

BEST PRACTICE GUIDE

BIODIVERSITY ON UNIVERSITY CAMPUSES

1. INTRODUCTION



The Importance of Biodiversity on University Campuses

More than half of the world's population lives in cities, and rapid urbanization is driving the decline in biodiversity (McKinney, 2002). To conserve biodiversity in urban ecosystems, it is essential to preserve urban green spaces (Cox and Gaston, 2018; Shaffer, 2018). This need has spurred research on biodiversity in public parks (Palliwoda et al., 2017), private gardens (Goddard et al., 2010), and university campuses (Liu et al., 2017; Wang et al., 2021), which can provide refuge for a diverse range of plant and animal species (Ives et al., 2016; Soanes and Lentini, 2019).

University campuses (including those of colleges and high schools) can be important components of urban green spaces (Colding, 2007; Vallejo et al., 2009), particularly in developing countries, where private green spaces are often insufficient (Goddard et al., 2010). For example, university campuses cover over 620 km² of urban area in China (Zhang et al., 2018), and many of them have an area larger than 100 ha (Liu et al., 2017).

Currently, there are over 26,000 universities worldwide (<http://www.webometrics.info/en/node/54>), each of which generally hosts thousands of students. Unlike other urban green spaces (e.g., parks), university campuses often host naturalists (e.g., botanists, zoologists, and conservationists), who provide a direct link to biodiversity research and education (Moerman and Estabrook, 2006). At the same time, university students can be educated about the region's specific biodiversity to enhance their appreciation of regional biodiversity and natural experiences (Zhang et al., 2014). Thus, the living biodiversity on campuses, such as plants (Güler, 2019; Liu et al., 2017), birds (Zhang et al., 2018), and insects (Guénard et al., 2015; Wheeler, 2008), has been recorded, protected, and studied for educational and academic purposes by students and researchers for decades.

Biodiversity on university campuses has the potential to establish a direct connection with the public. For example, biodiversity on university campuses influences students' perception of the attractiveness of urban areas (Lindemann-Matthies and Brieger, 2016), promotes appreciation of the natural environment among the local population (Colding and Barthel, 2017), and can pave the way toward an environmentally responsible future (Uhl and Anderson, 2001).

However, we do not have a systematic analysis of overall biodiversity patterns on university campuses, despite the growing availability of data on urban biodiversity and the increasing interest in and demand for enhancing biodiversity in urban areas.



What does biodiversity mean in an academic context?

In a university setting, biodiversity is not just a “list of species,” but rather the combination of how many and what kinds of species exist, how many types of habitats the campus offers, how well these are connected, and how intelligently buildings and infrastructure blend with natural spaces to support life and environmental education.

Tabel 1. The main aspects of biodiversity on a university campus

Component	What does "on campus" mean?
 Species diversity	the number, abundance, and ecological roles of species (plants, birds, insects, etc.)
 Habitat diversity	the variety of types of green spaces and ecological structures
 Ecological connectivity	links between green corridors and external ecological networks
 Built and natural environment	cc how buildings and infrastructure shape and accommodate nature



The objectives of the guide

This guide aims to support universities in protecting, conserving, and enhancing biodiversity on their campuses through an integrated approach based on assessment, planning, implementation, and monitoring.

Specifically, the guide aims to:

-  **Assessment of the current state of biodiversity on campus** – identifying and analyzing existing natural elements, such as habitats, flora and fauna, green spaces, ecological corridors, and pressure factors, to establish a baseline necessary for planning interventions.
-  **Defining concrete measures to protect and enhance biodiversity** – proposing practical actions tailored to the local context, such as the use of native species,

ecological management of green spaces, reducing interventions that negatively impact habitats, and creating favorable conditions for species and ecosystems.

- ✿ **Integrating biodiversity into campus management** – incorporating biodiversity conservation principles into current campus administration, maintenance, landscaping, and development processes, so that biodiversity becomes a permanent component of institutional policies and decisions.
- ✿ **Establishing a monitoring and evaluation system** – creating a framework for periodically tracking the state of biodiversity and the effects of the measures implemented, through indicators, responsibilities, and reporting mechanisms, which will allow interventions to be adapted over time.



2. CONCEPTUAL FRAMEWORK AND BASIC PRINCIPLES

Biodiversity management on university campuses must be based on an integrated, preventive approach tailored to the local context, aimed at both conserving existing natural features and improving the ecological quality of university spaces. To this end, this guide is based on a set of principles that guide the planning, implementation, and monitoring of measures designed to protect biodiversity.

- ✦ **The “avoid–reduce–restore–compensate” principle** — infrastructure and development must, in order of priority, avoid impacts, then reduce them, only then restore them, and, as a last resort, compensate for habitat loss (Wiegand, G. et al., 2013; Koh, N. et al., 2017)
- ✦ **Preventing degradation and ensuring ecological connectivity** - Habitat loss, fragmentation, and degradation are the primary threats to biodiversity; the priority is to prevent further loss and to expand and strengthen remaining habitats; Connectivity (corridors, habitat continuity) is essential for gene flow and species movement, including in urban or campus settings.
- ✦ **Native species, maintenance, and adaptive management**— SER guidelines and assessments from the Mediterranean region emphasize the use of native, locally sourced species to maintain local adaptation, biotic interactions, and resilience to climate change (Ahani, H., 2023); Practice demonstrates the risks of using non-native species and the importance of long-term monitoring and adjusting interventions (adaptive management) based on actual results.
- ✦ **University Community Participation** - Universities can become “sustainable communities” by involving students and staff in real-world, participatory projects that serve an educational purpose and promote behavioral change; participatory processes increase acceptance of environmental decisions, generate joint action plans, and strengthen the culture of sustainability at the institutional level (Da Silva, H., 2025)

3. THE BENEFITS OF BIODIVERSITY FOR THE CAMPUS

Ecological benefits

- ✦ University campuses are home to **very high levels of biodiversity**, including many endemic and endangered species, and can serve as “mini protected areas” within cities
- ✦ The green spaces and trees on campus improve **air quality, the microclimate, and water retention, while reducing noise and storing carbon**
- ✦ Campuses provide **key habitats for birds, pollinating insects, and other species**, contributing to urban ecological connectivity

Tabel 2. Types of ecological benefits

Benefit type	Examples on campus
✦ Regulators	Air cooling, pollution reduction, flood mitigation
✦ Support and Preservation	Habitats for rare species, ex situ conservation
✦ Cultural/ecological	Beautiful scenery, close to nature

Social and educational benefits

- 🌱 Green spaces rich in biodiversity are associated with lower levels of stress, anxiety, and fatigue, as well as improved concentration among students;
- 🌱 The campus becomes a living laboratory for research, ecology courses, PBL projects, and citizen science initiatives (bioblitzes, edible gardens, living labs);
- 🌱 Biodiversity education programs enhance knowledge, pro-environmental attitudes, eco-friendly behaviors, and a sense of connection with nature, including through online formats

Economic and operational benefits

- 🌱 Trees and green spaces generate substantial savings by reducing air conditioning costs, managing stormwater, sequestering carbon, and increasing property values.
- 🌱 Detailed assessments estimated that for one campus, the total value of the trees was approximately CAD 34.3 million, with annual ecosystem services worth at least CAD 343,000 (energy, stormwater, pollution, and aesthetic benefits); another campus derived annual benefits of USD 153,766 from its trees.

Well-managed green infrastructure supports operational resilience (less strain on the stormwater system, improved thermal comfort, enhanced institutional image, and increased appeal to students)

4. INITIAL ASSESSMENT OF THE CAMPUS

The initial campus assessment is the foundational step for planning measures to protect and enhance biodiversity. It provides a clear picture of the current state of the campus's natural and built elements, the relationships between them, and the main pressures affecting biodiversity. By conducting an initial assessment, the university can establish a baseline for future interventions, for prioritizing measures, and for monitoring progress over time.

Defining the scope of the analysis

- 🌱 Use GIS to delineate: the main campus, sports fields, gardens/courtyards, parking lots, buffer zones, and connections to surrounding green spaces and bodies of water
- 🌱 It integrates physical and anthropogenic variables (buildings, roads, built-up density, land cover types) to define urban habitat units

Inventory of existing elements

- 🌱 Systematic inventory of trees and shrubs, grasslands/lawns, hedges, water bodies, impervious surfaces, lighting, and buildings

Habitat Assessment

- aims to identify the types of habitats present on campus and analyze their quality

Species assessment

- must also include an assessment of the species present on campus, including both native and planted flora as well as associated fauna

Identifying pressures and risks

- Analyzing these factors helps us understand how current campus management and development activities affect habitats and species, and provides the basis for identifying corrective measures

Data collection methods

- Field observations are the primary tool for identifying habitats, species, and pressures (supplemented by the use of standardized forms, GIS mapping, and geotagged photographs).

The biodiversity assessment must cover the entire relevant area of the university campus, not just the obvious green spaces. Depending on the university's structure and location, the analysis may include the main campus, sports fields, gardens, courtyards, parking lots, areas with natural vegetation, as well as buffer zones and external connections to other green spaces or natural features in the surrounding area.

5. GOVERNANCE AND INSTITUTIONAL ORGANIZATION

Governance determines “who does what, under what rules, and in collaboration with whom” in the transition to a sustainable campus. Studies on green campuses show that success depends on clear roles, coherent internal policies, and well-structured external partnerships (Filho, L. et al., 2023; Phrophayak, J. Wt al., 2024; Barnett-Itzhaki, Z. Et al., 2025)

Roles and Responsibilities

- University leadership:** adopts the sustainability policy, integrates it into the strategy and KPIs, allocates budgets, and establishes structures (Sustainability Office/Green Office);
- Campus Administration & Technical Department:** implements standards for green spaces, buildings, lighting, and waste management; monitors indicators and reports;
- Faculty and researchers:** integrate sustainability into curricula and research, and coordinate “living lab” projects on campus;
- Students and volunteers:** co-creators of initiatives (waste, mobility, biodiversity), committee members, agents of change.

