

Green Cities and Humboldt's Cosmos of Nature in the Age of Mega Urbanization and Climate Change

4 January – 15 January

CATEGORY Metropolitan Studies & Urban Development

COURSE STRUCTURE

You will receive a total of **45 hours of academic lessons** (one lesson equals 45 minutes). Lessons will comprise lectures, group work, discussion sessions, and excursions.

WEEKLY SCHEDULE

HUWISU courses are grouped into different time sessions. Your course will take place in the **AFTERNOON SESSION**.

Monday-Friday: 2:00 pm – 6:00 pm (except on the first Monday: 2:30pm - 4:45pm)

COURSE LANGUAGE

This course is taught in **English**, including the readings. For the understanding of the texts and the discussions in class, a language-level of B2 (Common European Framework of Reference for Languages) is required.

TARGET GROUP

This course is designed **for undergraduate and postgraduate students of all subjects** with a strong interest in ecological, environmental, cultural, urban planning and agricultural topics.

CREDITS & CERTIFICATES

Participants will receive **6 ECTS** credit points and a certificate if they attend regularly (at least 80% attendance), participate actively and fulfill all course assignments. Additionally, six weeks after the end of the course a Transcript of Records is issued by Humboldt-Universität zu Berlin. All courses are accredited according to the European Credit Transfer System (ECTS).

CULTURAL ACTIVITIES

In addition to the academic program, you are invited to **join our cultural and social programs**. We offer a fine selection of interesting activities that aim to give you an unforgettable stay in Berlin. Through excursions, social gatherings, and sport activities, you have the opportunity to get to know the city, the university, and to meet students from all parts of the world. **Costs for these offers are included in the program fee.** Below, you find examples of previously offered cultural activities. You will be informed about the respective cultural program shortly before the start of the program via email as well as during the course period.



POLITICAL AND HISTORICAL GUIDED TOURS

- Federal Chancellery (*Bundeskanzleramt*)
- German Parliament (*Bundestag*)
- House of Representatives (*Abgeordnetenhaus*)
- Topography of Terror exhibition
- Political Archive of the Federal Foreign Office

CULTURAL GUIDED TOURS

- Kreuzberg Tour
- Museum Island (*Museumsinsel*)
- Berlin Cathedral (*Berliner Dom*)
- Daytrip to Potsdam
- Exhibitions

SOCIAL GATHERINGS

- Welcome Session
- Ice Skating
- Farewell Party

EXPECTATIONS & POLICIES

Preparation for lively discussions in the classroom: Be on time, have at least the required readings completed, and points in mind for discussion or clarification.

Assignments: Complete all assignments according to the specified requirements on the schedule including handing them over to the lecturer.

Commitment in class: Pay particular attention to the lecturer and respect differences of opinions (classmates', lecturers').

Academic guidelines: Comply with academic integrity policies (such as no plagiarism or cheating, nothing unethical) especially the academic honor code and the student code of conduct.

Attendance policy: No unexcused absences are permitted. Students must follow teachers' instructions to catch up on missed work – to excuse absence please contact the HUWISU office.

COURSE DESCRIPTION

The course will take the students on a journey through time with the brothers Wilhelm (1767-1835) and Alexander (1769-1859) von Humboldt, which are born in Berlin. They made an important contribution to the founding of the first university in Berlin in 1810 and the development of the concept of unity of teaching and research, which has been followed by many universities worldwide.

The students from around the world are invited to theoretical and practical experience on the trail of Alexander von Humboldt, a great Prussian geographer, naturalist and explorer of nature. Learn about his discoveries in the earth and natural sciences, and exploration of nature through his trips in Germany, Europe, America and Asia. You will become part of his research travels and fascination of many regions, climate zones and cultures of the world, exploring the biodiversity of fauna and flora to gain insights to Humboldt's Cosmos. Following in his footsteps, through lectures, seminars and excursions. Discover his traces and relics of travels & research. Students will understand the difficulties and dangers associated with research trips during this time, as equipment, transport routes, climate and communication were always a challenge. Alexander researched about minerals, air pressure at various altitudes; impact of agricultural cultivation on former forest areas and the diversity of flora and fauna in different climate zones, and even at that time wrote about climate change in certain areas due to human intervention. His discoveries are written in many letters, books and lectures. For example, his most important publication - KOSMOS - the Discovery of Nature. He is one of the first representative of a transdisciplinary science that continues to have a pioneering effect to this day.

Students will gain knowledge, about the meaning of nature and biodiversity, and the last biodiversity hotspots. The importance to protect nature and green areas inside and outside of cities. They will explore the traces of flora and fauna as well as food production in Berlin, both indoors and outdoors in the context of garden cultures and movements, classic gardens, forests and new innovative vertical gardening. The 17 sustainability goals of the Agenda 2030 and COP30 promoting the communication between architecture, politics, urban development, industry, agriculture and green spaces, to plan and work together for more sustainable and resilient cities to mitigate climate change.

The **excursions**, for example to the Humboldt Forum, Department of Urban Development and Mobility, Museum of Natural History Berlin, Botanical Garden Dahlem, Zoological Garden, Albrecht Daniel Thaer-Institute for Agriculture and Horticulture Science and other projects in Berlin will help to imprint knowledge about different subjects.

Learn about new developments in urban agriculture and horticulture that provides multiple functions and benefits to urban dwellers and cities. Their advantages are manifold: healthy nutrition, reduced loss of food due to inadequate transport and storage, poverty reduction through income opportunities and possible own consumption, education, leisure, and a greener liveable city with all its ecological benefits.

The international students from different cultural and knowledge backgrounds learn to communicate and understand each other in order to work together in groups and find common solutions in a diplomatic human way with respect for nature.

