

# Universities as Change Makers

Sustainability Initiatives from Across the Globe



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## Contributing Universities



Freie Universität Berlin





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# 1. Introduction

Higher Education Institutions (HEI) play a strategically important role in the multidimensional transformations needed to achieve more sustainable ways of living in this world. This importance is stressed by the United Nations Environment Programme (UNEP), which recognizes universities as agents of change that act as “catalysts for social and political action as well as centers of learning” (UNEP 2014). Through research, teaching, capacity-building, and networking, HEI create and disseminate knowledge and train specialists with technical knowledge and/or able to intervene critically in processes which aim to provide “sustainable development.” In particular, HEI train young people, the decision-makers of the future, in sustainability related fields. Moreover, HEIs provide structures and resources to bring together various kinds of actors and expertise. Consequently, they enable the development of approaches to creating, critically reflecting on, testing, and further developing concrete sustainable solutions (Kahle et al. 2018). Besides their huge impact in their core fields of action – research and teaching – HEI also play an important economic role as employers and consumers of goods and services. In general, the 17 Sustainable Development Goals (SDG), ratified by the United Nations in 2015, illustrate the broad canon of topics and activities, in which societal actors like HEI can become active and make significant practical and educational contributions.

All around the world, Higher Education Institutions increasingly embrace sustainability as a topic in research and teaching. In some cases, HEI go further and integrate sustainability considerations in their regulations, organization, and management. However, despite the growing awareness and level of action of universities worldwide, the great majority of HEI remain traditional institutions “strongly attached to mental models that prevent them from embarking on an honest cooperative outreach in favor of Sustainable Development” (Bauer et al. 2018). It is, therefore, of paramount importance “to find strategies against the currently prevalent compartmentalization of HEI fields” (ibid.). While educational systems around the world differ greatly, the administrative architecture of universities is often similar – the three core pillars of the institution (research, teaching, and administration/campus management) often operate side by side, with little or no interaction. With an overarching topic like sustainability, this compartmentalization impedes systematic approaches, which would allow for comprehensive solutions.

Higher Education Institutions (...) act as hubs for innovation and critical thinking, nurturing each generation of leaders, policy makers, entrepreneurs, scientists, researchers, and educators. Higher Education Institutions have a crucial role to play in raising awareness and fostering better understanding about the SDGs and their interconnectedness.

*Higher Education Sustainability Initiative 2017*

Embracing the issue of sustainable development in a holistic approach focusing on all areas of the university is, therefore, crucial. In addition, given the similar structures and missions at most universities, an exchange on topics related to the promotion of sustainability on and outside of academic campuses holds the promise of synergies, mutual learning, and the diffusion of innovative approaches and concrete initiatives. This dimension, sometimes referred to as the “third mission,” should explicitly entail transdisciplinary outreach: HEI are in a unique position to reach out to non-academic actors, promoting an exchange with civil society, business, and policy circles, and supporting them in their

initiatives for achieving more sustainable ways of being, while at the same time learning from other societal spheres. Many universities already embrace this “third mission” and engage with societal needs and market demands by linking their activities with the socio-economic context they are situated in. Again, this is especially important with respect to the complex and multidimensional topic of sustainability or sustainable development, which concerns social groups around the world. The holistic approach, also referred to as “whole institution approach,” does not only call for implementing sustainability in research, teaching, campus management, and “third mission” / transdisciplinary outreach. It also highlights the importance of connecting these different fields of action to systematically address an overarching topic like sustainability.

This publication embraces the holistic approach to sustainability in HEI and explores cases of HEI around the world that put it into practice. Universities from Canada, Chile, China, Colombia, Germany, Israel, Mexico, Peru, and Russia are sharing their experiences and projects to promote the topic of sustainability in governance, teaching, research, and campus management. The report follows three objectives: First, it presents key issues, recommendations, and lessons learned from these initiatives, thereby outlining innovative and diverse approaches that contribute to fostering sustainability at HEI. Second, by integrating cases from all over the globe, the report provides examples that could be adopted by interested HEI anywhere, in particular those HEI forced to operate under conditions of resource scarcity and in contexts where sustainability is not yet a major part of academic activities. Some measurements described in this document require few inputs and may encourage important processes that could even achieve outreach beyond campuses, to the communities hosting the HEI or the general public.

Lastly, the document wishes to initiate a closer exchange on sustainability initiatives among universities all over the globe. By providing examples and sharing experiences, we hope to inspire new and innovative sustainability projects and strengthen the role of universities as agents of change towards a more sustainable, and hence better, world.

Culture gives us a chance to ask the most basic values questions pertinent to our way of life. It enables us to see sustainability as a way of putting things together, in contrast to the typical university work of taking things apart.

*Aber et.al. 2009, p. 55*



The document assembles contributions from ten universities based in nine countries on three continents. The following universities contributed to this publication:

1. **University of British Columbia, Vancouver, Canada**
2. **Universidad Nacional Autónoma de México, Mexico City, Mexico**
3. **Pontificia Universidad Javeriana, Bogotá, Colombia**
4. **Universidad Nacional de la Amazonía Peruana, Iquitos, Peru**
5. **Pontificia Universidad Católica del Perú, Lima, Peru**
6. **Pontificia Universidad Católica de Chile, Santiago, Chile**
7. **Freie Universität Berlin, Germany**
8. **Saint Petersburg State University, Russia**
9. **The Hebrew University of Jerusalem, Israel**
10. **Peking University, Beijing, China**



Universities – as the core institutions of the academic and educational systems – have a special responsibility with regard to making the world sustainable. The contributors to this guide strive to increase sustainability across the university – in governance, education, campus management as well as in their transfer and outreach activities. © Bernd Wannemacher

**The Guide presents contributions in four categories:**

- **Governance:** How to implement and legitimize sustainability in the university structure.
- **Education:** How to include a complex topic like sustainable development in the curriculum of all students and PhD students.
- **Campus Management:** How to build and implement sustainable campus management.
- **Transfer & Outreach:** How to convey outputs from research, teaching, and sustainable campus management to the university community and larger society. How to implement a living lab approach for innovative sustainability research projects on campus.

Coming from across the globe, the contributions exhibit a broad variety of sustainability projects and management experiences, executed in diverse political and cultural settings and climate zones, making use of various resources and stakeholders. The contributions range from best-practice examples and case studies to research findings. They show the broad spectrum of areas of activity that Higher Education Institutions embrace in their specific regional, cultural, and political context. We have encouraged the authors of the case studies to recount the evolution of their projects, focusing not only on their successes, but also on how, with whom, and with what kind of resources they were able to reach their goals. Some also explain in more detail the theoretical approaches underlying their sustainability initiatives. This is intended to facilitate the exchange of in-depth insights from planning and executing sustainability projects at a Higher Education Institution and to help inspire the realization of similar projects. The contributions embrace this diversity. Focusing on the processes, concepts, and ideas behind each project, the cases will greatly enhance our understanding of sustainability challenges and the corresponding solutions or, in case of incipient projects, the approaches universities have developed in different contexts.

The document is divided into four sections: The first addresses the topic of “Governance.” The analysis of governance structures provides insights into the formation and operation of stakeholder networks within a HEI. Understanding mechanisms, needs, and challenges is important in order to build a strong and institutionally rooted sustainability governance structure at universities. The second section deals with education – one of the core tasks of any university. The topic of sustainability can be included in various ways in the curriculum – exposure to the topic during their studies can have a tremendous impact on the decisions of future graduates. In the section on Campus Management, we will take a closer look at different projects that try to “green” the university itself. The fourth section is dedicated to transfer and outreach: As mentioned above, we understand universities as societal stakeholders, who have the responsibility to play an active role in the transformation towards sustainability. Often set in the middle of a city, university campuses can act as testbeds for innovative climate solutions or as meeting places for the university and urban community.

#### References:

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## 2. Who is behind this project?

This publication is the product of a collaboration between the University Alliance for Sustainability (UAS) and the Postgraduate Program on Sustainable Development and Social Inequalities in the Andean Region (trAndeS). Both programs are joint initiatives coordinated by the Freie Universität Berlin (FU Berlin) and its international partner universities. The UAS and trAndeS are supported by the German Academic Exchange Service (Deutscher Akademischer Austauschdienst, DAAD) with funds from federal ministries.

### University Alliance for Sustainability

The UAS combines the strengths of five strategic partner universities to develop joint research and teaching projects on the topic of sustainability. We offer exchange options for students, faculty members, and administrative staff from across departments and universities to promote a sustainability discourse throughout institutions.

#### The partner universities are:

- Freie Universität Berlin, Germany
- The Hebrew University of Jerusalem, Israel
- Peking University, China
- Saint Petersburg State University, Russia
- University of British Columbia, Canada

The Alliance is funded by the German Academic Exchange Service (DAAD) and sponsored by the German Federal Ministry of Education and Research (Bundesministerium für Bildung und Forschung, BMBF).

### The partner universities have worked collaboratively to reach the goals of UAS since 2015:

- Develop joint research and teaching projects
- Offer exchange options for faculty, staff, and students
- Foster inter-institutional learning regarding management issues

The UAS is pursuing its goals by offering Spring Campus Conferences, an extensive Mobility Program as well as by developing joint teaching and research projects. The UAS Spring Campus Conference is meant to serve as a platform for sharing experiences. The program offers insights into state-of-the-art research in parallel workshops bringing together senior and junior researchers from across the globe. Additionally, we invite senior management staff to discuss best-practice examples of sustainable campus management in a specially designed workshop. Networking opportunities will be facilitated within the UAS network and beyond.

The UAS mobility program offers the opportunity of a research stay abroad to academics of all levels, from students to leading scientists, as well as university administrators. This is our key strength: engaging people from across the university in a dialogue about sustainable development.

## trAndeS – Programa de Posgrado en Desarrollo Sostenible y Desigualdades Sociales en la Región Andina

trAndeS – Postgraduate Program on Sustainable Development and Social Inequalities in the Andean Region – is a joint initiative of Freie Universität Berlin (FU Berlin) and the Pontificia Universidad Católica del Perú (PUCP). It is supported by the German Academic Exchange Service (DAAD) with funds from the Federal Ministry for Economic Cooperation and Development (Bundesministerium für wirtschaftliche Zusammenarbeit und Entwicklung, BMZ).

trAndeS seeks to create and promote knowledge that can contribute to the achievement of the United Nations' Sustainable Development

Goals in the Andean Region. It focuses its efforts by linking two dimensions: sustainable development as addressed by the 17 Sustainable Development Goals (SDG) that the United Nations established for the year 2030 and the serious socioeconomic, sociopolitical, and socioecological inequalities that persist in the Andean region. The program aims to identify how these inequalities challenge the achievement of SDG targets and how progress towards reaching these targets can, in turn, contribute to the reduction of these inequalities.

We live in a very complex world. The global population is projected to increase to 9 billion by the middle of this century. There are huge differences in welfare, in levels of development, huge, huge gaps between the rich and the poor, and we see the consequences of this. So in universities, we really need research focused on finding solutions for a peaceful world in the future and for overcoming poverty without burdening the environment any more. That is what sustainable development at universities means.

*Prof. Dr. Klaus Töpfer, former Director of the United Nations Environment Programme*



Participants of the UAS and trAndeS Network use the UAS Spring Campus Conference for discussion and exchange on sustainability issues. © Bernd Wannemacher

### **trAndeS encompasses three core activities:**

- Postgraduate studies
- Interdisciplinary research
- The Trans-Andean Network of Sustainability

We offer a supplemental studies program for Master and doctoral students at PUCP that provides training on its core theme, the impact of social inequalities on the opportunities for sustainable development in the Andean region. The program also promotes research in interdisciplinary research groups and by granting postdoctoral stipends. Thirdly, we aim to build a transandean network (red trAndeS), which promotes cooperation and the exchange of ideas and practices between researchers, academic institutions, civil society organizations, development organizations, and other actors related to the subjects of social inequalities and sustainable development in the region. In this line, trAndeS has established contact with the FU Berlin based University Alliance for Sustainability in order to disseminate knowledge and experiences regarding sustainability initiatives at HEI. We particularly wish to promote exchanges between Andean universities, where sustainability initiatives remain scarce and exchange is in general rare, and other HEI in the world.

This publication is based on two workshops on sustainable campus management held between PUCP and Freie Universität Berlin in 2016 and 2017 as well as the ongoing cooperation of the universities in the Spring Campus Conferences of the University Alliance for Sustainability at FU Berlin.









## 3. Contributors



### Governance

**Freie Universität Berlin** (FU Berlin) has been institutionally committed to sustainability issues for about two decades. The university's story of sustainability management is characterized by the gradual development of governance structures, programs, and measures which have helped to build and institutionalize a holistic sustainability management. The article "From Energy to Sustainability Management" outlines the most impactful milestones and describes the most important lessons learned. A special focus is put on governance aspects, as these have been paramount in the institutionalization of the holistic sustainability management that FU Berlin practices today.

The **Pontificia Universidad Católica de Chile** (UC) has implemented important environmental and institutional changes over the past two decades regarding the promotion of sustainability. The case study describes the overall approach promoting sustainability as a sort of cultural change. We provide three examples of initiatives (recycling, use of bicycles, and the publication of an annual sustainability report), depict some of the lessons learned from these initiatives, and explain how the overall focus of conceptualizing sustainability as a result of cultural change is reflected in these examples.

The **University of British Columbia** (UBC) places sustainability at the heart of teaching, learning, and research, operations and infrastructure, and community. Strategic plans and policies provide guidance, while annual reports and external benchmarks provide an opportunity to share successes, measure progress, and highlight the university's ongoing commitments. The purpose of the 20-Year Sustainability Strategy is to provide a document outlining UBC's sustainability vision and aspirations, and in so doing set the long-term direction towards a more sustainable university. It is intended to guide decision-making at UBC's Vancouver campus with regard to sustainability until 2035.

# Campus Management

The **Pontificia Universidad Javeriana** (PUJ) promotes sustainability by implementing a series of projects. In this report, it presents the “Historia Verde” (Green History) and “Cosmos” projects, which promote tree plantations on campus. These projects aim to offset carbon emissions and thereby contribute to the mitigation of climate change and the strengthening of ties with the communities living near the university. Moreover, the projects prove that environmental initiatives can result in hard economic benefits for universities.

The **Saint Petersburg State University** (SPBU) initiated a pioneering waste management project in Russia. The idea was developed as a grassroots project initiated by students. Following its first success, a university-wide program was established in 2015. At the so-called ‘Eco points’, containers for glass, waste paper, plastic, and hazardous waste were placed in different areas around campus. Within a short period of time, it was possible to raise awareness about waste separation among students. The ‘Eco points’ not only contribute to an environmentally friendly lifestyle at the university, but they have also helped SPbU save five million rubles (about 78,000 USD) since 2015.

The **Universidad Nacional Autónoma de México** (UNAM) is dedicated to promoting sustainability in particular with regard to water use. To this end, it created the Water Management, Use and Reuse Program (PUMAGUA) in 2008 with the goal of establishing an efficient water management tool. The case study describes the goals and components of this project, the stakeholders involved as well as the main achievements and lessons learned.

# Education

The Environmental Policy Research Center of **Freie Universität Berlin** (FU Berlin) developed the format Schools@University for Sustainability + Climate Protection in 2005. It offers hands-on activities to school students and their teachers and promotes the teaching and learning concept for Education for Sustainable Development (ESD). “Learning for a sustainable future” is the slogan of Schools@University. Its focus on a holistic ESD approach and the key topics of sustainable development distinguishes this educational format from other types of “Children’s Universities.”

**The Hebrew University of Jerusalem** (HUJI) conducts an intensive 3-day PhD workshop open for all doctorates working on environmental research topics. The lecturers and students involved represent different departments as well as educational backgrounds and focus on a variety of research topics. While the lecturers represent the Advanced School for Environmental Studies and the Department of Agriculture, the students involved study Social Sciences, Natural Sciences, Agriculture, Public Health, Humanities, and Law. Involving perspectives and state-of-the-art research methods from different disciplines gives talented researchers of tomorrow a broader view on their area of academic interest and promotes environmentally-minded research at different departments.

Professor Ling Xue from **Peking University** (PKU) and his students spent several months in the Yunnan province in order to develop a sustainable regional development strategy built around the production of Pu-erh tea, which is a valuable good for the region. The project reveals how innovative teaching methods can help equip the next generation with sustainable development knowledge and skills while also helping to address urgent local challenges. At the same time, the project demonstrates how creative ideas generated by university students can contribute to the integration of fresh ideas into regional development concepts.

**Pontificia Universidad Católica del Perú** (PUCP) is one of the few Peruvian universities institutionally committed to ecological sustainability. This commitment includes the mainstreaming of environmental content in almost all undergraduate and several postgraduate programs. Moreover, in order to raise environmental awareness and promote sustainability initiatives, a specific institutional framework has been set up. In our chapter, we describe the strategy of mainstreaming environmental content in our programs, explain the environmental institutionality at PUCP, and present some of the projects.

## Transfer & Outreach

The ofo bicycle sharing company was founded in 2015 by five students from **Peking University** (PKU). Only a few years later, ofo is operating in 250 cities. In just the few years of its existence, the ofo company has transformed from a university project to a billion-dollar startup and has had an impact on attitudes towards the concept of the sharing economy, bicycles as a means of transportation, and a low-carbon lifestyle in China.

The Botanical Garden at **Saint Petersburg State University** (SPBU) is rich in tradition and protected by the state as a monument of history and culture. Over the past few years, however, it has fallen into disrepair due to a lack of funding and proper care. The volunteer project ‘Friends of the Botanical Garden’ has been one way of helping to take care of the garden. With up to 100 students and citizens participating in traditional community clean-up days, the volunteer project is significantly helping the Botanical Garden to regain its old glory and become a place for practice-oriented learning.

The **Universidad Nacional de la Amazonía Peruana** (UNAP) has included environmental sustainability as one of its core missions in research, teaching, and management. One of its components is the promotion of the use of “clean” solar energy, which would help to reduce greenhouse gas emissions and air pollution. In order to back up its strategy for clean energy with sound empirical evidence, the university conducted a research project on the potential of solar radiation in the region. The project also integrated a social dimension since solar energy could also be used to serve the local communities in the department of Loreto (where the university is located), which is not connected to the regular infrastructure of fuel-based energy. It thus combined aspects of environmental and social responsibility.









## 4. Fields of Action

### Governance

Freie Universität Berlin  
Pontificia Universidad Católica de Chile  
University of British Columbia

### Campus Management

Pontificia Universidad Javeriana  
Saint Petersburg State University  
Universidad Nacional Autónoma de México

### Education

Freie Universität Berlin  
The Hebrew University of Jerusalem  
Peking University  
University of British Columbia  
Pontificia Universidad Católica del Perú

### Transfer & Outreach

Peking University  
Saint Petersburg State University  
Universidad Nacional de la Amazonía Peruana



PV panels and green roofs are an important part of sustainability management at Freie Universität Berlin.

© Bernd Wannemacher

## 4.1 Governance

### 4.1.1 Freie Universität Berlin: From Energy to Sustainability Management

Andreas Wanke / Katrin Schweigel

#### University Profile

**Name of the university:** Freie Universität Berlin

**Country:** Germany

**Number of students:** 36,537

**Number of academic staff / professors:** 2,845

**Number of administrative staff:** 2,415

**Amount of floor space:** 575,500 m<sup>2</sup>

**Person / department in charge of sustainability management:** Unit for Sustainability and Energy Management

## 1. Case Study

Freie Universität Berlin has been institutionally committed to sustainability issues for about two decades. This article outlines the most impactful milestones and describes the most important lessons learned. A special focus is put on governance aspects, as these have been paramount in the institutionalization of the holistic sustainability management that FU Berlin practices today.

## 2. Our Story

Freie Universität Berlin is one of the largest universities in Germany. With more than 35,000 students and more than 5,000 staff members, the university is a major public institution that can contribute to sustainable development. At the same time, such a large institution faces challenges when applying new management and participatory models to foster resource efficiency and environmental awareness. Our story of sustainability management is therefore characterized by the gradual development of governance structures, programs, and measures which have helped us build and institutionalize a holistic sustainability management.

Since the 1990s, Freie Universität Berlin has been a pioneer in implementing energy performance projects. The story of its university-wide sustainability management started in 2001, when Freie Universität Berlin launched its first steps towards establishing systematic energy and environmental management. During the first decade, programs and measures to improve energy efficiency (2003–2011) and to establish a systematic environmental management system (2004–2013) were given high priority. Our understanding of sustainability as a future-oriented task that has the potential to address the entire university motivated those first steps. Another important trigger was the prospect of substantial cost savings in operation. However, not only campus-related understandings contributed to the decision to establish the university management – the Environmental Policy Research Center at the Department of Political Sciences also provided an important impetus. This research unit gave several impulses to university management and provided ideas and concepts for dealing with the topic of energy efficiency and energy saving. This increased the awareness of the topic among the Executive Board. After a change in its directorate, the decision to set up a full-time energy management position in 2001 within the Division of Engineering and Utilities was reached.