Tabel 3. Linking domestic policies to clear responsibilities

<i>Field</i>	<i>Key governance elements</i>
 Landscape Maintenance	mowing standards, pesticide-free, biodiversity conservation
 Green procurement	Environmental criteria in specifications, GPP manual
 Construction/Renovation	NZEB (Nearly Zero-Energy Building) standards, green building materials, construction site management
 Outdoor lighting	reducing light pollution, LED, smart scheduling
 Waste management	zero-waste goals, 3R policies, unit-level responsibilities

External Partnerships

-  **Local authorities:** coordination on urban planning, mobility, energy, and waste management; the university as an “urban laboratory.”
-  **Managers of natural areas, NGOs, research institutes:** joint projects on conservation, monitoring, and education, as well as the exchange of data and expertise.
-  **Schools and local communities:** service-learning programs, participatory projects, and co-design of solutions for the SDGs.

An effective governance framework for a sustainable campus combines clear roles (top-down), genuine faculty and student involvement (bottom-up), coherent internal policies (green practices in operations and procurement), and strategic external partnerships with the city and the community.

6. SETTING OBJECTIVES AND TARGETS

Setting objectives and targets is an essential step in planning measures to protect and enhance biodiversity on university campuses. After conducting the initial assessment, the university must clearly define what it aims to achieve, within what timeframe, and through what types of interventions. Objectives and targets provide direction for the management process, facilitate the prioritization of resources, and enable the evaluation of progress over time.

How are objectives formulated? - Recommendation: the SMART model (Specific, Measurable, Achievable, Relevant, Time-bound).

A good lens meets the following criteria:

- 🌱 **What? (specific action)**
- 🌱 **Where? (area/campus/zone)**
- 🌱 **How much? (indicator/values)**
- 🌱 **By when? (deadline)**
- 🌱 **With what resources? (briefly, if applicable)**

Figure 1. Examples of SMART goals

	Increasing the area covered by native vegetation
	Reducing the area of intensively mowed land
	Pesticide removal
	Increase in the number of species observed
	Improving ecological connectivity

Setting priorities

Early interventions (1–2 years)

- ✎ Adjusting the mowing schedule (leaving some areas of tall grass).
- ✎ Immediately stopping or limiting the use of herbicides in certain areas.
- ✎ Installing informational signs (“biodiversity zones”).

High-impact interventions

- ✎ Converting large grassy areas into meadows with native species.
- ✎ Creating green corridors between habitat fragments.
- ✎ Restoring or ecologically managing water bodies.

Low-cost interventions

- ✎ Modifying internal procedures (mowing guidelines, nighttime lighting).
- ✎ Involving students in monitoring (citizen science).
- ✎ Planting native species provided by partners (NGOs, public nurseries).

Medium- and long-term measures (5–10 years)

- ✎ Restoring the structure of trees and hedges using native species.
- ✎ Incorporating biodiversity criteria into all construction and rehabilitation projects.
- ✎ An ongoing program to monitor species and habitats and review objectives every 3–5 years (adaptive management).

7. BEST PRACTICE GUIDELINES FOR CAMPUS PLANNING AND MANAGEMENT

Best practices for the design and management of university campuses aim to transform outdoor spaces into a functional, resilient, and biodiversity-friendly system. These measures must be adapted to local conditions, the size of the campus, the type of land use, and available resources, with the aim of both protecting existing natural features and creating new habitats or improving existing ones.

Vegetation and Ecological Landscaping



- ✎ Favoring native species and integrating existing landscape heritage increases tree diversity and ecosystem services, including building cooling;
- ✎ Avoiding invasive species and manually removing them from small areas prevents competition with native flora and health issues (allergens);
- ✎ Diversifying the vegetation structure (trees, shrubs, ground cover) and using varied hedges reduces the risk

of “urban forest” collapse and increases resilience to pests and climate change;

- Plantings should be selected based on criteria of local adaptation, low maintenance, and ecological role (shade, corridors, habitat).

Urban meadows, selective mowing, and habitats for pollinators



- Reducing mowing frequency and implementing mosaic mowing patterns significantly increase pollinator abundance (>170% compared to mowing every 2 weeks) and flower diversity;
- Clearly demarcating areas under extensive management, pollinator strips, and explanatory signage promote social acceptance and prevent accidental mowing;
- The combination of short grass, tall grass, and sown areas simultaneously optimizes soil, plants, and pollinators;
- The predominant use of native perennial mixtures, avoidance of neophyte seeds, and pesticide-free management are recommended for “pollinator-friendly” interventions.

Trees, wildlife habitats, and green infrastructure



- The protection of mature trees, their inventory, and risk management are essential for ecosystem services (shade, carbon sequestration, aesthetic value);
- New plantings focused on functional diversity, building shade, and ecological connectivity enhance the campus’s climate and biodiversity value;
- Birdhouses and “insect hotels” are useful when there are sufficient floral resources and refuge areas, integrated with disturbance reduction and prevention of collisions with windows;
- Green roofs/walls, rain gardens, and small wetlands contribute to stormwater retention and diverse microhabitats, supported by users’ preferences for native vegetation and nature-based solutions.

SOILS

Soils, lighting, pesticides, and invasive species



- Key best practices:** reducing soil compaction, compost
- Main benefits:** soil health, support for plants and pollinators

LIGHTING

- Key best practices:** directional lighting, low intensity, scheduling
- Main benefits:** low intensity, scheduling, reduced impact on insects and birds

PESTICIDE-FREE

- 🌱 **Key best practices:** *mechanical/biological control, intervention thresholds*
- 🌱 **Main benefits:** *protection of pollinators and soil*

Best practices for the design and management of the university campus should be implemented in an integrated, phased manner that is tailored to the local context. By using native vegetation, managing green spaces ecologically, protecting habitats, reducing pressures, and integrating nature-based solutions, the campus can become a more resilient, healthier, and more valuable space from an ecological, educational, and social perspective.

8. BIODIVERSITY IN CAMPUS DESIGN AND RENOVATION

A. INTEGRATING BIODIVERSITY INTO CAMPUS PROJECTS: FROM CONCEPT TO OPERATION

Best practices for the design and management of the university campus should be implemented in an integrated, phased manner that is tailored to the local context. By using native vegetation, managing green spaces ecologically, protecting habitats, reducing pressures, and integrating nature-based solutions, the campus can become a more resilient, healthier, and more valuable space from an ecological, educational, and social perspective.

Campus projects can integrate meaningful biodiversity outcomes if ecological goals, species needs and governance are embedded from the very first strategic and design decisions, not added as end-of-pipe greening.

1. START AT STRATEGIC & CONCEPTUAL PLANNING

- 🌱 Adopt campus-wide ecological objectives (e.g., habitat preservation, ecological integrity, ecosystem services) in master plans and statutory spatial plans, then cascade them into every project brief (Orenstein et al., 2019; Yerokhin et al., 2024).
- 🌱 Use baseline biodiversity and ecosystem-service surveys of the campus to identify priority habitats, species and corridors before any site layout is drawn (De Fátima da Rocha Pinto et al., 2025; Garrard et al., 2018; Wang et al., 2020).
- 🌱 Treat biodiversity as an “active” non-human stakeholder whose needs shape land-use, massing and circulation, rather than as incidental green space (Kirk et al., 2021; Hernandez-Santin et al., 2023; Wang et al., 2020).
- 🌱 Set quantitative biodiversity targets (e.g., habitat area, native species richness, connectivity metrics) as design performance criteria, as in Biodiversity Sensitive Urban Design (BSUD) and Biodiversity Inclusive Design (BID) frameworks (Wang et al., 2020; Shen et al., 2024).

2. TRANSLATE ECOLOGY INTO SPATIAL AND TECHNICAL DESIGN

- ✿ Design habitat networks across the campus (buffer–transition–core zones, habitat galleries along paths/roads) to support species movement and diversity (Sharma et al., 2024).
- ✿ Prioritize native, structurally diverse vegetation, avoid monocultures and reduce impervious cover; tree diversity and canopy around buildings improves microclimate and biodiversity (Wang et al., 2020; Shen et al., 2024).
- ✿ Integrate vertical and 3D greening (facades, narrow corridors) with plant selection based on digitized ecological data and local natives (Winkler et al., 2022).
- ✿ Manage water and soil (wetland renaturation, stormwater quality) to protect aquatic and riparian biodiversity downstream of campus expansion (Fu, 2023; Sako and Mcmanamay, 2023).

3. GOVERNANCE, OPERATIONS, AND CULTURE

- ✿ Build administrative structures and policies that give weight to ecological guidelines in procurement, maintenance and capital works (Abdelaal, 2019).
- ✿ Use campuses as living labs: EcoCampus programs, biodiversity monitoring, project-based learning and citizen science to sustain engagement and feedback into design (De Fátima da Rocha Pinto et al., 2025; Bigard et al., 2017).
- ✿ Involve students and staff in planning and stewardship to overcome low prioritization and conflicts of interest (Yerokhin et al., 2024).

From the conceptual phase onward, biodiversity is best integrated when it becomes a core campus objective, informs site layout and networks, is operationalized through native, connected habitats and water-sensitive design, and is reinforced by governance, curricula and ongoing community stewardship.

In dense cities, a mix of habitat types—especially tree-rich ground spaces plus connected green roofs and blue-green corridors—best supports biodiversity, and infrastructure design strongly shapes ecological connectivity.

