PRO GREEN LABS

UOP

ESTABLISHED LAB UNIT PORTFOLIO

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1. UOP ESTABLISHED LAB UNIT PORTFOLIO: URBAN GREEN LAB

The **Urban Green Lab** is a dedicated research unit within the Department of Architecture at the University of Petra, focusing on innovative research and practice in sustainable urbanism. Established through the Pro-GREEN-LABs initiative (Erasmus+), the lab addresses contemporary urban challenges through interdisciplinary approaches, serving as a center for critical thinking, teaching, and community-oriented research in architecture and urban design.

1.1. Aims, Mission Statement and Scope of Interests

AIMS: The lab aims to actively engage students (undergraduate and postgraduate), researchers, and faculty in applied urban research and innovation, and to forge strong partnerships with local authorities, community organizations, and international collaborators in addressing pressing urban challenges. It seeks to conduct comprehensive analyses of urban spaces in order to develop sustainable, context-specific solutions tailored to local needs and conditions, while also investigating the environmental and socio-economic factors that shape cities and urban life. Furthermore, the lab aspires to develop research-driven urban interventions that promote ecological balance, economic viability, and the preservation of cultural heritage in the built environment. Through these objectives, the Urban Green Lab positions itself as a catalyst for evidence-based urban improvements in Jordan and the wider region.

MISSION STATEMENT: The Urban Green Lab is committed to advancing the integration of research, education, and practice in sustainable urban development. By employing innovative urban design methodologies and participatory planning approaches, the lab seeks to push the boundaries of urban knowledge and best practices, enrich architectural education with real-world, research-driven projects, and promote sustainable urban solutions to contemporary challenges. Its mission emphasizes bridging the gap between academic inquiry and practical implementation, ensuring that research outcomes are both academically rigorous and directly applicable to improving urban environments. In doing so, the lab contributes to cultivating a new generation of architects and planners who are equipped with green competences and committed to sustainable city-building.

SCOPE OF INTEREST: The lab's activities and research interests closely align with its aims and the curriculum of UoP's architecture programs. Key focus areas include:

- Climate change and the city: exploring urban resilience and climate-adaptive design strategies.
- Mapping for urban planning and design: employing GIS and spatial analysis for urban studies.
- Heritage and cultural management: integrating conservation of historic urban fabric with modern development.
- Methodologies in urban planning and design: innovating planning processes and design-thinking approaches.

- Participatory planning and design: engaging communities in co-design and decision-making for urban projects.
- Sustainable urban planning and design: formulating strategies for environmentally sustainable city development.
- Principles of sustainable and smart cities: applying smart technologies and sustainability principles in urban contexts.
- Urban planning policy: analysing and contributing to policy frameworks for sustainable urban growth.

These focal areas ensure that the Urban Green Lab remains multidisciplinary and forward-looking, tackling issues from climate resilience to cultural heritage, and from community engagement to technological innovation in urban settings.

1.2. Hard Capacities of the Urban Form Lab

This section outlines the hard capacities of the Urban Green Lab at UoP, including its physical infrastructure and the technical tools that support the lab's operations, research activities, and educational engagement.

1.2.1. Venue

The Urban Green Lab is located on the 2nd Floor of the Department of Architecture building, Faculty of Architecture & Design, at the University of Petra. This central location within the faculty ensures the lab is in close proximity to studios and classrooms, facilitating daily interaction with students and faculty and enabling seamless integration of lab activities into the department's academic life. The dedicated lab space provides an accessible environment for collaborative research, hands-on workshops, and student projects focused on sustainable urban design.