The course will provide experiences, academic research and knowledge in theory and practice for future decision-makers in urban design and environmental planning, civil and landscape engineering, architecture, as well for students studying life science, (health and medicine issues), disaster and climate management, mathematics, physics, chemistry and pharmacy, finances, administration, politics and legislations and law.

The lectures and excursions will offer the students a deeper insight of plants and greenery as an integral part of urban sustainable development and climate change adaptation. Learn about urban agriculture and horticulture projects in Berlin, such as allotment gardens, community gardens, green roofs and walls and market oriented urban farms (vegetable, fish, mushroom and algae production). The Course addresses the issues of ecological challenges and responsibilities in sustainable urban development, in order to improve planning, design, architecture, politics, standards and laws in cities. Work together and act in harmony with flora and fauna to shape a sustainable living environment, city, and planet!

COURSE OBJECTIVES AND LEARNING OUTCOMES

By the end of the course, students will be able to understand:

- Alexander von Humboldt - the world traveler, researcher, explorer and explainer of nature at the end of the 18th and beginning of the 19th centuries;
- the role, benefits and institutional aspects of urban green and sustainable development in context of urbanization and climate change – winter and summer;
- applied research and innovation at the Humboldt University and in the city of Berlin in urban food production & classical urban green, such as parks, gardens, forests and new technologies of greening, such as green roofs and walls, rail track, riverside and roadside greening, permaculture, aquaculture and aquaponic gardening;
- the environmental, economical and social aspects in terms of education and integration of different generation and cultures on climate change, food security and biodiversity;
- tolerance and understanding - to form, organize and working in mixed groups of students from different countries, different native languages and different professional and cultural backgrounds.

ASSIGNMENT INFO

Working in groups of 4-5 students from different countries to present:

1. Paper (each student 4-5 pages),
2. Presentation (each group presents, discussion).

Material and information be generated by students out of:

1. Lectures, seminars and excursion,
2. Interviews, readings and literature research.

In order to be granted 6 ECTS, students are required to

1. participate actively in all lectures, seminars and field trips;
2. do the readings in time and preparing discussion questions on them in advance;
3. active participation in working groups and quality of assignments;
4. Punctuality and attendance rate (a minimum of 80% attendance rate is required).
5. Failure to fulfill one of the mentioned components results in failure of the class.

The final grade will be composed to the mentioned components and assignments.

YOUR INSTRUCTOR

Mr. Volker Minks, holds a doctor degree of science of the Universidade de Sao Paulo (USP) and a master degree in agricultural engineering with specialization in urban gardening, landscape design and sustainable urban planning from Humboldt Universität zu Berlin. Mr. Minks has worked in interdisciplinary research projects, filming and teaching in the areas of urban agriculture and horticulture, vertical farming, green technologies, innovation and sustainable urban planning to adapt cities to climate change and resilience in Germany, the United States, India, Mexico, France, Cuba and Brazil.

He works with Professors from the Life Sciences Faculty at the Albrecht Daniel Thaer-Institute of Agricultural and Horticultural Sciences of Humboldt-Universität zu Berlin, and is affiliated with the Escola Superior de Agricultura "Luiz de Queiroz" University of Sao Paulo (USP), currently working on a Post-Doctoral Project - City of the Future: A greener and more livable São Paulo – Strategies for integrating green infrastructure into ecologically sustainable urban planning. The case studies are Berlin, New York and Singapore.

His research is related to the ecological, economic and social benefits of green areas in cities as ecosystems, especially in the context of research, practice and education on megacities and climate change. In 2011 he worked as coordinator for the C40 Sao Paulo Large Cities - Climate Summit and co-produced the publication - Building Sustainable Cities. Since 2011 he acts as coordinator and lecturer for the HUWISU summer school course "Land in the City, Green in the City". Since 2009 he is developing the cooperation between USP and HU Berlin, and organized several KOSMOS Workshops as coordinator and instructor at USP and Humboldt: Berlin meets Sao Paulo: Cities for all – livable and sustainable.

Since 2014 he was part of the Cátedra José Bonifácio of the Ibero-American Center (CIBA USP), dealing with the challenges of Latin America in the areas of international governance, trade, negotiations, security, energy, education, innovation and environment.

Since 2016 he works with The Global Institute for Peace (GLIP USP) at the University of Sao Paulo. Working in projects with balance of gender and diversity, ESG, COP 30 in Belem e as well with the indigenous population to promote preservation of biodiversity and culture, green infrastructure food security, peace and sustainability.

COURSE SCHEDULE AND READINGS

Week 1: Introduction to Alexander von Humboldt the Explorer, History and Role of Nature and Biodiversity, Urban Agriculture and the Green Urban Design Network - Research & Innovation in Urban Agriculture

Course introduction

Presentation of Topics

Presentation of Students

Logistics

Introduction to Alexander von Humboldt and his Cosmos of Nature

The course takes in the first week a journey through time with Alexander von Humboldt, a great Prussian geographer, naturalist and explorer of nature in the 18th century. The students from different countries and backgrounds are invited to theoretical and practical experience on the trail of Alexander in Berlin and the world.

The students learn about Alexander von Humboldt, his discoveries in the earth and natural sciences, and exploration of nature through his research trips in Germany, Europe, America and Asia. You will become part of his research travels and fascination of many regions, climate zones and cultures of the world, exploring the biodiversity of fauna and flora.

The universal genius was in constant contact with other scientists, philosophers and scholars from different fields, for example Goethe, Schiller, George Foster, Joseph Banks, Amine Bonpland, Jose Celestino Mutis and others. Charles Darwin was inspired by his research work.