Table 4. Habitat Types and Their Effectiveness

Habitat Type	Examples	Biodiversity Level	Ecological Role	Key Evidence / Findings	Effectiveness Factors
Ground-level green spaces	Urban parks, forests, riparian zones, community gardens	High 	Core habitat + ecosystem services	- most biodiversity-rich; - tree-dominated systems are multifunctional	Native vegetation, structural diversity
Semi-natural private spaces	Yards, neighborhood gardens	Medium-High 	Connectivity + habitat support	~60% of priority bird corridors cross private land	Vegetation density, spatial continuity
Green roofs / vertical greening	Green roofs, green walls	Medium 	Complementary habitat + stepping stones	up to 4× birds, 7× arthropods vs. conventional roofs	Plant diversity, connection to other green areas
Ecological corridors	Greenways, riparian strips, vegetated streets	Medium 	Connectivity backbone	can contribute ~15% to regional connectivity	Continuity, moisture, vegetation complexity

Table 5. Functional Comparison of Habitat Types

Ecological Function	Green Spaces	Green Roofs	Corridors
Core habitat	★★★★★	★★	★★★
Connectivity	★★★	★★	★★★★★
Stepping stones	★★★	★★★	★★★
Ecosystem services	★★★★★	★★★	★★★
Space efficiency	★★	★★★★★	★★★

Table 6. Types of Interventions and Their Impact

Intervention	Biodiversity Impact	Connectivity Impact	Notes
Tree planting	Very high	Medium	Creates structurally complex habitats
Biodiverse green roofs	Medium-High	Medium	Especially valuable for insects

Urban green corridors	Medium	Very high	Essential for species movement
Natural private gardens	Medium	High	Often underestimated but critical

For urban biodiversity, no single habitat type is “most effective.” The strongest outcomes arise from networks that combine varied, vegetated ground spaces, riparian and street-tree corridors, and connected green roofs/walls, designed explicitly to overcome barriers like roads and fragmented development and tailored to target species’ movement needs.

Most effective habitat types in urban environments

Effectiveness depends on 3 criteria:

- 🌿 biodiversity supported (species richness)
- 🌿 ecological function (pollination, cooling, water management)
- 🌿 connectivity potential (ability to link habitats)

Figure 2. Urban green spaces (parks, native vegetation areas)



Table 7. Strengths, Limitations, and Effectiveness Conditions of Ground-Level Green Spaces

CATEGORY	KEY POINTS
STRENGTHS	1. Highest biodiversity potential (especially with native species) 2. Can support birds, insects, and small mammals 3. Provide core habitats (not just stepping stones)
LIMITATIONS	1. Require space (often limited in dense campuses) 2. Can become ecologically poor if overly landscaped (e.g., lawns)
MOST EFFECTIVE WHEN	1. Designed as native, structurally diverse habitats (trees + shrubs + meadow) 2. Managed with low intervention (less mowing, fewer chemicals)

B. MINIMUM REQUIREMENTS IN SPECIFICATIONS

Mandatory criteria should set quantified habitat/species outcomes, aligned with emerging EU reporting rules, with clear indicators and enforceable contractor duties.

- Require a measurable biodiversity outcome (e.g. “≥10% biodiversity net gain vs. baseline”, like England’s BNG using a standard habitat metric) and apply the mitigation hierarchy (avoid–minimize–restore–offset) (Rampling et al., 2023; Ermgassen et al, 2021).
- Specify no-go for high-value habitats and long-term management/monitoring obligations; governance gaps otherwise make gains unenforceable (McKenzie et al., 2025).

At EU level, biodiversity is increasingly mandatory via (Chapman et al, 2025; Oettel and Lapin, 2021)

- Corporate Sustainability Reporting Directive (CSRD) with European Sustainability Reporting Standards including biodiversity/ecosystems.
- Updated GRI biodiversity standard and upcoming ISSB biodiversity work, pushing harmonized metrics and disclosures.
- EU Biodiversity Strategy 2030 and Nature Restoration Regulation, plus Habitats/Birds Directives and Natura 2000 obligations for land-use projects.

Table 8. Biodiversity Requirements for Design and Construction

Requirement	Description	Best Practice
Early integration	Include biodiversity from concept stage	Consider biodiversity in all project phases
Habitat retention	Protect existing vegetation, especially mature trees	Avoid unnecessary removal

Net gain principle	 Ensure biodiversity improvement after project	 Replace or enhance habitats
Native planting	 Use locally adapted species	 Increase ecological value
Green infrastructure	 Integrate multifunctional systems	 Combine ecology + climate adaptation
Expert involvement	 Consult ecologists in design and execution	 Improve decision-making

Projects should retain existing habitats and integrate biodiversity early, as late interventions are less effective.

C. ASSESSMENT OF CONSTRUCTION IMPACT

In order to achieve a robust assessment, it is essential to combine baseline data, indicators, and spatial tools.

Table 9. Key Assessment Methods

METHOD	DESCRIPTION	STRENGTH
EIA (Environmental Impact Assessment)	 Standard framework using mitigation hierarchy	 Policy-aligned
Before–After / BACI	 Compare biodiversity before vs. after construction	 Strong causal evidence
Indicator-based monitoring	 Track species, habitats, ecosystem functions	 Quantifiable
GIS / remote sensing	 Spatial analysis of habitat loss and connectivity	 Large-scale assessment

Table 10. Impact Assessment Logic (Before–After Framework)

Step	Phase	Description	Key Actions	Expected Output
1	Baseline (Before)	Establish initial ecological conditions	- Map habitats - Survey species and ecosystems - Define indicators	Reference dataset (pre-project state)

2	Project Implementation	Execution of construction activities	- Carry out works - Document interventions	<i>Record of activities and changes</i>
3	Pressures / Impacts	Identify stressors generated by the project	- Noise - Habitat loss - Fragmentation - Pollution	<i>List of impact factors</i>
4	Monitoring (After)	Assess post-construction ecological conditions	- Repeat surveys - Use same methods and indicators	<i>Post-project dataset</i>
5	Comparison & Evaluation	Analyze differences between before and after	- Compare datasets - Apply statistical analysis	<i>Measured ecological change</i>
6	Interpretation & Response	Translate results into decisions	- Identify negative/positive impacts - Adjust management or mitigation	<i>Improved practices and mitigation measures</i>

D. CONSTRUCTION SCHEDULES AND WILDLIFE PROTECTION

The temporal aspect of construction, or the timing of its initiation, has been identified as a critical factor influencing the potential biodiversity impacts, particularly during sensitive periods such as breeding and migration. Disturbance during these phases has been shown to result in nest abandonment, reduced reproductive success, and altered species behavior. Consequently, the prevailing best practice advocates for the avoidance of high-impact activities during critical biological periods, with the concentration of necessary works being undertaken within designated time windows. The implementation of additional measures, including buffer zones, noise and light control, and the establishment of ecological corridors or temporary refuges, has been demonstrated to further mitigate impacts. Integrating ecological knowledge into construction scheduling is imperative for mitigating biodiversity loss and ensuring more sustainable project outcomes

Table 11. Scheduling Principles

PRINCIPLE	APPLICATION	BENEFIT
Avoid sensitive periods	🌱 No works during breeding/migration	🌱 Protect fauna
Concentrate disturbance	🌱 Short construction windows	🌱 Reduce long-term impact
Limit night work	🌱 Control lighting and noise	🌱 Protect nocturnal species

Use buffers

 Protect nests and habitats

 Reduce disturbance

E. NATURE-BASED SOLUTIONS (NBS) IN CAMPUS DESIGN

Nature-based solutions are environmental strategies that utilize natural processes to address ecological issues, thereby fostering biodiversity.

Table 12. Common NbS for Campuses

NbS Type	Function	Benefits
Green roofs & walls	Cooling, habitat creation	Reduce heat + support biodiversity
Rain gardens / bioswales	Water management	Improve water quality
Urban trees & forests	Climate regulation	Carbon storage + habitat
Wetlands / ponds	Water treatment	Habitat + flood control
Green corridors	Connectivity	Species movement

Spatial Design Principles

Table 13. Key Spatial Strategies

PRINCIPLE	DESCRIPTION	OUTCOME
Connectivity	Link habitats through corridors	Reduce fragmentation
Multifunctionality	Combine ecological + social uses	Efficient land use
Diversity of habitats	Include different habitat types	Higher biodiversity
Scale integration	Combine small and large green areas	Stronger ecological network

9. ENVIRONMENTALLY FRIENDLY MAINTENANCE AND DAY-TO-DAY OPERATIONS

A. ANNUAL MAINTENANCE PLAN

An annual campus ecological plan should be zoned, seasonal, and adaptive, with explicit biodiversity goals and simple, repeatable indicators.

Table 14. Core Principle of Ecological Maintenance

Step	Component	Description	Expected Outcome
1	Baseline ecological review	Initial assessment of habitats, species, and site conditions	Understanding of ecological context
2	Annual maintenance plan	Definition of objectives, zoning, tasks, and resources	Structured and goal-oriented management
3	Seasonal work schedule	Alignment of activities with ecological cycles (seasons, breeding, flowering)	Reduced ecological disturbance
4	Trained staff & SOPs	Implementation by trained personnel using standard procedures	Consistent and biodiversity-friendly operations
5	Low-input operations	Reduced mowing, chemicals, and intensive interventions	Lower impact on ecosystems
6	Plant waste reuse	Composting, mulching, and habitat creation (deadwood)	Circular resource use and soil improvement
7	Monitoring and adaptation	Continuous evaluation and adjustment of practices	Improved long-term biodiversity outcomes

A biodiversity-friendly maintenance system should start with a baseline review of the site, then translate that into an annual plan, a seasonal schedule, staff training, standard procedures, and on-site reuse of plant waste. Guidance for campuses and urban green spaces consistently emphasizes biodiversity, biosecurity, long-term maintenance quality, and coordination between design, operations, and monitoring.

