real-world contexts while continuously expanding it through peer exchange and collective problem-solving. In this way, they function as competence-building environments where expertise is both exercised and developed over time.







## Diversity of Backgrounds, Perspectives, and Roles

A strong network of Green Learning Ambassadors should reflect diversity across disciplines, institutional roles, lived experiences, and social contexts. Diversity in this sense is a core condition for effective sustainability learning and curriculum greening.

Sustainability challenges are complex, systemic, and context-dependent. Addressing them meaningfully requires the integration of multiple forms of knowledge and perspective, including scientific, social, cultural, technical, and experiential understandings. Green Ambassadors drawn from diverse academic fields, professional roles, and educational levels are better positioned to interpret sustainability in ways that are relevant across curricula and institutional settings.

Diversity also supports inclusion and legitimacy. When ambassador networks include students, educators, researchers, and professional staff, as well as individuals from different socio-economic, cultural, and educational backgrounds, sustainability initiatives are more likely to resonate with wider institutional communities. This breadth helps avoid narrow or discipline-bound interpretations of sustainability and supports more equitable participation in curriculum greening processes. From a practical perspective, diversity strengthens peer influence and knowledge diffusion. Ambassadors operating in different faculties, services, or learning environments act as connectors, translating sustainability concepts into locally meaningful practices. Institutions should therefore prioritise diversity when identifying ambassadors, ensuring balanced representation across disciplines, roles, and perspectives, while remaining attentive to issues of access, participation, and voice.

**Box 25. Leveraging diversity through multi-sector networks: SDSN Italy**

The **SDSN Italy** network provides a concrete example of how diversity of backgrounds, disciplines, and institutional roles can strengthen sustainability learning and action. Established in 2016 and hosted by the University of Brescia and the Politecnico di Torino, SDSN Italy operates at the intersection of academia, policy, civil society, and the private sector to support the implementation of the Sustainable Development Goals.

The network brings together a wide range of actors, including universities, research institutes, NGOs, foundations, youth organisations, cultural institutions, and UN-affiliated bodies. This diversity enables the integration of scientific, pedagogical, artistic, policy-oriented, and practice-based perspectives, supporting sustainability initiatives that are context-sensitive and socially relevant.

SDSN Italy's activities—such as collaboration with national university sustainability networks, youth-focused climate initiatives, engagement with the creative sector, and cross-sectoral seminars—demonstrate how heterogeneous communities can contribute complementary expertise and viewpoints. Rather than relying on a single disciplinary or institutional perspective, the network creates spaces where diverse forms of knowledge are recognised and mobilised.

## Process of identification

Once the key attributes of Green Learning Ambassadors have been defined, institutions need a clear and practical process for identifying individuals who demonstrate these qualities in practice. Identification should be understood as an **active and ongoing process** (see Figure 8).

**Figure 8**
*Process for identifying green learning ambassadors*


## Make sustainability visible and discussable

The first step is to ensure that sustainability and curriculum greening are visible priorities within the institution. This requires intentional communication and structured opportunities for engagement. Institutions should organise activities such as thematic seminars, workshops, challenge-based learning events, learning labs, and open discussions focused on sustainability, green competences, and educational transformation.

These activities serve a dual purpose: they raise awareness and create spaces where potential ambassadors naturally become visible through participation, initiative, and contribution. Individuals who consistently engage, propose ideas, facilitate discussions, or connect sustainability themes to learning and practice are strong candidates for ambassador roles.

Where relevant, institutions can amplify this process through **cross-institutional or alliance-level activities**, such as joint events, shared challenges, or collaborative learning formats at European alliance level (e.g. EELISA), which further broaden the pool of potential candidates.

### Use informed nomination channels

In parallel with open engagement activities, institutions should work with key actors who have insight into everyday academic and educational practice. Department heads, programme coordinators, research supervisors, student representatives, sustainability officers, and community partners can be asked to **nominate individuals** who have demonstrated:

- sustained commitment to sustainability or curriculum greening,
- leadership through facilitation or coordination,
- relevant disciplinary, pedagogical, or practice-based expertise, and
- the ability to engage diverse groups.

This step helps identify candidates whose contributions may not be highly visible at institutional level but are recognised locally within departments, programmes, or projects.

### Launch an open call with clear criteria

Institutions should complement targeted identification with an **open call for Green Learning Ambassadors**. Open calls lower barriers to participation and allow motivated individuals to self-identify, including students, early-career educators, professional staff, or community partners who may otherwise be overlooked.

