



SEEDS KNOWLEDGE EXCHANGE:
**Urban Biodiversity in a
Changing Climate ToolTree**



a place of mind
THE UNIVERSITY OF BRITISH COLUMBIA

Campus + Community Planning

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Disclaimer:

** The UBC SEEDS Sustainability Program provides students with the opportunity to share the findings of their research, as well as their opinions, conclusions and recommendations with the UBC community. The reader should bear in mind that this report is a compilation of student research conducted on the topic of urban biodiversity and should not be construed as an official position of the University. Furthermore, readers should bear in mind that these reports may not reflect the current status of activities at UBC. We urge you to contact the research persons mentioned in a report or the SEEDS Sustainability Program representative about the current status of the subject matter of a project/report.

Footnotes:

*The UBC SEEDS Sustainability Program is an internationally recognized Campus as Living Laboratory initiative that advances UBC's sustainability and wellbeing commitments through applied student-led research and interdisciplinary partnerships between students, faculty, staff and community partners.

***Climate Crisis in Urban Biodiversity (CCUB) is an initiative aimed towards co-creating interdisciplinary, demand-driven, diverse, and inclusive student-led research that informs urban solutions to the climate and biodiversity crises simultaneously. CCUB was launched as a PURE (Program for Undergraduate Research Experiences) funded pilot as part of the SEEDS Sustainability Program in partnership with the Faculties of Arts, Forestry, Science, and others.