Table 15. Recommended structure of an annual ecological maintenance plan

COMPONENT	WHAT IT SHOULD INCLUDE	WHY IT MATTERS
 Site baseline	Habitat map, existing planting, wildlife survey, invasive species risks	Helps choose the right actions and avoid damaging valuable areas
 Zoning	Intensive, moderate, extensive, no-mow / habitat zones	Allows different maintenance regimes instead of one uniform standard
 Annual tasks	Mowing, pruning, planting, watering, invasive control, monitoring	Turns ecological objectives into a work program
 Responsibilities	Grounds team, contractors, ecologist, estates manager, volunteers	Clarifies who approves and who delivers each task
 Biosecurity	Cleaning equipment, movement controls, invasive species procedures	Reduces spread of invasive species and pathogens



Monitoring

Simple indicators, annual review, corrective actions

Supports adaptive management

A good annual plan should be map-based, include a baseline survey, define where biodiversity options will be applied, and integrate biodiversity and biosecurity into routine grounds operations. Universities such as Oxford explicitly require biodiversity and biosecurity to be considered in the maintenance of landscaped areas, and toolkits for urban sites recommend wildlife surveys before works start so that management can be targeted where it will have the most benefit

B. SEASONAL WORK SCHEDULE

The principle of ecological maintenance necessitates the synchronization of activities with biological cycles as opposed to the implementation of a uniform, cosmetic schedule. It is evident from the literature on species-rich grasslands and pollinator habitats that cyclical management, reduced mowing, the introduction of native wildflowers, and the timing of cuts to allow flowering and seeding all contribute to improved biodiversity. Furthermore, it has been demonstrated that these practices can also result in a reduction in long-term management costs. It is imperative to note that wildflower and long-grass cuttings typically require extraction rather than being left in situ, as accumulated cut material has been observed to impede regrowth and diminish habitat quality.

Table 16. Seasonal work calendar for campuses

SEASON	RECOMMENDED ACTIONS	KEY RESTRICTIONS / NOTES
SPRING	 Light maintenance, planting, habitat checks, selective path-edge cutting	 Avoid disturbing nesting and early pollinator activity where possible
SUMMER	 Selective mowing, irrigation only where needed, invasive monitoring, pollinator habitat protection	 Reduce mowing frequency in biodiversity zones; retain flowering resources
AUTUMN	 Meadow cuts after flowering/seeding, leaf and biomass collection for compost or mulch, tree/shrub planting	 Lift cuttings from wildflower areas; sort waste streams
WINTER	 Structural pruning, access repairs, training refreshers, equipment servicing, planning update	 Good period for heavier structural work in many landscapes, but still check species-specific constraints

The creation and management of species-rich grassland through cyclical regimes has been demonstrated to support increased biodiversity, enhance resilience, and can be cost-effective. Pollinator guidance also notes that a reduction in mowing and an increase in native flowering plants can improve habitat quality and reduce mortality by limiting the need for insects to move elsewhere in search of resources.

C. TRAINING OF MAINTENANCE STAFF

It is imperative that staff training encompasses more than just technical horticulture. Maintenance that is environmentally sustainable is contingent upon staff members having a comprehensive understanding of the value of habitats, the ecological ramifications of mowing and pruning, the risks posed by invasive species, and the ability to communicate the rationale behind a less meticulous management approach to users of the campus. Urban forestry guidance also underscores the significance of stakeholder coordination, public outreach, education, and participatory tools in green space management.

Table 17. Training modules for maintenance staff

Training module	Core content	Preferred format
BIODIVERSITY LITERACY	Native vs. non-native plants, habitat types, seasonal ecology, indicator species	Short field-based sessions on campus
ECOLOGICAL MAINTENANCE SKILLS	Differentiated mowing, meadow management, low-input planting, deadwood retention, pollinator-friendly practice	Demonstration plots + toolbox talks
BIOSECURITY AND INVASIVE SPECIES	Equipment cleaning, site-to-site movement, reporting sightings, disposal rules	SOP drills and refresher briefings
COMMUNICATION AND PUBLIC-FACING SKILLS	Explaining “messy” habitats, responding to complaints, signage support	Scenario-based workshops
MAPPING AND COORDINATION	Reading estate maps, GIS outputs, maintenance zones, approval chains	Practical planning exercises

D. STANDARD OPERATING PROCEDURES

Standard operating procedures should make ecological maintenance repeatable. They are especially important for mowing, pruning, invasive species control, work near sensitive habitats, and equipment hygiene.

Table 18. Suggested SOPs for campus ecological maintenance

SOP area	Minimum good practice
Mowing	Define mowing frequency by zone; reduce frequency in biodiversity areas; avoid whole-site mowing at once; lift cuttings where required in meadow/wildflower areas
Pruning / tree works	Check timing, nesting risk, and habitat value before works; retain deadwood where safe and appropriate
Planting	Prioritize native or locally appropriate species; match species to habitat and maintenance capacity
Invasive species	Record locations, isolate material, clean machinery and footwear, follow disposal and containment procedures
Sensitive sites	Require approval before work near valuable habitats, mature trees, water, or protected areas
Lighting / disturbance	Use only where needed; avoid unnecessary disturbance in ecological zones
Waste handling	Separate reusable biomass, compost suitable material, retain some woody material as habitat where safe

Biosecurity procedures frequently mandate the mapping of sites harboring invasive species, the regular training of staff, and the cleaning of machinery and boots prior to the transition between catchments or work areas. For sites that are classified as protected or sensitive, formal checks and approvals may be mandated prior to the initiation of any operations.

E. PLANT WASTE MANAGEMENT

The approach to plant waste should be redefined to align with its designation as a resource rather than a disposal problem. Best-practice guidelines for green-space composting advocate on-site composting when feasible, as it is frequently the most cost-effective and environmentally preferable option. The text further underscores the significance of temporal considerations and the nature of the cut material, emphasizing that hot composting systems are particularly advantageous when the objective entails seed destruction. RHS guidance further elaborates that vegetative waste can be composted, leaves can be transformed into leaf mould or mulch, and the accumulation of logs can serve as a straightforward method to augment biodiversity value.

Table 19. Plant waste management hierarchy

MATERIAL	PREFERRED TREATMENT	BIODIVERSITY / OPERATIONAL BENEFIT
Grass and meadow cuttings	Collect and compost; do not leave thick layers on species-rich areas	Prevents smothering and returns nutrients through compost where appropriate
Leaves	Make leaf mould or use as mulch in suitable zones	Improves soil and moisture retention
Prunings and woody debris	Chip for mulch or retain some logs / piles on site	Creates habitat and reduces transport/disposal
Invasive plant material	Separate and handle under biosecurity rules	Prevents spread
Mixed green waste	Sort before treatment	Improves reuse quality

Table 20. Best-practice framework for ecological maintenance on campus

THEME	BEST-PRACTICE RULE	TYPICAL TOOLS
Annual maintenance plan	Plan by habitat zone, not one regime for all	Estate map, habitat survey, annual task sheet
Seasonal work schedule	Match works to flowering, seeding, nesting, and dormancy cycles	Seasonal calendar, no-mow / low-mow windows
Staff training	Train for ecology, field operations, biosecurity, and communication	Field sessions, toolbox talks, refresher training
Standard procedures	Use repeatable SOPs for mowing, pruning, planting, invasive species, and hygiene	Checklists, approval chain, work logs

**Plant waste
management**

 Reuse biomass on site wherever feasible

 Compost bays, mulch, leaf mould, habitat logs

The efficacy of ecological maintenance on university campuses is contingent upon the replacement of routine grounds care with a planned, seasonal, low-input system that is supported by trained staff, clear Standard Operating Procedures (SOPs), and circular plant-waste management. The most prevalent recurring recommendations across campus and urban green-space guidance are to map and zone sites, reduce uniform mowing, integrate biodiversity and biosecurity into maintenance contracts and daily practice, and reuse biomass on site through compost, mulch, and habitat features wherever possible.

10. EDUCATION, PARTICIPATION, AND ENGAGEMENT OF THE UNIVERSITY COMMUNITY

University campuses have the potential to function as living laboratories for biodiversity, wherein the dimensions of teaching, research, operations, and community engagement reinforce one another. Research on campus-based projects indicates that biodiversity education is most effective when students and staff can learn in situ, contribute observations, and observe how data leads to management decisions. Citizen science and Bioblitz-style events are particularly advantageous in this regard, as they have the capacity to integrate learning, participation, biodiversity documentation, and long-term engagement into a unified framework.

A. BIODIVERSITY AS AN EDUCATIONAL RESOURCE

Campus green spaces have the potential to function as outdoor classrooms, field sites, and applied research environments. Recent case studies of higher education institutions illustrate the implementation of project-based learning in the context of urban biodiversity. This learning approach encompasses activities such as species identification, habitat observation, field recording, and sustainability problem-solving. In addition, "living lab" models employ the campus environment as a platform where teaching and campus management can be integrated.

Table 21. Using campus biodiversity as an educational resource

EDUCATIONAL USE	TYPICAL ACTIVITIES	MAIN BENEFIT
<i>Field-based teaching</i>	 Species surveys, habitat mapping, tree inventories	 Direct observation and ecological literacy
<i>Applied coursework</i>	 Campus design studios, restoration proposals, monitoring exercises	 Links theory to real management problems

Undergraduate / postgraduate research	 Biodiversity baselines, pollinator surveys, GIS analysis	 Produces usable campus knowledge
Living-lab learning	 Students work with estates, grounds teams, or sustainability offices	 Connects learning with operational change

B. CURRICULAR AND EXTRACURRICULAR ACTIVITIES

The efficacy of curricular activities is maximized when biodiversity is integrated across disciplines, rather than being confined to the domain of ecology alone. Extracurricular activities, such as clubs, workshops, guided walks, habitat projects, and interdisciplinary sustainability challenges, serve to extend this commitment.

Table 22. Curricular and extracurricular formats

FORMAT	EXAMPLES	RECOMMENDED OUTCOME
CURRICULAR	Ecology field classes, GIS labs, environmental design studios	Academic knowledge and skills
CO-CURRICULAR	Course-linked volunteering, field notebooks, capstone projects	Applied learning
EXTRACURRICULAR	Nature clubs, bird walks, pollinator garden care, talks	Broader participation
INTERDISCIPLINARY	Sustainability weeks, design-build projects, challenge-based learning	Systems thinking and teamwork

C. VOLUNTEER AND CITIZEN SCIENCE PROGRAMS

Citizen science has emerged as a potent instrument for engaging university communities in biodiversity research, given its capacity to generate substantial observational data while concurrently enhancing knowledge, engagement, and environmental consciousness (Tiago et al., 2024).