In order to more strongly network and profile the university's sustainability activities, the Unit for Sustainability and Energy Management was founded in 2015, reporting directly to the Executive Board. The unit emerged from the Office of Energy and Environment, which had previously reported to the Division for Engineering and Utilities. Other important governance steps since then have included the formation of the Sustainability Steering Committee, the adoption of the Sustainability Mission Statement in 2015, the establishment of the DAAD (German Academic Exchange Service) funded University Alliance for Sustainability (UAS), and the broad-based participation structure with diverse team-building processes.

## 3. The Change – Key Activities and Milestones

Between 2001 and 2011, the energy efficiency programs helped to reduce our energy consumption by more than 26% amounting to saving around 42 million kilowatt hours. Programs that especially contributed to saving energy included an internal bonus scheme, rewarding departments with additional funding for their energy savings as well as a Green IT program, implemented in 2010. Since 2011, energy consumption has remained virtually

### The following governance steps proved to be particularly relevant:

**2001:** Installing a full-time position for the development of campus management with a focus on energy efficiency and climate protection.

**2002:** Founding of the Environmental Steering Committee, headed by the Provost for Administration and Finances.

**2004:** Certification of Environmental Management System according to ISO 14001 (until 2013) and establishment of environmental teams in the specialist areas.

**2010:** Founding of the sustainability initiative SUSTAIN IT!, a mixed volunteer group of students and employees of Freie Universität Berlin.

**2011:** Signing of the Climate Protection Agreement with the State of Berlin (as the first university in Berlin).

**2013/14:** Joining the international sustainability networks UNICA Green and International Sustainable Campus Network (ISCN).

**2014:** Sustainability in research and teaching become an official responsibility of the Vice President for Research.

**2015:** Establishment of the Unit for Sustainability & Energy Management, as a task force to foster sustainability in research, teaching, and campus management that is assigned to the Executive Board.

Founding of the DAAD-funded UAS in cooperation with the four international strategic partner universities of FU Berlin.

**2015:** Executive Board releases FU Berlin's Sustainability Mission Statement.

**2016:** Formation of Sustainability Steering Committee with four working groups on "Research," "Teaching," "Campus Management," and "Participation & Communication."

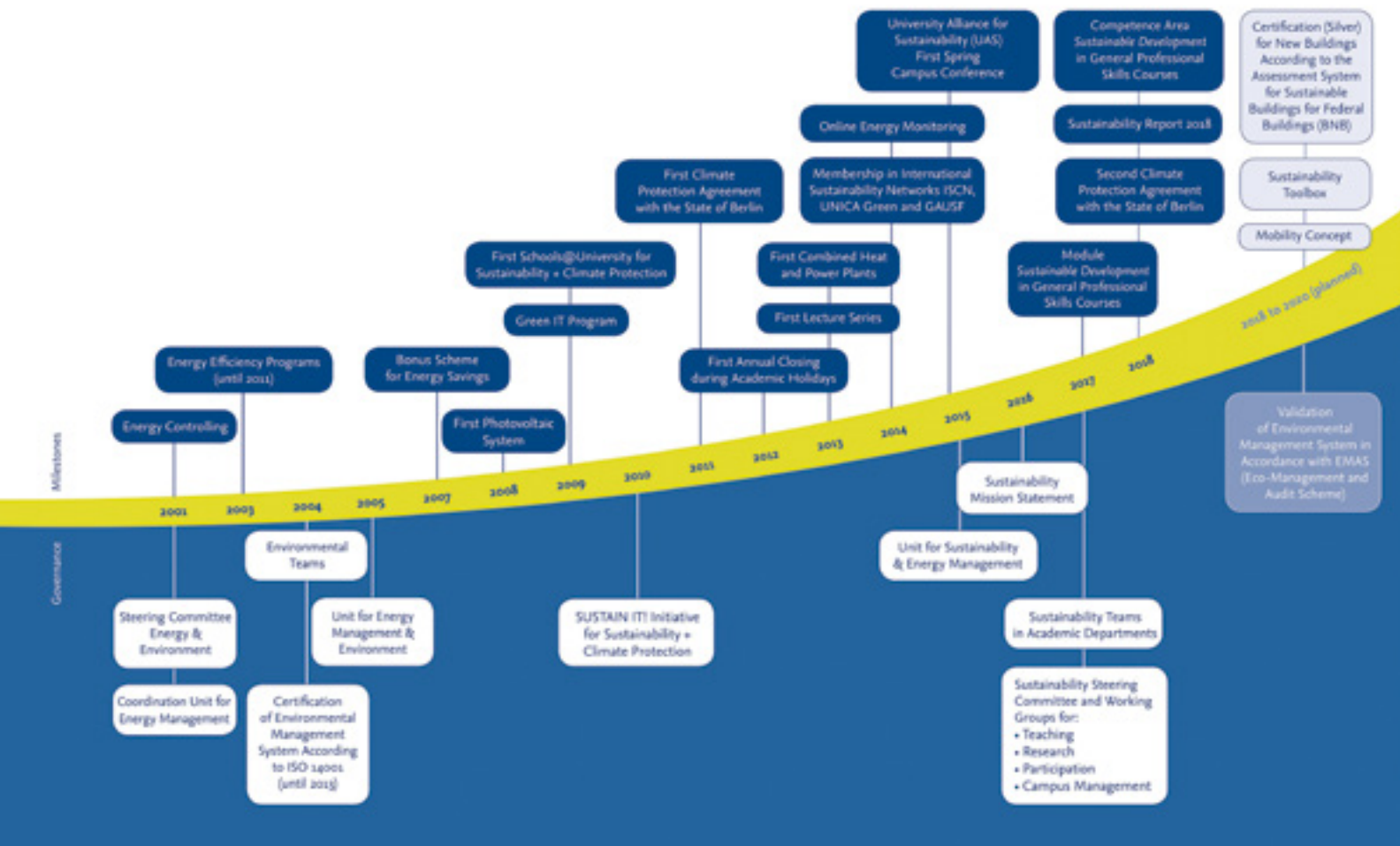
**2017:** Establishment of the competence area "Sustainable Development" in the study area "General Professional Skills Courses."

**2018:** Publication of the first Sustainability Report.

unchanged, despite a minor increase in floor space. In 2017, on a like-for-like basis, energy consumption dropped to its lowest level since 2001 with a reduction of 27.6%. Freie Universität Berlin saved 4.2 million Euros (about 4.6 million USD) in energy costs in 2017 compared to the baseline of 2001 and cumulatively over 42.7 million Euros (about 47.4 million USD) on a like-for-like basis. Energy-related greenhouse gas emissions have diminished by about 36% (based on the Global Emission Model for Integrated Systems [GEMIS] and the Federal Environmental Agency's [UBA] emission factors) and by 81% when factoring in CO<sub>2</sub>-neutral electricity purchases. Freie Universität Berlin draws its electricity from the Central Purchasing Tender of the State of Berlin, which has been procuring CO<sub>2</sub>-free electricity exclusively from renewable energy sources since 2010.

The first photovoltaic system was installed on the roof of the Physics Department building in 2008. By 2011, eight more solar systems were installed, including one initiated and funded by students. The systems have a combined capacity of 675 kilowatts. In February 2013, Freie





Timeline Sustainability Management at Freie Universität Berlin. © Unit for Sustainability and Energy Management. Sustainability Report 2018.

Universität Berlin also put two combined heat and power (CHP) plants into operation. Two additional CHP units followed in 2014 and 2016. These systems have a total electrical output of 715 kilowatts and generate 4.5 to 5 million kilowatt hours of electricity a year, 95% of which is directly consumed at the university.

In 2015, the Executive Board of Freie Universität Berlin adopted a sustainability mission statement, which was based on a draft of the SUSTAIN IT! initiative. Subsequently, all university members were asked by the university president to submit suggestions for additions and changes to the text, which were discussed later during a public workshop. The amended mission statement was officially adopted and published by the Executive Board in April 2016.

However, the activities of FU Berlin in the field of sustainability go beyond the projects at the university level. As part of an international network of universities, Freie Universität Berlin gives high priority to international cooperation. In 2015, it founded the University Alliance for Sustainability (UAS) together with its four strategic partner universities – the Hebrew University of Jerusalem, the University of British Columbia in Vancouver, Saint Petersburg State University, and Peking University. The Alliance follows a holistic approach and aims to systematically link activities in research, teaching, knowledge transfer, and campus management. The partner universities complement each other’s strengths to develop joint research and teaching projects. In the context of annual Spring Campus Conferences and regular teaching and management workshops, the latest research results, best-practice examples, and potential collaborative projects are discussed. The Alliance is funded by the German Academic Exchange Service (DAAD) for a period of six years (2015–2020).

In order to increase the visibility and weight of the topic of sustainable development in teaching, the Working Group on Teaching of the Sustainability Steering Committee developed the new competence area Sustainable Development for the (obligatory) study area General Professional Skills Courses (ABV) in 2017. Students in Bachelor programs acquire professionally relevant methodological and social skills. The new area was officially launched in Winter Semester 2018/19 and was coordinated by the Unit for Sustainability & Energy Management. It included four modules: “Managing Sustainability,” “Researching Sustainability,” “Shaping Sustainability,” and “Communicating Sustainability.” All modules address the 17 UN Sustainable Development Goals, combining groundwork and a practical phase and are oriented towards the criteria of the concept of Education for Sustainable Development (ESD).

The Sustainability Toolbox project, launched in 2018, aims to establish an online teaching and learning platform that provides comprehensive information on sustainability topics in teaching, research, and campus management. It extends the classroom teaching of the future teaching area Sustainable Development and the teaching cooperation of the UAS through digital teaching and learning possibilities.

This short overview of key activities illustrates the progressive development of the sustainability management at Freie Universität Berlin. The process can be understood as systematic and management-driven, implementing various instruments, measures, and incentive programs, which increasingly comprise more areas and entities of the university. Looking back, we see a development that started in an important infrastructural area (e.g. energy controlling and building-related energy efficiency programs) and then moved step-by-step to the core areas of universities (certification, management, teaching, as well as international networking). Another

The development at Freie Universität Berlin started in an important infrastructural area (e.g. energy controlling and building-related energy efficiency programs) and then moved step-by-step to the core areas of universities (certification, management, teaching, as well as international networking). We look at the long-term activities as a learning journey or a process of organizational development, which started with a one-person unit in 2001 and moved across the university developing an increasingly holistic approach.

way to look at the long-term activities at FU Berlin is as a learning journey or a process of organizational development, which started with a one-person unit in 2001 and moved across the university developing an increasingly holistic approach. Speaking of people – our next chapter will provide further information on the stakeholders behind the scenes and what we have learnt about who needs to be involved to implement projects successfully.

#### 4. Stakeholders & People

Sustainability is a future-oriented task that can only succeed if consistently embedded throughout the university. At a university with 36,500 students and almost 5,200 employees, 250 study programs, 16 academic departments and central institutes, as well as a campus with 220 buildings, every discipline and administrative area is able to contribute.

We have already mentioned the establishment of our unit in 2015. Since then, our core task has been the systematic integration of sustainability aspects into all areas of the university. As of 2018, our unit has a total of ten employees and four student employees. We follow



FU Berlin's students and staff are enthusiastic gardeners – in the Uni garden, fruit and vegetables are grown organically. A dyer's garden also invites participants of the Schools@University program to experiment in the Botanical Garden. © Michael Fahrig

a whole-institution approach aimed at systematically integrating activities in research, teaching, transfer, and campus management. We believe that the cross-sectoral challenge of sustainability management can only be addressed successfully through cooperation between all disciplines and areas. For this reason, networking and participatory formats such as steering groups, sustainability teams, audit teams, or the participation in the sustainability initiative SUSTAIN IT! are indispensable.

**The core tasks of the Unit for Sustainability & Energy Management include:**

- Visualizing and aggregating of sustainability-related research and teaching activities.
- Maintaining the integrated management system.
- Coordinating the central steering committee including its supporting working groups on research, teaching, campus management, and participation as well as the sustainability teams at the faculty level.
- Steering and coordinating the UAS, funded by the DAAD in cooperation with the four strategic partner universities of FU Berlin.
- Participating in construction, facility, IT, and procurement management.
- Establishing and further developing the environmental management system and its certification according to the Eco-Management and Audit Scheme (EMAS).
- Monitoring the university's energy consumption and the bonus system for energy savings.
- Managing waste disposal.
- Participating in the 2010 co-founded initiative for sustainability and climate protection SUSTAIN IT!
- Participating in regional and international sustainability networks, like Network of Universities from the Capitals of Europe (UNICA Green) and the International Sustainable Campus Network (ISCN).



From the roof to the cellar – sustainable energy management at FU Berlin also lets us explore the hidden corners of the university. During the Management Incubator of the University Alliance for Sustainability, we take our international guests underneath the Botanical Garden. © UAS Team



This profile results on the one hand from the current holistic understanding of sustainability management and on the other from the historical development at Freie Universität Berlin, which started with operational energy and environmental management 17 years ago.

### 5. Lessons Learned

The development of a holistic sustainability management at Freie Universität Berlin was aided by various factors and windows of opportunity. The strong and continuous commitment of the university management played a key role and also allowed for direct access of the sustainability coordinator by the university management. Additionally, the different participatory approaches, in particular the environmental teams, the initiative SUSTAIN IT! as well as the audit teams have increasingly become the social basis for a sustainability-oriented organizational development of the university. The ISO 14001 certification and diverse awards (KlimaSchutzPartner Berlin 2003, 2008, and 2015 and the GASAG Future Competition 2010 and 2012) have supported this process. The UAS became a catalyst for international cooperation and facilitated FU Berlin's internal networking processes.

Despite those positive conditions, we needed to address the following structural challenges:

- High participation and communication efforts through the involvement of many internal stakeholders
- Consideration of the interdependencies between technical-economic, organizational, and behavioral measures
- High need for inter- and transdisciplinary coordination



These potential obstacles have required growing project management and communication skills from the staff members of the units. They also led to closer cooperation with the university's press department, international office, and researchers working in the field of public engagement processes. Workflows have become increasingly complex and have led to the re-distribution of tasks among the employees of the unit, new team building processes for complex projects as well as the hiring of new staff members for newly created lines of work.

With the activities described above, Freie Universität Berlin has demonstrated that universities are in a position to institutionalize university-wide sustainability management on a voluntary basis. With its energy-saving and efficiency activities, Freie Universität Berlin has demonstrated that there are also interesting and feasible potentials in this area. All in all, the success factors described illustrate that sustainability can be successfully implemented at a large university if it is perceived as a long-term management and integration task. International cooperation is becoming increasingly relevant – not only for the international exchange of experience, but also for networking processes within the university. On the whole, sustainability management at Freie Universität Berlin has been characterized by a gradual approach and should be considered as an institutional learning process.

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Popular bicycle parking, the result of good design. © Área de comunicaciones Dirección de Sustentabilidad. Pontificia Universidad Católica de Chile

## 4.1.2 Pontificia Universidad Católica de Chile: Sustainability in Motion

Francisco Urquiza Gómez / Patricio Camoglino Escobar

### University Profile

**Name of the university:** Pontificia Universidad Católica de Chile

**Country:** Chile

**Number of students:** 30,526

**Number of academic staff / professors:** 3,555

**Number of administrative staff:** 3,273

**Amount of floor space:** 330,741 m<sup>2</sup>

**Person / department in charge of sustainability management:**

Director of Sustainability – Maryon Urbina

Sustainability Chair – Juan Carlos Muñoz

## 1. Case Study

Regarding the promotion of sustainability, the Pontificia Universidad Católica de Chile (UC) has managed to implement important environmental and institutional changes over the past two decades. This case study describes the overall approach promoting sustainability as a sort of cultural change. Next, we provide three examples of initiatives (recycling, use of bicycles, and the publication of an annual sustainability report), depict some of the lessons learned from these cases, and explain how the overall focus of conceptualizing sustainability as a result of cultural change is reflected in these examples.

## 2. Our Story

When we ask ourselves what triggers an organizational change toward sustainability, we can list a series or recurring factors such as leadership, critical mass, the political situation, and others. However, these are insufficient when looking at the complexity and dynamism inherent in processes of change. Change is cultural: an organization cannot be “adjusted” hierarchically through regulations, like a machine, and even less so with mere statements of intent. The tacit agreements contained in people’s cultural mindsets cannot, in the long run, be manipulated or ultimately betrayed. If the change does not “make sense” or “reverberate” with previously held notions already internalized at an individual, collective, or institutional level, it has no chance to take root and grow.

This brings us to the following question: How can an organization’s culture change? This question led us to reflect on various lessons learned over more than 15 years of transformation toward sustainability at the Pontificia Universidad Católica de Chile (UC). The first institutional glimpse of change came at the end of the 1980s when an environmental commission was set up and lasted for a brief period. No tangible results from that time are known to us. Another step was the creation of some courses in the area of ecology and an academic certificate in environmental studies in 1990. Despite this background, the most important period for the growth of sustainability began in the 2000s, after many years of pushing by students. From there, it moved on to a period of institutionalization in which staff members, administrators, and academics joined in significant numbers. This history is far from successful if we assess it from the perspective of sustainability and the global goals set out by Agenda 2030 of the United Nations (SDG), to name one reference. However, this transformation has doubtlessly led to important changes and is positioned in such a way that it can grow further in the years to come.

As of 2000, the institution had no recycling projects to speak of. While this may not be the best measure that can and should be implemented in terms of sustainability, it is often one of the first. There were neither policies on efficient energy use, nor on sustainable construction or landscaping with low water consumption or native vegetation. There was nothing visible anywhere on any of the campuses that would indicate a concern for the environment. Furthermore, the San Joaquín campus (the largest of UC) appeared to be in the process of turning into a huge parking lot as every available space was being filled with vehicles. From an academic perspective, the situation was somewhat different. There were already courses of study focused on environmental matters including regulatory compliance, monitoring the quality of environmental components, and natural resource management for fisheries and forests. However, there were no courses focused on integrating the analysis of societal problems with environmental ones, and nobody spoke of sustainability. The sole





The annual massive bicycle ride denotes the growing cycling community at the university. © Área de comunicaciones Dirección de Sustentabilidad. Pontificia Universidad Católica de Chile

exception may have been the course “Conservation and Management of Natural Renewable Resources,” taught by Professor Dr. Juan Gastó, which offered a comprehensive perspective on the environmental crisis in Chile. It served as a training space for many of the students participating in the university’s changes during the period of 2000-2010. At that time, there were no student organizations working on environmental issues since social matters were taking precedence. Lastly, none of the institution’s strategic documents mentioned caring for the environment, let alone sustainability. In short, sustainability was not a pressing matter or even being considered.

Until 2018, UC had established a recycling system that operates on the main campuses and extends to many of the offices. It includes organic waste handling. Again, while it may not be the most important measure in terms of sustainability, since it requires institutional changes and active community involvement, its implementation can be viewed as one step towards change. Buildings have been constructed using sustainability criteria, and renewable energy production systems have been installed (although small in scale). Roadways on the main campus have been removed in order to recover them for pedestrian use, and there are more facilities available for bicyclists. An urban agro-ecology garden was created, participatory tree planting sessions using native trees have been conducted, and there are now courses on sustainability. These are just some of the examples in a long list of notable initiatives and achievements.

From an institutional perspective, the university incorporated sustainability into its strategic plan, creating the Sustainability Department (at the vice-chancellor's office) for this purpose, which periodically issues reports on sustainability. Beyond this, it is clear that the matter has fully arrived on campus and in conversations taking place in its community. In the past, the subject was mentioned as a distant concern, but today it has become strategic and core to the university's mission. Progress has definitely been made.

From our advantaged perspective, first as student activists and then as directors of the sustainability department (Francisco Urquiza 2011-2016 and Patricio Camogolino 2016-2018), we are witnesses and agents of this transformational process. The aim is to include what we see as concrete examples that depict the cultural change that has occurred at UC. We wish to advise the reader that this is in no way a recipe that is directly applicable to other contexts, but it can aid reflection on the importance, sometimes in surprising ways, of initiatives and strategies of organizational change.

### 3. The Change – Key Activities and Milestones

To modify our personal and institutional habits, a certain amount of discomfort is necessary as these actions and messages intentionally disturb automatic psychological and social processes, tacit agreements that should be challenged. This may be the primary objective behind the recycling project, since it is installed in shared spaces with a clear message: "Trash is a decision." We can discuss to what degree waste separated for subsequent recycling is an environmentally useful measure, but what is evident is the impact it creates within the community. Suddenly, people have to decide whether or not to separate their trash, making it a personal and community problem instead of something distant or "someone else's problem." A once-hidden facet of the community is revealed: who recycles and who does not. The first ones proudly carry out a task that used to be impossible, while the rest may look on with growing curiosity. Although simply installing containers is not enough to make a recycling program successful, their mere appearance does have a real social impact.