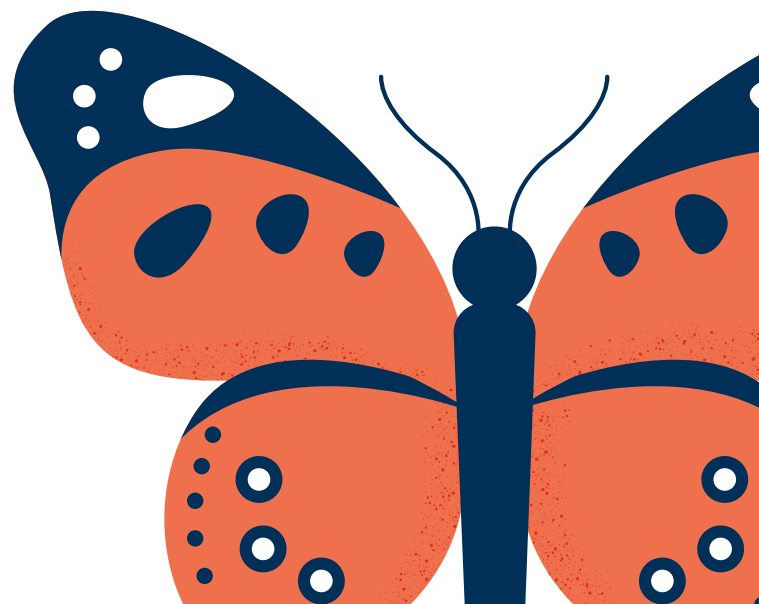
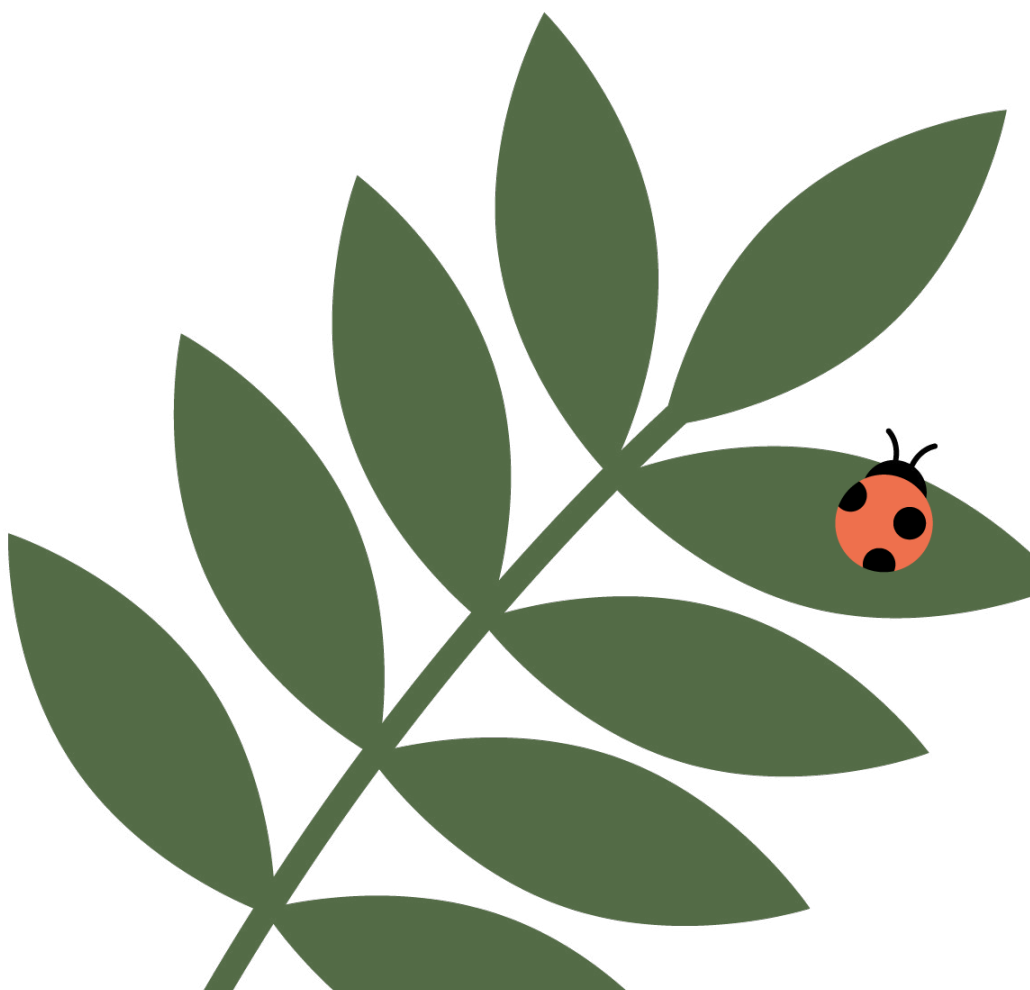
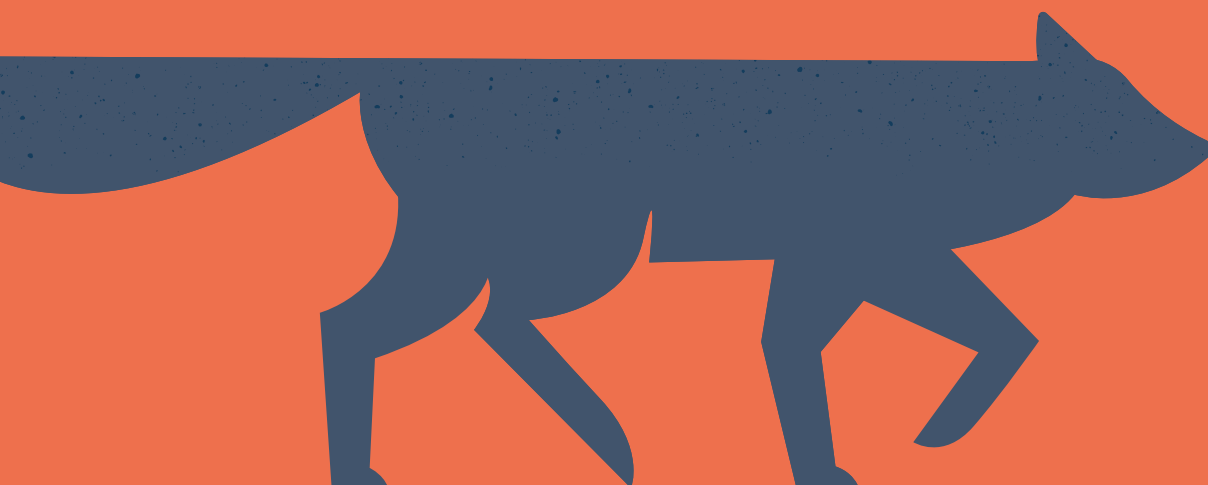


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Introducing the ToolTree



Introducing the ToolTree: How it got started:

The Urban Biodiversity in a Changing Climate ToolTree was set in motion by the Climate Crisis in Urban Biodiversity (CCUB), an initiative aimed towards creating interdisciplinary, demand-driven, diverse, and inclusive student-led research that designs and informs urban solutions to the climate and biodiversity crises simultaneously. Applying an inclusive research design and engagement model, CCUB fosters community-based and applied research collaborations with students, faculty, staff and community partners aimed at informing related policies and practices for accelerating action on the climate and biodiversity crises. By co-developing localised urban actions and adaptations, we advance research to inform solutions to local and global issues while supporting transformative learning and research opportunities.

OUR VISION

We aim to inspire students to work towards the interconnected global challenges of climate change and biodiversity loss by co-creating student-led, inclusive, and demand-driven research opportunities that yield scalable solutions towards the two interconnected crises of climate change and biodiversity loss.

OUR MISSION

To co-create impactful and inclusive student research opportunities with faculty, staff and community partners, that inform policies and practices at UBC which tackle the climate crisis and its connection to urban biodiversity loss.



About the ToolTree: What is a ToolTree? What is a Toolkit?