Table 23. Structure of a campus citizen science program

Component	Description	Good practice
Platform	 iNaturalist or similar biodiversity platform	 Use a common platform for visibility and data quality
Participation model	 Open to students, staff, alumni, local community	 Keep entry barriers low
Training	 Short sessions on species recording and photo-based identification	 Build confidence early
Data use	 Feed records into campus planning, interpretation, and events	 Show participants that data matters

Continuity

Seasonal challenges, repeated surveys, annual review

Avoid one-off participation only

D. AWARENESS CAMPAIGNS

The necessity for awareness campaigns is predicated on the recognition that biodiversity-friendly campus management is not invariably readily comprehensible or accepted. University biodiversity toolkits prioritize the implementation of awareness-raising events and communications as integral components of campus biodiversity initiatives (Baker et al., 2024).

Table 24. Awareness campaign tools

Tool	Purpose	Example use
Social media	Reach students quickly	Seasonal biodiversity posts, species-of-the-week
Posters and campus screens	Visibility in common spaces	Promote events, explain habitat areas
Campaign weeks	Concentrate attention	Biodiversity week, pollinator week
Storytelling	Build emotional connection	“What lives on our campus?”
Feedback loops	Show results	Share species counts, volunteer impact, before/after photos

E. INVOLVEMENT OF STUDENT ASSOCIATIONS

Student organizations frequently serve as the most effective conduit between institutional objectives and the quotidian campus environment.

Table 25. Roles for student associations

ROLE	POSSIBLE ACTIVITIES	INSTITUTIONAL SUPPORT NEEDED
EVENT ORGANIZER	Bioblitzes, awareness weeks, talks, walks	Small grants, logistics, promotion
VOLUNTEER MOBILIZER	Habitat workdays, monitoring teams	Staff liaison, materials, insurance clarity
PEER EDUCATOR	Campaigns, social media, orientation events	Training and access to content

PROJECT PARTNER

Work with estates, academics,
NGOs

Formal recognition and continuity
planning

Table 26. Best-practice framework for education, participation, and engagement

THEME	BEST-PRACTICE RULE	TYPICAL TOOLS
Biodiversity as educational resource	 Use campus as a living laboratory	 Field classes, habitat mapping, student projects
Curricular and extracurricular activities	 Combine formal learning with informal participation	 Courses, clubs, workshops, guided walks
Volunteer and citizen science programs	 Use simple, visible recording systems and show data use	 iNaturalist, campus surveys, seasonal challenges
Bioblitzes and themed events	 Use events to combine data, learning, and outreach	 Bioblitzes, biodiversity week, pollinator days
Signage and educational trails	 Make biodiversity legible in everyday campus use	 Panels, QR codes, mapped routes
Awareness campaigns	 Repeat messages and connect them to action	 Social media, posters, campaign weeks
Student associations	 Treat students as co-deliverers, not just audiences	 Small grants, co-creation, formal roles

11. RESEARCH AND INNOVATION

Universities have a unique capacity to integrate research, operational processes, and educational initiatives, thereby facilitating the real-world evaluation of sustainability solutions within the confines of the campus environment.

A. THE CAMPUS AS A LIVING LABORATORY

In recent years, institutions of higher education have increasingly adopted the practice of utilizing campuses as "living labs," thereby facilitating collaborative endeavors amongst students, researchers, and operational staff members. These collaborative efforts are driven towards the objective of evaluating and testing biodiversity solutions under real-world conditions. These environments facilitate experiential learning, applied research, and co-creation with stakeholders.

Table 27. Living Lab Characteristics

Feature	Description	Benefit
<i>Real-world setting</i>	Campus as experimental space	Practical testing of solutions
<i>Co-creation</i>	Students, staff, partners collaborate	Innovation and relevance
<i>Interdisciplinary</i>	Combines science, design, policy	Holistic solutions
<i>Iterative learning</i>	Test → evaluate → improve	Adaptive management

B. INTEGRATING RESEARCH INTO CAMPUS MANAGEMENT

A fundamental best practice is the integration of research outputs with decision-making processes and operational activities. Living lab programs illustrate the manner in which research can influence policy, infrastructure, and maintenance practices.

Table 28. Research-Management Integration

Component	Example	Outcome
<i>Monitoring data</i>	🌱 Species surveys, habitat mapping	🌱 Informed planning
<i>Applied research</i>	🌱 Testing NbS (green roofs, habitats)	🌱 Improved design
<i>Decision support</i>	🌱 GIS tools, models	🌱 Better spatial planning
<i>Feedback loops</i>	🌱 Monitoring → adaptation	🌱 Continuous improvement

C. INTERDISCIPLINARY PROJECTS

The challenges posed by biodiversity on university campuses necessitate interdisciplinary collaboration. The efficacy of integrating disparate fields such as ecology, engineering, urban planning, and social sciences is exemplified by living lab initiatives, which have demonstrated the potential for more effective solutions through interdisciplinary collaboration.

Table 30. Interdisciplinary Approaches

Discipline	Contribution
<i>Ecology</i>	🌱 Species and habitat knowledge
<i>Urban planning</i>	🌱 Spatial design and connectivity

<i>Engineering</i>	 Green infrastructure solutions
<i>Social sciences</i>	 Behavior and participation
<i>Data science</i>	 Monitoring and modeling

D. OPEN DATA AND REPORTING

The implementation of open data practices has been demonstrated to foster enhanced transparency, collaboration, and long-term monitoring. Citizen science initiatives exemplify the capacity to generate and disseminate substantial datasets, thereby facilitating research and management endeavors. For instance, a university campus project documented thousands of biodiversity observations and identified hundreds of species, thereby enhancing both knowledge and engagement.

Table 31. Open Data Practices

Practice	Tool / Method	Benefit
Open platforms	iNaturalist, biodiversity portals	Public participation
Data sharing	Open-access databases	Transparency
Reporting	Annual biodiversity reports	Accountability
Visualization	Maps, dashboards	Decision support

E. COLLABORATIONS WITH UNIVERSITIES AND NETWORKS

Collaboration is imperative for amplifying impact. Universities frequently collaborate with: a variety of academic institutions, research organizations, non-governmental organizations (NGOs), and public authorities have been identified as relevant actors in this field.

The presence of substantial research centers and networks has been demonstrated to facilitate a number of key processes, including, but not limited to, knowledge exchange, interdisciplinary research, and the attainment of global impact.

Table 32. Types of Collaboration

Partner	Role
 Universities	Joint research and projects
 Research centers	Advanced scientific expertise
 NGOs	Implementation and outreach
 Local authorities	Policy and planning integration
 Networks	Knowledge sharing and scaling

12. MONITORING, INDICATORS, AND EVALUATION

A. Why monitoring is necessary?

The efficacy of biodiversity actions can be assessed through monitoring.

Table 33. Functions of Monitoring

FUNCTION	DESCRIPTION	OUTCOME
Baseline understanding	 Establish initial ecological conditions	 Reference for comparison
Impact detection	 Identify changes over time	 Detect positive/negative trends
Decision support	 Inform management actions	 Better planning
Accountability	 Demonstrate progress toward targets	 Transparency
Learning	 Understand what works	 Improved strategies

B. Types of indicators

The prevailing best practice in this field advocates for a multi-level indicator system that integrates ecological condition, pressures, and responses.

Table 34. Indicator Types

Type	Description	Examples
State indicators	Condition of biodiversity	<i>Species richness, habitat quality</i>
Pressure indicators	Human impacts	<i>Land sealing, pollution, disturbance</i>
Response indicators	Management actions	<i>Area under ecological management</i>
Benefit indicators	Outcomes and benefits	<i>Ecosystem services, climate adaptation</i>

C. Examples of indicators

The prevailing best practice in this field advocates for a multi-level indicator system that integrates ecological condition, pressures, and responses.

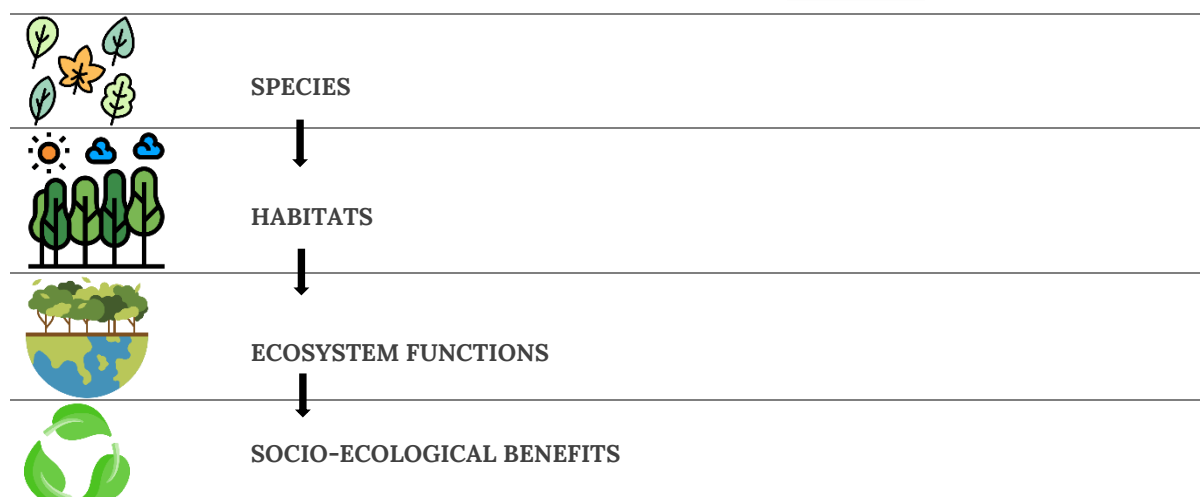


Table 35. Biodiversity Indicators for Campuses

Dimension	Indicators	Purpose
Species	Richness, abundance, indicator species	Track biodiversity
Habitats	Area, connectivity, structural diversity	Assess habitat quality
Soil & processes	Soil biodiversity, nutrient cycling	Ecosystem functioning
Management	Mowing frequency, chemical use	Evaluate practices
Engagement	Participation, citizen science data	Social impact

D. Frequency of monitoring

The frequency of monitoring should align with the ecological processes and management requirements

Table 36. Monitoring Frequency

Indicator Type	Recommended Frequency	Notes
Species (plants, birds)	1–2 times/year	Seasonal variation
Pollinators/insects	Multiple times/year	Sensitive to climate
Habitats	Annual	Detect structural change
Soil indicators	Every 2–5 years	Slow processes
Management practices	Continuous / annual	Operational tracking

Monitoring Cycle:



E. Reporting progress

Transparency and effective decision-making are supported by reporting

Table 37. Reporting Tools

Tool	Description	Benefit
Reports	Annual biodiversity reports	Track progress
Dashboards	Visual data platforms	Easy interpretation
GIS maps	Spatial visualization	Identify patterns
Open data platforms	Public data access	Engagement and transparency

F. Reviewing and adapting measures

Management decisions should be informed by monitoring results.