In the specific case of UC, the Recicla UC project was promoted originally by students who saw this shortcoming as a clear symptom of the lack of interest in ecological sustainability on the part of the university. Ecological sustainability will be achieved through waste recycling and waste reduction and, therefore, the reduction of the environmental impact. A group was organized to insistently push the administrators and deans until a pilot program was set up in 2004 in the engineering department. It was primarily administered by students and supported by cleaning personnel. A few years later, the effect was visible. Students in other departments demanded that the project be installed in their own faculties, leading to its expansion across the four primary campuses of the university. Despite its success, the project had serious budgetary and management problems, which led to a critical moment in 2010. It became clear that due to the scale of the project,

Change is cultural: an organization cannot be "adjusted" hierarchically through regulations, like a machine, and even less so with mere statements of intent. The tacit agreements contained in people's cultural mindsets cannot, in the long run, be manipulated or ultimately betrayed. If the change does not "make sense" or "reverberate" with previously held notions already internalized at an individual, collective, or institutional level, it has no chance to take root and grow.





The central “punto limpio” at the main campus allows the recycling of 12 different materials. © Área de comunicaciones Dirección de Sustentabilidad. Pontificia Universidad Católica de Chile

it could no longer depend solely on the volunteer work of students. The university would have to institutionalize it. Today, the system has been modernized and made official, and at the largest university campus, recycling went from 9 tons in 2008 to 100 tons in 2017.

Two key lessons from the project: (1) Understanding that a strategic project cannot only be assessed from an economic or environmental perspective, but also from a social and cultural viewpoint. In this case, it is a project that directly challenges people and their daily habits. (2) The importance of insistence and dissent. While it is essential to understand and navigate the university’s bureaucracy, sometimes small groups can and should push difficult changes against the status quo. This includes daring to show by example that the efforts are necessary and feasible. The Recicla UC project is a clear example of this as it was promoted and piloted by a small group of students. Additional initiatives are: (1) Animalia UC, a project for responsible pet ownership by taking care of cats and dogs abandoned on campus; (2) Biohuerto, a project designed on campus to demonstrate an agro-ecological way of producing food and the need to reconnect to the source of sustenance; (3) ISolar, a student project that was able to set up the first photovoltaic system of the university. These are a few of the projects that took a similar course and were eventually formalized by the university. Without the persistence of students, they would have taken much longer to be realized.

Changes are often just waiting for a push to get off the ground. Such low-hanging fruit includes things whose time is ripe to emerge, to be developed and installed at the institution due to the global, national, or local context. This does not mean any project should be pursued just because it can. Projects should be strategic and help to promote larger efforts in the future. In the case of UC, promoting the use of bicycles between 2011 and 2013 fits this description perfectly, especially regarding efforts to improve bike parking equipment. The use of bicycles and their popularity as a means of transport have grown significantly around the world, and Santiago, Chile is no exception. While trips using bicycles only

represented 3.9% of all trips in 2012, they went from 329,000 in 2001 to 676,000 daily trips in 2012, an increase of 105% (MTT 2012). This change was noticeable on the streets and in the growth of civil society organizations encouraging the use of this transportation alternative. Despite these numbers, in the middle of 2011, when the work of the UC sustainability office began, this trend was less evident in the university community. Furthermore, the campus did not have minimal basic equipment for cyclists such as bicycle parking. Bicycles were even viewed as a problem whenever they would appear locked up in unexpected places. Thefts and subsequent complaints by students and staff were also common, which was a direct result of the precarious parking situation.

To address this, we launched a number of parallel efforts. We created an origin-destination survey and designed a good standard parking model for the campus along with signs to guide users on how to ensure their bicycles were properly locked to reduce the risk of theft. We also installed repair spots in the parking areas. A survey of the prevalence of bicycles on the various university campuses was conducted to understand the level of demand and show that it was important to invest in adequate equipment. This enabled the creation of a solid proposal, which was accepted as a solution for the problem of bicycle theft. It was also in line with efforts to regain the walkable character of the main university campus. As soon as they were installed, the first parking units were quickly in full use, demonstrating the hidden demand, and, more importantly, showing the campus community that bicycles are a viable transportation option.

Before the parking racks were available, bikes were hidden away in other spaces like offices, stairwells, and a range of nooks improvised as parking locations. Once bicycles and parking racks appeared in clear view, everyone saw that many people were already using this transportation option, just like the recycling system. Those who did not already do so realized they had a more sustainable option for getting around. Along with this discovery, the cyclist community began to form and create other projects that contributed even more to this process. As a result of this and other efforts, the percentage of trips made by bicycle in the community on an average day increased from 3.8% in 2012 to 5.9% in 2017 (UC 2017). Even today, the number of bicycle parking racks continues to grow, reaching 1,393 in 2018, and the result is always the same: the bicycle parking areas fill up quickly. It is important to note that the scenario of increasing bicycle use in Santiago was already underway and definitely influenced this trend. UC was able to capitalize on this to promote the use of bicycles by making strategic investments in high-quality bicycle parking racks.

One of the key lessons of this project is that the value of a good design consists of: (1) choosing visible, attractive locations concentrated in a few parking areas to enable their supervision; (2) creating a simple visual explaining how to use the parking system and the optimal way to protect a bicycle (which was then copied and spread throughout the city of Santiago); and (3) choosing metallic structures with an inverted “U” shape for parking. Poor design would have set the project up for failure. The users rewarded the effort by filling up the parking spaces. The second lesson is the importance of paying attention to the situational opportunities that can help launch strategic initiatives. In this case, the clear success of the bicycle parking effort paved the ground for many other sustainable transportation options. Today we have a co-operative bike workshop, and we hold an inter-campus bike ride every year. The origin-destination survey has continued in order to measure progress. Campaigns for promoting sustainable transportation continue, and the university president occasionally cycles to work as well.

#### 4. Stakeholders & People

UC understands sustainability as a collective effort through which humanity aspires towards the possibility that humans and other forms of life could flourish on earth forever (Ehrenfeld 2008; UC 2014).

Incorporating the notion of collective effort appears to contradict the very idea of a definition, since it opens up a fluid, non-normative understanding of the concept that arises from dialogue. Some might argue that it's best for everyone to mean the same thing by "sustainability" in order to clearly progress in a single direction. To a certain degree this is true, which is why we have come up with a definition and strategic guidelines that have been shared through formal university media. But this is clearly not enough. Before moving forward, how many people really understand the mission of the institution where they work? How many ask themselves if their work decisions are in line with that mission? Probably very few. While definitions give us a framework, what is more important is how the concept "makes sense" to groups of people in their context, which in this case is the university and its work areas. For UC, the concept of sustainability began to become linked to various spaces inside the institution thanks to the participatory process to create the first sustainability report. This was not an accident. It was designed and is perhaps one of the most relevant successes of the Department of Sustainability since it enabled the organization to talk in depth about sustainability and its scope within the institution.

The idea to develop a sustainability report comes from the importance that prestige has for universities in Chile (and worldwide), associated with international rankings or accreditation systems. Taking advantage of this motivation that was already part of the university and its departments dedicated to carrying out assessment procedures, we thought it best to propose a system of public sustainability reporting under a Global Reporting Initiative (GRI) standard. The idea was taken as a strategic project with direct supervision and support from the president and his board. Additionally, a methodological proposal based on a highly participatory process was made. While the participatory process was presented simply as a means to develop the report, it actually became the principal achievement of the project, since it gathered diverse people who negotiated their visions of what sustainability means and who tried to answer the questions: What do I and my department have to do about sustainability? What challenges do we face as an institution? What actions can we take to advance sustainability? This put many in a tough position. Feeling uncomfortable for being ignorant on the subject led them to reveal the preconceptions they held and to then surprise themselves with remarkable ongoing achievements that kicked off an unstoppable dialogue which in many ways continues today.

The two key lessons of this experience are: First, the importance of creating spaces for meaningful dialogue and building a shared understanding of sustainability rather than imposing a standard definition, which would likely end up buried in some forgotten document. This dialogue must be revisited periodically so that it can be updated in accordance with the changing global and local context. Second, choosing procedures that the institution is already prepared for, both in terms of the value assigned to them and the ability to address them. Recall that these opportunities require both astuteness and humility in order to ask for help as well as offer generosity when it is time to agree on projects that support shared goals.



## 5. Success Factors and Challenges

We turn once more to the question, how can we change an organization's culture? First of all, we must recognize that there is no general answer, but only concrete insights derived from concrete experiences. Using these three examples, our goal was to share recurring lessons. We tried to uncover patterns to learn from and potentially use for future work.

In closing, we wish to emphasize the phrase "sustainability in motion." This recognizes that the process of organizational change is essentially created using various key movements. While the long-term strategic perspective is important, the route actually taken appears more like being adrift while remaining attentive. Continuing with this metaphor, if we know we want to reach the other side of the river, we cannot ignore the current or the changes in the terrain. Sometimes we have to let the current take us where it will so we do not expend all our effort on senseless fights that sap our drive and energy. Likewise, the projects discussed here show how such "alert drifting" takes form according to the particular context of an organization. This requires paying full attention to the various co-existing processes within and outside of the organization to find those situations that will benefit the creation of strategic projects that can launch greater changes, in addition to promoting and sustaining a dialogue that enables a better community-level understanding of sustainability. Lastly, we must remember that sometimes we have to row against the current. It's not all drifting. There are causes that require the creation of new circumstances rather than submitting to existing ones. We must build new understandings and transform our universities into institutions that can face the challenges of today's paradigmatic movement toward sustainability.

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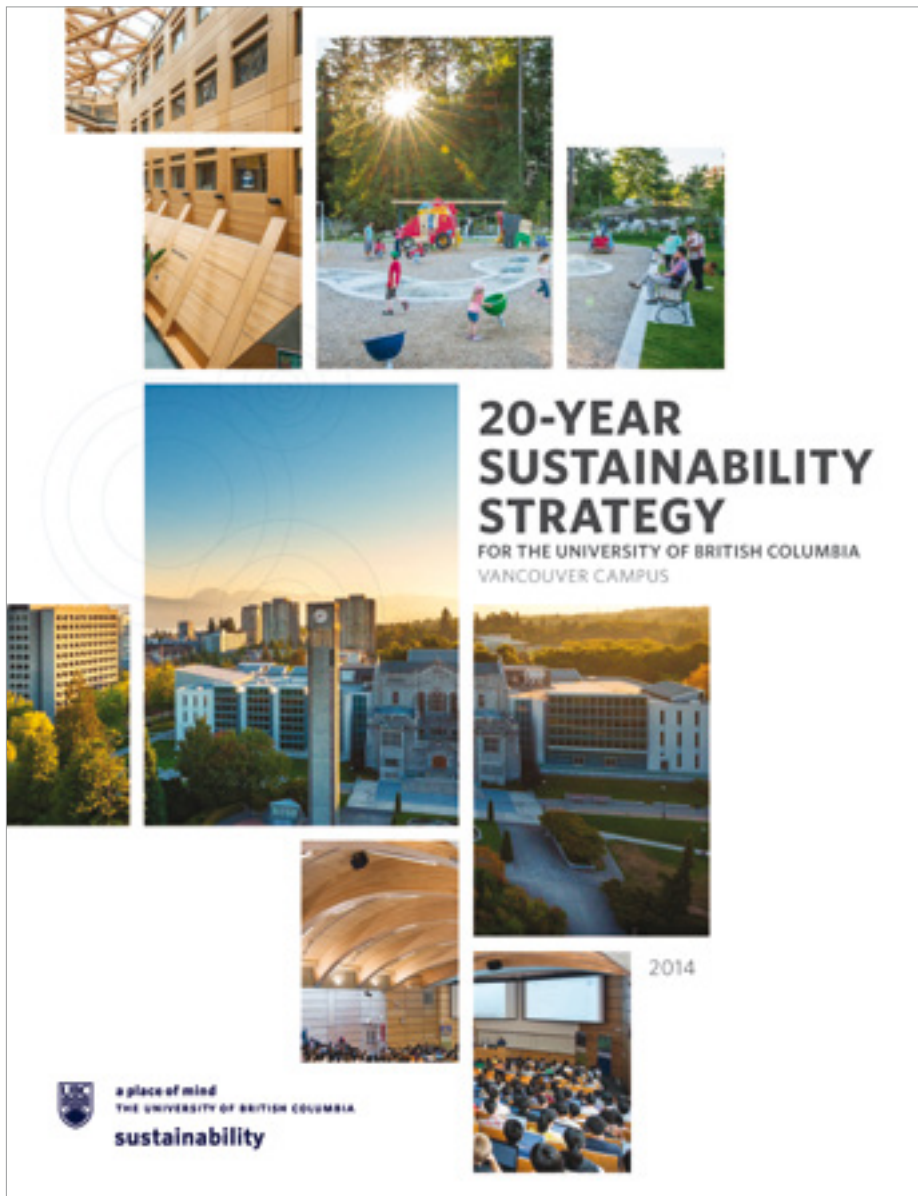
### Further Information:

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Cover of the 20-Year Sustainability Strategy booklet.

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### 4.1.3 University of British Columbia: 20-Year Sustainability Strategy

Shannon Lambie / Victoria Smith

#### University Profile

**Name of university:** University of British Columbia

**Country:** Canada

**Number of students:** 56,331

**Number of academic staff / professors:** 6,057

**Number of administrative staff:** 10,834

**Amount of floor space:** 178,000 m<sup>2</sup>

**Person / department in charge of sustainability management:** UBC Sustainability Initiative and Campus and Community Planning

## 1. Case Study

The purpose of the 20-Year Sustainability Strategy is to provide a document outlining UBC's sustainability vision and aspirations and, in so doing, set the long-term direction towards a more sustainable university. The process began in 2013 and the text was finalized in 2014. It builds on UBC's Sustainability Academic Strategy (SAS) (2009), a mid-level plan under Place and Promise, UBC's Strategic Plan, and it is intended to guide decision-making at UBC's Vancouver campus with regard to sustainability until 2035.

## 2. Our Story

The University believes in sustainability because it is necessary as the ecological and human consequences of unsustainability are devastating; it is the right thing to do ethically and in terms of distributive justice; and it is desirable in itself, offering the possibility of a better life for people and the planet.

The 20-Year Sustainability Strategy addresses how sustainability will be advanced across the following three components: 1) teaching, learning, and research, 2) operations and infrastructure, and 3) the UBC community. The strategy was developed for UBC's Vancouver campus, in the spirit of respectful collaboration with the Musqueam First Nation. It is non-binding on the University Neighbourhoods Association (UNA), yet opens possibilities for further co-operation on specific initiatives that may be replicated by either party or the wider community. The strategy was developed by the 20-Year Sustainability Strategy Steering Committee comprised of faculty, students, staff, external community partners, the University Neighbourhoods Association, and the Musqueam First Nation. Feedback was sought widely from campus constituents online and through in-person workshop sessions. The engagement process was staged in two phases: Phase 1 engaged the community in the development of a vision; Phase 2 engaged the community in the development of strategic goals across the three pillars 1) teaching, learning, and research, 2) operations and infrastructure, and 3) the UBC community.

The project was coordinated by an Engagement Specialist and was supported by a Steering Committee which consisted of students, faculty, staff, campus residents, the University Neighbourhoods Association (UNA), the Musqueam First Nation, and external community partners.

Since fall 2013, a number of engagement activities have taken place. At a glance, some engagement highlights include:

- Targeted 10,870 LinkedIn members registered as UBC staff
- 84,264 impressions
- 45 clicks by those in a senior function
- With over 5,200 views, "Conversations 2034" was the most visited site on [sustain.ubc.ca](http://sustain.ubc.ca)
- 800 in-person
- Online Feedback: 1,368 community members (64% students, 26% staff, 8% faculty, 2% other)



### 3. The Change, Success Factors, and Challenges

The partnerships that were formed during the development of the 20-Year Sustainability Strategy built a strong foundation of engagement, enabled USI to expand its reach both regionally and internationally, and led to a number of collaborations.

The engagement process informed the re-design of the Annual Sustainability Report and led to the development of the Okanagan Charter and the ISCN Sustainable Campus.

The strategy brought forth an understanding that sustainability means simultaneous improvements in human and environmental wellbeing, not just reductions in damage or harm.

Like every project, we have faced some challenges. With any engagement process, it can be difficult to decide when to end it. This process did not have a set deadline but did have constraints around resources and time. It can also be difficult to get groups involved. For example, at UNA meetings, very few residents attended events, and many, therefore, did not have their voices heard as well as they could have.

At UBC's Vancouver campus, sustainability means simultaneous improvements in human and environmental wellbeing, not just reductions in damage or harm. By 2035, such regenerative sustainability is embedded across the University throughout teaching, learning, research, partnerships, operations and infrastructure, and the UBC community. UBC is a vibrant, healthy, and resilient community, deeply engaged with its neighbors, surrounding region, partners around the world, and in a supportive and mutually respectful relationship with the Musqueam people.

As with any strategy or plan, monitoring and evaluation must take place to determine if targets are being met. Based on our experience, we would make three recommendations to those planning to facilitate a similar project:

- Having a sustainability strategy is necessary as the ecological and human consequences of unsustainability are devastating; it is the right thing to do ethically and in terms of distributive justice; and it is desirable in itself, offering the possibility of a better life for people and the planet.
- Leading a strong engagement process strengthens relationships and will lead to future collaborations.
- Developing a strategy like this can provide several cross-cutting themes to serve as guiding principles: partnerships, integration, campus as a living lab, and the university as an agent of change off-campus.

#### Contact:

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Tree planting day. Faculty for Environmental and Rural Studies. © Luis Alfonso Castellanos S.J.

## 4.2 Campus Management

### 4.2.1 Pontificia Universidad Javeriana, Colombia: Achieving Carbon Neutrality and material benefits: “Historia Verde,” “Cosmos,” and the “Javerian Forest”

Carlos Devia / Luis Alfonso Castellanos / Angela Moncaleano / María Suárez

#### University Profile

**Name of the university:** Pontificia Universidad Javeriana

**Country:** Colombia

**Number of students:** 24,203

**Number of academic staff / professors:** 1,382

**Number of administrative staff:** 1,611

**Amount of floor space:** 232,746 m<sup>2</sup>

**Person / department in charge of sustainability management:** Department of Physical Resources





Tree-planting for the CO<sub>2</sub> compensation of emissions generated at the Javerian Symposium. © Carlos Devia

### 1. Case Study

The Pontificia Universidad Javeriana (PUJ) presents three projects, which it is realizing as part of its sustainability strategy: the “Historia Verde” (Green History), the “Cosmos” project, and the consolidation of the “Javerian forest.” All of these aim to offset carbon emissions by first calculating them and then offsetting them by planting trees. The objective is to contribute to the mitigation of climate change. The “Javerian forest” also serves to strengthen ties with the communities who live near the university. Finally, the projects are based on the conviction that environmental initiatives should be viewed as “investments” (rather than costs) because they can result in hard economic benefits for universities.

### 2. Our Story

Climate change is evident in the negative effects associated with variations in precipitation, both in terms of annual increases or decreases as well as in terms of rainfall intensity (Pabón & Nicholls 2005; Costa Posada 2007; Bedoya et al. 2010). As a result, in 2011, Colombia had to allocate more than 13% of its national budget to covering the costs of damages caused by river overflows that affected cities and areas with agricultural and livestock uses, as well as the country’s transportation infrastructure. Likewise, the increase of droughts and floods has caused crop losses and water scarcity. The increase of temperatures carries with it the risks of tropical diseases for those parts of the country lying beyond 2,000 meters above sea level, with the corresponding negative effects on health (Pabón & Nicholls 2005; Feo et al. 2009).



Trees deliver important ecosystem services such as: (1) support, (2) habitat and regulation, and (3) culture. The first includes the provision of food, raw materials, and energy; the second refers to thermal and water attenuation, support for wildlife, and soil protection (against rain and large swells); finally, in cultural terms, trees offer the opportunity to put our knowledge to use, develop it, and advance it. The tools carved out of wood, the recipes made out of the fruits, the tincture from the bark, the medicine from the roots: trees have it all (Salbitano et al. 2016; Haines-Young & Potschin 2018)!

Restoring forest landscapes enlarges the ecosystem services of trees. This can include the planting of trees in already existing forests, which helps to replenish the number of species in place and may add new genetic material that strengthens existing species or can increase the supply of food for the fauna in situ. The planting of trees in agricultural or livestock systems, under approaches of soil and fauna conservation, helps to transform degraded areas into new, highly diverse forest relics used as seed banks and for recreational practices.