Figure 1: The Urban Green Lab, the 2nd Floor, Department of Architecture, Faculty of Architecture and Design, University of Petra

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Figure 2 : Lab Area, and Fabrication Zone

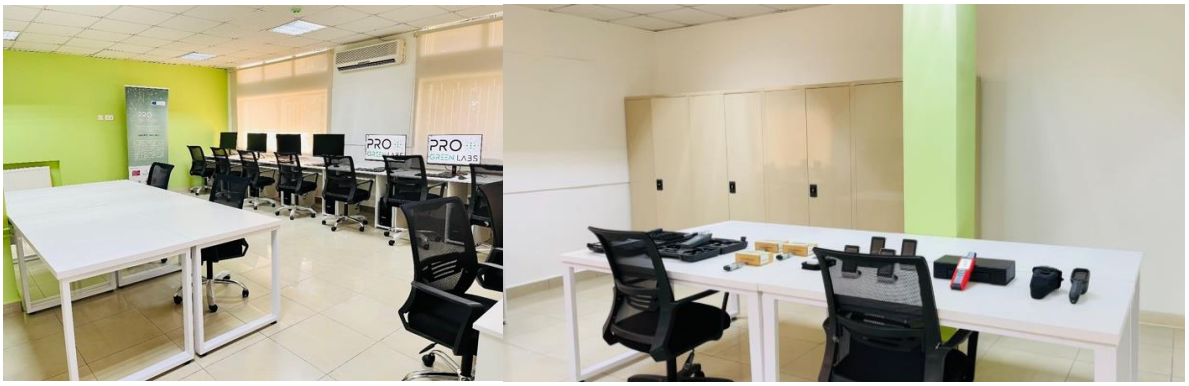

Figure 3 : Interior Shots of Urban Green Lab Area

1.2.2. List of Equipment and Software

The Urban Green Lab is equipped with a range of modern hardware and software tools to support its teaching and research objectives. Table 1 below summarizes the key equipment and software resources available in the lab (as procured under project Work Package 3):

- **High-performance Computing**: 8 desktop PCs and 2 laptops with advanced specifications (multi-core Intel Core i9 processors and NVIDIA RTX 4070 GPUs) provide the computing power needed for intensive tasks such as 3D modeling, simulations, and data analysis. These machines enable students and researchers to run building performance simulations, GIS analyses, and other computational urban design workflows efficiently.
- **3D Printers (2 units)**: A pair of desktop 3D printers (FLSUN Super Racer S1 and Creality K1 models) are available for rapid prototyping and model fabrication. These printers allow architecture students to quickly produce physical models of urban forms or building components, facilitating an experiential learning process in sustainable design and testing of innovative concepts.

- **Portable Traffic Counter**: A field-deployable traffic counting device is part of the lab's equipment, used to measure vehicular flow and speed in urban settings. This device supports research and student projects on urban mobility, allowing for the collection of real-world data on traffic patterns to inform transportation planning and walkability studies.

- **Outdoor Weather Stations (2 units)**: Two advanced meteorological stations have been installed for real-time monitoring of environmental conditions. These weather stations record micro-climatic data (temperature, humidity, wind, etc.) on campus or in study areas, underpinning research on urban heat islands, thermal comfort, and climate-responsive design strategies. Students are able to engage in hands-on learning by analysing climate data and evaluating passive design solutions.

- **Storm Water Management Model (SWMM)**: The lab utilizes the EPA's SWMM software for hydrological modeling and simulation of urban stormwater systems. This tool is employed in both teaching and research to design and evaluate green infrastructure interventions (such as permeable pavements or rain gardens) and to simulate how different urban designs affect runoff and flood risk. By integrating SWMM into coursework, the lab helps students learn about climate adaptation in city planning through practical, software-based exercises.

Table 1: UOP List of Equipment & Software Applications

Name	Model	Specs
Desktop PC	Intel Core 20	Cores up to 5.5 GHz, Nvidia RTX 4070, 12 GB (8 units)
Laptop	Intel Core i9	24 Cores, Nvidia RTX 4070, 16 GB (2 units)
3D Printer	FLSUN S1	Creality K1, High-speed desktop 3D printer (2 units)
Portable Traffic Counter	–	Field-deployable traffic volume and speed measurement tool
Storm Water Management Model	SWMM	EPA-developed dynamic rainfall-runoff simulation model
Weather Station (Outdoor)	–	Advanced meteorological station for real-time climate monitoring (2 units)
Air Quality Monitor	MET-AQ100-72B	Air Quality Monitor: Measuring PM 2.5/1.0/10, CO_2, TVOC, Temperature, and Humidity
CO_2 Meter with Datalogger	CENTER 512	CO_2 Meter with Datalogger
Sound Level Meter with Datalogger	CENTER 32/323	Sound Level Meter with Datalogger
CO_2 Meter with Temperature & Humidity	AZ-77535	CO_2 Meter with Temperature & Humidity