Alexander criticized slavery and also registered what destruction the unrestricted use of natural resources (especially deforestation) caused. The scientist who dealt with climate change and sustainability. Alexander von Humboldt has researched and explained the interdisciplinarity and close connections between the natural sciences (biology, physics, chemistry, geology - geosciences, meteorology, agriculture, pharmacy). He included technique, poetry, art, history and politics. his work - Cosmos.

Students follow in his footsteps. Where did he leave traces in Berlin, and where can be found and shown information and relics of his travels and research. In the class students will understand the difficulties and dangers associated with research trips during this time, as equipment, transport routes, climate and communication were always a challenge. Alexander researched flora and fauna, explored the biodiversity in different climate zones, and even at that time wrote about climate change in certain areas due to human intervention.

Geier, Manfred (2010): Die Brüder Humboldt: Eine Biographie. Rowohlt Taschenbuch. 5. Edition. Hamburg.

Wulf, Andrea (2015): The Invention of Nature - The Adventures of Alexander von Humboldt - the Lost Hero of Science. Vintage Books. Bertelsmann. New York.

Lack, H. Walter (2018): Alexander von Humboldt und die botanische Erforschung Amerikas. Prestel Verlag. Neuausg. Edition. München.

Meinhardt, Maren (2019): Alexander von Humboldt: How the Most Famous Scientist of the Romantic Age Found the Soul of Nature. Blue Bridge. New York.

Helferich, Gerald (2004): Humboldt's Cosmos: Alexander von Humboldt and the Latin American Journey that Changed the Way We See the World. Gotham Sheridan. Wyoming.

Daum, Andreas, W. (2024): Alexander von Humboldt: A Concise Biography. Princeton University Press.

Biodiversity and Earth Last Biodiversity Hotspots – The Biological Richest and Endangered Regions (S)

Biodiversity and its conservation it's one of the major challenges for the present and coming generations. The term biodiversity has become established for the diversity of living nature in ecosystems and unique species communities. Biodiversity is defined as the totality of the genes, species and ecosystems of a region and its processes. It combines the study of the exploration of biological diversity of plant and animal species in ecosystems, and the degree of the threat

through environmental changes and human impact, as well the development of appropriate protective measures.

In this context the concept of Biodiversity Hotspots has become established. Biodiversity Hotspots are biologically richest and endangered regions where a large number (at least 1,500) of endemic species are found, and a high percentage of plant life found nowhere else on the planet. A Hotspots is irreplaceable, their habitats are particularly threatened and has already lost at least 70% of its original vegetation. The Hotspot studies covered range from genetics and taxonomy to evolutionary biology, biogeography and the social sciences. Around 35 biodiversity hotspots are recognized worldwide. There is already a large proportion of the original area and original flora and fauna destroyed.

The class will discuss the biologically richest and endangered regions in the world (especially Brasil - Mata Atlântica and the Amazon Rainforest Region). The impact of human activities and invasions in these regions, through deforestation and burning for urbanization and agriculture purposes. And above all protective measures on state, private and individual level.

Recommendation Field Trips: Naturkunde Museum Berlin, Zoologischen Garten and Tierpark Berlin - <https://www.museumfuernaturkunde.berlin/en>

Conservation International Agrupación Sierra Madre; CEMEX (2004): Hotspots Revisited: Earth's Biologically Richest and Most Endangered Terrestrial Ecoregions. Mexico City.

ZACHOS, F. E.; Habel, J. Ch. (2011): Biodiversity Hotspots: Distribution and Protection of Conservation Priority Areas 2011. Springer. Heidelberg/New York.

BAUR, B. (2010): Biodiversität. UTB Haupt. Bern.

WITTIG, R. et al. (2014): Biodiversität: Grundlagen, Gefährdung, Schutz. Springer Verlag. Berlin/Heidelberg.

UNEP (1992): Convention on Biological Diversity (CBD). Nairobi. In: <https://www.cbd.int/doc/legal/cbd-en.pdf>, 06/2017

NARAYANANKUTT, A; Job, J. T. (2023): Global Biodiversity Hotspots and its Endemic Flora and Fauna: Part I. Scholars' Press. Chisinau.

Introduction to the History and Role of urban Green and Gardening in the Age of Mega-Urbanization and Climate Change (L)

Urban Greenery has important functions, whether in summer and in winter. For example, they are recreational area, habitat, food source, compensation of temperature and humidity, rainwater management, pollutant degradation, as well protection against dehydration and erosion of the soils. For functional ecosystem services land, conditions, variety, health and maintenance of plants playing a major role.

The ability to grow crops has changed the way of life for humankind. The development of agriculture made it possible to settle. Since then, food has been grown outside and inside of cities. The class will deal with the history of urban agriculture and horticulture techniques and garden cultures as examples from the old Persian world, Europa, Africa, Asia and America.

Within intensive industrialization and urbanization the gardens were lost in many cities. Now with increasing environmental problems, lack of farmland and food supply, urban agriculture and horticulture activities, also described as urban gardening, can find the way back into the cities. Therefore, it is subject of intense debates regarding its viability and impact to mitigate climate change and increase biodiversity.

Today, more than 50% of the world population lives in urban areas, showing that the world is becoming increasingly urban, with a global population of 8.2 billion. In 2050 approximately 68% to 70% (or nearly 7 in 10 people) will live in Cities. 3.4 billion people worldwide lack access to secure, safe, healthy foods and adequate housing. Urban Gardening can help to fulfill the changing needs and demands of people who live in the growing urban areas. Urban Gardening is a term for a large and complex area of scientific horticulture and sustainable urban food production. It deals with the complex problems of growing plants in dense populated areas, using them effectively, and maintaining their long-term health and functional value.