Table 38. Adaptive Management Process

Step	Action	Outcome
Evaluate	Compare results vs. targets	Identify gaps
Diagnose	Understand causes	Targeted solutions
Adjust	Modify management practices	Improved effectiveness
Re-monitor	Track new results	Continuous improvement

13. FUNDING AND RESOURCES

A combination of internal and external funding sources, partnerships, human resources, and cost-efficient procurement practices achieves sustainable biodiversity financing. These factors contribute to the long-term implementation and resilience of biodiversity initiatives.

A. Internal budget

Internal funding is essential for long-term biodiversity management on campus.

Table 39. Internal Budget Components

Budget Category	Description	Examples
<i>Operational budget</i>	 Routine maintenance and management	 Ecological mowing, planting
<i>Capital investments</i>	 Infrastructure and upgrades	 Green roofs, wetlands
<i>Research funding</i>	 Monitoring and innovation projects	 Biodiversity studies
<i>Education & engagement</i>	 Programs and events	 Workshops, Bioblitzes

The best practice is to integrate biodiversity into existing operational budgets rather than treating it as an optional add-on.

In order to support comprehensive and effective campus management, the total campus budget should be allocated across key areas, including maintenance, infrastructure, research, and education.

B. External grants and funding

Larger or innovative biodiversity projects are supported by external funding.

Table 40. External Funding Sources

SOURCE	EXAMPLES	USE
<i>EU programs</i>	 Horizon Europe, LIFE Programme	 Large-scale projects
<i>National funds</i>	 Environmental agencies	 Restoration projects
<i>Foundations</i>	 Environmental NGOs	 Pilot initiatives
<i>Research grants</i>	 Academic funding bodies	 Innovation and studies

Strong proposals and partnerships are often necessary because external funding is often project-based.

C. Sponsorships and partnerships

Partnerships can offer financial, technical, and operational support.

Table 41. Partnership Types

PARTNER	CONTRIBUTION	BENEFIT
Private companies	 Sponsorship, materials	 Visibility, CSR
NGOs	 Expertise, outreach	 Knowledge transfer
Public authorities	 Funding, policy support	 Alignment with strategies
Alumni networks	 Donations, advocacy	 Community engagement

Partnerships increase the capacity and visibility of biodiversity initiatives.

The university collaborates with a range of partners, including companies, NGOs, government institutions, and alumni, forming a network that supports biodiversity initiatives through shared resources, expertise, and engagement.

D. Human resources and volunteer work

Human resources are essential to implementation.

Table 42. Human Resource Types

RESOURCE	ROLE	VALUE
Staff (grounds, researchers)	 Implementation and expertise	 Core capacity
Students	 Monitoring, projects	 Innovation + engagement
Volunteers	 Maintenance, events	 Cost-effective support
External experts	 Consultancy	 Specialized knowledge

Volunteer programs and student involvement play a crucial role in supporting campus biodiversity initiatives by both reducing operational costs and increasing community participation. By engaging students and volunteers in activities such as monitoring, habitat management, and awareness campaigns, universities can extend their capacity beyond that of formal staff resources while fostering a sense of environmental responsibility and ownership. This approach has been demonstrated to enhance the cost-effectiveness of biodiversity initiatives, while also fostering long-term engagement and cultivating a culture of sustainability within the university community.

E. Procurement and maintenance costs

The procurement process is a critical aspect of ensuring long-term sustainability.

Table 43. Cost Considerations

Category	Strategy	Benefit
Planting	🌱 Use native species	🌱 Lower maintenance
Maintenance	🌱 Reduce mowing, chemicals	🌱 Cost savings
Materials	🌱 Sustainable, local sourcing	🌱 Environmental benefits
Lifecycle costs	🌱 Consider long-term costs	🌱 Better investment decisions

Nature-based solutions (NbS) frequently result in diminished long-term maintenance expenditures relative to conventional, highly engineered methods. By leveraging natural processes, such as vegetation for water management, soil systems for nutrient cycling, and diverse plant communities for resilience, NbS often necessitates fewer inputs, including irrigation, chemicals, and intensive maintenance. While the initial implementation costs may be comparable or marginally higher in some cases, these expenses are counterbalanced over time through a reduction in operational expenses, enhanced durability, and supplementary ecosystem benefits. Consequently, NbS emerges as a cost-effective and sustainable alternative for campus design and management.

The establishment of a sustainable biodiversity financing system necessitates the integration of internal budgets, external funding sources, partnerships, human resources, and cost-efficient practices. This comprehensive approach ensures the long-term support and effectiveness of biodiversity initiatives.

14. COMMUNICATION AND VISIBILITY

Effective biodiversity communication can be achieved through a variety of methods, including transparency, accessibility, storytelling, the use of digital tools, and integration into institutional practices. These approaches contribute to increased awareness, stronger engagement, and an enhanced institutional reputation.

A. How we communicate implemented measures?

The importance of clear communication in ensuring the comprehension, acceptance, and support of biodiversity actions cannot be overstated.

Table 44. Communication Methods

METHOD	DESCRIPTION	EXAMPLE
On-site communication	Signage, labels, interpretation panels	"Pollinator meadow – low mowing area"
Digital communication	Websites, social media, newsletters	Biodiversity updates, species highlights
Interactive tools	Apps, QR codes	Access to species lists or maps
Events	Guided tours, workshops	Campus biodiversity walks

The optimal approach entails the integration of physical, digital, and interactive modes of communication.

The communication process commences with the implementation of an action, which is subsequently translated into a clear message. This message is disseminated through both online and on-site channels, leading to user engagement. Subsequently, feedback from users is collected and utilized to promote continuous enhancement.

B. Annual biodiversity report

The practice of annual reporting is an essential component of a broader commitment to transparency and accountability.

Table 45. Biodiversity Report Structure

SECTION	CONTENT	PURPOSE
Overview	Key achievements	Summary of progress
Indicators	Biodiversity metrics	Evidence-based evaluation
Projects	Implemented actions	Show concrete work

Engagement	 Events, participation	 Social impact
Future actions	Planned improvements	 Strategic direction

It is essential that reports be clear, visual, and accessible to individuals outside of the relevant field.

The reporting cycle commences with data collection, subsequently followed by a thorough analysis of the collected information. The results of these inspections are then compiled into a report, which is communicated to the relevant stakeholders. Subsequently, feedback is collected, which can inform future reporting and improvement processes.

C. Online map of the green campus

The utilization of interactive maps serves to enhance the visibility and accessibility of biodiversity.

Table 46. Map Features

FEATURE	FUNCTION	BENEFIT
HABITAT LAYERS	 Show green areas, habitats	 Spatial understanding
SPECIES DATA	 Display observations	 Educational value
PROJECTS	 Highlight interventions	 Transparency
ROUTES	 Educational trails	 User engagement

The digital visualization model commences with the aggregation of field data, which is subsequently processed and integrated into a Geographic Information System (GIS) platform. This information is presented through an online map, enabling user interaction and exploration of biodiversity data.

D. Examples of success stories

Success stories in biodiversity communication and visibility on university campuses play a crucial role in translating technical actions into accessible and engaging narratives. These accounts typically highlight specific interventions, including habitat restoration, citizen science initiatives, and nature-based solutions, presenting their outcomes in a structured "problem-action-result-impact" format. By demonstrating quantifiable enhancements, student engagement, or novel methodologies, success narratives facilitate the articulation of the significance of biodiversity initiatives to a broader audience. These instruments also function as potent tools for raising awareness, motivating participation, and fortifying institutional identity. By offering stakeholders clear examples of positive change on campus, these tools facilitate a deeper understanding and connection with the tangible outcomes of these efforts.

Table 47. International Success Stories in Biodiversity Communication and Visibility

University	Country	Initiative	Communication Approach	Key Results	Impact
University of British Columbia	Canada	Campus as a Living Lab	Digital platforms, reports, public engagement	Hundreds of projects, strong visibility	Global leadership in campus sustainability
University of Leeds	UK	Leeds Living Lab	Student-led projects, exhibitions, storytelling	Increased awareness and participation	Integration of research and operations
University of Melbourne	Australia	Biodiversity Mapping	Interactive GIS maps, online tools	Improved access to biodiversity data	Higher engagement and learning
University of Oxford	UK	Biodiversity-Friendly Grounds	On-site signage, communication campaigns	Increased acceptance of ecological practices	Behavioral change on campus
Western University	Canada	Citizen Science Program	Use of iNaturalist, campaigns	Thousands of observations recorded	Strong student engagement
University of Lisbon	Portugal	Bioblitz & Awareness Events	Events, digital platforms, campaigns	Increased participation and species records	Improved biodiversity visibility

E. Institutional branding and reputation

The presence of biodiversity within an institution has been demonstrated to contribute to its institutional identity and visibility.