Sound Level Meter with Datalogger	CENTER 324	Sound Level Meter with Datalogger
LED Light Meter	CENTER 531	LED Light Meter
Temperature & Humidity Datalogger	SSN-22	Temperature & Humidity Datalogger
Multi-Field EMF METER	TM190	Multi-Field EMF METER
Thermal Imager / Camera	Flir TG267	Thermal Imager / Camera

	Equipment already bought
	Purchasing in progress
	Additional existing equipment incorporated into the lab

Each of these hard capacity elements is aligned with the lab's educational and research goals. The high-performance computers and modeling software enable data-driven analysis and design; the 3D printing and sensing equipment encourage hands-on experimentation; and the specialized simulation tools integrate cutting-edge sustainability practices into the curriculum. Together, these resources create a state-of-the-art environment where students and faculty can explore innovative solutions for green urban development.

1.3. Soft Capacities of the Urban Green Lab

This section describes the soft capacities of the Urban Green Lab, focusing on its human resources, organizational structure, communication channels, partnerships, and strategies for long-term sustainability. These capacities ensure the lab's activities are effectively managed, widely disseminated, and institutionally sustained.

1.3.1. Administrative Hierarchy of Staff

The Urban Green Lab operates within a well-defined governance framework that is integrated into the Faculty of Architecture and Design's existing structure. The lab's organizational hierarchy involves five primary groups of personnel, each with distinct roles and responsibilities, working together to achieve the lab's mission and objectives:

- **Faculty Leadership**: Oversight of the lab is provided by the Dean of the Faculty of Architecture and Design and the Faculty Council. The Dean and Faculty Council ensure that the lab's activities align with the university's academic priorities and strategic goals, and they offer high-level guidance on research directions and resource allocation. The Dean, as part of the university's top leadership, also helps secure institutional support and external funding for the lab, and represents the lab's interests in university-wide decision-making forums. The Faculty Council (comprising senior faculty and experts) advises on the lab's strategic priorities, reviews major research proposals, and facilitates connections with industry and policymaking bodies as needed.

- **Departmental Leadership**: The Head of the Department of Architecture provides direct academic leadership for the Urban Green Lab. In this role, the Head of Department guides the lab's strategic and research direction and ensures that lab initiatives are integrated with the department's curriculum and long-term development plans. The Head coordinates closely with the Dean to make sure the lab's activities complement faculty goals and oversees the incorporation of lab research into teaching (for example, linking lab projects to design studio topics or thesis work). Additionally, the Head of Department plays a key role in establishing external collaborations on behalf of the lab, such as partnerships with other academic institutions, government agencies, or industry stakeholders, to expand the lab's impact and resources.

- **Scientific Research Committee**: At the core of the lab's academic activity is the Scientific Research Committee, which is responsible for setting the lab's research agenda and ensuring that projects meet high academic standards as well as practical needs. This committee approves and oversees research projects, aligning them with both university objectives and real-world urban challenges. The committee is composed of faculty members and researchers who bring expertise in the lab's focus areas. Within this committee, a dedicated Research Team (including faculty researchers, Master's students, and teaching assistants) carries out the day-to-day research work and project implementation. The Research Team conducts interdisciplinary studies and pilot's new methodologies in sustainable urban design and also feeds insights back into the committee for decision-making. Through regular meetings, the Scientific Research Committee evaluates progress, provides mentorship to student researchers, and adjusts the research direction to remain relevant to evolving urban issues.