To ensure quality and alignment, the call should clearly specify:

- the purpose of the ambassador role,
- the expected areas of contribution (e.g. learning, engagement, action),
- the selection criteria (commitment, leadership, expertise, diversity), and
- the forms of support offered (training, recognition, networking).

Applications should focus on **evidence of practice**, such as project involvement, teaching innovations, community engagement, or collaborative initiatives, rather than formal positions or titles.

### Treat identification as iterative

Identification should not be limited to a single cohort. Institutions are encouraged to treat it as an **iterative and adaptive process**, periodically revisiting the pool of engaged individuals and allowing new ambassadors to emerge as sustainability initiatives evolve.

This approach supports continuity, renewal, and diversity within the ambassador network, while reinforcing sustainability engagement as an integral part of institutional culture rather than a fixed programme.

## Recruitment process

Once the key attributes of Green Learning Ambassadors have been defined and potential candidates identified, institutions should establish a structured and transparent recruitment process to formalise engagement. Recruitment represents a critical step in

translating interest and demonstrated capacity into sustained participation, ensuring coherence between institutional sustainability objectives and individual contributions.

This phase should be conceived as a planned and inclusive process, grounded in clear criteria and communicated expectations (Figure 9). It serves to clarify roles, responsibilities, and support mechanisms, while fostering accountability and long-term commitment. When designed effectively, recruitment contributes to the development of a stable and diverse ambassador network capable of supporting curriculum greening and sustainability learning across institutional contexts.

**Figure 9**

*Overview of the recruitment process for Green Learning Ambassadors*


## Setting Clear Expectations

Clear and shared expectations are a foundational element of the recruitment process for Green Learning Ambassadors. Establishing these expectations at an early stage supports mutual understanding between institutions and ambassadors and provides a stable basis for effective and sustained engagement.

Institutions should explicitly define the objectives of the ambassador role, the scope of activities involved, and the expected level of commitment. This includes clarifying core responsibilities, forms of participation, and anticipated contributions to sustainability learning and curriculum greening. Where appropriate, expectations should also acknowledge different institutional roles and contexts, allowing for flexibility while maintaining coherence.

**Figure 10**
*Examples of shared expectations for the Green Learning Ambassador Role*


Articulating expectations in a transparent manner contributes to accountability and role clarity and supports alignment between institutional priorities and individual motivation. As the ambassador initiative evolves, expectations should be periodically reviewed to ensure continued relevance and consistency with broader sustainability strategies and governance arrangements.