Much like the diversity of life found in our urban forests across our campus, this ToolTree has branches that represent various forms of knowledge. SEEDS Research Mobilization Toolkits represent the “branches” that are part of a bigger “ToolTree”. This Urban Biodiversity in a Changing Climate ToolTree consists of a suite of different Toolkits that relate to Urban Biodiversity in a Changing Climate topics.

Each Toolkit aims to support applied student-led research projects in partnership with UBC faculty and staff in ways that can advance UBC’s sustainability commitments. They also serve as accessible resources to increase awareness, knowledge and action, and improve resilience to climate change, through biodiversity and other nature-based solutions on campus and beyond.

Each toolkit includes resources that have been adapted from previous SEEDS student-led research projects, and should not be construed as an official position of the University

What can you get out of it?

UBC STUDENTS:

Tools can be used to support student applied research to inform UBC’s guiding sustainability policies and commitments, and professional skills development related to the complex challenges connected to climate change and its impacts on biodiversity.

UBC OPERATIONAL STAFF:

Serve as a collection of summarised knowledge and lessons learned from student-led research, to continue to inform the areas of work which have inspired and guided the direction of SEEDS research projects.

UBC FACULTY:

Serve as a resource to integrate biodiversity and climate topics into curriculum, and support student research and professional skills development.

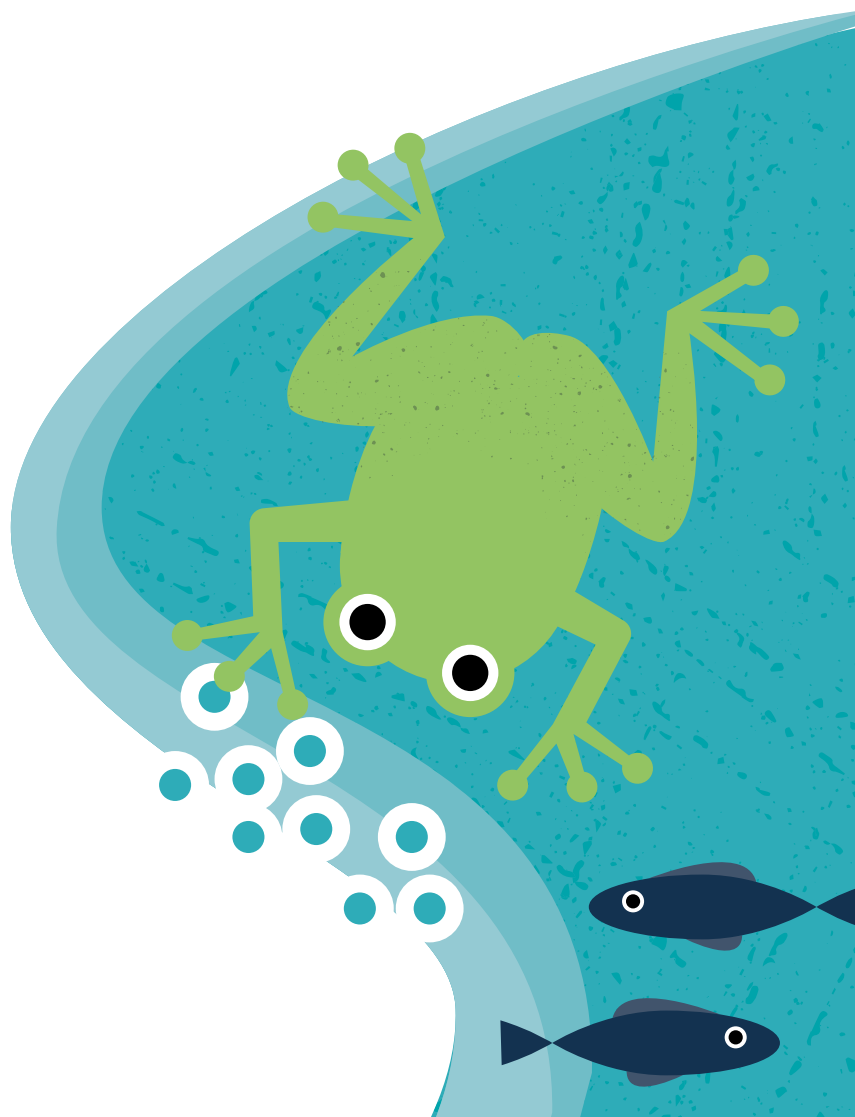
UBC COMMUNITY:

Promote community engagement and collaboration on biodiversity and climate change challenges & opportunities at UBC and beyond.

What information can you find in this ToolTree?

In this Urban Biodiversity in a Changing Climate ToolTree, you will find information about:

- Challenges of biodiversity loss and climate change
- How biodiversity is affected by climate change
- How climate change impacts biodiversity
- The role biodiverse ecosystems play in UBC's vibrant community and ecosystems
- An at-a-glance view of the different interconnected Toolkits and the ways they relate to the main themes of biodiversity and climate, and a snapshot of what you can find inside!