- **Technical Staff**: The lab's technical staff provides essential operational support, ensuring that the lab's facilities and equipment are fully functional and effectively utilized. The technical team manages the lab's resources (such as computers, software licenses, sensors, and fabrication tools) and maintains the technical infrastructure. They assist with research tasks by helping students and faculty in data collection, simulation runs, and the use of specialized equipment. Technical staff also offer training or troubleshooting for lab technologies, thereby enabling faculty and students to focus on research and learning without technical hindrances. By keeping all hardware and software up-to-date and running optimally, the technical staff ensures the lab's projects proceed smoothly and safely.

- **Administrative Staff**: The lab's administrative staff handles organizational and logistical tasks that keep the Urban Green Lab running daily. This team manages the lab's budget and finances (including any grants or project funds), coordinates meetings and events (such as workshops, lectures, or community outreach programs), and oversees documentation and record-keeping for all lab activities. Administrative staff serve as the point of contact for communications: they facilitate information flow between the research team, faculty, and external partners, and manage the lab's email inquiries and scheduling. In essence, they provide the necessary administrative backbone, handling procurement, reporting, and internal coordination, which allows the academic and technical staff to focus on content-driven work.

This multi-tiered hierarchy and clear division of roles ensure effective governance and operational efficiency within the Urban Green Lab. Strategic decisions and oversight come

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from faculty leadership, academic quality is maintained by the research committee, and day-to-day functions are supported by dedicated technical and administrative personnel. Such a structure not only aligns the lab with UoP's institutional framework but also fosters collaboration among all members of the lab, creating a cohesive team working toward shared sustainability goals.

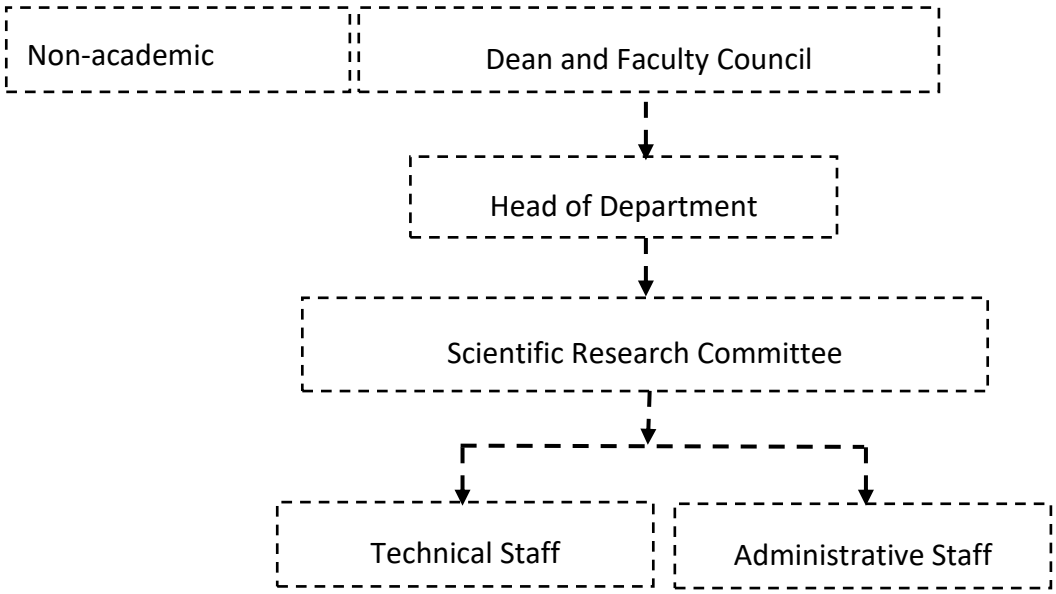

Figure 4*: The Organisational Structure of the Urban Green Lab, University of Petra*