Even in times of war and health crises—such as the COVID-19 pandemic - urban gardens play a vital role in providing healthy food and serving as sanctuaries for people, flora, and fauna. The urban gardening movement has its obstacles to be involved in the concepts of smart, green, compact, global and resilient cities. The current role of urban gardening in the world will be discussed and explored.

Recommended Field Trips and Literature: Domäne Dahlem - Museum and Organic Farm, Allmende Kontor - Tempelhofer Feld, Rehberge Kleingartenkolonie (Allotment Gardens)

Cuba's urban farming revolution (2014): www.architectural-review.com/comment-and-opinion/cubas-urban-farming-revolution-how-to-create-self-sufficient-cities/8660204.article

KRAAS, F. (Hg.) at al. (2014): Megacities: Our Global Urban Future. Springer Verlag. Heidelberg. Horticultural Industry, European Journal of Horticultural Science by Verlag Eugen Ulmer. ISSN (printed): 1611-4426. ISSN (electronic): 1611-4434

MUELLER, Ch. (2011): Urban Gardening: Über die Rückkehr der Gärten in die Stadt. oekom. München.

ROAF, S.; Crichton, D.; Nicol, F. (2005): Adapting Buildings and Cities for Climate Change. Architectural Press.

UN HABITAT (2026): World Cities Report 2026: Urbanization and Development. Emerging Futures. Nairobi

UN Revision of World Urbanization Prospects (2025)

History of Garden Cultures and Urban Agriculture (S)

Gardens and the vegetation have inspired human history and art. The vision of paradise - 'paradesa' pairi-daēza the old Persian word for a fenced area - has influenced the phantasy of human kind with the aspiration of heaven on earth. Even today the many different types of garden cultures reflect this basic need to create a place of beauty and connectedness to nature according to diverse interpretations of esthetical values and philosophy.

Garden cultures are excellent examples of the concept of 'Nature-Culture', that will show the way human beings have accommodated within their social and natural environment. The human ecological triangle as the Nature-Culture arrangements operates with two dynamic motivations. There is the need for social acceptance, as articulated by the contemporary German philosopher Axel Honneth alongside and as strong as the one for material existence. The Lecture will introduce the human ecological framework that will help to analyze the history of garden cultures in different parts of the world.

Kuhnke, Rainer W. (2001): Byzanz und die islamischen Gärten. In: Sarkowicz, Hans (Hg.): Die Geschichte der Gärten und der Parks, Insel Verlag, Frankfurt, S. 108 – 123.

Teherani-Krönner, Parto 2012: Gärten der Begegnung – Entstehung transkultureller Räume in der Stadt. Unsere Pflanzen und tägliche Nahrung – ein Stück Kulturgeschichte. In: Hammerich, Kurt et al. (eds.) Minderheiten im Umgang mit der Natur. Academia Verlag, Sankt Augustin, S. 359-41

Teherani-Krönner, Parto (2008): Geschlechtergerechtigkeit – Zugangsrechte zu Ressourcen, eine humanökologische Aufgabe, in: Bruckmeier, Karl und Wolfgang Serbser (Hg.), Ethik und Umweltpolitik. Humanökologische Positionen und Perspektiven, oekom Verlag, München, S. 237 – 260.

Thacker, Christopher 1979: The History of Gardens, Berkeley, University of California, Berkeley and Los Angeles.

Green Cities - The Green Urban Design Network and the Open Space System in Berlin (S)

Urbanization, buildings and vegetation seem to be three difficult non-compatible elements within cities. The Green Urban Design Network, includes and connects classic and modern green infrastructure (Nature-based Solutions (NbS), and also agriculture and horticulture activities urban gardening and vertical farming as an integral part of sustainable urban planning.

The lecture introduces the students to green infrastructure and ecological design technologies that help render the urban environment sustainable, crucial to addressing the economic, demographic, social and environmental challenges in cities. The different ways to protect and create new green habitats: green roof and walls, allotment gardens, city farms, rail track and roadside greening, riverside greening, parks, tree planting and forestry, vertical farming, community gardens, guerrilla-gardening and others. The class also shows that market oriented urban farms with vegetables, fish and algae production can play an important role of urban sustainable development. The city of Berlin combines today all kinds of green spaces and technologies and is an example of a green City. The Open Space System in Berlin connects green areas by district cross linking through "green corridors" and "green belts". A network of green spaces to multiply the social and environmental benefits.

DESPOMMIER, Dickson (2010): The Vertical Farm - Feeding the World in the 21st Century. Thomas Dunne Books. St. Martin's Press. New York.

ELMQUIST, T. et al. (2013): Urbanization, Biodiversity and Ecosystem Services: Challenges and Opportunities. Springer Dordrecht/Heidelberg.

FOSTER, Hal. The ABCS of contemporary Design, Hall Foster 2002.

FRY, Tony. Design futuring: sustainability, ethics, a new practice, Berg, New York, 2009.

JOHNSTON, David; Gibson, Scott (2008): Green from the Ground Up: Sustainable, Healthy, and Energy-Efficient Home Construction. Taunton.

MILLER, R. W. (2007): Urban Forestry: Planning and Managing Urban Greenspaces. Waveland Press. Long Grove. ISBN 1-57766-510-4.

RYN, Sim Van der; Cowan, St. (1996): Ecological Design. Tenth Anniversary Edition. Island Press.

Nature, Ecosystem Services and Climate Change – The current Situation of Cities and Bioeconomy - Land Use, Governance and Adaptation Strategies in Berlin (L)

Nature as a productive force provides ecosystem functions and services in ecological, economic, as well as cultural (social) terms. Basic services are oxygen production and carbon dioxide

reduction, soil formation, provides raw material, protection for erosion, as well water and temperature management, food production and recreation opportunities.