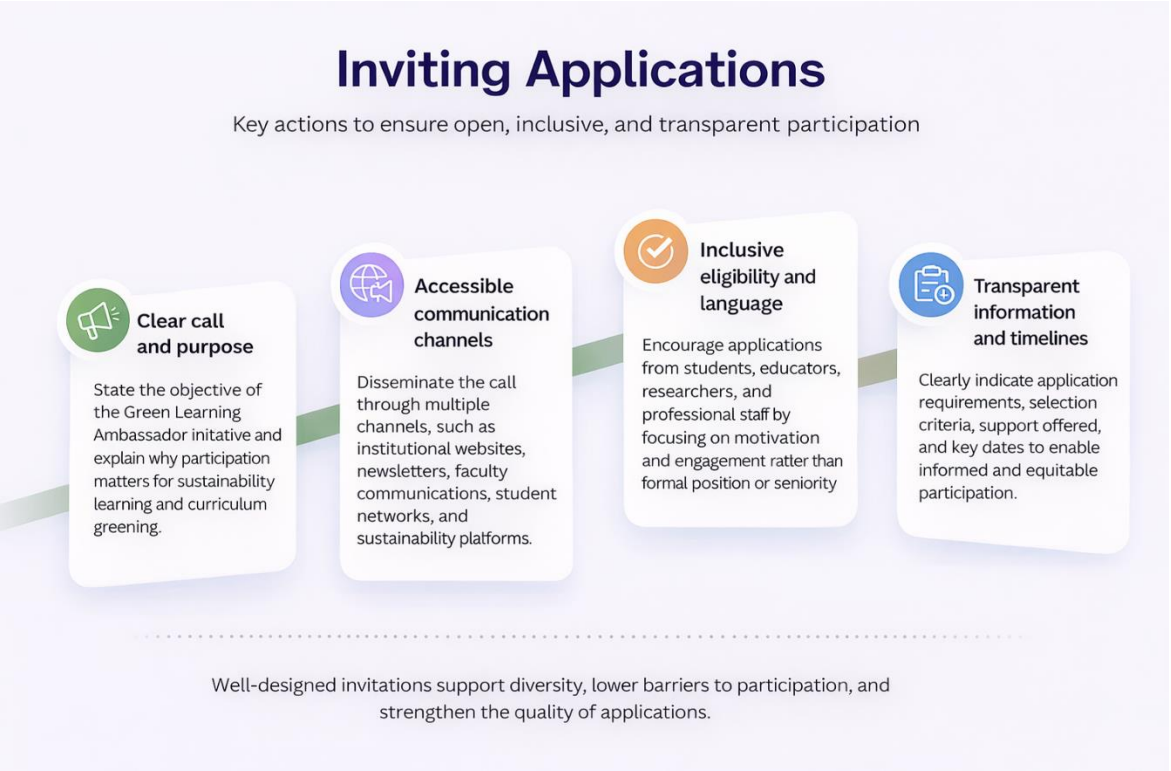
## Inviting applicants

Inviting applications is a central component of the recruitment process and plays a key role in ensuring openness, inclusiveness, and transparency (Figure 11). Well-designed invitations help translate institutional intent into active participation and enable a broad range of individuals to consider engagement as Green Learning Ambassadors.

Institutions should communicate the call for applications clearly and through multiple channels, including institutional websites, internal communication platforms, faculty and student networks, and sustainability-related events. The invitation should articulate the purpose of the ambassador initiative, outline expected roles and contributions, and indicate the forms of support and recognition available. Clear reference to selection criteria and timelines supports informed decision-making by potential applicants.

Invitations should be framed to encourage participation from diverse institutional roles and disciplinary backgrounds. Language should emphasise demonstrated engagement and motivation rather than formal status, helping to lower barriers for students, early-career educators, professional staff, and community partners. Where relevant, targeted outreach may complement open calls to ensure balanced representation across faculties, programmes, and stakeholder groups.

**Figure 11**
*Actions to ensure open, inclusive, and transparent participation*




## Evaluation and Selection

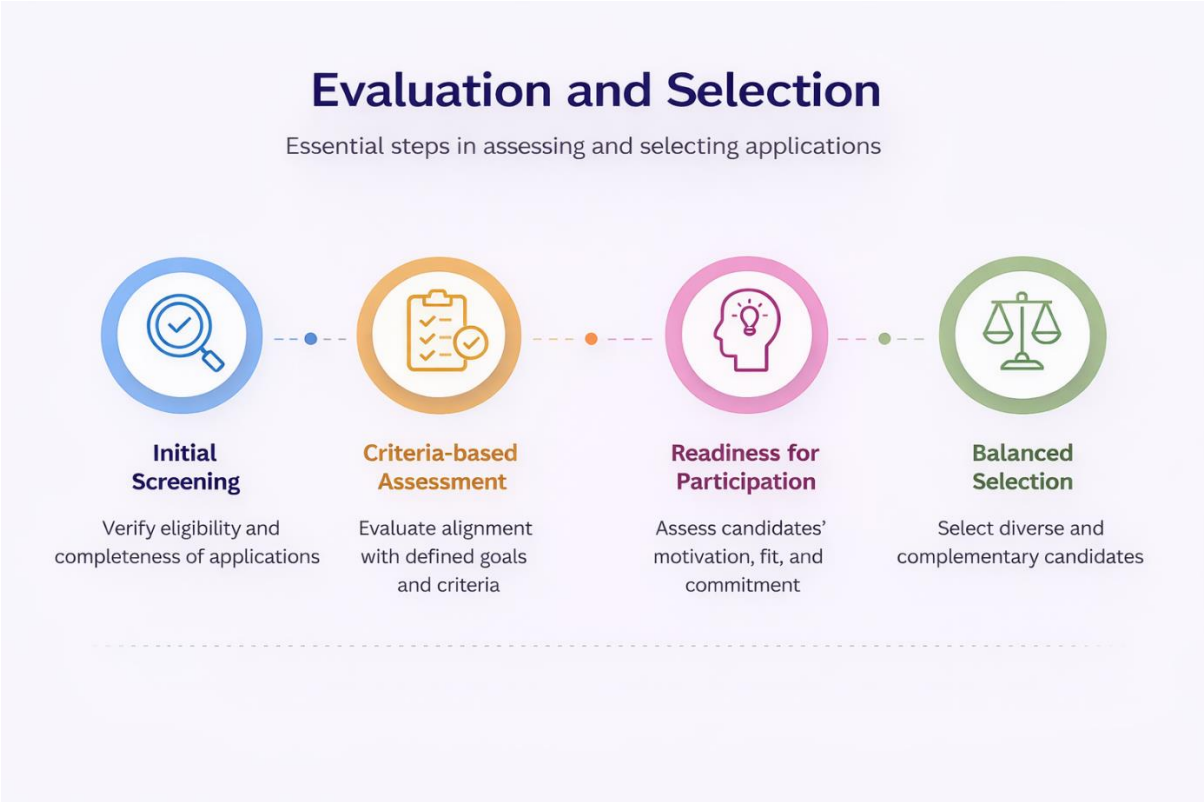
Evaluation and selection provide the basis for ensuring that the Green Learning Ambassador initiative is credible, balanced, and aligned with institutional objectives. This stage translates applications and nominations into informed decisions, based on clearly defined and consistently applied criteria (Figure 12).