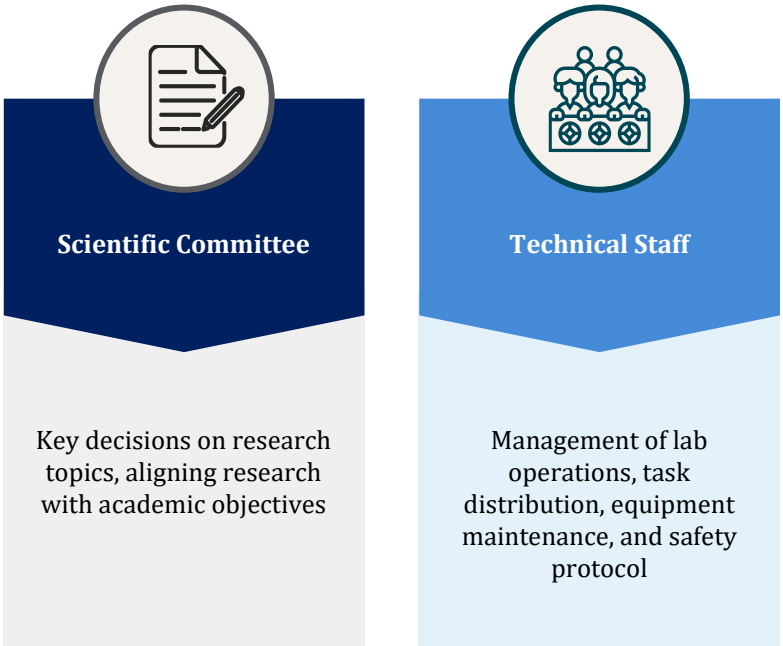

Figure 5: Hierarchy and Decision-making System at the Urban Green Lab, University of Petra

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1.3.2. Communication Channels and Contacts

Effective communication is vital for promoting the Urban Green Lab and engaging both the university community and external stakeholders. The lab primarily utilizes the University of Petra's official website as its main platform for dissemination and outreach. The Urban Green Lab has a dedicated webpage hosted under the Department of Architecture section of the UoP website, which serves as a central hub of information about the lab's mission, activities, and opportunities. This webpage provides a comprehensive overview of the lab's vision and strategic focus, details of ongoing and completed research projects (highlighting contributions to sustainable urban development), access to the lab's publications and reports, announcements of upcoming events (such as workshops or seminars), and information on collaboration opportunities for partners or students. By maintaining an up-to-date and informative web presence, the lab ensures transparency and encourages interested parties to connect with its work.

In addition to the official website, the Urban Green Lab communicates through the university's internal channels and direct contacts. Lab news and updates are shared via departmental newsletters and notice boards to reach faculty and students on campus. For external outreach, the lab leverages UoP's social media and networking events (e.g., public lectures or open days) to showcase its projects and invite community engagement. Contact information for the lab (email and phone through the Department of Architecture office) is provided on the lab's webpage, enabling prospective partners, students, or other stakeholders to reach out easily. This multi-channel communication approach ensures that the Urban Green Lab remains visible within the academic community and accessible to external collaborators, thereby broadening its impact and network.

URBAN GREEN LAB:

Website: https://arch.uop.edu.jo/En/pages/urbangreenlab.aspx

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1.3.3. Partners (Academic and Non-Academic)

Building strong partnerships is a cornerstone of the Urban Green Lab's strategy to enhance its research impact and real-world relevance. The lab engages both academic and non-academic partners, recognizing that sustainable urban development challenges are best addressed through collaborative efforts across different sectors.

- **Academic Partners:** The Urban Green Lab collaborates with universities and research institutes, both nationally and internationally, to exchange knowledge and undertake joint research initiatives. Through the Pro-GREEN-LABs project consortium, UoP is already connected to European partners (such as Politecnico di Milano and Bauhaus-Universität

Weimar) and regional universities, fostering an international exchange of best practices in architectural education and green design. Beyond the consortium, the lab seeks partnerships with other faculties and research centers in topics like urban planning, environmental science, and engineering. These academic collaborations enable faculty and students at UoP to participate in exchange programs, co-authored research, and comparative studies, thereby elevating the quality of research and integrating global perspectives into local urban issues.