Table 48. Branding Benefits

ASPECT	CONTRIBUTION
Sustainability image	 Positions university as responsible
Rankings and certifications	 Supports sustainability metrics
Student attraction	 Appeals to environmentally aware students
Partnerships	 Attracts funding and collaboration

The implementation of effective biodiversity strategies has been demonstrated to contribute to enhanced institutional credibility and competitiveness. When biodiversity initiatives are communicated and made visible in an effective manner, they shape a positive public perception, which in turn strengthens the institution's overall reputation.

15. SAMPLE BIODIVERSITY ACTION PLAN

A strong biodiversity action plan should be evidence-based, target-led, and iterative. Universities such as Surrey, Leicester, and Cambridge explicitly link their plans to baseline assessment, strategic objectives, monitoring, and review. In contrast, design guidance from Leicester places biodiversity considerations across the full project cycle, from scoping through aftercare and annual monitoring.



Figure 3. Biodiversity Action Plan cycle

This cyclical model is consistent with campus plans that require regular monitoring and periodic review. For instance, Heriot-Watt stipulates that its campus biodiversity action plan is subject to annual monitoring and a comprehensive review is conducted every five years. In contrast, Leicester proposes a biennial review of its initial plan following the first year to evaluate the actions, objectives, and monitoring targets.

Step 1: Initial assessment

The initial assessment should establish the baseline ecological condition of the campus. In practice, the process generally encompasses the mapping of habitats, the undertaking of species surveys, the review of extant records, and the identification of pressures and opportunities.

Table 49. What to include in the initial assessment

COMPONENT	WHAT TO ASSESS	TYPICAL OUTPUTS
Habitat baseline	🌿 Habitat types, extent, condition, connectivity	🌿 Campus habitat map
Species baseline	🌿 Plants, birds, pollinators, bats, indicator taxa	🌿 Species lists and priority species records
Existing data review	🌿 Previous ecological audits, surveys, GIS data	🌿 Consolidated evidence base
Pressures	🌿 Sealed land, mowing intensity, lighting, disturbance, invasive species	🌿 Risk and pressure map

Opportunities

 Habitat restoration, native planting, NbS, green corridors

 Opportunity areas and project shortlist

The initial assessment combines existing data, field surveys, campus mapping, and pressure analysis to develop a comprehensive baseline understanding of the site's ecological conditions.

Step 2: Setting objectives

The objectives of the initiative are to translate the baseline into a clear direction for action. In order to ensure optimal efficacy, it is imperative to establish objectives that are sufficiently specific to provide a clear framework for delivery, while simultaneously being measurable to facilitate effective progress evaluation. It is a common feature of university plans that they encompass a combination of ecological, operational, educational, and engagement objectives.

Table 50. Types of objectives in a campus biodiversity action plan

OBJECTIVE TYPE	EXAMPLE OBJECTIVE	WHY IT MATTERS
Habitat protection	 Protect existing high-value habitats and mature trees	 Prevents avoidable biodiversity loss
Habitat enhancement	 Increase meadow, wetland, woodland, or pollinator habitat	 Improves ecological quality
Species support	 Support priority or indicator species	 Focuses effort on measurable biodiversity outcomes
Campus management	 Integrate biodiversity into estates and maintenance practice	 Embeds action into operations
Learning and engagement	 Use the campus as a teaching and volunteering resource	 Builds long-term institutional support

The strategy encompasses objectives pertaining to species protection, partnerships, estate management, compliance, awareness, education, and staff and student experience. In this section, the collection and reporting of biodiversity data, the protection of habitats and key species, and the facilitation of education and engagement opportunities can also be included.

Step 3: Priority actions

It is imperative that priority actions be implemented to convert objectives into a deliverable work programme. Within a university environment, these initiatives frequently encompass habitat restoration, biodiversity-friendly grounds management, protection of priority species, biodiversity-sensitive design for new developments, and community engagement.

Table 51. Example priority actions

ACTION AREA	EXAMPLE ACTIONS	TIMESCALE
Habitat management	🌱 Meadow creation, reduced mowing, pond or wetland enhancement, native planting	🌱 Short to medium term
Species measures	🌱 Bird and bat boxes, nesting checks, pollinator planting, species surveys	🌱 Annual / seasonal
Estate and development	🌱 Biodiversity screening of projects, habitat retention, biodiversity net gain measures	🌱 Ongoing
Engagement	🌱 Bioblitzes, signage, student projects, volunteering	🌱 Annual
Governance	🌱 Biodiversity working group, data management, officer responsibilities	🌱 Ongoing

Step 4: Monitoring

Monitoring is a process that enables the determination of whether actions are delivering the intended outcomes. Campus action plans frequently encompass recurring wildlife surveys, habitat tracking, documentation of gains and losses, and annual reporting of monitoring activities. For instance, Leicester articulates monitoring as being pivotal to long-term success, while Swansea incorporates ongoing records of biodiversity gains and losses, as well as wildlife survey activity, within its annual reporting framework.

Table 52. Monitoring framework

MONITORING ELEMENT	WHAT TO MONITOR	FREQUENCY
Habitats	🌱 Area, quality, connectivity, management regime	🌱 Annual
Species	🌱 Indicator species, birds, pollinators, bats, flora	🌱 Seasonal / annual
Project delivery	🌱 Whether actions were implemented on time and to specification	🌱 Annual
Impacts of development	🌱 Habitat losses/gains, mitigation measures, biodiversity net gain	🌱 Ongoing / annual
Engagement	🌱 Student participation, volunteer hours, citizen science records	🌱 Annual

Leicester recommends conducting repeat species surveys within a maximum period of five years for a multitude of targets and the implementation of annual checks for features such as bird boxes. Conversely, Swansea advocates the maintenance of records pertaining to survey and monitoring activities, with these records to be incorporated within the annual report.

Step 5: Annual review

An annual review is a process that should systematically collect and analyse data on a range of key performance indicators. These indicators should include actions completed, monitoring results, problems encountered, and next-year priorities. This step is pivotal in transforming a biodiversity action plan from a static document into an adaptive management tool. Leicester explicitly recommends reviewing its first biodiversity action plan after one year, and Heriot-Watt states its plan is monitored annually with periodic full review. In Brunel's 2024–2029 plan, the concept of review is also presented as a means of evaluating the successes and challenges of previous action plans, as well as identifying opportunities for enhancement.

Table 53. What the annual review should cover

Review component	Key questions	Typical outputs
Delivery review	Which actions were completed, delayed, or not started?	Progress summary
Ecological review	What changed in habitats, species, and pressures?	Indicator update
Resource review	Were staffing, budget, and partnerships adequate?	Resource adjustments
Lessons learned	What worked, what failed, what needs redesign?	Recommendations
Next-year plan	What should be maintained, expanded, or revised?	Updated action plan

The development of an action plan for biodiversity on a university campus should commence with a baseline assessment, followed by the establishment of explicit objectives and the identification of priority actions. This plan should then be supported by ongoing monitoring and annual reviews. A review of published university action plans reveals a consistent best-practice pattern. This pattern involves the following steps: measurement of initial data, setting of targeted goals, delivery of feasible actions, monitoring of progress, and revision of the plan using evidence from implementation.

REFERENCES

- A.G.J. Wheeler. College campuses: patches of insect diversity, opportunities for entomological discovery, and means for enhancing ecological literacy. *Am. Entomol.*, 54 (2008), pp. 18–35
- Abdelaal, M. (2019). Biophilic campus: An emerging planning approach for a sustainable innovation-conducive university. *Journal of Cleaner Production*.
<https://doi.org/10.1016/j.jclepro.2019.01.185>
- Ahani, H. (2023). Ecological Restoration of Pinus Pinaster Woodlands, After Degradation with Focusing on Rehabilitation of Target Habitats. *Cell & Cellular Life Sciences Journal*.
<https://doi.org/10.23880/cclsj-16000183>.
- B. Guénard, A. Cardinal-De Casas, R.R. Dunn. High diversity in an urban habitat: are some animal assemblages resilient to long-term anthropogenic change?. *Urban Ecosyst.*, 18 (2015), pp. 449–463, 10.1007/s11252-014-0406-8
- B. Güler. Diversity and drivers of plant species on Turkish university campuses. *Biologia (Bratisl)* (2019), pp. 1–9, 10.2478/s11756-019-00276-1
- B.M. Vallejo, A.B. Aloy, P.S. Ong. The distribution, abundance and diversity of birds in Manila's last greenspaces. *Landsc. Urban Plan.*, 89 (2009), pp. 75–85, 10.1016/j.landurbplan.2008.10.013
- Baker, P. M., Samuels, B., & Hain, T. J. A. (2024). Using citizen science to document biodiversity on a university campus: A year-long case study. *Conservation*, 4(3), 533–546.
<https://doi.org/10.3390/conservation4030032>
- Barnett-Itzhaki, Z., Tifferet, S., Berkowicz, D., Arviv, T., Daya, A., Romano, G., & Levi, A. (2025). Strategies and challenges for green campuses. *Frontiers in Sustainable Cities*.
<https://doi.org/10.3389/frsc.2025.1469274>.
- Bigard, C., Pioch, S., & Thompson, J. (2017). The inclusion of biodiversity in environmental impact assessment: Policy-related progress limited by gaps and semantic confusion. *Journal of Environmental Management*, 200, 35–45. <https://doi.org/10.1016/j.jenvman.2017.05.057>
- C. Uhl, A. Anderson. Green destiny: universities leading the way to a sustainable future. *Bioscience*, 51 (2001), pp. 36–42, 10.1641/0006-3568(2001)051[0036:GDULTW]2.0.CO;2
- C.D. Ives, P.E. Lentini, C.G. Threlfall, K. Ikin, D.F. Shanahan, G.E. Garrard, S.A. Bekessy, R.A. Fuller, L. Mumaw, L. Rayner, R. Rowe, L.E. Valentine, D. Kendal. Cities are hotspots for threatened species. *Glob. Ecol. Biogeogr.*, 25 (2016), pp. 117–126, 10.1111/geb.12404
- Chapman, M., Jung, M., Leclère, D., Boettiger, C., Augustynczyk, A., Gusti, M., Ringwald, L., & Visconti, P. (2025). Meeting European Union biodiversity targets under future land-use demands. *Nature Ecology & Evolution*, 9, 810–821. <https://doi.org/10.1038/s41559-025-02671-1>
- D.E. Moerman, G.F. Estabrook. The botanist effect: counties with maximal species richness tend to be home to universities and botanists. *J. Biogeogr.*, 33 (2006), pp. 1969–1974, 10.1111/j.1365-2699.2006.01549.x