In this sense, tree planting as a mechanism of carbon sequestration should not be viewed as the simple and systematic planting of trees. Rather, it should be interpreted as the maximization of all the services trees are offering, such as species, arrangements (how plants are grouped), and different products.

Based on these considerations and approaches, PUJ initiated the “Green History” project in 2008, which was followed later by “Cosmos” and the “Javerian forest” projects. “Cosmos” extends “History Verde” by formulating a model to evaluate the total carbon emissions of our University (not just for events). Our aim is to reduce the carbon and biodiversity footprint of our university on the basis of these results until achieving carbon neutrality. This will be achieved by planting trees on the campus and by creating the Javerian forest outside of the campus in the countryside. The university community plans to plant between 60,000 and 150,000 trees of different types each year.

It is of utmost importance to break with the paradigm that “being responsible with the planet is a cost” and turn it into “being responsible with the planet is a necessary and appropriate investment.” To the extent that universities lead initiatives of this type and extend their ties to the families in the wider community, to their providers, and to the cities where they are located, climate change can be mitigated, and we will effectively contribute to caring for “our shared home.”



PUJ students filling out the carbon footprint calculator. Earth Day event. University Environment Vice President's Office. © Carlos Devia

### 3. The Change – Key Activities and Milestones

At the Pontificia Universidad Javeriana, we have been developing the “Green History” project since 2008. This project addresses, among other aspects, our responsibility to compensate carbon emissions caused by events held at the university. To reach this aim, a carbon emissions calculator for events was designed. On the basis of the emissions it measured, we established and executed a plan for tree planting that would offset the carbon emission caused by our events. The carbon emissions calculator for events was first inaugurated at the IX Research Congress in 2009. As a next step, we developed a carbon calculator for individual footprints, which was launched for the celebration of Earth Day on April 22, 2016. Based on a self-evaluation of a sample of more than 500 students, it established that each member of the Javerian community emitted on average 2.6 tons of carbon dioxide (CO<sub>2</sub>) per year. The value of the carbon offsetting was calculated between 0.1% and 1% of the cost of activities that emit carbon. The amount of trees to be planted in order to offset said emissions was estimated using Picard’s allometric construction equations for carbon capture (Picard et al. 2012). The costs associated with the planting of these trees is viewed as an investment because, as explained earlier, the trees will provide services and products. Hence, we calculated the ratio between costs and potential gains. Considering context-specific conditions related to urban or rural environments, we estimated that the cost-benefit ratio is approximately 1:1.5. This means for every dollar invested, we will gain 1.5 dollars: The average tree price is estimated at 10 to 15 USD (32,000 COP), including all expenses associated with inputs, labor, maintenance, and stewardship. On average, depending on the selected species, trees begin providing products in the second year. For example, the cost and maintenance of an avocado tree (*Persea americana*) is about 48,000 COP (15 USD). Over a period of 10 years, this avocado tree can produce approximately 250 fruits. At an average price of 320 COP (0.10 USD) per avocado, this equals 80,000 COP (25 USD), which is 1.67 times the investment cost.

### 4. Stakeholders & People

The proposal for carbon neutrality through tree planting addressed two major stakeholders i) the university itself including its buildings, its operation, and the events organized on campus, and ii) the Javeriana academic community who emits carbon dioxide through mobility and consumption while at the university. Investing in carbon neutrality will benefit both.

Moreover, we think that a community that wishes to be “carbon neutral” should participate in the decision over which tree species to plant. This participation must be based on information that enables decision making in line with the species’ and the territory’s characteristics (Ecott 2002; Bennett 1999; Maginnis & Jackson 2005; Feldman et al. 2012).

### 5. Success Factors and Challenges

The “Green History” project has contributed greatly to the renewal of the tree population of the campus and in particular to the increase of native species. Currently, we have more than 160 different tree species, which include varieties unique to urban environments and threatened species as registered in the International Union for Conservation of Nature’s (IUCN) high-risk categories.

The „Green History“ project also marks a milestone in terms of linking the Javeriana community with the campus by planting trees together. The sowings include rituals that

seek to spiritually link students to the trees, creating spaces that strengthen ties within the university and the planet as a whole.

We would like to stress that the success of the “Green History” and “Cosmos” projects was possible because the projects were supported by the university’s authorities. The Administrative Vice-President’s Office (Vicerrectoría Administrativa), the University Environment Vice-President’s Office (Vicerrectoría del Medio Ambiente), and the Schools of Science and Environmental and Rural Studies (Facultades de Ciencias y Estudios Ambientales y Rurales) all determinedly embraced the projects.

Moreover, it was key to present the projects as an “investment” in the future that will result in tangible benefits. We have stressed that in the future, there will be valuable forestry products like timber that can be used in the construction and/or remodeling plans of the university or to build furniture. We will also be able to harvest fruits and sell them in the campus store. Lastly, the trees on campus and in the Javerian forest provide “green sites” people can use for their recreation and other practices of well-being. Furthermore, the Javerian forest promotes mutual recognition between urban, peri-urban, and rural communities. Then there is, of course, the supply of goods and services such as wood, fiber, fruit, and other non-timber products (described above). It also offers services associated with water cleaning, recreation, and tourism (Salbitano et al. 2016).

In general, it is of utmost importance to break with the paradigm that “being responsible with the planet is a cost” and turn it into “being responsible with the planet is a necessary and appropriate investment.” To the extent that universities lead initiatives of this type and extend their ties to the families in the wider community, to the providers, and to the cities where they are located, climate change can be mitigated, and we will effectively contribute to caring for “our shared home.”

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Public action at the campus in Peterhof – volunteers and their families collecting reusable waste materials.

© Saint Petersburg State University

## 4.2.2 Saint Petersburg State University: Step-by-Step Improvements in Waste Management

Anton Khoroshavin

### University Profile

**Name of university:** Saint Petersburg State University

**Country:** Russia

**Number of students:** 30,000

**Number of academic staff / professors:** 6,000

**Number of administrative staff:** 6,000

**Person / department in charge of sustainability management:** Vice-Rector for the Material and Technical Support, Environmental Department

The 'Eco-Point' project was successful in two focus areas: promoting environmentally friendly waste management on campus and raising awareness among students about the issue. The financial side-effect was also important – by generating income, the project is able to further invest in such activities.

### 1. Case Study

The idea of waste separation was developed as a grassroots project initiated by students at the Peterhof district campus of Saint Petersburg State University (SPbU). Following its first success, a university-wide program was established in 2015. At so-called 'Eco points,' containers for glass, waste paper, plastic, and hazardous waste (printer cartridges, batteries, etc.) were placed in different areas of the campus. Within a short period of time, it was possible to raise awareness about waste separation among students. The 'Eco points' not only contribute to the environmentally friendly lifestyle at the university but they have also helped SPbU to save five million rubles (about 78,000 USD) since 2015.

### 2. Our Story

Implementing environmental projects at Russian universities is often a challenging task. In case of Saint Petersburg State University, most of the historic buildings were built up to 300 years ago, which makes it very difficult to install solar panels on the roofs, build local sewage treatment units, and organize waste separation. Additionally, Saint Petersburg State University is one of Russia's largest universities with more than 380 buildings and structures in six regions of Russia, where 12,000 students live permanently, and the number of employees and students is approximately 11,000 and 27,000, respectively. The sheer size and the fact that campuses are located in different cities pose an additional challenge for implementing sustainability projects at the university level.

Waste management is increasingly becoming an important issue for society in general and universities in particular. Russia does not have a real tradition of recycling and waste separation; more than 90% of waste goes to landfills. However, in the past few years, the waste management issue has received more political attention. Recycling of valuable materials can become a significant pillar for tackling environmental challenges in Russia.

Under these circumstances, the waste separation program at the SPbU is a pioneer project, constituting an exemplary practice for other Russian universities. It is worth mentioning that the program grew out of an idea initiated by students living in dormitories at the Peterhof university campus. At the beginning, the most environmentally responsible students began collecting waste directly in their rooms in order to take it to the nearest waste collection point at Peterhof once a month. Students Rimma Serova and Yulia Sled were the first to conduct the monthly 'Separate Collection' campaigns, which included the collection of waste paper and waste metal. They presented the results to the Vice-Rector for the Material and Technical Support of the University. These achievements demonstrated to the university administration that the first steps realized by active students can be much more efficient if supported by university management. As a result, Saint Petersburg State University developed a program for the organization of waste separation at the beginning of 2015. The main goal is to reduce the landfill waste rate in order to achieve environmental and economic effects.

### 3. The Change – Key Activities and Milestones

One of the core ideas of the waste separation program was the organization of an 'Eco point' at the campus in Peterhof. After some discussion, the project team decided to install separate small containers of 120 liters for each type of recyclable: waste paper, glass, plastic, and aluminum cans as well as one 20-foot 'sea container' for storing recycled materials before their transportation to waste processing companies. At the beginning, many students

left the bags with mixed garbage next to the waste separation ‘Eco point’ in order to save time. Fortunately, due to the active information campaign conducted by the ‘Eco point’ coordinator, the new initiative was established and accepted by the students. After one year, about 50% of students and staff actively participated in waste separation on a daily basis.

In the next phase, ‘Eco points’ were installed in some areas on the main campus in downtown Saint Petersburg (including e.g. the main building and the Institute for Earth Sciences), where a systematic collection of glass, waste paper, plastic, and hazardous waste (printer cartridges, batteries, etc.) was organized. The administration agreed with a student volunteer (who had long been taking care of organizing waste separation) that they would organize the transport of recyclable waste from small containers to the larger collection sites. The university management negotiated the collection of the waste from the campuses with the garbage disposal companies.

Another main focus of the project was to induce behavioral change regarding waste management among students as well as staff at the university. One important step was to create more awareness of the issue and give guidance to students. Students learned how to separate their waste and were encouraged to use the ‘Eco point’ containers. However, besides positive communication efforts it was also made clear that it is forbidden to deposit mixed waste from the dorms in the ‘Eco point’ containers.

On the basis of these considerations concerning the students, a motivational system of bonuses and fines was developed for the staff of Saint Petersburg State University in charge of administrative and business issues in order to encourage further waste separation.

Within a short period of time, a local student initiative had become a university-wide project supported by the SPbU administration. After the student activists and management were able to raise awareness of waste separation among students and staff, the project had a significant environmental effect. Economically, the program has also had a strong impact. Since its introduction in 2015, the total savings from the introduction of the new waste management system have amounted to about 5 million rubles (about 78,000 USD). This result was achieved due to the income from returning the recycled materials and saving costs through the reduction of landfill waste. As of 2018, the situation is favorable – the amount of high-quality recycled materials is steadily growing by about six to seven percent every month. Students’ attitude and awareness towards separate collection have definitely changed.

#### 4. Lessons Learned

After the successful cooperation between students and management, Saint Petersburg State University has become a pioneer among educational institutions in Russia with regard to waste separation, since this practice of waste management has not yet been implemented in any other university in Russia. Therefore, SPbU initiates activities in order to popularize this best practice example in the field of waste management among other Russian universities. We regularly address the current development and updates in the field of waste management at the SPbU on our website. Based on the lessons learned during the project’s implementation, a best-practice guide and training materials on “How to support the waste separation at the university” were developed. These instructions describe three main steps necessary for putting a waste separation concept into practice:

(1) Work out an action program in order to set the goals and means of implementation for each participant. This may be a regulation, a program, or another official document. All





'Eco-Point' at the Peterhof district campus of Saint Petersburg State University. © Saint Petersburg State University

participants involved in the process should be aware that the initiative will be both supervised and supported by the administration.

(2) Organize a team of students, staff, and other participants. It should involve representatives of the administration responsible for the maintenance of buildings, those responsible for public relations and news, and students who are willing to participate in the creative process. Be aware that many different people will give their input and explain their points of view.

(3) Create a recognizable style. Create various events: festivals, community clean-up days, meetings, lectures – so that as many people as possible are aware of and participate in the separate collection. The systematic collection of recyclables and their processing have not only had environmental effects, but also quite tangible economic ones.

Our experience from the program of waste separation organization allows us to predict that waste separation figures will grow, and the income from the recycling of collected materials will exceed the costs of waste disposal in the future. The calculations of the Environmental Department show that if as much as 30% of the university's waste products are collected separately, a positive balance in this area can be obtained. This result is expected to be achieved within a relatively short period of time, in about five years. By 2021, SPbU will be able to start 'making money' with waste, allowing for investments in new projects.

Our experience at SPbU demonstrates that solving the problem of waste does not necessarily mean having to change regulations or undertake big investments. Progress in this area is possible without such large measures. In particular, this waste management project demonstrates how students can successfully meet ambitious challenges. Within a few years, a grassroots volunteer initiative has turned into a university-wide project significantly contributing to the university's waste management and raising awareness of environmentally friendly behavior.

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Students participating in the 1st Nudgeathon in Mexico, organized by Warwick Business School, United Kingdom, the Faculty of Psychology, UNAM, and PUMAGUA. Credits: Stephanie Espinosa, PUMAGUA.

### 4.2.3 Universidad Nacional Autónoma de México: The Water Management, Use and Reuse Program at UNAM – a Program with Tangible Results

Fernando González Villarreal / Cecilia Lartigue Baca / Josué Hidalgo Jiménez /  
Stephanie Espinosa Garda / Yanell Matamoros Muñoz

#### University Profile:

**Name of the university:** Universidad Nacional Autónoma de México

**Country:** Mexico

**Number of students:** 350,000

**Number of academic staff / professors:** 40,000

**Number of administrative staff:** 42,000

**Amount of floor space:** 7,400,000 m<sup>2</sup>

**Person / department in charge of sustainability management:** Dr. Fernando González Villarreal



### 1. Case Study

The Universidad Nacional Autónoma de México created the Programa de Manejo, Uso y Reuso del Agua (PUMAGUA, Water Management, Use and Reuse Program) in 2008 with the goal of establishing an efficient water management model. The case study describes the goals and areas of this project, the stakeholders involved as well as the main achievements and lessons learned.

### 2. Our Story

The 4<sup>th</sup> Global Water Forum was held in Mexico City in 2006. Twenty-six branches of the Universidad Nacional Autónoma de México (UNAM) participated in the event, presenting their projects on water management in Mexico. Likewise, sessions and roundtables were held. In connection with this Forum, the First University Water Summit convened in October 2006. The aim was to coordinate the efforts of the university regarding research, teaching, and the creation of awareness on subjects related to hydrological resources.

As a result of UNAM's participation in these multi-disciplinary events, the University Council deemed it imperative to adopt concrete measures to encourage the efficient use and management of water on all UNAM campuses. This was in response to problems associated with the constant growth of the facilities as well as to serve as an example of using university knowledge in the solution of key national problems. Thus, in 2008, the University Council launched the Water Management, Use and Reuse Program (PUMAGUA) at UNAM with the support of the President's Office.

### 3. The Change – Key Activities and Milestones

PUMAGUA began its activities at the main campus of UNAM in order to create an efficient water management model that could then be implemented on the other university campuses. It was also planned to serve as a model that could be replicated at other institutions and agencies in Mexico.

The program has three main goals.

- (1) Reduce the water provision for human consumption and use by 50%.
- (2) Improve the quality of water for human consumption and use treated wastewater for watering plants, abiding by the respective official rules.
- (3) Achieve the participation of the entire university community in water management and consumption.

To achieve its goals, PUMAGUA comprises three areas:

- **Water Balance:** consists of various strategies for decreasing potable water consumption
- **Water Quality:** conducts constant monitoring of water for human consumption and use, as well as treated wastewater (DOF 2003). Gives recommendations for water safety
- **Encourage Societal Participation:** Specific strategies are carried out in each sector of the university community in order to include them in the responsible use and management of water



In 2008, the Program started by diagnosing water management on UNAM's main campus. The principal findings were:

- Loss of 50% of water extracted from wells due to leaks in the network and general waste
- Lack of consumption meters
- Around 30% of restrooms either out of service or with leaks
- Irregular concentrations of free residual chlorine in water for human consumption and use
- Approximately one million pesos (52,000 USD) per day spent by the university community on bottled water
- Noncompliance with official Mexican regulations in terms of quality of treated wastewater for irrigation, for most of the year
- Water treatment plants functioning at less than 50% of their capacity
- Low importance assigned to the subject of water by university students
- Employment of ineffectual practices by the community

#### 4. Stakeholders & People

PUMAGUA is organized as follows:

- An interdisciplinary group led by Dr. Fernando González Villarreal, a researcher at the Instituto de Ingeniería (Engineering Institute). The group was in charge of providing scientific knowledge for the three areas, issuing recommendations on them, and conducting ongoing monitoring in all three areas. The number of people involved in the group has varied as a function of the Program's needs and budget.
- The Dirección General de Obras y Conservación (General Directorate for Works and Conservation) at UNAM. The task of this department has been fundamental given that it executes the largest part of the activities including the renovation of the wastewater treatment plants, the installation of the potable water purification system, and leakage repair.
- The role of the authorities in university units and departments such as faculties, institutes, administrative offices, and sports facilities has also been highly relevant since they have implemented the measures recommended by PUMAGUA in their facilities.

#### 5. Success Factors and Challenges

In terms of water conservation on UNAM's main campus, there has been a 25% decrease in potable water use since 2008 even though the total university community has grown by 37%. Reducing leakages at the UNAM campus has saved more than two million pesos annually (USD 100,000) in pipe purchases.

The decrease in water provision has been achieved by installing a real-time measurement system in order to know how much water is consumed by the main network and in which buildings and to detect leaks. Nearly 6,000 restroom items (toilets, urinals, faucets) have been replaced with low-water-consumption components.

Regarding the quality of water for human consumption, an automatic purification system was installed in each of the three wells of the campus with sodium hypochlorite at 13%

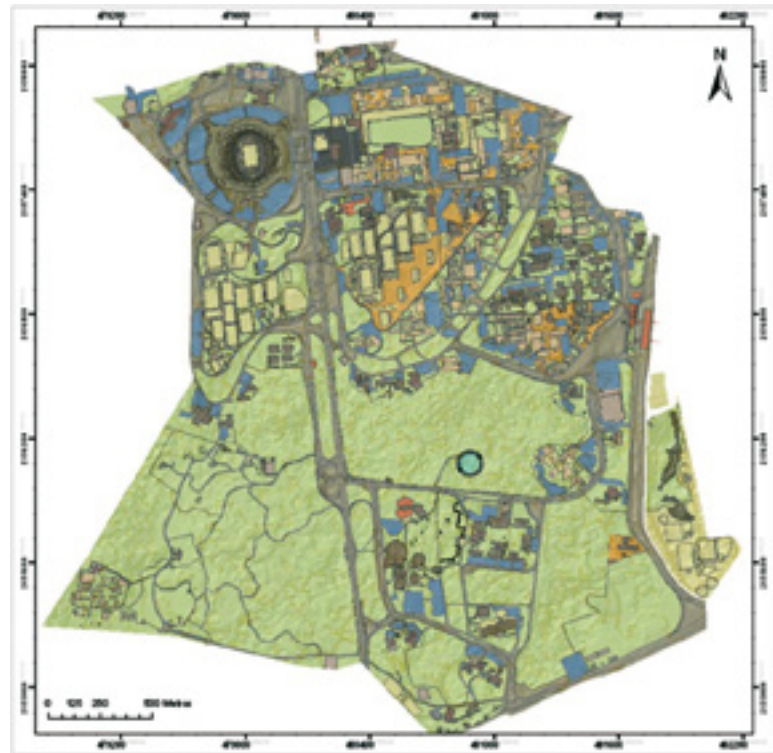


Workshop aimed at gardeners to promote the efficient use of water in irrigation. © Berenice Hernández, PUMAGUA.

(PUMAGUA 2012). It has a robust, permanent monitoring system. Taking the official norms as a foundation, drinking fountain water quality is monitored at various network and cistern points (DOF 2000b). It also has a real-time monitoring system that measures six physiochemical parameters: free residual chlorine, nitrates, pH, turbidity, temperature, and total dissolved solids. Once per year, an external, certified laboratory conducts an analysis of three network points to determine if the 47 parameters of the official Mexican water quality standards for human consumption and use are fulfilled (DOF 2000a). Over the course of two years, PUMAGUA monitored microbiological indicators (viruses, bacteria, and protozoans) important to human health that are supplementary to the regulations (Toranzos et al. 2007; World Health Organization 2011). None of these were found after the purification had been conducted.

It is now possible to drink tap water on UNAM's main campus. Several water dispensers have been installed on the campus since 2013. Two companies designed water dispensers based on the specifications of the program, and companies whose models were adapted to the needs of the university are also included.