Institutions should assess candidates against the attributes established in the identification phase, including commitment to sustainability, leadership potential, relevant expertise, and contribution to diversity. Evaluation processes may combine qualitative review of applications, evidence of prior engagement or practice, and, where appropriate, short interviews or conversations to clarify motivation and capacity for participation.

Selection decisions should be proportionate to the scale and scope of the initiative. Institutions may prioritise balance across disciplines, roles, and institutional units, as well as feasibility in terms of coordination and support. Transparent documentation of decisions and clear communication with applicants contribute to trust in the process and support continued engagement, including for candidates not selected in a given cycle.

Evaluation and selection should be embedded within a broader, iterative recruitment strategy. Periodic review of criteria and outcomes allows institutions to refine the process over time, ensuring continued relevance, inclusiveness, and alignment with evolving sustainability and curriculum-greening priorities.

**Figure 12**
*Evaluation and Selection Steps*




## Appointment Period and Network Enrichment

Institutions should define the appointment period for Green Learning Ambassadors. In doing so, they should take into account the need to regularly enrich and renew the ambassador network. Maintaining a dynamic and diverse group of ambassadors is essential for supporting knowledge exchange, fostering collaboration, and strengthening the overall impact of sustainability learning and curriculum greening across institutions.

## Providing a Platform for Engagement

Following the selection and appointment process, Green Learning Ambassadors should be formally introduced and embedded within the institutional learning ecosystem. Providing a visible and accessible platform for engagement serves both symbolic and functional purposes.

Formal introduction recognises the role of ambassadors and signals institutional commitment to sustainability learning and curriculum greening. At the same time, it ensures that students, educators, and staff are aware of who the ambassadors are, what they do, and how they can be contacted for support, collaboration, or guidance. Clear visibility strengthens legitimacy and facilitates uptake of sustainability-related initiatives across the institution.

Institutions should therefore provide dedicated spaces—physical, digital, or hybrid—where ambassadors can interact with peers, exchange practices, and engage with wider institutional and external stakeholders. Such platforms support continuity, peer learning, and the translation of sustainability goals into everyday educational practice.

**Box 26. ASviS as a national platform for engagement**

A relevant example of a structured engagement platform is provided by **Alleanza Italiana per lo Sviluppo Sostenibile (ASviS)**, which brings together a broad network of universities, research institutions, civil society organisations, public bodies, and private-sector actors committed to the implementation of the 2030 Agenda.
ASviS operates as a visible and accessible platform for sustainability-related dialogue, knowledge exchange, and public engagement. Through its regular publications, events, thematic working groups, festivals, training initiatives, and communication channels, the Alliance enables individuals and organisations to contribute to sustainability debates, share practices, and connect learning, research, policy, and societal action.
For individuals engaged in sustainability education and learning—including potential Green Learning Ambassadors—ASviS provides an enabling environment where roles are recognised, contributions are made visible, and engagement can extend beyond individual institutions. The platform supports interaction across disciplines, sectors, and territories, reinforcing legitimacy and amplifying impact.

## Roles and responsibilities

Green learning ambassadors are campus heroes, who promote sustainability learning through advocacy, education, support, and community-building. They connect students, faculty, staff, and community partners to turn climate action into classroom learning, everyday practices, and campus life.