- **Non-Academic (Industry and Community) Partners:** Equally important, the lab has been forging links with non-academic stakeholders. This includes local government agencies and municipal authorities (e.g. city planning departments or the Greater Amman Municipality) to work on research and pilot projects that inform public urban policy. It also involves private sector partners such as architectural design firms, real-estate developers, and technology companies interested in sustainable city solutions. Partnerships with these industry actors can lead to sponsored research, internships for students, or adoption of the lab's proposals in real development projects. Moreover, the Urban Green Lab reaches out to community organizations and NGOs focused on urban issues (like heritage conservation groups or environmental advocacy organizations). By involving community partners, the lab ensures that its projects are grounded in local needs and that there is a path for implementing solutions on the ground. These diverse collaborations, spanning academia, government, industry, and civil society amplify the lab's interdisciplinary approach and resource base, allowing it to tackle complex urban sustainability challenges from multiple angles.

Through these partner networks, the Urban Green Lab gains access to additional expertise, data, and funding opportunities while also extending its influence beyond the university. Joint workshops, stakeholder meetings, and memorandum-of-understanding agreements are among the mechanisms used to formalize and maintain these partnerships. By actively engaging external partners, the lab not only enhances its research output and educational offerings but also helps bridge the gap between academic research and practical implementation in urban planning and design. This collaborative ethos supports the overarching goal of the Pro-GREEN-LABs project: to create a regional hub of innovation and knowledge exchange for green urban development.

1.3.4. Strategies for sustainability

To ensure the long-term sustainability of the Urban Green Lab beyond the Pro-GREEN-LABs project timeline, a comprehensive strategy has been developed that addresses financial, organizational, and human resource dimensions. This strategy is geared towards maintaining the lab's operations, continuing its growth, and solidifying its role as a center of excellence in sustainable urban research and education.

Financial Sustainability: The lab's financial plan emphasizes diversification of funding sources and prudent financial management. In the coming years, the Urban Green Lab will actively pursue a variety of funding opportunities, including national and international research grants (from government agencies or programs like Erasmus+), sponsorships or donations from private foundations and industry, and collaborative projects funded through partnerships. UoP has empowered the lab to seek strategic partnerships with local authorities, architectural

firms, and industry stakeholders whereby those partners provide financial contributions or in-kind support for research in areas of mutual interest. Additionally, the lab plans to generate revenue through fee-for-service activities, for example, offering consultancy services, specialized training workshops, or access to lab equipment/expertise for external projects – which can funnel income back into supporting the lab's core educational mission.

On the expenditure side, the lab has adopted a strategic budgeting approach to ensure that available funds are used effectively. This involves allocating sufficient resources for maintaining and upgrading lab equipment (to keep pace with technological advances) and setting aside budgets for key activities like student competitions, community outreach events, or publication costs. The lab's finances are managed with transparency and oversight: regular financial reports are prepared as part of the department's budgeting process, and there are provisions for periodic audits to evaluate the lab's financial health. Risk management is also a part of the strategy by diversifying funding streams and building a modest reserve, the lab aims to be resilient against funding shortfalls or economic fluctuations. In summary, through proactive fundraising, partnerships, entrepreneurial services, and sound financial governance, the Urban Green Lab is positioned to sustain its operations and growth in the long run.

Human Resources and Continuous Improvement: Beyond finances, sustaining the lab's impact relies on its people and processes. The Urban Green Lab places strong emphasis on capacity-building for its staff and associated faculty. A structured professional development program will be implemented, including regular training workshops to update technical skills (such as new software tools or research methods in sustainability), opportunities for staff to attend or present at conferences, and exchanges with partner institutions to learn from their lab setups. Mentorship is another key element: senior researchers and faculty mentors will guide junior staff and students, build leadership skills and ensuring knowledge transfer within the team. By investing in its human capital, the lab ensures that it remains at the forefront of emerging topics in green urbanism and that it can adapt to new challenges over time.