Regarding wastewater, the main treatment plant was renovated using cutting-edge technology (ultrafiltration membranes). Consequently, the capacity increased from 18 to 26 l/s (liters per second). Water quality is continuously monitored, and all samples comply with official regulations (DOF 2000a).



Digitalized map of the main campus indicating the water reservoirs.

© PUMAGUA

Regarding the promotion of social participation, there are two main target audiences: the authorities of all university departments and campuses and the university community. More than 80% of the departments and campuses implement measures set out by PUMAGUA: installing water consumption meters, water-saving dispensers, and restroom elements; planting native vegetation that does not need watering; attending PUMAGUA workshops; and disseminating educational materials.

Specific strategies are implemented for each sector of the university community (students, academics, administrative staff, maintenance personnel): training workshops, research, water audits, contests, artistic and leisure activities. Various media are used to reach the public outside of UNAM: mass media, general interest and specialized articles, participation in national and international fora, and more.

PUMAGUA also has a Water Observatory<sup>1</sup>, an open access digital platform. It shows the water consumption of the various university campuses and departments, the quality of water for human consumption and its use in drinking fountains and dispensers, as well as

Another lesson learned is that the success of a university environmental program, especially concerning water, requires the work of a multi-disciplinary team in close coordination with the authorities of the university. It requires ongoing training and communication with maintenance personnel and the university community in general. Communication is important both within the university as well as outside of the university because it provides visibility.

other network and cistern points (DOF 2000a) and the level of participation among the university campuses and departments. It also has a survey section to receive feedback from the university community on issues such as water consumption in drinking fountains and dispensers, reporting of leaks, etc.



Another benefit is that PUMAGUA has become a model for responsible water use and management. These measures have been repeated at five other UNAM campuses, the Universidad Autónoma de Baja California Sur, in eight Mexican municipalities and one residential unit in Mexico City. The hope is that these can continue to expand nationally and even internationally over the medium and long terms.

There have been environmental, social, and economic benefits as a result. The monthly water savings on UNAM's main campus are equivalent to 3,000 families' usage. Tap water consumption decreases plastic bottle waste as well as the water and energy required to produce and transport them. The social benefits include training and communication activities that improve the culture around water for university students, which is a benefit that surpasses the walls of the university. Lastly, although the water costs on the main campus are written off for UNAM, it does have to pay for electricity. The decreased water extraction has resulted in lower electricity costs for UNAM.

Another lesson learned is that the success of a university environmental program, especially concerning water, requires the work of a multi-disciplinary team in close coordination with the authorities of the university. It requires ongoing training and communication with maintenance personnel and the university community in general. Communication is important both within the university as well as outside of the university because it provides visibility.

Although the subject of water is apparently a priority for society, in reality, budgetary allotments are insecure. Therefore, it is absolutely essential that we learn to pursue our goals despite personnel and financial limitations.

A program of this kind must be permanent. Water use and management includes a multitude of variables that require constant attention, as is the case with detecting and fixing leaks and monitoring water quality.

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#### Contact:

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Learning with head, heart, and hands: students experimenting in a hands-on workshop. © Karola Braun-Wanke

## 4.3 Education

### 4.3.1 Freie Universität Berlin: The Education for Sustainable Development (ESD) Format – Schools@University for Sustainability + Climate Protection

Karola Braun-Wanke

#### University Profile:

**Name of the university:** Freie Universität Berlin

**Country:** Germany

**Number of students:** 36,537

**Number of academic staff / professors:** 2,845

**Number of administrative staff:** 2,415

**Amount of floor space:** 575,500 m<sup>2</sup>

**Person / department in charge of the project:** FFU, Karola Braun-Wanke

## 1. Case Study

This case study introduces the concept of the ESD format “Schools@University for Sustainability + Climate Protection” that was developed by the Environmental Policy Research Center (FFU) of Freie Universität Berlin in 2005.

Learning and teaching for a sustainable future is the slogan of Schools@University. The educational format is based on the principles of Education for Sustainable Development (ESD) and the Agenda 2030, in terms of content and methodology, and works effectively on the practical realization of these goals. The aim of the format is to disseminate the ESD culture of teaching and learning, to initiate transformation processes in schools and universities, and to promote cooperation between schools, universities and extracurricular learning venues in Berlin. Twice a year, FFU opens the FU Berlin campus to make the abstract topic of sustainability and climate protection tangible and accessible for children in 5<sup>th</sup> and 6<sup>th</sup> grade and their teachers. With Schools@University, FFU expanded its outreach activities because research in 2005 showed that despite the political importance of climate change, schools have given little attention to the whole issue. With this format, FFU builds bridges between the University, other Berlin schools, and the community. The idea behind launching the project was and is to close the existing knowledge and competence deficits regarding the key topics of sustainable development in primary schools. Schools@University is a highly evaluated and experienced model that can be replicated and adapted by other universities.

## 2. Our Story

Every spring and autumn, during the semester breaks, FFU opens the campus of the FUB to Berlin schools. The key topics of sustainable development (17 SDGs) are on the agenda for one week. At six different learning venues on campus, the FFU offers around 90–100 hands-on workshops a year that take place both indoors and outdoors. The FFU transforms different locations such as academic lecture halls, seminar rooms, the weather station and weather garden, dining halls, eco garden as well as the botanical garden into hands-on laboratories for children and teachers.

All the workshops of Schools@University enable holistic and age-appropriate learning. In the workshops, the children can explore what lies behind the abstract concepts of sustainability and climate protection. Through various formats, students benefit from the hands-on learning experience, explore the facilities at the university, and live out their creativity by developing their own ideas.

The topics and contents are conveyed by different scientists, link different professional perspectives, and communicate comprehensibly the ecological, economic, social, and cultural dimensions of sustainable development.

The following methods in combination with topics of sustainable development have proven particularly successful:

- Scientific experiments in the field of renewable energies
- Tours through the weather garden, in the dining halls, to the solar plants on the roofs, or through the botanical garden (e.g. on topics like weather, climate, renewable energies, nutrition, agriculture)

To achieve the highest possible sustainability and ensure long-term learning effects, Schools@University is focusing both on young students and on teachers and multipliers.



- Art, creative and theater workshops (e.g. on energy and resource conservation, consumption)
- The future and writing workshops / Design Thinking and Creative Writing (e.g. on the topics of the future of cities, energy system transformation, the “good” life, resource conservation)
- Planning and role plays (e.g. on the topic of climate and biodiversity)

In order to achieve the highest possible sustainability and ensure long-term learning effects, Schools@University is focusing both on young students and on teachers and multipliers. Schools@University is based on two modules:

#### **Module 1: Action-oriented and interactive one-week program for 5<sup>th</sup> and 6<sup>th</sup> graders**

The one-week program in spring and autumn has an open program structure. Teachers can select individual events for their school classes, depending on the subject they are interested in and the available time. The workshops are designed for one class and last between two and four hours. The workshops deal with social, economic, ecological, and cultural aspects of sustainable development. The aim of the interactive workshops is to make students aware of the themes of sustainable development in connection with their lifestyle and consumption habits – for example with regard to clothing, nutrition, travel, and hobbies – and to develop alternative real-life solutions for everyday (school) life.

#### **Module 2: Action-based teacher training to inspire teachers for the new ESD teaching and learning culture and to support its implementation in schools**

In order to encourage and to inspire teachers to implement topics and cross-disciplinary methods in their lesson plans, FFU offers accompanying training for teachers. In half-day learning stations, participants are introduced to innovative ESD methods and extracurricular learning venues. Experienced ESD educators introduce innovative cross-curricular project and teaching units and materials. In addition, innovative practical examples from school and science practice will be presented by teachers to teachers.

### **4. Success Factors and Challenges**

Ensuring the quality of content and methods through monitoring and training:

At FFU, we want to guarantee a permanently high quality of our outreach offer. This is the only way to encourage teachers to repeatedly participate in and implement their own projects and teaching units in their schools. Regular monitoring and trainer instruction contribute to a consistently high quality.

#### **Quality through monitoring:**

To ensure the didactic quality of the workshop program, each workshop will be evaluated by the participating teachers and three students through a questionnaire. The results serve to improve the teaching content and methods in order to adapt them optimally to the target groups. The results also serve to improve organizational processes.



Climate Meals: Students discover how climate and food are connected by exploring the university canteen.

© Karola Braun-Wanke

### Quality through ESD trainings:

In order to optimize the didactic quality of the workshop, the FFU offers ESD training for the workshop trainers once a year. The aim is to promote the exchange of experiences among the trainers and to improve the quality of the teaching methods.

### Key challenges and success factors in creating a learning place for ESD for Berlin schools at the university:

Schools@University's realization depended and still depends on continuity, reliable financial support, a regional ESD network, supporters, and the commitment of individual scientists. At the same time, these are the relevant success factors. The main challenges for the FFU was to establish an organizational, logistical and didactic framework for the format and to make the format known throughout Berlin.

### Challenges and success factors for the organizational and didactic implementation of the ESD approach:

- Conceptualization and continuous optimization of an organizational framework, project management, and monitoring
- Generating acceptance of the format in the university's management board, research, teaching, school, and the state of Berlin
- Establishment of suitable authentic learning venues on campus
- Ensuring of an annual procurement of funding and co-financing



Not only students are learning during the Schools@University weeks – the program also provides interactive teacher trainings, helping educators take insights and experiences back to their classroom. © Karola Braun-Wanke

- Ensuring the quality of content and methods through monitoring and training.
- Development and maintenance of an educational network between university and civil society for the realization of a transdisciplinary approach
- Establishment of “teachers train the teachers”-formats and peer-to-peer formats with Berlin schools
- International and national recognition (ISCN, UNESCO) as a role model for ESD

### 5. Lessons Learned

Co-design und Collaboration are key. The quality and quantity of the content as well as the variety of topics and methods depend heavily on the transdisciplinary team of trainers. Since 2009, the FFU has built up an ESD education and partner network, which now consists of 100 stakeholders from academia and civil society.

Since 2009, FFU cooperates within Schools@University at various levels with:

- Various departments and institutes of Freie Universität Berlin
- The Senate Department for Education, Youth, and Family
- The Senate Department for the Environment, Transport, and Climate Protection
- Three Berlin companies
- 100 different stakeholders from culture, arts, science, economy, politics
- 5 Berlin schools to realize peer-to-peer formats



## 6. The Change

Every year, 3,000–3,200 students from around 50 Berlin schools take part in the program. 140–160 teachers regularly visit the accompanying advanced training courses.

From 2009 to the end of 2018, the FFU offered 19 one-week student programs and 19 advanced training courses for teachers. 28,051 students and 2,455 teachers took part in the programs with a total of 1,178 practical workshops. 1,181 teachers attended the training courses.

The high occupancy rates and the positive evaluation results prove that FFU has created a recognized and reliable learning and meeting place, “Teaching & Learning for a Sustainable World,” for Berlin schools. The monitoring also proves that the format promotes the transfer of knowledge and skills on the core issues of sustainable development and supports the integration of sustainability, leadership, and participation in schools.

### A Schools@University Best Practice Workshop.

#### Workshop example I:

Water is life – homemade stop-motion movies.

Peer-to-peer film and media workshop, duration 4 hours

Addressing SDGs 3, 6, 10, and 14



Water is life! This statement appears self-evident in our everyday life. When we are cooking or thirsty, we turn on the tap, and clean drinking water comes out. We consume

110 liters of water every day. For cleaning, cooking, showering, rinsing, or bathing. But that's not all. Water is mainly used for the production of consumer goods such as meat, fruit, or clothing. In Germany, the drinking water supply is considered secure, and in Berlin tap water is even of very good quality. On the other hand, water is a very scarce and therefore valuable commodity in other regions of the world. The already visible consequences of climate change, such as increasing numbers of droughts or melting glaciers, will have an impact on drinking water reserves and will change water conditions worldwide.

In this workshop, we go on a water journey and follow the sentence “water is life”. How can we deal with water in an environmentally conscious way in our everyday lives and put this into practice in a small video? We want to tackle this task in the workshop. As a film crew, we create little stories about water and create film sets out of cardboard, paper, or plasticine. These serve as a stage for our stop-motion films. From the cutting of individual photos, we create short animated videos with small “water messages,” which sensitize us, our friends, and families to a sustainable use of water.

A special feature of the workshop is that 10<sup>th</sup>-grade students lead the workshop together with a filmmaker and teacher. In this workshop, the topic of the resource water is combined with media competence. 10<sup>th</sup> graders from a secondary school will lead the workshop within the framework of the Schools@University. In this format, both the teaching students and the learning students acquire design skills, methods, social competence, team skills, and lecture skills.

**Workshop example II:**

Making bioenergy yourself. Experimental workshop, duration 1.5 hours

Addressing SDGs 7 and 13



Our food waste is collected in the brown organic waste bin because it is far too good to be thrown away along with household waste. Old lettuce, potato peels, hard bread, and shriveled apples can actually be used to generate climate-friendly electricity, heat, and fuel! How you can generate energy from these organic waste materials or plant seeds can be learned in experiments carried out independently. Together, we will advise you on how biogas can be used to light up lamps and what explosive power there is in biowaste. But we also slip into the roles of farmers and fuel producers and discuss what should be grown on our fields in the future: plants for food or plants for biofuels?

Trainer: Dr. Karin Drong, Oekowerk Berlin in cooperation with the Berliner Stadtreinigung (BSR, Berlin Municipal Cleaning Service)

**Workshop example III: Off the water.**

We explore the cycle of water. Research laboratory, duration 4 hours

Addressing SDGs 6 and 12



Drink, wash, cook, shower, clean: Our everyday life would be inconceivable without the resource (drinking) water. But where does the water actually disappear to after use? How and by whom is it purified or even renewed? In our research laboratory, we take a closer

look at global water resources using a functional model and talk about the natural cycle of water. In addition, we discuss what we actually use water for on a daily basis and follow the path of the wastewater to the sewage treatment plant. We produce wastewater ourselves and experiment in small teams on how we can best purify wastewater and compare our results with the purification methods in a real sewage treatment plant. We also consider how we can protect the resource (waste) water at home.

Trainer: Marcel Jahre, Project Heureka & Berliner Wasserbetriebe (BWB) and Dörte Albers, Berliner Wasserbetriebe (BWB)

**Further Information:**

Learning & Teaching for a Sustainable Future

[www.fu-berlin.de/en/sites/schueleruni/\\_inhaltselemente-rd/poster\\_schueleruni\\_en.pdf](http://www.fu-berlin.de/en/sites/schueleruni/_inhaltselemente-rd/poster_schueleruni_en.pdf)

Schools@University for Sustainability + Climate Protection (2019)

[www.fu-berlin.de/en/sites/schueleruni](http://www.fu-berlin.de/en/sites/schueleruni)

[www.fu-berlin.de/sites/schueleruni/ueber\\_uns/team/braun-wanke](http://www.fu-berlin.de/sites/schueleruni/ueber_uns/team/braun-wanke)

SchülerUni FU Berlin (2017) ([www.youtube.com/watch?v=FTxLk934cpo](https://www.youtube.com/watch?v=FTxLk934cpo))

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Magnes Road, Campus Givat Ram, The Hebrew University of Jerusalem. © Giora Drachler

### 4.3.2 The Hebrew University of Jerusalem: Fostering Cutting-Edge Environmental Research through Interdisciplinary PhD Workshops

Eran Feitelson / Liora Haver / Amit Tubi

#### **University Profile:**

**Name of university:** The Hebrew University of Jerusalem

**Country:** Israel

**Number of students:** 23,000

**Number of academic staff / professors:** 1,000

**Number of administrative staff:** 2,100

**Amount of floor space:** 650,000 m<sup>2</sup>

**Person / department in charge of sustainability management:** Prof. Nadav Katz – Head of the Green Campus Committee



## 1. Case Study

Both the lecturers and students involved represent different faculties as well as educational backgrounds and focus on a variety of research topics. While the lecturers represent the Advanced School for Environmental Studies and the Faculty of Agriculture, the students involved study Social Sciences, Natural Sciences, Agriculture, Public Health, Humanities, and Law. Involving perspectives and state-of-the-art research methods from different disciplines gives talented researchers of tomorrow a broad view on their area of academic interest and boosts environmental research at different faculties.

## 2. Our Story

As graduate studies lead to specialization, the broad view of the field often gets lost. Yet, once they graduate, PhD students will need to work in multi-disciplinary teams and settings. Hence, the Environmental Research PhD Workshop seeks to bring together PhD students from all disciplines and engage them with cutting-edge research issues in order to broaden their view on other aspects of the environment and what kind of research is being done outside their research field. While in Master-level programs there are joint courses for research students, there are no organized PhD programs, as doctoral studies at the Hebrew University are highly personalized. This workshop is meant to address this lacuna – essentially providing an opportunity for all PhD students studying environmental issues to engage with other PhD students studying the environment.

The workshop is organized by the Advanced School for Environmental Studies established in 2012. The purpose of the School is to train advanced graduate students to work in multi-disciplinary teams and to foster multi-disciplinary research. To this end, students registered in all environmental study programs at the Hebrew University jointly take several common core courses while maintaining their disciplinary training. Hence, students are double-registered at the school and in the disciplinary programs within faculties. Thus, the school seeks to connect students from different environmental programs providing them with a common core that allows them to understand the perspectives of disciplines other than their own and to maintain a broad view of the field while specializing in their discipline. Students from different faculties participate: Social Sciences, Natural Sciences, Agriculture, Medicine (Public Health), Humanities, and Law. The professoriate is interdisciplinary, too. Apart from Prof. Eran Feitelson, Professor at the Faculty of Social Sciences working at the Advanced School for Environmental Studies, another lecturer from the Faculty of Agriculture is involved. During the first workshops this was Prof. Yizthak Hadar, for the past two years it was Dr. Yael Mandelick.

The course has three elements:

- Joint reading of an article – groups are comprised of students from different faculties and research fields (about 3–4 students per group). Each group discusses an article they read before their assigned workshop began. Then they present the article and their critique of it to all other participants.
- In the first two days, there is a morning lecture by a leading scholar, exemplifying how broad cutting-edge issues are addressed by such scholars.

- Each student presents the rationale for his/her research – keeping in mind that the audience is mainly not from the same field. The student, thus, has to explain and convince the others that their research is meaningful, thereby forcing them to step back from their day-to-day work and place their research in a broader context.

The course is made available to all university research students with the assistance of the Authority for Research Students at the University. The course is mandatory for all PhD students who are enrolled in the school. It takes place at an ecological farm just outside Jerusalem, which is a secluded place that students can reach by transportation organized and provided by the school. In this manner, they are fully committed to the workshop for three consecutive days, 8 hours each day. During this period, the students also make contact among themselves, which is one of the intended side effects of the workshop.

### 3. The Change – Key Activities and Milestones

Students meet peers from other disciplines and engage in discussions with a wide range of perspectives, thereby providing them with a broader understanding of the scope of environmental studies and research, as well as with cutting-edge current research in the field. In the past years, students have been working on a diverse set of topics, for instance:

- Effects of the individual, group-related interactions and the environment on movements of damselfish in the coral reef.
- Biotransformation of 2,4-dinitrotoluene by *Escherichia coli* and its implications for the detection of trace explosives.
- The early-pregnancy exposure of women and their offspring to environmental contaminants.
- The fragmentation of energy policy: unconventional fossil fuels and Green Building.
- How do Eastern Mediterranean heavy precipitation events vary with changes in the climate?
- Perceptions of sustainability in education programs in Israel.
- Development of new active materials based on natural and expendable polymers for use in agriculture and food.

Discussing research topics in an interdisciplinary environment consequently widens students' perspectives on the nature of environmental research and issues. In addition, they receive feedback regarding their own research from researchers from other disciplines but at similar stages. These often challenge some of the basic assumptions they bring into the workshop. This leads to a broader and deeper thinking and to interdisciplinary research. The students welcome this workshop. The feedback we received from students in all four years the workshop was conducted was extremely positive. They stated that the workshop expanded their horizons and challenged them. They particularly welcomed the feedback they received on their presentations. Some of the most important learning effects occurred during the joint analysis of the journal articles. This exercise forces the students to think as an interdisciplinary team, thereby bringing to the fore some of the main difficulties encountered by such teams. These include the different 'languages' and terms used by the students to approach similar problems, highlighting the different emphasis placed by different disciplines on how to deal

with academic material (e.g. trying to understand the details vs. gaining an understanding of the broader picture), as well as the different views on the importance of environmental challenges and their implications for social and ecological systems.

The organized workshop brings students from different faculties and programs together in a structured manner and exposes the research students to other fields that research environmental issues. They have to convey to peers, who are not from their discipline, what it is that they research and why it is important. In addition, they have to work in a team with researchers from other disciplines - it shows them what happens outside the university, when dealing with environmental issues in “real life.”