For example, terrestrial and oceanic ecosystems absorb nearly 60% of the carbon that enters the atmosphere through human activities. Nature's air purification processes counteract the greenhouse effect and slow down global and local climate change. However, with increasing population and urbanization, human demand for ecosystem functions and services is increasing enormously and pressure ecosystems with their biodiversity (ecological Footprint).

The extent of global environmental degradation is high. Over the past 300 years, 50% of the wetlands and 40% of the forest land of the original stock has been lost. This means that humankind is carrying out a huge worldwide depletion of ecosystem functions and biodiversity. In this context, biodiversity hotspots play an important role, there are more than 70% of forests already destroyed. Are regions in which large numbers of endemic plant species occur, and their habitats are particularly endangered.

Especially in cities most natural resources are consumed. At the same time, the relationship to nature is the lowest. The overuse of forest, soil, water, air, land and resources is little or not noticed. According to experts, economic productivity depends on the quality of the environment and natural capital. Therefore, nature and environmental protection play an essential role for long-term economic development. A worldwide networked bioeconomy with green growth strategies can improve natural capital by reducing environmental degradation. The integration of ecosystem and biodiversity values into the economic, technological and urban planning processes of companies, cities and economies are crucial. Therefore, the current 2030 Agenda formulates 17 sustainability goals are important to promote to live in harmony with social justice and the Earth's ecological boundaries.

The class will discuss the subjects: nature, ecological footprint, ecosystem functions and services, climate change and bioeconomy – the current situation and strategies of Cities.

ALCAMO, J. et al (2003): Ecosystems and Human Well-Being: A Framework for Assessment. Aufl.2. Island Press. Washington.

GERMAN BIOECONOMY COUNCIL (2018): Bioeconomy Policy (Part III) Update Report of National Strategies around the World. Berlin.

ELMQVIST, T. et al. (2013): Urbanization, Biodiversity and Ecosystem Services: Challenges and Opportunities. Springer Dordrecht/Heidelberg.

Recommended Field Trip: Humboldt Forum - Exhibition – OnWater - WaterWissen - exhibition of the Humboldt Laboratory

The Humboldt Lab's Exhibitions - experimental-interactive-scientific - How are climate change, extinction of species and the crisis of democracy connected?

Global environmental changes not only pose a threat to the very basis of our livelihoods; they also have far-reaching repercussions for the political and social structures of societies. The Humboldt Lab's exhibitions deal with the interdependencies of climate change and the loss of biodiversity and with worldwide challenges to democratic principles of order.

The crisis of nature is closely interlinked with societal crises, and at the expense of quality and vital resources such as water. The enormous changes in environment systems led to considerable inequalities, both within societies and between countries. As a result of climate change, growing cities, and global inequality, water has become a challenge. Water is not a

passive object, but instead a dynamic element that demands new scientific perspectives and social negotiation.

The OnWater: WasserWissen in Berlin exhibition presents Berlin University Alliance (BUA) research projects that deal with water from a wide range of perspectives and properties, such as its cycles, adaptability, and binding force, to find solutions for the future. The exhibition uses exemplary research projects to bring science to life and show the interplay between humans and water.

For example, deal with puddles in the city, with vortices in rivers and street fountains in Berlin, with the melting of glaciers in the Alps, the bathtub as a therapeutic place or life on and in rivers. The projects of the scientists should be seen to experience the diversity and complexity of water knowledge in Berlin. However, the research projects also deal with solutions to water scarcity in Egypt and Kurdistan. Understand the dynamics and inherent logic of water – take it seriously and also recognizes the limits of overuse in industrial production, food production, and the daily lives of every single individual.

Berlin a Sponge City concept is pursuing a comprehensive strategy for decentralized rainwater management, to stop discharging rainwater directly into the sewer system and instead absorb, store, & evaporate it locally, to provide protection against heavy rainfall and extreme heat waves – NbS. <https://regenwasseragentur.berlin/schwammstadt/>

<https://www.humboldtforum.org/en/programm/laufzeitangebot/exhibition/on-water-waterknowledge-in-berlin-149246/>

Recommended Field Trip: Senatsverwaltung für Mobilität, Verkehr, Klimaschutz und Umwelt - SenMVKU - (Department for Mobility, Transport, Climate Protection and the Environment) - City Models Berlin and Land Use Plan

In the permanent exhibition "Berlin City Models" and the green area map showing the urban development of Berlin. A source of information for Berlin's citizens, describing the "green" and "blue" side of the city on a scale of 1:500. Individual projects from the Berlin Building Atlas can be called up on the terminal, which then appear with project data, maps and photos and are simultaneously controlled on the Berlin model with a spotlight.

The Berlin Open Space System linked public parks, forests, gardens and cemeteries, and created an inner & an outer green ring. The Landscape Program includes a Nature Conservation Program and the Land Use Plan - all long-term Plans in order to promote all forms of greening.

The climate crisis with very hot and dry summers is threatening Berlin's water resources (channels and lakes) and green infrastructure (forests, parks and gardens). The health of Berlin's forest trees has deteriorated. 37 percent of Berlin's forest trees show significant damage (2023: 30 percent). The proportion of healthy trees has decreased: only four percent of the trees shown no visible damage. The result of the past dry, hot years and stagnating regeneration.