Concurrently, the lab has established a monitoring and evaluation framework to continually assess and improve its performance. Clear key performance indicators (KPIs) have been defined to measure various aspects of the lab's success: for instance, the amount of research funding secured, the number and quality of research outputs (publications, prototypes, etc.), and the extent of student involvement in research activities. The integration of lab work into teaching is also tracked (e.g. how many courses include lab components or how many students do thesis projects through the lab), to ensure the lab is enriching academic programs in a meaningful way. Regular internal reviews are scheduled (annually or semi-annually) where the lab's team and faculty advisors analyze these KPIs and gather feedback from participants. Mechanisms such as feedback sessions with students and external partners, plus annual strategic meetings, allow the lab to identify areas for improvement and update its strategies accordingly. This commitment to continuous improvement means the lab can evolve with changing educational needs and urban trends, thereby sustaining its relevance and effectiveness.

In essence, the Urban Green Lab's sustainability strategy ensures that it is not a one-off project facility, but rather a lasting institution within UoP. By securing diverse funding, building a skilled and dynamic team, and rigorously evaluating its progress, the lab is well-prepared to

continue promoting green competences in architectural education and generating impactful research for years to come.

1.4. Integration of Teaching and Scientific Research within Lab Activities

A defining feature of the Urban Green Lab is the seamless integration of its research activities with the teaching and learning process at the University of Petra. Rather than functioning as an isolated research center, the lab is embedded into the department's academic programs, thereby serving as a bridge between theoretical knowledge and practical application in architectural education. Courses and studios within the Faculty of Architecture and Design are closely linked with the lab's focus areas, ensuring that cutting-edge research informs teaching content and, conversely, that pedagogical needs shape the lab's research agenda. For example, findings from the lab's research on sustainable urban design and climate-responsive architecture are introduced into classroom discussions and design assignments. At the same time, questions and challenges raised in undergraduate and postgraduate studios often become starting points for new research projects in the lab, creating a feedback loop that benefits both domains.

One way this integration manifests is through hands-on student involvement in lab projects. Students are encouraged to participate in ongoing research – whether as research assistants, interns, or through capstone projects, allowing them to apply concepts from their coursework to real-world problems under the mentorship of faculty researchers. This experiential learning approach gives students invaluable exposure to research methodologies, data collection in the field, and the collaborative problem-solving process. In studio courses, the lab's equipment (such as environmental sensors or modeling software) is utilized for assignments, so students learn to use professional tools in an academic setting. The lab also hosts workshops and training sessions that are built into the academic calendar, for instance, a workshop on urban climate analysis using the lab's weather station data, or a seminar series on green building materials co-taught by faculty and industry experts. Such activities enrich the curriculum and ensure that theoretical lessons are complemented by practical investigation. As a result, students gain a deeper, research-informed understanding of sustainable design principles, and faculty can teach emerging topics with the support of empirical evidence and case studies developed in-house.

Moreover, the lab's integration with teaching extends to the formulation of new courses and academic offerings. The presence of the Urban Green Lab has supported the development of specialized electives and a planned Master's program in Sustainable Smart Cities at UoP, wherein lab projects form a core component of the syllabus. Graduate students in these programs base their thesis work on lab research themes, ensuring alignment between academic outputs (theses, publications) and the lab's objectives. This synergy elevates the academic profile of the department – students and faculty co-author papers, present joint work at conferences, and incorporate lab research into design exhibitions and critiques. The institutional commitment to this integration is evident: the lab's directors and the Department Head jointly coordinate to schedule lab activities in tandem with the academic calendar, and the Dean's office facilitates the recognition of lab contributions in curriculum development.

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In summary, the Urban Green Lab functions as an intellectual engine at the heart of the Department of Architecture. By weaving research into the fabric of teaching, the lab helps produce graduates who are not only well-versed in sustainability theories but also capable of applying research-driven insights to real architectural and urban design challenges. This model of integration, aligning academic programs with active research and using the lab as a pedagogical resource, exemplifies the Pro-GREEN-LABs vision of experiential, lab-based learning. It ensures that the advancements made within the lab directly contribute to educational excellence, and that academic endeavors remain grounded in addressing tangible urban issues. Through this dynamic interplay of teaching and research, the Urban Green Lab is contributing to a transformative learning environment at UoP, one that equips future architects and planners with both the knowledge and the practical skills to drive sustainable urban development.