PhD students are eager to meet researchers from other disciplines and discuss their research with researchers in other fields. Students from the natural sciences find it especially interesting and fruitful to engage with students from the social sciences, law, and humanities. Such interactions are otherwise virtually non-existent in their graduate studies.

The workshop is conducted each year. We have every intention of continuing this workshop. As it is conducted in English we may open it up to students from other universities.

Creating spaces for inter-disciplinary engagement, particularly between the experimental sciences and social sciences and humanities is of particular importance for all involved. Such spaces of engagement have to be friendly and inviting. The fact that our workshop is in a beautiful setting outside the city is very conducive to this.

Such workshops are crucial for counter-balancing the effects of specialization in advanced studies. Ultimately, all the specialists graduating from advanced programs will need to engage with other disciplines. Hence, it is critical to prepare them for such engagements.

#### 4. Success Factors and Challenges

The Hebrew University of Jerusalem operates on different campuses throughout the city. Therefore, students of different faculties cannot easily interact, since they are often located on different campuses geographically. Thus, bringing them together requires finding a time and place and organizing the logistics. We also found it useful to locate the workshop off-campus so that the students will not come and go during the day, but will stay for the whole duration of the workshop.

The workshop addresses the need of PhD students to receive good feedback and to interact with professors and other PhD students. As one participant puts it, “Some students (mainly in the social sciences) spend much of their PhD alone in a room, while students in the natural sciences spend it in research groups that more often than not deal with highly specific topics. The workshop is an opportunity to break this cycle.” However, in order to create a lasting impact, such meetings would need to happen every couple of months to have a more pronounced effect. This presents considerable problems regarding the availability of staff and students as well as the course credit system currently in use. Different modes of interaction, organized by different faculty members, are currently under review to address this question.

##### Contact:

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West Gate of Peking University. © 維基小霸王

### 4.3.3 Peking University: Pu-erh Tea as a Key to Sustainable Regional Development

Xue Ling

#### University Profile:

**Name of the university:** Peking University

**Country:** China

**Number of students:** 42,655

**Number of academic staff / professors:** 7,317

**Amount of floor space:** 2,743,532 m<sup>2</sup>

### 1. Case Study

Professor Ling Xue and his students from Peking University spent several months in the Yunnan province in order to develop a sustainable regional development strategy built around the production of Pu-erh tea, which is a valuable good for the region. The project reveals how innovative teaching methods can help equip the next generation with sustainable development knowledge and skills while also helping to address urgent local challenges. At the same time, the project demonstrates how creative ideas generated by university students can contribute to the integration of fresh ideas into regional development concepts.

### 2. Our Story

The field research project at Peking University reveals how sustainability teaching can help equip the next generation with sustainable development knowledge and skills while also helping to address urgent local challenges.

In the context of ecological challenges in the 21<sup>st</sup> century, regional sustainable development remains paramount. This is especially true for the fastest growing economies. In China, Ling Xue, Professor of Regional Development and Social Computing at the School of Government at Peking University, has been working on sustainable regional development issues for many

years. One of his projects is the Pu-erh tea initiative that was implemented in Yunnan. Yunnan is a province of the People's Republic of China, situated in a mountainous area in the southwest of the country. It shares borders with Burma, Laos, and Vietnam. The province has several different tea growing regions and is internationally well-known for its Pu-erh tea. Pu-erh tea is currently transported by the Tea Horse Road, which is a network of caravan paths winding through the mountains, but the growing markets and high travel costs call for alternative transportation methods. Recent growth in Pu-erh tea demand and tourism are altering the region and require ecologically friendly solutions. For these reasons, Peking University became interested in investigating sustainable strategies for the region and chose Yunnan province as a case study for a field-work student project based on sustainability teaching. The project was conducted by Peking University as a Social Investigation Summer Program, supervised by Prof. Ling Xue who is an expert in urban and regional economics, and specializes in regional industrial development planning and spatial layout, regional policy, and project evaluation.

### 3. The Change – Key Activities and Milestones

In the course of this long-term project, Prof. Ling Xue spent several months in Yunnan province with a group of students from Peking University. The project was aimed at generating ideas for a change towards a more sustainable regional economy based around the Pu-erh tea industry. The Rural Revitalization and Ecological Civilization strategy recently launched by the Chinese government constituted an important strategic alignment for the project. Another defining concept that shaped the program was the Sustainable Development Goals formulated by the UN which Prof. Ling Xue integrated in his teaching concept. Last but not least, the local requirements as well as economic, ecological and social prerequisites in the Yunnan province had to be taken into consideration. At the end of the day, the concepts and measures developed by the students were meant to support local government strategies in the area of sustainable regional development.





Peking University students during their field trip in the Yunnan province. © Peking University



Pu-erh tea. © Pixabay

During their field-trip activities, the students came to the conclusion that the existing economic patterns were not sustainable. Through their field research, they were able to identify potentials that could be used to both foster the region's economic growth and significantly improve its sustainability.

In the course of the research and field-trip activities, the following concepts were developed by the students:

1. The region should build a new Tea Horse Road to reshape the economic geography of the region. The new road would allow goods, people, money, information, and technology to move more easily in and out of Yunnan. The road could, in the future, be converted into a self-driving road.
2. Currently, the region's economy is too focused on tea. Therefore, it should be diversified in order to broaden the economic base for creating greater economic stability. One way to do this would be through organizing events and developing marketing strategies in order to make the region more attractive for eco-tourists.
3. The region should adopt total quality management strategies for tea to ensure quality. Strategies from the wine industry could be used as best-practice examples.

The experiential and interactive learning approach provided students with the opportunity to work on a current and concrete sustainable development task. At the same time, due to the numerous factors that needed to be taken into consideration, the project was a challenging undertaking. While developing concrete measures and concepts, students needed to balance economic, social, and environmental concerns. However, in the end, the project team was rewarded for its commitment. The students had the opportunity to present their research findings and ideas to local government officials. After the project had ended, some students continued to work on further developing and concretizing their ideas.



#### 4. Lessons Learned

For many years, China has been undergoing an unprecedented process of economic growth and urbanization. According to Prof. Ling, China is currently witnessing a gradual change from 'speed' to 'quality' in terms of regional development. For this reason, the support for sustainability initiatives at the regional level is growing among authorities and educational institutions. Peking University has initiated and patronized the Pu-erh tea project. Also, there was a chance for the students to cooperate with the local authorities in Yunnan province. This support has significantly contributed to the scope of the project during the planning phase and its eventual impact.

In practical terms, two aspects of the project were especially valuable for the students. On the one hand, during this long-term project, students have acquired sustainable development knowledge and skills. On the other hand, the practical character of the project allowed them to develop their own ideas based on their own understanding of sustainable regional development and the skills they learned in the course of the project. The Pu-erh tea project reveals how sustainability teaching can help equip the next generation with sustainable development knowledge and skills while also helping to address urgent local challenges. In the course of the project, students conceptualized strategies for sustainable development in the sense of the Sustainable Development Goal 11 (sustainable cities and communities) and presented them to the local government officials. Prof. Ling Xue's initiative itself constitutes a great example of quality education, which is another one of the 17 SDGs defined by the UN.

In many ways, the Pu-erh tea project constitutes a best-practice example in terms of sustainability. First, the sustainability teaching involved a practice-oriented learning concept, encouraging the students to develop their own ideas based on the skills and knowledge acquired before. Second, the project goal itself was a change towards more sustainable development in a regional context, involving both the academic considerations from Peking University and the local authorities who possess knowledge about the specifics in the field. Third, one of the core project outcomes was the concept of the diversification of the local economy bridging the sustainable tea industry and logistics with eco-tourism.

**Contact:**

Prof. Xue Ling, School of Government: [paulsnow@pku.edu.cn](mailto:paulsnow@pku.edu.cn)



UBC student explores the concepts of “refuge”, “home” and “identity” by combining species-specific bird houses with narratives from UBC students who came to Canada as political refugees. © UBC SEEDS Sustainability Program

#### 4.3.4 University of British Columbia: SEEDS (Social, Ecological, Economic, Development Studies) Sustainability Program

Liska Richer / Lynn Warburton

##### University Profile

**Name of university:** University of British Columbia

**Country:** Canada

**Number of students:** 56,331

**Number of academic staff / professors:** 6,057

**Number of administrative staff:** 10,834

**Amount of floor space:** 178,000 m<sup>2</sup>

**Person / department in charge of sustainability management:** Campus + Community Planning (mandate for operational sustainability)

## Case Study

The SEEDS Sustainability Program provides a valuable interface between academic work, university operations, and the students, faculty, staff, and residents who experience the campus every day. SEEDS students participate in experiential learning; faculty participants are provided with opportunities to offer applied learning to their students by integrating SEEDS projects into the curriculum; and operational staff can use the outcomes of SEEDS applied research projects to inform policies and initiatives that help the university advance its operational sustainability objectives.

SEEDS brings together multidisciplinary teams to do research in a real-world setting while integrating sustainability into the curriculum.

## Our Story

“I was able to build a structure prototype that drew a lot of interest. My project exposed me to possibilities and obstacles that I hadn’t previously considered.”

*Student working on a SEEDS Project*

The University of British Columbia’s ambitious sustainability goals are reflected in its 20-Year Sustainability Strategy, its Strategic Plan, and many of its action plans. To address the challenges in supporting these goals, UBC is using its vast Campus as a Living Laboratory (CLL). This is a societal testbed where studies lead

to outcomes with transformative impacts. By combining academic and applied research, we address challenges that UBC and communities face.

Several factors have catalyzed UBC’s approach to date, including serving as an early signatory of the Halifax and Talloires Declarations<sup>1</sup>, a commitment that UBC (among many visionary universities) pledged to make sustainability a foundation for teaching, research, and campus operations. Rather than simply teach sustainability, UBC committed to be an early adopter of sustainability policies and practices including Sustainable Development Policy #5<sup>2</sup>, Sustainability Academic Strategy<sup>3</sup>, and the most recent adoption of a 20-Year Sustainability Strategy<sup>4</sup>, and UBC’s Strategic Plan<sup>5</sup>.

Through applied research and partnerships, the SEEDS Sustainability Program advances sustainability ideas, policies, and practices and creates societal impacts by using the Campus as a Living Laboratory. Projects support the integration of academic and operational work on sustainability, contributing to UBC’s academic mission in teaching, learning and research, and advancing sustainability goals.

SEEDS Program Goals are defined as follows:

- Achieve university and department goals in social, ecological, and economic sustainability by helping staff identify more sustainable methods of doing university business or enabling exploration of broader policy issues
- Support operational staff in developing strategies that will achieve the university’s environmental and social sustainability goals in 15 thematic areas: climate, energy, water, waste, land, food, transportation, community, finance, buildings, materials, biodiversity, procurement, health, and wellbeing

“SEEDS provides us with the ability to leverage the research capabilities of UBC students and faculty to dive deeper into strategic questions of institutional interest than we otherwise would be able to given limited staff resources.”

*UBC Staff*



- Integrate operational and academic efforts in sustainability through projects and partnerships
- Build capacity for strategic partnerships to advance sustainability initiatives across the campus community
- Enrich the student learning experience through applied research in sustainability
- Provide faculties with an applied sustainability curriculum and pedagogy for classroom-based learning

### The Change – Key Activities and Milestones

The SEEDS Program was initiated in 2000, as a response to UBC’s Sustainability Policy #5, which called for a “Greening the Campus” initiative. SEEDS was Western Canada’s first academic operational program to integrate students’ energy and enthusiasm for sustainability with faculty members’ research experience, and staff members’ commitment and expertise to advance sustainability on campus.

SEEDS is embedded into Campus and Community Planning to support the university’s operational sustainability strategies, plans, and commitments while providing learning opportunities for students on research and sustainability practices, which they can apply throughout their careers. At the same time, UBC and external communities benefit from research that informs policies and practices. Faculty are supported to integrate applied research and sustainability into their curriculum and provide students with impactful learning experiences. Projects are designed with a framework that has consistent elements including research phases and outcome measurements, yet is flexible enough for participants to respond to situational factors. This approach enables continuity in measurable, scalable, and transferrable results. Basic project framework phases include Ideation, Scoping, Launch and Execution, Monitoring and Control, Project Closing, and Follow-up. The framework consists of Project Pathways classified along four broad typologies in: Curricular (Senior Undergraduate, Graduate), Volunteer (Competitions, Data Collection), Paid (specialized skills, off-academic cycle), and Cross-faculty/interdisciplinary. Accredited projects are integrated either as part of a class, a whole class, individual project, or as cross-faculty interdisciplinary projects. When completed, the faculty members evaluate SEEDS projects.

All projects must meet the following four criteria:

- 1) Advance UBC operational sustainability plans, policies, or objectives,
- 2) Action-orientated (ability to affect decision making/produce tangible outcomes),
- 3) Involve both academics (students and faculty) and practitioners (staff/community partners), and
- 4) Grounded in Community-Based Action Research.

“SEEDS is an excellent resource for connecting with various clients across the UBC campus. The projects are highly engaging for our students because of the social dimension as well as the impact that the projects can have on the student’s environment.”

*UBC Faculty*

“Aside from all the fantastic outcomes of the projects, it’s the opportunity to engage meaningfully with students and help manage the process with SEEDS staff that has really increased my job satisfaction and given me a greater sense of contribution.”

*UBC Staff*



A UBC PhD student designed this window application as part of a competition to prevent bird-building collisions and bring attention to bird biodiversity on campus through the SEEDS Sustainability Program.

© Angelique Crowther

SEEDS is budget-funded and tangibly advances operational sustainability, while contributing to the teaching, learning and research of the university. A project manager assigned to each project ensures they stay on track; the project team is well supported to share knowledge; and enhances access to resources and opportunities. Project management also helps teams navigate complex institutional challenges and meet research objectives.

The research projects (wherever possible) align with and help inform and implement planning frameworks and policies such as the Climate Action Plan; the Green Building Action Plan; Water Action Plan; Transportation Plan; Wellbeing Strategy; Zero Waste Action Plan; urban forest and biodiversity planning; and future Biodiversity Strategy, among many others.

The results frequently abound in unexpected findings that contribute to the university's sustainability knowledge, expertise, and memory. Students submit a research report with recommendations, and deliver a presentation to the operational staff and community partner clients. In other cases, students develop and design a community or art installation, technology or application, build a prototype or product, or create a conceptual design.

The program is comprised of three staff members, administrative and seasonal student support. Key responsibilities to support the program development and implementation include Partnership Development, Strategic Planning, Project Management, Program Development, Administration, Communication & Engagement, and Evaluation.

SEEDS employs a variety of approaches and methods to enable collaborative, applied learning. The program builds upon the pedagogical foundations of: Participatory Action Research, Community-Based Action Research, Community Service-Learning, Experiential Education, Case Study, and Best Practices in all stages of the process (i.e. planning, establishing, managing, evaluating).

Students, faculty, staff and external stakeholders enter into projects as partners facilitated by a project manager. They gain access to diverse perspectives on a common applied research topic that helps address an operational sustainability challenge or objective. Together, they are able to leverage their academic resources and connect to a wide SEEDS network that opens opportunities to partnerships and leads to progressive applied research results.

SEEDS has created partnerships between 8,500 students, faculty, staff, and external community partners to enable over 1,000 innovative and impactful sustainability projects at UBC. Projects can be found on the SEEDS website<sup>6</sup>.

Since the program was initiated in 2000, SEEDS has been known for:

- Being an early and continuous influencer in contributing to a culture of sustainability at UBC
- Having a high project implementation rate/ability to affect decision making
- Its institutional knowledge and intellectual resources in a broad range of sustainability and policy issues
- Its resourcefulness and capacity to deliver a high output
- Its proven track record in enhancing student educational experience and career capital
- Its aptitude to foster impactful interdisciplinary collaborations
- The SEEDS Sustainability Library serves as a comprehensive campus repository of sustainability knowledge and research and is a valuable resource
- International recognition as exemplary model of Campus as Living Laboratory and global replication

To date, over 8,500 participants have collaborated in 1,500 applied research reports to advance UBC's sustainability priorities, with over 1,000 sustainability projects that have informed sustainability practices and 23 policies and plans. Projects have been integrated into approximately 250 different courses, within 12 faculties and schools. In the last reporting year, more than 100 projects were integrated into 47 courses with approximately 1,000 participants, generating 196 research reports.

SEEDS provides valuable and practical opportunities for students, staff, and faculty to collaborate on the integration of sustainability on campus and support these strategic priorities. SEEDS is Western Canada's first academic operational program to promote the Campus as Living Laboratory (CLL) and is internationally recognized as an exemplary CLL program in UBC's Sustainability Academic Strategy. Impactful partnerships were built in which community-based action research influences sustainability policies and plans such as Climate Action Plan, UBC's Green Building Action Plan, Zero Waste Action Plan, Water Action Plan, Transportation Plan, Wellbeing Plan, and the emerging urban biodiversity plans and policies.



### 1. **Demonstrative and Scalable Pilots:**

The UBC Campus is part of an important migratory pathway for many bird species. Pilots such as building artwork to prevent bird collisions were so successful in reducing bird deaths that UBC has officially included the toolkit into its Green Building Action Plan. This plan will also be shared with external communities beyond campus.

### 2. **Transforming our Public Realm with Teaching, Learning & Research Opportunities:**

A Biodiversity Inventory project series is mapping the campus' trees as a means to baseline their value to the community. Students working with professional landscape planners and designers are taking the classroom outside make the most of natural assets that enhance learning experiences and quality of life. Their findings will inform decisions on UBC's landscape development and planning.

### 3. **Trialing New Models of Interdisciplinary Collaborations:**

One of SEEDS' key achievements has been the development of the Campus Biodiversity Initiative Research and Demonstration (CBIRD), the first of its kind in Canada, a campus-wide initiative bringing together a panel of UBC practitioners and community partners to support the development of biodiversity strategies and actions. The group includes representatives from over 17 faculties and operational units.

### **Forging Impactful Partnerships**

An Inclusion in Athletics + Recreation project addressed the wellness of players in group sports who are typically marginalized or unlikely to participate. The project was a collaboration between Athletics + Recreation and the Education, Equity and Inclusion Office's Student Diversity Initiative. It integrates sustainability and applied research into teaching, learning, and research.

The SEEDS Program demonstrates continued success – 100% of faculty rated their overall experience as “excellent” or “good;” 96% of faculty either agreed or strongly agreed that SEEDS prepares students for professional work environments; 81% of staff indicated that SEEDS supports efforts to increase sustainability in unit operations; and 78% of staff agreed that SEEDS provides valuable information/data that would assist them in their area of operations.

Impacts of SEEDS are vast and varied. Projects enable UBC to deliver on its commitment to address societal challenges with an innovative, collaborative approach and leverage the Campus as a Living Laboratory. Additionally, UBC's ambitious sustainability priorities, policies, and plans are developed and implemented. Students gain valuable professional skills and experience in research, communication, and project management, and emerge as leaders who accelerate positive change. Sustainability knowledge and skills are gained, and their work has tangible impact.

The capacity of faculty to integrate applied sustainability research into the curriculum and teaching of pedagogical models is enhanced. Opportunities to create interdisciplinary collaborations with other faculties, practitioners both within campus operations and across the broader university community are realized. Mechanisms are embedded in the curriculum to offer students practical and impactful sustainability learning and applied research experience. SEEDS continues to be innovative through the breadth and depth of projects and the



The Pollinator Homes project saw a team of students from the UBC School of Architecture and Landscape Architecture design pollinator homes for a wide variety of pollinators, including bees, butterflies, bats, and hummingbirds. The homes were created using natural and sustainable materials and will be showcased at UBC and at the “Pollinator Pop-Up Park” in Vancouver Fairview. © UBC SEEDS Sustainability Program

collaborations bringing diverse participants together. The project management support is recognized as a key feature for academics because it ensures continuity and high-quality reports. But perhaps the most innovative aspect of SEEDS is its role in turning applied research into action ranging across 15 thematic areas, including climate, energy, water, waste, land, food, transportation, community, finance, buildings, materials, biodiversity, procurement, health, and wellbeing to align with UBC’s policies and plans. SEEDS’ legacy is a community of alumni whose experiences and collaboration often advance sustainability throughout their careers.

### Success Factors and Challenges

Making research findings widely accessible is a fundamental tool to build resiliency and produce impacts. The SEEDS Sustainability Library contains a wealth of knowledge with over 1,500 reports and is a key asset providing research across a series of studies in multiple subjects. This richness of information is available to anyone and supports SEEDS in being accessible, collaborative, and impactful.

Collaborations between skillsets and, where possible, across disciplines, enrich outcomes immeasurably. Participants identify issues beyond their areas of specialization or work and

gain a broader perspective to address the increasing complexity of sustainability challenges. Embedding projects in the communities which they affect is paramount to co-developing solutions that are meaningful and impactful.