Forests and green infrastructure are natural CO2 stores better air and clean water. The City and the people must therefore make every effort to minimize stress and risks to green areas through effective climate protection measures. The methods and concepts of forest conversion – such as the mixed forest program and the silviculture directive. They are constantly being evaluated in the face of the challenges of the climate crisis. (Press release 27/11/2024, Bonde, U., Senator for Mobility, Transport, Climate Protection and the Environment)

Climatic conditions are changing too quickly for the green ecosystems to adapt naturally. The efforts of the Berlin forestry service to maintain and restructure Berlin's forests and green areas through natural regeneration and planting are essential, but also research and science.

There for research and adaption of species is important to improve sustainable production, use and impact of plants within densely populated areas, dealing with the complex problems of growing plants in urban areas, using them effectively, and maintaining their long-term health and functional value for urban greening, biodiversity, climate balance & food production. These efforts must be continued and intensified for further generations, sustainable and resilient cities.

<https://www.berlin.de/sen/uvk/service/stadtmodelle/>

<https://www.businesslocationcenter.de/en/economic-atlas/download-portal>

Recommended field trips: Museum of Natural History Berlin - Biological diversity and species protection - with reference to Alexander von Humboldt

Guided tour in English – with special information on Alexander von Humboldt, research, animal and plant exhibits for example his rock collection

Discovering nature - marine and terrestrial life with interactive demonstration instruments - in dialogue with every visitor - promoting scientific and social discourse on the future of our planet worldwide - implying respect and protection for nature.

Dynamics of nature - scientific questions from the fields of biology, geosciences and planetology are investigated in an interdisciplinary manner and together with partners around the world. The research is collection-related and the new scientific findings are incorporated into the further development of our extensive collection. Zoologists, paleontologists and geoscientists discover and research the diversity of life on earth, the mechanisms of population differentiation and speciation, the evolution of body plans and the diversity of organisms. The work covers the entire history of the earth - from the formation of our solar system to the present and even to the modeling of future scenarios. The investigation processes underlying diversity dynamics based on changes in ecological communities in space and time.

<https://www.museumfuernaturkunde.berlin/en>

Albrecht-Daniel Thaer Institute of Agriculture and Horticulture - Campus Dahlem - Introduction to research projects and teaching

Plants serve different purposes, whether food, medicinal purposes, climate and water improvement, urban design and garden function, they all have different requirements in terms of soil, water and care. Different cultivation methods and techniques are used. Combined with energy and water saving technologies.

The CUBES Circle (L), Bio-Invitro, Introduction to FYTA- Sensors, Hyperspectral Imaging - cultivation, conditioning and use of ornamental Plants and Campus Tour

In the future, food production will be based on connected and standardized production modules communicating with each other. Together they form the CUBES Circle. Besides population growth and climate change, urban growth is one of the largest challenges of the 21st century. Spatial and infrastructural borders between urban centers and rural areas disappear. Agricultural production needs to feed an ever-growing population. At the same time, current innovations in animal breeding and plant cultivation, as well as measures for increasing productivity are not able to compensate for the ever-diminishing cultivation area. The vision of agricultural systems of the future is based on the idea that food will be produced in connected, mutually

communicating and standardized production units, the so-called CUBES. Those CUBES are the basis for a closed food production system, which overcomes the weaknesses of earlier agricultural production systems by using ISO-standards, stackable units and a bio-cybernetic regulation approach. At the same time, the system integrates easily into the urban future. Due to its mobile nature, adaptability to a changing environment and an inherent scalability, the CUBES can be implemented in urban, rural and even desertified sites. Principles of closed cultivation methods will be integrated into a new process chain and the individual elements of the chain are intelligently connected and regulated. <https://www.agrar.hu-berlin.de>

The ornamental plant range offers a wide range of different species and varieties from different origins. For many inexperienced consumers, this can lead to cultivation errors and ultimately to the death of the plants when fulfilling the species-specific requirements. On the other hand, the plants are often only seen as inanimate objects or decorations, which creates a certain throwaway mentality among many consumers.

The Berlin start-up company FYTA GmbH has set itself the goal of actively supporting people in caring for their plants and also educating them about the basics of ornamental plant cultivation. The long-term survival of the plants should be supported and promoted through positive experiences and an active examination of the plants.

Campus tour at the Agricultural Research Institute in Dahlem

Aquaculture and Aquaponic Gardening - Introduction to Theory and Practice (S)

This Seminar will introduce students to the theory and practice of aquaculture and aquaponic gardening. A 2011 FAO report predicts that food production will need to increase by 70% globally and by 100% in developing countries, to meet the increasing demand for nutritious food. In order to produce greater quantities of high-quality food and adapt to the drastically changing horticultural production conditions, including climate change and increasing resource scarcity, new and comprehensive knowledge, as well as innovative methods and approaches, are required. One such promising innovation is aquaponic gardening. Aquaponic links aquaculture with hydroponic vegetable and herb production as a bio-integrated system.

BERNSTEIN, S. (2011): Aquaponic Gardening - A Step-by-Step Guide to Raising Vegetables & Fish Together, New Society Publishers; Original edition, ISBN-13: 978-0865717015

GRABER, A., and Junge, R., 2008. Aquaponic Systems: Nutrient recycling from fish wastewater by vegetable production", ScienceDirect, Desalination 246 (2009) 147–156.

HUGHEY, T. W., 2005. Barrel-Ponics. Aquaponics in a Barrel. Available free online: <http://www.aces.edu/dept/fisheries/education/documents/barrel-ponics.pdf>

JONES S., 2002. Evolution of Aquaponics. Aquaponics Journal 24, Vol. 6, No 1.

SAVIDOV, N., 2003. Aquaponics, an Environmentally Friendly Production System. Agrinews.

WILSON, G., 2005. Greenhouses Aquaponics Proves Superior to Inorganic Hydroponics. Aquaponics Journal, Issue 39.