The main role of an ambassador is **advocacy**. Green Learning Ambassadors promote sustainability learning by sharing both its principles and its benefits, like increased climate and justice literacy, campus resilience and community well-being. Through talks, meetings, and casual talks, but also using the instruments provided by social media, they can highlight successes in greening the curricula, local or international, to keep this topic top of mind and show that it is an attainable task. Green Ambassadors also connect with local governments, NGOs, and businesses to match campus efforts with real-world needs. Finally, they lead by example, showing sustainable habits and climate-smart choices in their own activities, according to their positions and background.

Green Learning Ambassadors not only inform, but also **educate** their peers and staff, by sharing key concepts like systems thinking, lifecycle approaches, and climate justice. They can organize workshops on place-based learning, energy budgeting, lifecycle assessments, and real-world projects, and provide for their audience useful resources like guides and case studies. Building up repositories of such resources can help them stay up to date regarding local priorities and international advances on the subject.

The **support** role of green ambassadors consists of offering hands-on help to faculty, students, and staff, bringing sustainability into lessons and projects. They offer guidance on incorporating sustainability into courses or choosing the right activities and assessments. When needed, they can also help by pushing for resources.

Green Learning Ambassadors **build** a campus culture of sustainability learning by creating and sustaining communities. They organise events like seminars, student showcases, green hackathons, and challenges; set up online networks for collaboration; and help craft a shared action plan. These activities support knowledge-sharing, peer learning, and collective efforts for climate-aware education and practice.

When discussing roles and responsibilities, it is also important how we implement the concept of green ambassadors. First of all, the scope for each of them needs to be tailored to the disciplines taught in each university, to the local sustainability priorities, and to existing partnerships. Moreover, roles of ambassadors are flexible, they can cover multiple areas (for example, advocacy and education, or education and support, etc.), and they can rotate as needed. And last, but not least, in order to assess their impact and improve their activities, some metrics need to be recorded and analysed: curricular integrations, number of courses influenced, events held, and evidence of practice changes.

## Training

Green Learning Ambassadors need focused training and ongoing support to lead sustainability efforts that fit their local context. This gives them the know-how, skills, and tools to connect academia, institutions, and communities.

### Getting Started: Sustainability Basics

Kick-off sessions cover key ideas like systems thinking, climate justice, and place-based learning, plus tips for greening curricula and university guidelines. Delivered through workshops, online modules, and practical exercises, initial training helps ambassadors drive real change.

### Continuous learning opportunities

Sustainability changes fast, due to increased interest and concern on an international level; therefore, ambassadors would benefit from getting continuous training through workshops, webinars, and e-learning materials on trends like regenerative design and community projects. Regular updates should address local climate issues, policy changes, and curriculum tools.

### Mentorship and peer-support activities

New ambassadors should pair with experienced ones and/or staff for advice and support. This can encourage knowledge sharing and collaborative problem-solving, that would make the new ambassadors' path smoother and would keep them committed to the scope.

### Supply of essential resources

The Green Learning Ambassadors get toolkits, guides, case study databases, and access to platforms to share projects with the community and stakeholders. The GreenUs platform is a great example for such an environment.

### Recognition

Universities should reward the ambassadors with certificates, badges, or credits, plus regular assessments to identify and fix barriers and keep motivation high.

## Strategies for active engagement

Staying engaged keeps Green Learning Ambassadors effective as they work on greening the curricula and supporting sustainability. Key approaches include organizing regular events, adapted outreach tasks, collaboration with stakeholders, exchange programmes, incentives and recognition, and gamification.

**Regular events**, such as forums, workshops on sustainable pedagogy, and showcases, help keep ambassadors engaged. Involving them in planning encourages ownership and develops facilitation and innovation skills.

**Individualised Outreach Plans** - tailoring plans to each ambassador's context and abilities empowers ambassadors to leverage their strengths in promoting sustainability learning, thus maximising their impact and motivation.

**Collaboration** between ambassadors and key partners inside and outside the university, including support teams, senior leadership, NGOs, industry, and civil society groups, helps align sustainability work with institutional and community priorities, and strengthens support for climate-focused teaching and projects.

Setting up **exchange programmes** between institutions so Green Learning Ambassadors can learn from different green practices encourages knowledge-sharing and introduces new ideas suited to local contexts. The EELISA university consortium is a good example for a favourable environment for these types of exchanges, as presented previously, in Box 12.