The Campus as a Living Laboratory is a significant asset distinguishing the SEEDS Program and has subsequently been replicated across several universities in North America and Europe. Few universities have similar programs, and SEEDS is certainly the largest and most comprehensive. Integrating ambitious societal goals into the curriculum resonates with all stakeholders as we build a community of change makers.

SEEDS was an early initiator of Campus as Living Laboratory emerging nearly two decades ago. With our experience of almost 20 years, we would do a few things differently now. If provided with the opportunity to create a CLL program in 2020, we would begin with the following fundamental changes:

- Align each project with existing and emerging campus sustainability plans, policies, and strategies. Alignment can foster greater institutional buy-in, enhance efficiency, and increase the potential impact of the research.
- Frame campus sustainability challenges as societal challenges. Thinking more broadly and systematically can create collaborations and foster new perspectives to realize greater impact and efficiencies in developing solutions to shared sustainability challenges experienced on campus and in the wider regions the campus is embedded in.
- When developing projects, establish them as part of well-developed research clusters. Rather than creating a series of individual projects, create each project as part of a family to work strategically together to achieve greater impact.
- Start by working with the hands that are ‘open.’ Find a few champions and work with them so you can demonstrate a successful project and relationship. This will make it easier to “prove” your program’s worth to others.

We have three suggestions for people in other organizations who are planning to facilitate a similar project:

- Frame challenges as opportunities. Sustainability challenges equal excellent research opportunities with multiple co-benefits. Design each project to enhance capacity by enabling staff to tap into campus research and have students develop implementable recommendations.
- Leverage the academic resources of the university to achieve mutually beneficial interests and outcomes. Establishing a Campus as Living Laboratory (CLL) program has benefits not only from a strictly ecological sustainability lens, but also contributes to place stewardship and community building, as well as advancing the university’s teaching, learning, and research mandate. By integrating the physical and planning operations of the university into the campus curriculum as key subject matters to explore and address sustainability challenges, the university is transformed into a place of applied learning and teaching, contributing to preparing students to be our leaders of tomorrow.
- Sustainability is not an end-point; rather, it’s an ever-evolving and complex process.



A few temporal initiatives will likely prove inadequate to move the sustainability dial and keep it moving forward. A series of projects as well as a program to steward them and ensure the research is strategically aligned with the campus' sustainability priorities and strategic goals and vision are needed.

The development and evolution of SEEDS is inspired and influenced by many experiences and lessons. To highlight a few, SEEDS' central guiding methodology is informed by Ernest T. Stringer's Community-Based Action Research, applying principles to ensure research involves all stakeholders affected by the issue under investigation, serves as a catalyst to assist participants in the issues that affect them, and produces something useful *with* others that can be practically applied to address actually experienced issues.

Other instrumental influencers include lessons from David Orr's influential work – "What is Education For?" (1991), in which he calls for a transition in higher education towards utilizing the campus as a type of living laboratory, where notions of success are measured against sustainability standards and graduates emerge well-versed in "planetary citizenship."

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<sup>1</sup> <http://ulsf.org/wp-content/uploads/2015/06/TD.pdf>.

<sup>2</sup> <https://www.universitycounsel.ubc.ca/files/2010/08/policy5.pdf>.

<sup>3</sup> [https://sustain.ubc.ca/sites/sustain.ubc.ca/files/uploads/CampusSustainability/CS\\_PDFs/PlansReports/Plans/UBCSustainabilityAcademicStrategy.pdf](https://sustain.ubc.ca/sites/sustain.ubc.ca/files/uploads/CampusSustainability/CS_PDFs/PlansReports/Plans/UBCSustainabilityAcademicStrategy.pdf).

<sup>4</sup> [https://sustain.ubc.ca/sites/sustain.ubc.ca/files/uploads/CampusSustainability/CS\\_PDFs/PlansReports/Plans/20-Year-Sustainability-Strategy-UBC.pdf](https://sustain.ubc.ca/sites/sustain.ubc.ca/files/uploads/CampusSustainability/CS_PDFs/PlansReports/Plans/20-Year-Sustainability-Strategy-UBC.pdf).

<sup>5</sup> <https://president.ubc.ca/strategic-initiatives/creating-our-strategic-plan/>.

<sup>6</sup> <https://sustain.ubc.ca/seeds-sustainability-program>.



PUCP Botanical Garden: Desert ecosystem. © Ana Sabogal

#### 4.3.5 Pontificia Universidad Católica del Perú: Mainstreaming Environmental Education in Teaching, Management, Research and Outreach

Ana Sabogal Dunin Borkowski / José Luis Zuloaga Obregón / María Alejandra Cuentas Romero

##### University Profile

**Name of the university:** Pontificia Universidad Católica del Perú

**Country:** Peru

**Number of students:** 27,682

**Number of academic staff / professors:** 3,009

**Number of administrative staff:** 2,954

**Amount of floor space:** 413,902 m<sup>2</sup>

**Person / department in charge of sustainability management:** Comisión Ambiental ('Environmental Commission')

## 1. Case Study

Pontificia Universidad Católica del Perú (PUCP) is one of the few Peruvian universities institutionally committed to ecological sustainability. This commitment includes the mainstreaming of environmental content in almost all undergraduate and several postgraduate programs. Moreover, in order to raise environmental awareness and promote sustainability initiatives, a specific institutional framework has been set up. Together with students, professors, and administrative staff, the special agencies realize projects, help establish environmental education as part of the agenda of the academic community, and promote sustainability initiatives off-campus. In the following profile, we describe our strategy of mainstreaming environmental content in our programs, describe the environmental institutionality at PUCP, and present some of the projects.

## 2. Our Story

In Peru, the National Environmental Education Plan (PLANEA), as issued by the Ministry for Education (Ministerio de Educación) in cooperation with the Environmental Ministry (Ministerio del Ambiente), stipulates that environmental content should be included in the course offers of national education facilities in order to raise environmental awareness and ultimately facilitate eco-friendly behavior. Although this is a national guideline, the Pontificia Universidad Católica del Perú (PUCP) is currently one of the few Peruvian universities committed to this plan at an institutional level. In fact, PUCP started to mainstream environmental

In order to institutionalize its ecological commitment, PUCP has established a specified institutional framework which consists of the 'Comisión Ambiental' (Environmental Commission), Dirección Académica de Responsabilidad Social (DARS), Clima de Cambios (Climate of Change), and Dirección de Asuntos Financieros (DAF, Direction for financial issues). These agencies have become important stakeholders in the university's sustainability strategy by getting the subject onto the agenda, supporting initiatives, and organizing activities on campus.

content and to raise ecological awareness independently, as part of its self-conception as a humanist and interdisciplinary institution of higher education, based in strong ethical principles and committed to thorough research in support of our planet and its people. In this vein, PUCP launched a mandatory basic course on ecology for all undergraduate students in 2000. Gradually, more and more obligatory courses with environmental content were added to the curriculum. Today, almost all of the undergraduate programs include environmental education and thereby contribute to raising environmental awareness among our students. In 2005, PUCP expanded this strategy to the postgraduate level by establishing a series of interdisciplinary Master's programs, which include environmental subjects.

Moreover, in order to institutionalize its ecological commitment, PUCP has established a specified institutional framework which consists of the 'Comisión Ambiental' (Environmental Commission), Dirección Académica de Responsabilidad Social (DARS), Clima de Cambios (Climate of Change), and Dirección de Asuntos Financieros (DAF, Direction for financial issues). These agencies have become important stakeholders in the university's sustainability strategy by getting the subject onto the agenda, supporting initiatives, and organizing activities on campus.



PUCP compost preparation, project realized by “Clima de Cambios” and DARS. © Ana Sabogal



### 3. The Change – Key Activities and Milestones

The mainstreaming of environmental education as a core subject across disciplines was pushed by the academic coordinators of the Studium Generale of Humanities (EEGLL, Estudios Generales Letras). It first offered a bio-gardening class, which was very well received by the students. Afterwards, it stipulated that all students of EEGLL must take at least one natural science class (e.g. in physics, chemistry, or biology) and gradually broadened the curriculum to include courses on ecology and experimental sciences. In 2019, a course on Geography and Environment was established as a mandatory course for students in the basic education program.

Pushed by this trailblazer, more and more programs joined the initiative and expanded or modified their offered courses with environmental content, each adapting the environmental subjects to their own discipline and field of study. For example, the Faculty of Education started to offer courses on the didactics of environmental education. The Geography and Environment program, which was founded in 1987 as a ‘section of geography,’ increasingly included environmental content in its courses, for instance on climate change, vegetation ecology, biogeography, or environmental management. In 2005, the program changed its name to Geography and Environment. Currently, it is the program with the greatest emphasis on environmental subjects at PUCP, which provides students with valuable methodological tools to adequately assess and manage territory, prevent, monitor, and mitigate environmental contamination, and to produce a critical environmental consciousness.

Other examples include the program of architecture offered by the Faculty of Architecture and Urbanism, which started including courses on urban sustainability and offering workshops on issues like savings in materials, the use of eco-friendly materials, recycling, reuse, and other sustainable practices for designing mock-ups and structures. Basic sciences always relate to the environment and are therefore very suitable for introducing sustainability-related subjects. For instance, in chemistry, courses on ecosystem degradation

or environmental and contamination problems were added. Archeology includes topics such as Environmental Archeology, Submarine Archeology, Paleo-archeology, and others, which all have environmental relevance. Only recently, in 2018, the Faculty of Science and Engineering started the Environmental Engineering study program. Likewise, responding to students' and corporate demands, the Geography and Environment program is creating two specializations: Territory Management and Environmental Management.

Starting in 2005, PUCP expanded this strategy of offering courses with environmental content to the postgraduate level. Four Master's programs were established which involve professors specialized in environmental subjects: the Master's program of 'Environmental Development' (Maestría en Desarrollo Ambiental), the Master's program in water resources (Maestría de Recursos Hídrico), the Master's in Amazonian Studies (Maestría en Altos Estudios Amazónicos), and the Master's in Bio-commerce (Maestría en Biocomercio).

In order to institutionalize its environmental focus, the presidency of PUCP established a specialized institutional framework which includes the 'Comisión Ambiental' (Environmental Commission), Dirección Académica de Responsabilidad Social (Social Responsibility Academic Direction), Clima de Cambios (Climate of Change), and Dirección de Asuntos Financieros (DAF, Direction for financial issues). Since 2013, this institutionality is based in a general policy: Driven by the desire to contribute to the mitigation of climate change, PUCP adopted the 'Institutional Policy of Environmental Management' (Política Institucional de Gestión Ambiental) in which it commits itself to promoting environmental sustainability by reducing, recycling, and reusing the five most important environmental components: energy, plants, air, water, and soil.

The Comisión Ambiental, created in 2009, acts as the head of this framework. It is appointed by the president and unites representatives from students, teaching staff, and administrative staff. The Commission is in charge of supervising environmental affairs at PUCP and of issuing recommendations regarding the environmental performance of PUCP. These recommendations can be executed by Dirección Académica de Responsabilidad Social (DARS) or Clima de Cambios (Climate of Change). The third component of the environmental framework at PUCP constitutes the Dirección de Asuntos Financieros (DAF) which provides funding for 'green initiatives' via its environmental section.

The DARS was already established in 2007 as an office that links and develops social projects promoted by professors, students, and the church (PUCP is a Catholic university run by jesuits). While it only focused on socio-economic projects in its early years, in 2010, it explicitly adopted an environmental focus in line with the mission statement of the university of acting responsibly towards the environment and people. DARS has its own budget, and its staff comprises around 20 people. The office is headed by a general director.

Within the campus, DARS supports campaigns promoting responsible water use, recycling, or non-violent communication<sup>1</sup>. Off-campus, the office works with organizations and communities and realizes projects that foster eco-friendly, socially responsible development in Peru. For instance, DARS supports the development of the town of La Garita, a migrant settlement located at the outskirts of Lima. Assisted by professors and students from the Faculty of Urban Planning and Architecture, a territorial planning tool was developed which takes into account the properties and specific requirements of the settlement. Recently, together with staff from the Geography and Environment program, DARS has initiated a similar project with the community of Atiquipa, located in southern Peru, where it

helps to promote eco-tourism. Moreover, in the frame of the organization Red Peruana de Universidades (Network of Peruvian Universities), created in 2002, which integrates 21 Peruvian universities all over the country, PUCP has developed a Cartography project, which is conducted together with the National University San Cristóbal de Huamanga (UNSCH). Professors and students of the Geography and Environment Section of PUCP teach professors and students of the UNSCH in this interdisciplinary project with a special focus on ecotourism.

‘Clima de Cambios’ was created in 2008 with the special task of promoting and disseminating environmental initiatives, especially those related to climate change. For instance, encouraged by the Environmental Commission, it built a Botanical garden and implemented the Ecoruta (Eco-route) project. The garden consists of Peruvian and foreign flora and is divided into areas which correspond to the main ecosystems of the country: an area of the dry North Peruvian forest, an area of tropical forest, and an area of Andean forest, as well as spaces with non-domestic flora introduced to Latin America from all over the world. In total, the university has approximately 14 hectares of green space with 3,250 trees and 400 different species on it. There is also a zookeeper situated in the Amazonian forest caring for 7 whitetail deer, 3 alpaca, and more than 14 turtles. The ‘Ecoruta’ was set up as a didactical tool for environmental education. It constitutes a walking route through the botanical garden, open to the academic community and guests who can learn about the flora and fauna in the country as well as about the importance of biodiversity and its conservation<sup>2</sup>.

In 2011, PUCP created an institute focused on the promotion of environmental research: The Institute for Natural Sciences, Territory and Renewable Energy (INTE). INTE defines itself as an institution for research and the identification and promotion of issues regarding ecological sustainability, including renewable energy, territorial development, and biodiversity. It aims to bring together researchers from different disciplines and groups concerned with environmental issues and provides a forum for an interdisciplinary dialogue. Moreover, as part of its outreach strategy, it offers specific extracurricular classes and workshops on environmental topics, which are open to the general public.

#### 4. Stakeholders and People

One of the main goals of modern universities should be to inspire an environmental consciousness in their students, professors, and staff. PUCP pursues this objective by mainstreaming environmental content in all of its undergraduate courses and by promoting sustainability initiatives on campus. Our stakeholders encompass the whole academic community including the students, the professors, and the administrative staff. Moreover, we also consider the neighborhood surrounding our campus as well as the whole population as important stakeholders.

The agencies which have been especially created to promote environmental education and projects (environmental Commission, DARS and DAF) have also become important stakeholders in the environmental strategy of PUCP. With their specialized knowledge, they contribute to keeping the subject on the agenda, supporting initiatives, and organizing activities on campus. It is also important to stress that the sustainability management and promotion at PUCP is participatory: Students, professors, and staff can articulate their ideas and bring in their proposals for initiatives and projects. If evaluated positively, the specialized offices support them with funds and expertise to realize their projects.



## 5. Lessons Learned

In Peru, PUCP stands out as a pioneer regarding the inclusion of environmental subjects in teaching, research, and campus management as well as with respect to outreach activities promoting more sustainable livelihoods for poor communities. Our engagement for sustainability allows us to draw the following conclusions:

First, for our sustainability strategy to succeed, the pioneering engagement of certain individuals and institutions was of utmost importance. In particular, the Studium Generale of Humanities, which started to implement environmental content in its courses, and the DARS, which shifted from a social to a socio-environmental focus in 2010, contributed significantly to the promotion and expansion of our sustainability strategy.

Second, the sustainability strategy as implemented by PUCP greatly benefited from the enormous support by the authorities who assigned funds and created the special agencies in charge of promoting sustainability at PUCP and beyond. Most importantly, the rectorate adopted general policies in order to guide both institutional and individual behavior.

Third, the specialized institutionality comprising different agencies with different foci has guaranteed that the environmental focus persists and can expand. It is important to mention that these agencies have their own budgets and staff which allow them to implement and monitor projects.

Fourth, the many sustainability initiatives carried out at PUCP or supported by the DARS in other communities throughout the country, greatly benefit from a participatory approach: Professors, students, and administrative staff can propose projects and are invited to help with their implementation. In fact, many ideas originally came from younger students. This participatory approach not only raises awareness of the issues addressed but also builds an esprit de corps, social cohesion, and a sense of ownership regarding the initiatives that are being implemented.

### Further Information

Clima de cambios [www.pucp.edu.pe/climadecambios](http://www.pucp.edu.pe/climadecambios)

Clima de cambios: Flora y fauna de la PUCP

[www.pucp.edu.pe/climadecambios/la-pucp-frente-al-cambio-climatico/registro-de-flora-y-fauna-de-la-pucp](http://www.pucp.edu.pe/climadecambios/la-pucp-frente-al-cambio-climatico/registro-de-flora-y-fauna-de-la-pucp)

Dirección Académica de Responsabilidad Social (DARS)

<https://dars.pucp.edu.pe/que-hacemos/desarrollo-organizacional/medio-ambiente>

Estudios Generales Letras: Misión y visión

<http://facultad.pucp.edu.pe/generales-letras/sobre-eeggll/mision-y-vision>

Estudios Generales Letras: Plan de estudios

<http://facultad.pucp.edu.pe/generales-letras/informacion-para-estudiantes/plan-de-estudios>

Ministerio del Ambiente: Plan Nacional de Educación Ambiental 2017-2022 [www.minedu.gob.pe/planea](http://www.minedu.gob.pe/planea)

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<sup>1</sup> <https://dars.pucp.edu.pe/que-hacemos/desarrollo-organizacional/medio-ambiente>

<sup>2</sup> [www.pucp.edu.pe/climadecambios/la-pucp-frente-al-cambio-climatico/registro-de-flora-y-fauna-de-la-pucp](http://www.pucp.edu.pe/climadecambios/la-pucp-frente-al-cambio-climatico/registro-de-flora-y-fauna-de-la-pucp)



ofo bicycles on the Peking University campus. © UAS team

## 4.4 Transfer & Outreach

### 4.4.1 Peking University: ofo. Born in Peking University. Affecting the World

Chen Wei

#### University Profile

**Name of the university:** Peking University

**Country:** China

**Number of students:** 42,655

**Number of academic staff / professors:** 7,317

**Amount of floor space:** 2,743,532 m<sup>2</sup>

### 1. Case Study

The ofo bicycle sharing company was founded in 2015 by five students from Peking University, one of China's leading universities. A few years later, ofo is operating in 250 cities. The company is contributing significantly to the solution of transportation and emission problems across China and internationally. In just the few years of its existence, the ofo company has gone through a development from a university project to a billion-dollar startup and has an impact on the attitudes towards the concept of a sharing economy, bicycles as a means of transportation, and the low-carbon lifestyle in China.

### 2. Our Story

Peking University looks back at an impressive history of 120 years. The courage and conviction of the self-imposed aspiration 'Dare to be the best in the world' always had an impact on the university's spirit. Following this vision, the ofo company was founded by five Peking University students in 2015 and rapidly became a successful international bicycle sharing enterprise. Moreover, ofo was the first company to introduce a dockless shared bicycle system, so that users do not have to look for a docking station to return the bike anymore. Dai Wei, CEO and Co-founder of ofo, said that in the seven years at Peking University, he and his classmates and teachers talked a lot about personal ideals, social status, national destiny, and the responsibility of Chinese youth for national development. Based on this, ofo has chosen to start its business in the transportation field with its strong connection to the public interest.

The university campus can act as a testbed for green and social student entrepreneurs. The ofo bicycle sharing company started out on the premises of Peking University and has now shaped the idea of bike sharing in cities worldwide.

### 3. The Change – Key Activities and Milestones

In June 2015, when the first ofo shared bicycle with the license plate number 8808 was introduced on the campus of Peking University, many people were still unfamiliar with the concept of the sharing economy. Few people thought that a bike sharing project created by Peking University students and born on the campus of Peking University would go on to profoundly influence the travels and everyday life of people in China and even around the world. By now, the ofo company is operating in 250 cities in and outside of China; it deployed over 10 million bicycles in 2017.

Within just a few months, shared bicycles have impressively helped to tackle the big problem of the last mile in city transportation, which is a major issue in China. Bike sharing is contributing to the "slow traffic system" that brings people from transportation hubs to their work or place of study in a fast, eco-friendly, and convenient way. This development is not particularly new, since China used to be a bicycle kingdom in the past with more than 500 million bikes in the country in 1986. With the rise of private cars and higher levels of wealth, bicycles were increasingly replaced by cars. Ofo has, however, contributed to the revival of the bicycle culture in China. "The original way of using a bike is not that convenient. [But] if there is a bike that people can access anywhere in the city at a very low cost and can return conveniently, then people must love it," says Zhang Yanqi, Co-Founder and COO of the ofo company. The dockless sharing mode pioneered by ofo has made it easy to use, and it has quickly gained recognition from its users.