Green Urban Design - Technical Aspects of Green Roofs and Green Walls (L) and Field Trip (Ex)

Green roof and walls are an important system of ecological design and Natural Based Solutions (NbS). The different types of Green Roof systems can collectively serve the green infrastructure in urban areas with a multiplicity of benefits. They benefit urban areas ecologically, economically and socially, and have important advantages for rendering cities more sustainable. Creating new

green areas on roofs and walls is one of the most innovative and efficient fields of study, constantly developing in the areas of ecology, agriculture and horticulture, as well in engineering and landscape architecture.

This technology has long been championed and practiced in Germany, Austria, and other northern European countries. Many Cities in Germany including green roofs and walls in there construction codes and sustainable urban development plans. Berlin is a good example. Germany also create the FLL Green Roof Guidelines (*Guidelines for the Planning, Construction and Maintenance of Green Roofs*) are the universally recognized benchmark standards for green roof design, created by the German Landscape Development and Landscaping Research Society (Forschungsgesellschaft Landschaftsentwicklung Landschaftsbau).

Many countries adapted this Guidelines and developing research centers, adequate legislation and providing financial motivation through tax exemption. The number of green roofs and walls in the whole world is growing. The dialog among Designers, Architects, Politicians and Scientists from different fields must increase, aiming towards a more interdisciplinary work, taking into consideration how important green areas are for infrastructure, environment and human life in urban centers.

In the Field Trip and lecture will be discussed the definition, past and present - types of green roof and wall systems - extensive and intensive green roofs, environment aspects and effects – motivation and significance, potential, risks and chances, and examples in Berlin and worldwide. DUNNETT, Nigel. Kingsbury, Noël (2005): *Planting green Roofs and Living Walls*. Timber Press. Portland. London.

KOEHLER, M. et al. (2012): *Handbuch Bauwerksbegrünung. Planung. Konstruktion. Ausführung*. Rudolf Müller. Köln.

SNODGRASS, Edmund C. et al. (2006): *Green Roof Plants: A Resource and Planting Guide*. Timber Press. Portland.

Recommended field trips: *Green Roofs and Green Wall Systems indoor and outdoor* - Springer Nature and Berlin HYP and Dussmann Kulturkaufhaus – International Book Shop and Indoor Greening on a Wall

Week 2: Biodiversity and Species Conservation - Ecological Design Principals - Education and Best practice in Berlin in Urban Agriculture - Student Presentations and Certification

Recommended field trips: Botanical Garden Dahlem - From North to South – Protection, Research, Education of different Plant and Animal Species from all over the World (Ex)

The World in a Garden - is since 1889 the mission of the modern Botanic Garden Berlin. The botanical garden has a long history and developed on impressive rich diversity of plants, for example from herbaceous and medicinal plants to roses, aquatic and marsh plants, an arboretum including American trees, an Italian garden, an impressive art nouveau Tropical Greenhouse with subtropical plants. The Botanic Garden in Berlin is one of the world's leading gardens, with an area of over 43 hectares and about 22,000 different plant species. He is part of the Freie Universität Berlin. The task is the protection, research, demonstration and education of plant species from all over the world.

In the 15 greenhouse and outdoor areas of the Botanical Garden, plants can be grown for research and field trials can be carried out under controlled conditions. The laboratory area supports the methods available today for analyzing the genetic makeup of plants and their characteristics (light and electron microscopy). Development and maintaining extensive databases on biological diversity and they are available online. The IT infrastructure not only supports the field of biodiversity informatics, but also the coordination and networking of all research and collection activities. In conjunction with the Department of Biology, Chemistry, and Pharmacy at the Free University of Berlin.

Humboldt's discovery sites - www.herbarium.gbif.de - botany enthusiasts can also discover the exact locations of plants on a digital world map. There are also specimens of plants that are now endangered or threatened with extinction: such as a form of the royal fern (*Osmunda regalis* f. *crispa* Willd) that Humboldt collected near the Humboldt Palace in Berlin.

Herbarium specimens are a valuable source of information and material for today's biological research, for example for getting a better understanding of past and ongoing changes (and losses) of our biodiversity, for biodiversity modelling and conservation planning. Specimen scans can be the starting point for automated image recognition by artificial intelligence, thus enabling provenance research as well as education, outreach and citizen science. <https://www.bo.berlin/en>

Recommended field trip: Efficient City Farming - Aquaponic-Water-Circulation System combines Vegetable and Herb Cultivation with fish Farming (Ex)

One example - Combined production and retail – REWE Green Farming store in Berlin: Shop for groceries downstairs while vegetables and herbs grow upstairs – urban horticulture production is moving right into the city. Since 2026, Germany's largest rooftop farm with green roofs and solar energy has been designed above the timber-framed market hall. The leaf lettuce is grown there just a few meters above the customers' heads. A new generation of supermarkets built from wood and designed for a circular economy. A Green Building strategy, combining eco-friendly construction with urban food production.

The REWE City farming system enables vegetable, herb and fish production within an urban environment. Is a CO₂-neutral production with no pesticides, zero transportation miles, and with a reduced water footprint. The result is year-round sustainable food production with high resource efficiency and exemplary environmental standards. City farms are ideal for restaurateurs, hoteliers, supermarkets, architects, schools and universities.

Students learn about the manifold benefits of different urban farming concepts. The economic and environmental protection goes hand in hand with 1) sustainable production of local vegetables, mushrooms and fish; 2) elimination of environmentally harmful transport routes and cold chains; 3) transparent production process; and 4) synergistic effects of using waste heat to allow year-round cultivation.