- D.T.C. Cox, K.J. Gaston. Human-nature interactions and the consequences and drivers of provisioning wildlife. *Philos. Trans. R. Soc. Lond., B, Biol. Sci.*, 373 (2018), Article 20170092
- De Fátima da Rocha Pinto, M., Scavarda, A., & Machado, F. (2025). The integration of SDGs and biodiversity in HEIs curricula and practices: A systematic literature review. *International Journal of Sustainability in Higher Education*. <https://doi.org/10.1108/ijshe-05-2024-0360>
- Ermgassen, S., Marsh, S., Ryland, K., Church, E., Marsh, R., & Bull, J. (2021). Exploring the ecological outcomes of mandatory biodiversity net gain using evidence from early-adopter jurisdictions in England. *Conservation Letters*, 14. <https://doi.org/10.1111/conl.12820>
- Filho, L., Dibbern, T., Trevisan, L., Cristofolletti, E., Dinis, M., Matandirotya, N., Sierra, J., Shulla, K., Buttriss, G., Decosta, P., Mbah, M., & Sanni, M. (2023). Mapping universities-communities partnerships in the delivery of the Sustainable Development Goals. *Frontiers in Environmental Science*. <https://doi.org/10.3389/fenvs.2023.1246875>.
- Fu, W. (2023). Enhancing university campus landscape design through regression analysis: Integrating ecological environmental protection. *Soft Computing*, 27, 16309–16329. <https://doi.org/10.1007/s00500-023-09134-4>
- Garrard, G., Williams, N., Mata, L., Thomas, J., & Bekessy, S. (2018). Biodiversity sensitive urban design. *Conservation Letters*, 11. <https://doi.org/10.1111/conl.12411>
- H.B. Shaffer. Urban biodiversity arks. *Nat. Sustain.*, 1 (2018), pp. 725–727, 10.1038/s41893-018-0193-y
- Hernandez-Santin, C., Amati, M., Bekessy, S., & Desha, C. (2023). Integrating biodiversity as a non-human stakeholder within urban development. *Landscape and Urban Planning*. <https://doi.org/10.1016/j.landurbplan.2022.104678>
- J. Colding, S. Barthel. The role of university campuses in reconnecting humans to the biosphere. *Sustainability*, 9 (2017), p. 2349, 10.3390/su9122349
- J. Colding. “Ecological land-use complementation” for building resilience in urban ecosystems
- J. Liu, M. Yu, K. Tomlinson, J.W.F. Slik Patterns and drivers of plant biodiversity in Chinese university campuses *Landsc. Urban Plan.*, 164 (2017), pp. 64–70, 10.1016/j.landurbplan.2017.04.008
- J. Palliwoda, I. Kowarik, M. von der Lippe. Human-biodiversity interactions in urban parks: the species level matters. *Landsc. Urban Plan.*, 157 (2017), pp. 394–406, 10.1016/j.landurbplan.2016.09.003
- K. Soanes, P.E. Lentini. When cities are the last chance for saving species. *Front. Ecol. Environ.*, 17 (2019), pp. 225–231, 10.1002/fee.2032
- Kirk, H., Garrard, G., Croeser, T., Backstrom, A., Berthon, K., Furlong, C., Hurley, J., Thomas, F., Webb, A., & Bekessy, S. (2021). Building biodiversity into the urban fabric: A case study in applying biodiversity sensitive urban design (BSUD). *Urban Forestry & Urban Greening*. <https://doi.org/10.1016/j.ufug.2021.127176>

- Koh, N., Hahn, T., & Ituarte-Lima, C. (2017). Safeguards for enhancing ecological compensation in Sweden. *Land Use Policy*, 64, 186-199. <https://doi.org/10.1016/j.landusepol.2017.02.035>.
- Landscape Urban Planning*, 81 (2007), pp. 46-55, 10.1016/j.landurbplan.2006.10.016
- M.A. Goddard, A.J. Dougill, T.G. Benton. Scaling up from gardens: biodiversity conservation in urban environments. *Trends Ecol. Evol. (Amst.)*, 25 (2010), pp. 90-98, 10.1016/j.tree.2009.07.016
- M.L. McKinney. Urbanization, biodiversity, and conservation. *Bioscience*, 52 (2002), pp. 883-890, [10.1641/0006-3568\(2002\)052\[0883:UBAC\]2.0.CO;2](https://doi.org/10.1641/0006-3568(2002)052[0883:UBAC]2.0.CO;2)
- McKenzie, E., Jones, M., Seega, N., Siikamäki, J., & Vijay, V. (2025). Science and technical priorities for private sector action to address biodiversity loss. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 380. <https://doi.org/10.1098/rstb.2023.0208>
- Oettel, J., & Lapin, K. (2021). Linking forest management and biodiversity indicators to strengthen sustainable forest management in Europe. *Ecological Indicators*. <https://doi.org/10.1016/j.ecolind.2020.107275>
- Orenstein, D., Troupin, D., Segal, E., Holzer, J., & Hakima-Koniak, G. (2019). Integrating ecological objectives in university campus strategic and spatial planning: A case study. *International Journal of Sustainability in Higher Education*. <https://doi.org/10.1108/ijshe-12-2017-0219>
- P. Lindemann-Matthies, H. Brieger. Does urban gardening increase aesthetic quality of urban areas? A case study from Germany. *Urban For. Urban Green.*, 17 (2016), pp. 33-41, 10.1016/j.ufug.2016.03.010
- Phrophayak, J., Techarungruengsakul, R., Khotdee, M., Thuangchon, S., Ngamsert, R., Prasanchum, H., Sivanpheng, O., & Kangrang, A. (2024). Enhancing Green University Practices through Effective Waste Management Strategies. *Sustainability*. <https://doi.org/10.3390/su16083346>.
- Ramplang, E., Ermgassen, S., Hawkins, I., & Bull, J. (2023). Achieving biodiversity net gain by addressing governance gaps underpinning ecological compensation policies. *Conservation Biology*, 38. <https://doi.org/10.1111/cobi.14198>
- Sharma, A., Chauhan, A., Parkar, V., Raghuram, A., & Sinha, B. (2024). Planning eco-sensitive zones for promoting tree diversity and ecosystem services in urban academic landscapes: A case study from the north-western Indo-Gangetic plain. *Arboricultural Journal*, 47, 4-21. <https://doi.org/10.1080/03071375.2024.2426414>
- Shen, Z., Yin, H., Kong, F., Wu, W., Sun, H., Su, J., & Tian, S. (2024). Enhancing ecological network establishment with explicit species information and spatially coordinated optimization for supporting urban landscape planning and management. *Landscape and Urban Planning*. <https://doi.org/10.1016/j.landurbplan.2024.105079>
- Tiago, P., Leal, A. I., Rosário, I. T., et al. (2024). Discovering urban nature: Citizen science and biodiversity on a university campus. *Urban Ecosystems*, 27, 1609-1621. <https://doi.org/10.1007/s11252-024-01526-0>

- W. Zhang, C. Liang, J. Liu, X. Si, G. Feng. Species richness, phylogenetic and functional structure of bird communities in Chinese university campuses are associated with divergent variables. *Urban Ecosyst.*, 21 (2018), pp. 1213-1225, [10.1007/s11252-018-0803-5](https://doi.org/10.1007/s11252-018-0803-5)
- W. Zhang, E. Goodale, J. Chen. How contact with nature affects children's biophilia, biophobia and conservation attitude in China. *Biol. Conserv.*, 177 (2014), pp. 109-116, [10.1016/j.biocon.2014.06.011](https://doi.org/10.1016/j.biocon.2014.06.011)
- Wang, J., Zheng, L., Liu, H., Xu, B., & Zou, Z. (2020). The effects of habitat network construction and urban block unit structure on biodiversity in semiarid green spaces. *Environmental Monitoring and Assessment*, 192, 1-23. <https://doi.org/10.1007/s10661-020-8115-7>
- Wiegand, G., Bröring, U., Choi, G., Dahms, H., Kanongdate, K., Byeon, C., & Ler, L. (2013). Ecological restoration as precaution and not as restitutional compensation. *Biodiversity and Conservation*, 22, 1931-1948. <https://doi.org/10.1007/s10531-013-0518-0>.
- Winkler, J., Jeznach, J., Koda, E., Sas, W., Mazur, Ł., & Vaverková, M. (2022). Promoting biodiversity: Vegetation in a model small park located in the research and educational centre. *Journal of Ecological Engineering*. <https://doi.org/10.12911/22998993/143997>
- X. Wang, J.-C. Svenning, J. Liu, Z. Zhao, Z. Zhang, G. Feng, X. Si, J. Zhang. Regional effects of plant diversity and biotic homogenization in urban greenspace – the case of university campuses across China. *Urban For. Urban Green.*, 62 (2021), Article 127170, [10.1016/j.ufug.2021.127170](https://doi.org/10.1016/j.ufug.2021.127170)
- Yerokhin, S., Feuer, Y., & Sassen, R. (2024). Biodiversity preservation in German higher education institutions: Existing approaches, challenges and future developments. *International Journal of Sustainability in Higher Education*. <https://doi.org/10.1108/ijshe-12-2023-0608>