The Peking University has a large-scale campus and many students use rental bikes to commute between the buildings. © UAS Team

According to studies, shared bicycles play an active role in energy conservation and emission reduction across China. According to the Community Economic Social Impact Report of 2017, bicycle sharing in China has reduced energy and fuel consumption. In 2017, the sharing of bicycles saved 1.41 million tons of gasoline, equivalent to 1% of the national gasoline production in 2017, and the energy conservation savings amounted to 12.4 billion yuan (about 1.7 billion USD). On the other hand, shared bicycles in 2017 reduced CO<sub>2</sub> emissions by 4.22 million tons, reduced PM<sub>2.5</sub> emissions by 3.22 million tons, and saved air pollution control costs of 1.6 billion yuan (about 227 million USD), equivalent to 10% of the central government's air pollution control costs.

In addition to the environmental impact of shared bicycles, there is a long-term learning effect for society. The environmentally friendly lifestyle following the principle 'Lucid waters and lush mountains are invaluable assets' is becoming more popular among young people. Shared bicycles are a solution to transportation and environmental problems in major cities, and everybody can contribute.

#### 4. Lessons Learned

The development of ofo tells an impressive story about how a student project can become a successful billion-dollar enterprise. By November 2016, the bike boom had not yet expanded beyond the Peking University campus. However, 8 months later, ofo was the largest bike sharing company in the world. So, why is bike sharing becoming so popular among people all over the world, and why is this market as competitive as it is?

The ofo concept benefited from both societal developments in China and technological progress. First, the bicycles were able to provide the solution to the ‘last mile’ problem existing in many Chinese cities. Second, ofo revived the Chinese bicycle culture by adapting it to modern needs – nowadays, some Chinese people do not need to own a bike anymore but they would gladly share one. Third, the dockless system provided more flexibility to users. And last but not least, the eco-friendly bike sharing model fits with a growing awareness of environmental issues in China, especially among young people, and is helping to combat air pollution.

It is still unclear how the bike sharing market will develop in China and worldwide. After a massive growth, the whole bike-sharing industry has weakened. Ofo company has been experiencing problems lately, especially regarding cash flow, just like other companies in the bike sharing market. However, the ofo company has already contributed to a renaissance of bicycle culture in China. The practice of bike sharing in China has raised awareness of environmental issues in general and challenged the necessity of cars, especially as a short-distance means of transportation in major cities. Due to air pollution and traffic jams, people are realizing that cars cannot solve all transportation problems and are increasingly considering bicycles as an eco-friendly, cheap, and convenient alternative.

In the few years of its existence, the ofo company has gone through an enormous development from a university project to a billion-dollar startup, far surpassing a student enterprise. Ofo’s pioneering role within the Chinese bike sharing market has influenced the way young people in major Chinese cities deal with mobility issues.

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For many students, the clean-up days are a meaningful way to spend their free time and meet like-minded people. ©Sabina Nadschafowa, SPbU Press Service

## 4.4.2 Saint Petersburg State University: SPbU Hortus – Renovation through Volunteering

Natalia Popova

### University Profile

**Name of university:** Saint Petersburg State University

**Country:** Russia

**Number of students:** 30,000

**Number of academic staff / professors:** 6,000

**Number of administrative staff:** 6,000

**Person / department in charge of sustainability management:** Vice-Rector for the Material and Technical Support, Environmental Department



## 1. Case Study

The Botanical Garden at Saint Petersburg State University is rich in tradition and protected by the state as a monument of history and culture. In the past years, however, it has fallen into disrepair due to a lack of funding and proper care. The volunteer project 'Friends of the Botanical Garden' has been one instrument to help take care of the garden. With up to 100 students participating in traditional community clean-up days, the volunteer project is significantly helping the Botanical Garden to regain its old glory and become a place for practice-oriented learning suited for discovering nature.

## 2. Our Story

The Botanical Garden at Saint Petersburg State University was founded in the 1830s. It was originally created for students specializing in Botany. In 1866, the garden was modernized through the initiative of Andrei Nikolaevich Beketov, an outstanding botanist and founder of the geography of vegetation in Russia. The Botanical Garden became home to an enormous variety of plants, including those brought from expeditions. In 1935, the Botanical Garden at the University, then known as Leningrad State University, was assigned to the monuments of history, culture, and art and given state protection. In the greenhouses of the Botanical Garden, which cover an area of 1,300 m<sup>3</sup>, there are 2,200 species and varieties of tropical and subtropical plants. Collections and expositions of plants in greenhouses are made according to botanical-geographical and systematic principles.

Reviving a tradition like the volunteer activities during a “subbotnik” helped restore the Botanical Garden of SPbU. Furthermore, it gives the university staff a chance to interact with students beyond the classroom as well as the opportunity to involve the community living and working close to the university.

Today, the Botanical Garden of the University has five exhibition and four collection greenhouses, which accommodate five specialized collections:

- Conifers
- Cactuses
- Succulents
- Wetland plants
- Rare and protected plants of the local flora

But, unfortunately, nowadays the garden is experiencing some difficulties. For decades, due to the lack of proper attention and funding, the garden area was neglected and overgrown with weeds and shrubs. Large and small greenhouses were gradually destroyed, and the collections of rare thermophilic plants began to suffer and degrade. Due to an initiative of the Endowment Fund of the Saint Petersburg State University as well as the volunteer program launched in 2012, the Botanical Garden is regaining its old glory and becoming a place for practice-oriented learning suited for discovering nature. Volunteer activities play a key role in the development of the Botanical Garden, due to a growing number of committed students, staff, and residents who are taking part in the initiative.

### 3. The Change – Key Activities and Milestones

The reconstruction of the Botanical Garden started as a volunteer student project in 2012, when Oksana Kuznetsova, a member of the Student Council of the Faculty of Biology at Saint Petersburg State University, proposed to hold volunteer sessions on Saturdays – so-called ‘subbotniks’ – at the Botanical garden. Nowadays, the volunteer program ‘Friends of the Botanical Garden’ plays a significant role in the process of restoring the historical appearance of the garden and reconstructing the obsolete greenhouses. The program is aimed at involving students and staff in the life of the Botanical Garden and introducing the idea of green spaces within an urban community to them.

Subbotniks are held in spring and autumn in order to prepare the plants for the summer and winter season, respectively. On those Saturdays, students clean up the deadwood, weed flower beds, cut shrubs, lay the collected grass and leaves in the compost, and do other necessary work under the guidance of the Botanical Garden staff. Only a few people came to the first clean-up events, but the number of caring students and university employees has increased steadily. Up to 100 people now participate in the traditional clean-up gatherings. Students and employees of the university as well as residents attend these ‘days with plants’ and participate in the development of the Botanical Garden. Usually, the ‘subbotniks’ at the Botanical Garden are not perceived only as a duty, but also as an opportunity to get in touch with other enthusiasts sharing the same interests, to acquire new knowledge about plant care, to receive plant seedlings as a token of gratitude, and to listen to lectures about open ground plants and greenhouses. ‘In the past few years, we have had many volunteers who are supporting us and observe that the interest in the Botanical Garden and plants is increasing among students and university employees. It is fulfilling work, which allows the participants to interact, relax, and do a good deed at the same time,’ says Oksana Rodina, PhD candidate and one of the organizers of the clean-up activities. In spring 2018, about 50 new volunteers signed up for clean-up activities.

*Subbotniks (from Russian ‘subbota’ – Saturday) are unpaid community clean-up activities, which were common during Soviet times. They mostly – but not exclusively – took place on weekends in the beginning of spring and therefore became associated with spring cleaning. In contemporary Russia, the tradition of subbotniks is being revived by young people. Typically, subbotniks aim at environmental activities like cleaning the streets of garbage, collecting recyclable material, or other community services.*

One reason for the growing success of the community clean-up days is communication. In order to make the volunteering program at the Botanical Garden more popular, Ms. Kuznetsova maintains a ‘Subbotniks in the Botanical Garden’ page on the social network VKontakte\*. In this group, she publishes news about upcoming events, reports on past gatherings, and informs about happenings that are closely associated with the Botanical Garden and its activities.

Community clean-up days are, however, not the only way for volunteers to participate in the life of the Botanical Garden. For those who want to get acquainted with the work of the Botanical Garden of Saint Petersburg State University, there is an active subprogram ‘Free Volunteers’. Through this program, everyone can get in touch with the management of the Botanical Garden and work independently both in the open fields and in greenhouses. The volunteers can choose the fields of activity themselves, which include not only weeding

and transplanting plants: there is a wide range of activities related to the Botanical Garden. One can help, for instance, by photographing garden objects, cataloging, proposing graphic design ideas for the garden, and much more.

In addition to the volunteering activities, the Botanical Garden has an important educational function. The educational activities are constantly expanding. As before, the garden resources are actively used by specialists in the field of botany. Additionally, the garden is also a place for training sessions for students of other areas, for example graphic design, making it a place for interdisciplinary learning.

#### 4. Lessons Learned

The success of the volunteer project in the Botanical Garden is determined by several factors. First of all, the volunteering activities make it possible to access the Botanical Garden free of charge. Moreover, the work at the Botanical Garden offers the opportunity to become actively involved in the neighborhood. Especially the subbotnik events are a familiar form of community service in Russia, since many used to participate in similar activities during their schooldays. For the inhabitants of a major city like Saint Petersburg, it is also a good opportunity to do some gardening work and get closer to nature without having to leave the city center. As for the students, the volunteer work offers an opportunity to receive a certificate, which is taken into account when applying for an increased scholarship. Additionally, the programs are an important outreach project, connecting researchers, students, and citizen volunteers, opening up the university to interested residents. Last but not least, volunteer projects at the Botanical Garden are a meaningful way to spend one's free-time and meet like-minded people.

Recently, the volunteer work has gone hand in hand with the initiative from the Endowment Fund of the Saint Petersburg State University that supports pre-design work in order to reconstruct the garden. In the near future, the Botanical Garden will be reconstructed and the greenhouses will be renovated. Also, the volunteering projects will be further developed – both the subbotnik events and the 'free volunteers' program. In particular, there is a plan to pass the responsibility for certain areas in the garden over to volunteers who will take care of them on a regular basis.

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\* <https://vk.com/subbotnikbioss17>





The use of clean energies, such as solar energy, would allow us to avoid affecting the populations and biodiversity of the rural areas of the Peruvian Amazon. © Gustavo Malca Salas

### 4.4.3 Universidad Nacional de la Amazonía Peruana: Using Solar Energy to Reduce CO<sub>2</sub> Emissions

Gustavo Malca Salas / José Manuel Perdiz Dávila / Rodil Tello Espinoza / Herman Guimet

#### **University Profile:**

**Name of the university:** Universidad Nacional de la Amazonía Peruana – UNAP

**Country:** Peru

**Number of students:** 8,000

**Number of academic staff / professors:** 535

**Number of administrative staff:** 600

**Amount of surface area:** 18 hectares for 14 academic faculties, 30 professional training schools, and a post-graduate school.

**Person / department in charge of sustainability management:** M.Sc. Gustavo Malca Salas, Coordinator of the Laboratorio de Unidad Especializada en Investigación Ambiental (Specialized Laboratory Unit for Environmental Research) and Dr. Heiter Valderrama Freyre of the University Environmental Commission (CAU in Spanish).

## 1. Case Study

The Universidad Nacional de la Amazonía Peruana (National University of the Peruvian Amazon) has included environmental sustainability as one of its core missions in research, teaching, and management. One of its components is the promotion of the use of “clean” solar energy, which would help to reduce greenhouse gas emissions and air pollution. In order to back up its strategy for clean energy with sound empirical evidence, the university conducted a research project on the potential of solar radiation in the region. The project also integrated a social dimension since solar energy could also be used to serve the local communities in Loreto (where the university is located), not connected to the regular infrastructure of fuel-based energy. It thus combined aspects of environmental and social responsibility.

## 2. Our Story

In order to mitigate environmental problems, a multi-disciplinary approach must be taken which enables the identification of alternatives that can contribute to greater sustainability (Bursztyn & Drummond 2014). Universities today are increasingly incorporating such approaches and training professionals able to handle the challenges of sustainable development. UNAP follows this path. As part of our social and environmental responsibility, UNAP is currently implementing action plans toward fulfilling the objectives set out by the United Nations Agenda 2030. One of our core goals is the use of clean energy. In order to ground this initiative in solid empirical evidence, a research project was conducted in Iquitos, Loreto from 2015 to 2016. Its goal was to evaluate solar radiation and its capacity for photovoltaic energy production, which could be used to produce clean electricity and prevent greenhouse gas emissions (GHG).

This research is important because specific knowledge about solar radiation is needed to establish the ranges necessary for taking advantage of photovoltaic energy and turning it into electricity through the use of solar panels. Compared to conventional fuel-based energy supplies, solar energy is clean and free of GHG. Our research project aimed to identify the optimal conditions for taking advantage of solar energy for our university. Moreover, complying with our social responsibility, we also explored the possibility of providing solar energy to the nearby local communities not served by the local electricity company.

## 3. The Change – Key Activities and Milestones

Based in the New University Law of Peru ratified in 2014, UNAP has modified its mission statement assuring that it will “provide humanistic, scientific, and technological training to university students using an intercultural focus with respect to the Amazonian biodiversity and re-assuring its social responsibility framed in terms of sustainable development” (UNAP 2016). Consequently, the university has created a series of administrative, academic, and research tools based in principles of ecological sustainability. Moreover, UNAP has established the University

In terms of its social and environmental responsibility, UNAP is currently implementing action plans to fulfill the objectives set out by the United Nations Agenda 2030. Therefore, a research project was conducted in Iquitos, Loreto from 2015-2016 with the general goal of evaluating solar radiation and its impact on the capacity for photovoltaic energy production which would be able to produce clean electricity and prevent greenhouse gas emissions (GHG).



Defining the importance of solar radiation and photovoltaic energy generation as an alternative source of energy to thermal power plants in the department of Loreto. Meeting with UNAP researchers and students.

© Gustavo Malca Salas

Environmental Committee (Comité Ambiental Universitario, CAU, see Cárdenas 2013) that elaborated an Environmental Management Plan (Plan de Manejo Ambiental, UNAP 2016). This plan has set the following goals:

- Assessing the environmental situation of the university including the potential and limitations of its campus and formulating an environmental policy in line with these characteristics
- Implementing mitigation and prevention activities regarding environmental problems
- Incorporating and complying with current legislative and regulatory requirements
- Promoting the efficient use of water, electricity, materials, and other resources used by the university
- Ensuring proper waste management
- Carrying out awareness raising and training activities for the university's academic and administrative staff and its students that promote a change in attitude and culture, the internalization and implementation of the environmental plan, and best environmental practices
- Designing future scenarios of coordinated and sustainable use for renewable natural resources

Furthermore, the plan stipulates that actions such as the construction of ecological campuses, the optimization of energy and water consumption, the reduction of the ecological footprint



and carbon emissions, as well as the promotion of public transportation, recycling, and revegetation of the area with native species should be implemented. Likewise, the commitment should include a social dimension with actions like volunteering, assistance to vulnerable populations, having a healthier campus, etc.

Regarding the provision of “clean” electricity, we identified an enormous challenge: UNAP is served by “Electro Oriente S.A.” (ELOR) which is the only supplier of electricity in Iquitos. It generates electricity in traditional power plants using oil and waste. As a consequence, it constitutes an enormous source of greenhouse gas emissions, thus contributing to air pollution in the region. In addition, the plants are partly outdated (with some being up to 30 years old), which further increases their environmental impact (CONSULTORA ANDINA 2009; MINPETEL 2006).

Compared to diesel generators, the use of photovoltaic energy for electricity production has the following advantages (Bajano et al. 1998; Arroyo 2008):

- Energy generation free of noise, odor, or pollution
- Solar energy is a renewable resource
- Economic independence with regard to the global oil market
- Low maintenance costs
- Photovoltaic energy is more reliable, with low or no periods of inactivity
- No pollution caused by leakages or failures
- Amortization after about 20 years (depending on a number of conditions), if high-quality components are used

Given these advantages and with the aim of providing sound empirical evidence for a possible sustainability initiative, UNAP conducted a research project between July 2015 and June 2017 to evaluate the values of solar radiation parameters and their potential capacity for photovoltaic production.

#### 4. Stakeholders & People

In recent years, UNAP has incorporated content on sustainability into all professional study programs. This activity addresses the students as well as the local population and follows the aim of instilling an “environmental mindset.”

The professors at UNAP are also important stakeholders. They are encouraged to design and conduct multi-disciplinary research projects and to earmark financial resources, giving priority to research lines that emphasize environmental aspects. Moreover, they support undergraduate and graduate students to develop thesis projects, which revolve around questions regarding ecological sustainability.

#### 5. Design, strategies and results

In the study carried out to assess the capacity for photovoltaic energy production, we used a quantitative approach with an explanatory scope. This study utilized the following methods: observation, documentary analysis, and group discussion.

The data on solar radiation was provided by the Vantage Pro2 Plus DAVIS Weather Station Console located in the Environment Research Laboratory (L.I.M.A.) of the UNAP Natural

Resources Research Center (CIRNA-UNAP) which counts on an automated register. Between February 2016 and June 2017, two modules gathered data simultaneously at the DAVIS meteorological station in order to determine the electricity generation capacity of photovoltaic energy (in terms of power or amperage).

In order to determine the level of GHG emissions which could be avoided by using solar power, we collected data from the power-plant in the town of Tamshiyacu that belongs to the electricity provider in Loreto, Electro Oriente S.A.. The information on fuel consumption of the plant was collected for a period of two years from July 2015 until June 2017.

By analyzing the data from DAVIS we found an oscillating behavior with greater values in September of 2015 and April and May 2016 during the first evaluation period (one year). Higher values were recorded for the second period during March, April, and May 2017. We identified an almost linear behavior for the radiation parameters. For the first period, a tendency of linear decrease was detected; however, during the second period, we observed their tendency to remain linear in time, i.e. the radiation cycles showed repetitive patterns. We calculated that daily solar radiation is on average 3.59 Kwh/m<sup>2</sup> for the first assessment period and 3.50 Kwh/m<sup>2</sup> for the second year. We deduced that a similar behavior over the following periods can be expected which would facilitate taking advantage of solar radiation as an alternative source of energy.

With regard to the capacity for the production of photovoltaic energy, the data show an oscillating behavior between 11.40 volts and 14.00 volts, with higher values in April, June, August, and November 2016, and in March and April 2017. Electricity generation depends on solar radiation that can be captured during the hours of solar exposure, the capacity of the solar module used, as well as the continuous electricity storage capacity (battery banks). In any case, we determined that the amount would be high enough to serve rural areas so far not connected to the electricity infrastructure.

Taking the fuel consumption of the Tamshiyacu Power Plant as a baseline, the study calculated the generation of greenhouse gas using the methodology set out by the Intergovernmental Panel on Climate Change (Gómez et al. 2006). We also took into account the special properties (regarding conversion and combustion factors) of the biodiesel utilized at the Tamshiyacu Power Plant (INFOCARBONO 2012). We found that using solar energy would help to prevent GHG emissions at values around 1,000 t of CO<sub>2</sub>-e. The analysis of fuel consumption and the estimation of the emissions of the power plant Tamshiyacu provides us with data to prove that solar energy would indeed help to reduce a fair amount of GHG emissions. Considering that the production of continuous electrical energy is inherent to the installed solar module, and taking into account the tendency to maintain an almost constant energy supply in the hours of solar exposure, solar energy constitutes an alternative to the conventional energy supply.



Environmental Research Laboratory (LIMA) of the Natural Resources Research Center (CIRNA) of the National University of the Peruvian Amazon, where the project was developed. © Gustavo Malca Salas

## 6. Success Factors and Challenges

Our conclusions, recommendations, and lessons learned from the project include:

- The UNAP promotes sustainability measures through research and encourages the use of alternative energy sources. As demonstrated in our study, given the geographic conditions of the area and the beneficial solar radiation values we found, solar power especially can be expanded in the future
- In order to effectively create and use solar energy, it is important to first observe the radiation behavior and understand the behavior of this parameter
- The power plant in Tamshiyacu has a monthly consumption of 8,700 gallons of fuel. According to the case study presented here, replacing this electricity plant with one based on solar energy would prevent the emissions of approximately 1,000 tons of CO<sub>2-e</sub> per year.
- Even though the proportion of GHG resulting from power generation in Loreto is less than 10%, adapting the energy matrix is a feasible option to approaching sustainability.
- The use of solar power is feasible but depends on the solar radiation and the availability of technology to transform it into electricity and extend it to areas not reached by conventional energy (rural areas with small facilities that use biodiesel as fuel).





The use of clean energies, such as solar energy, would allow us to avoid affecting the populations and biodiversity of the rural areas of the Peruvian Amazon. © Gustavo Malca Salas

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