Permaculture - An Alternative Planning Method in Urban Gardening - Principles of Permaculture (L & Ex)

The lecture and the exercise will give an introduction to Permaculture as an alternative planning method. Bill Mollison (2002) has defined "A Permaculture is a complex agricultural ecological system, which is designed, so that minimal work is put in and maximum harvest is gained". Permaculture is based on ecological and biological principles. The Philosophy behind Permaculture is to work with nature instead of against it. This means a system which is integrated harmoniously and sustainable between the environment and humans, food, energy and other materials. The Lecture gives an overview of the philosophy and the application area of Permaculture. Thus, biodiversity is the basic principle of the idea of year-round self-sufficiency in food.

The lecture discussed the 12 most important Permaculture planning principles created by Bill Mollison. In the outdoor exercise students will experience the philosophy of Permaculture.

Allen, J. and B. Mollison (2007): Smart Permaculture Design, New Holland, ISBN 978-1877069178

Frey, D. (2011): Bioshelter Market Garden: A Permaculture Farm, New Society Publishers

Mollison, B. (1988): Permaculture: A Designers' Manual, Tagari Publications, ISBN 978-0908228010

Recommended field trip: Zoological Garden Berlin - Climate Change – important impact on the Animal World and Species Conservation and Reintegration (Ex)

A Guided tour - It is home to countless fantastic animal species, whose habitat is becoming more and more endangered. The protection of fauna and flora, the breeding of endangered species and the reintroduction of new species is therefore very important. The zoo educates visitors about nature and animals and makes a sustainable contribution to the protection of species worldwide. For example, the Humboldt penguins - Berlin Zoo and Tierpark are working with local partners to ensure the long-term protection of Humboldt penguins in Chile and Peru. In addition to raising awareness among the local population due to human activity, the focus is on protecting the breeding colonies and the surrounding marine areas. The aim is to protect is providing support and assistance in developing sustainable fishing methods. There are only around 20,000 Humboldt penguins left in their natural habitat.

The Berlin Zoo is home to many endangered species and rare domestic animal breeds. Unique in Germany: Since summer 2017, giant pandas have been among them. In addition to exotic species such as okapis, Sumatran tigers and axolotls. Zoos are not only popular leisure facilities, but also play an important role in species protection, research and education. Many people, especially children, often have their first contact with the large, colorful animal world in zoos and animal parks. The true experience of a large elephant cannot be replaced by photos or films. Animal species that were once highly endangered or even extinct in their natural habitat have been reintroduced with the help of zoos. Research makes an important contribution to species conservation - the results of research work in zoos benefit conspecifics in their natural habitat. The Berlin Zoological Gardens can build on a very good collaboration with the renowned Leibniz Institute for Zoo and Wildlife Research (IZW) and the Berlin universities.

Education is one of the most important tools for raising awareness of species conservation in society. In a fast-paced and highly digitalized world, there is a risk of losing access to nature. The earth is a place of biodiversity and diverse life. Every year several thousand species

disappear from our planet forever. Everyone can help to preserve, maintain and create new nature, natural habitats and green spaces in order to stop species extinction.

<https://www.zoo-berlin.de/de/ueber-uns/zahlen-daten-fakten>

Recommended field trips: Into the Woods: Urban Trees and Forestry - From Plant Selection to tree and Park Management (Ex)

The Großer Tiergarten, it is Berlin's "green lung" and balances the inner-city climate. It serves as a habitat for flora and fauna, is situated in the center of Berlin. It is the place for recreation and nature experience as well as exploring various historical gardens and cultural monuments. Its history goes back 500 years and has a many faceted horticultural and scenery-formative tradition. Typically for the park are the wide laws crisscrossed with small watercourses and with groups of trees, the lakes with small islands and the numerous bridges and paths as well the single ornament gardens such as the Luiseninsel and the Rosengarten. In the 16th century it used to be a forest and hunting reserve with humid meadows and swamps. In the 18th century it was a baroque garden with forest character, and in the 19th century reshaped as a scenery garden in the style of English gardens by Peter Joseph Lenné. In the 20th century the Großer Tiergarten served during and after the second world war shortly as a firewood resource and agricultural space.

The field trip will explain the history, planning and construction of the Tiergarten, and the excursion demonstrate certain botanical species, the characteristic of the landscape and habitats, as well the planting and institutional aspects to maintain the urban forest. Discussion: urban forests last major refuges for fauna and flora - why and how to preserve

CARREIRO, M.M., Song, Y., Wu, J.: Ecology, planning and management of urban forests – an International perspective. 2011. ISBN 0-387-71424-3

KROSIG, Klaus von: Der Berliner Tiergarten. Markus Sebastian Braun (Hersg.) – Berlin: Berlin-Ed., (Berliner Ansichten; Bd. 21), 2001. ISBN 3-8148-0030-3

MILLER, R.W.: Urban Forestry: Planning and Managing Urban Greenspaces. 2007. ISBN 1-57766-510-4

TWARDAWA, Susanne: Der Tiergarten in Berlin – Das Abenteuer liegt um die Ecke. Berlin: motzbuch-edition, 2., überarbeitete Auflage, 2006. ISBN 3-935790-08-2

Exercises: Students will develop small tasks to be carried out before, during, or after the excursions - observing, sketching, asking, researching and explaining:

- 1) in preparation, select a scientific article on one of the various topics and save it to Moodle;
- 2) draw a specific subject, animal, or plant of your choice—include a description, name, habitat, and special characteristics—and note whether it is endangered (and why) and what conservation measures are in place.

Paper of the Student Working Groups to different subjects

Presentations (Examination)

Final Presentation of the Student Working Groups to different subjects

Evaluation and Certification