Another strategy for keeping green ambassadors actively engaged is through **incentives and recognition**. Provide rewards such as certificates, CV endorsements, or micro-credentials for achievements like hosting events or updating curricula. Also, highlight successes in newsletters or awards to maintain motivation.

**Gamification and challenges** are a great way to keep ambassadors engaged. Run campus challenges, such as a "Green Curriculum Sprint" or zero-waste weeks, with leaderboards, badges, or prizes. At the same time, use apps or social media for peer competitions to track progress.

Combining these strategies with mentorship helps build real commitment over time. It gets sustainability properly embedded in universities and local communities, helping the ambassadors achieve their goals.

## The LEAF Network[1]

The LEAF Network brings together Green Learning Ambassadors to put the LEAF into practice across universities. It helps integrate sustainability into curricula through local efforts and coordination between institutions

### Key Milestones

The network works towards these steps:

- launch the main LEAF guide;
- create institutional action plans;
- recruit ambassadors;
- set up digital tools;
- start dissemination and work plan activities.

### Institutional Foundations

Using the LEAF framework, partner universities develop Green Learning Action Plans suited to their needs. These cover strategies for updating curricula, with ambassadors helping to carry them out while the institutions take responsibility. Each partner selects its ambassadors, who apply the framework, raise awareness, and run sustainability projects.

[1] **Note on development**. This section presents the initial design of the LEAF Network. It will be further refined and expanded as the Network becomes operational, incorporating insights from implementation, ambassador activities, and institutional practice.

### Network Activation

A grassroots LEAF Community handles nominations and encourages ambassador cooperation. This group includes students, educators, researchers, NGOs, and community partners to tackle sustainability issues through joint activities, evaluation, and resource sharing. It focuses on peer learning and fitting activities to local contexts.

### Local Implementation

It starts with forums to define ambassador roles and recruitment. Partners then set guidelines for selection, training, and involvement, leading to appointments. At the same time, the online platform is developed, supporting best practice sharing and planning.

### Network Operations

Activities involve several partners, with local hubs handling context-specific work. The decentralised setup lets institutions manage their priorities, backed by shared digital tools for tracking progress and transparency. Early steps focus on getting started, with ambassadors helping to refine things over time.

This structure ensures the LEAF Network functions as a practical mechanism for sustainable curriculum transformation, linking local action to collective progress.

# Conclusion

The sustainability challenges of the twenty-first century require profound transformations across societies, economies, and institutions. Higher education has a crucial role to play in this transition by preparing learners to understand complexity, navigate uncertainty, and contribute to the development of more sustainable futures. Achieving this ambition requires more than isolated initiatives or incremental curriculum adjustments. It calls for a comprehensive approach that connects learning, institutional engagement, and practical implementation.

The **GREEN LEAF Framework** offers such an approach. By organising transformation around the three pillars of **Learning, Engagement, and Action**, it provides higher education institutions with a coherent structure for embedding sustainability across teaching, institutional practices, and partnerships with society. The framework recognises that sustainability education must operate simultaneously at multiple levels: within curricula, through pedagogical innovation, across learning environments, and within institutional governance systems.

A central contribution of the framework lies in its emphasis on integration. Transformative learning emerges when students engage with sustainability concepts across disciplines, participate in collaborative and experiential learning processes, and encounter real-world challenges through partnerships with communities and organisations. At the same time, institutional structures must sustain these efforts through governance mechanisms, quality assurance processes, and long-term strategic commitments.

The framework also highlights the importance of collective responsibility. Educators, students, institutional leaders, policymakers, and community partners all contribute to shaping sustainability learning ecosystems. Through collaborative networks, ambassador initiatives, and stakeholder engagement, universities can create environments in which sustainability becomes embedded within everyday academic practices and institutional cultures.

Importantly, the GREEN LEAF Framework is not intended as a prescriptive model but as a **living framework**. It provides guiding principles and practical pathways that can be adapted to different institutional contexts, disciplinary traditions, and national education systems. As institutions experiment with new pedagogies, partnerships, and governance approaches, the framework can evolve alongside emerging practices and insights.

Ultimately, the significance of the GREEN LEAF Framework lies in its ability to connect educational innovation with institutional transformation. When learning, engagement, and action reinforce one another, sustainability becomes part of the everyday practice of higher education. In this way, universities strengthen their capacity to educate informed, responsible, and creative citizens capable of shaping more sustainable futures.

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