Context

First off, what do we mean by the terms “biodiversity” and “climate change”? How are they interconnected?

Biodiversity refers to the variety of all living things on Earth and their interrelationships and interactions (adapted from UNESCO, 2018). It directly contributes to the function and resilience of ecosystems — which are communities of organisms and their physical environment. Biodiversity is manifested at all levels of the organization and functioning of biological life, from the micro to the macro level, including genetic diversity, diversity of species, ecosystems and biomes, and cultural diversity.

Climate Change refers to:

- A dramatic shift in temperature and precipitation patterns around the world, caused by:
- An increase in concentration of greenhouse gases (GHGs) like carbon dioxide and methane.

These GHGs are:

- Generally a direct result of human activity.

According to the United Nations Framework Convention on Climate Change (UNFCCC), [climate change is the defining issue of our time.](#)

The Biodiversity and Climate Crisis — Two Deeply Connected Crises:

Around the world, there is increasing recognition that the biodiversity and climate change crises are interconnected and complex. Over the past 500 years humans have also caused biodiversity declines that are as severe and widespread as many other mass extinctions in Earth’s history. There are also a number of “symptoms” of climate change, such as rising sea levels and increased extreme weather events, which are also usually associated with the term. Urban ecosystems already face numerous stressors on biodiversity, and climate change will interact with these existing issues to increase their severity. Global environmental change, such as land cover changes, species introductions, pollution, and altered disturbance regimes can also interact with changing climates to further affect population dynamics. For this reason, climate change needs to be framed as one of the key stressors that urban ecosystems will experience.

According to the United Nations’ [Intergovernmental Science-Policy Platform of Biodiversity and Ecosystem Services](#) (IPBES) stated that 1 million species are currently at risk of extinction. The report indicated that climate change is in the top 3 drivers of biodiversity loss. Just like rising sea levels and other symptoms of climate change, the issue of biodiversity loss is generally very connected in the same way. As a variety of research has shown, the effects of climate change on biodiversity are well documented for many species in environments underwater and on land. Many species are also changing their life cycles as climate change affects their growing seasons.

GLOBAL POLICY SOLUTIONS:

International policy commitments have acknowledged that climate change and biodiversity loss are intertwined. For example, the 2030 Agenda for Sustainable Development adopted by all United Nations member states proposed 17 Sustainable Development Goals (SDGs).

Three of these goals target climate change and biodiversity loss:



These three goals represent a powerful example of global unity among nations towards advancing ideas and developing solutions for the climate and biodiversity crises. Nature itself serves a key role in contributing to the advancement of complex and cross-cutting actions within each and across these Sustainable Development Goals (SDGs).

NATURE-BASED SOLUTIONS FOR GLOBAL ISSUES:

In the same way that a changing climate can reduce biodiversity, taking action to enhance biodiversity can help mitigate and adapt to climate change. In many ways, a biodiverse ecosystem is one of the most powerful and resilient allies in building climate-resilient communities. The concept “Nature-based Solutions” (NbS) is a framework that in many ways can be considered “a new term for an old idea that has been understood and practiced for millennia” ([NbS Youth Position](#), 2021). The International Union for Conservation of Nature (IUCN) specifically defines NbS as actions to address societal challenges through the protection, sustainable management and restoration of ecosystems, benefiting both biodiversity and human wellbeing.

According to the [NbS Youth Position Statement](#), led by the [Global Youth Biodiversity Network](#), [YOUNGO](#), and [Youth4Nature](#), and powered by youth across the globe:

- The term “NbS” is vulnerable to greenwashing that could promote monoculture plantations, the commodification of nature, land grabbing, and other impacts on human rights.
- NbS must provide benefits for both biodiversity and climate, since they are interlinked, and biodiversity conservation and ecosystem integrity must be centralized within NbS policy, research, and practice.
- For NbS to be effective, they must prioritize local biodiversity conservation, ecosystem integrity, and ecosystem functions, and must be grounded in justice, equity, and inclusion.

Examples of practical solutions aimed at accelerating climate change action are also notable for their contributions in conserving biodiversity. For example, in many cases by planting trees to sequester carbon emissions, we can expand populations and distribution ranges of endangered tree species. Policy initiatives that sit at the intersection of climate action and biodiversity include the Aichi Biodiversity Targets. Specifically, Target 10 stated that: “By 2015, the multiple anthropogenic pressures on coral reefs, and other vulnerable ecosystems impacted by climate change or ocean acidification are minimized, so as to maintain their integrity and functioning”, with the post 2020 agenda being currently discussed in policy meetings.

REGIONAL CONTEXT

City planners and policymakers have the power to drive real change to support biodiversity and climate resilience. Regionally, cities are leading the change in climate action and biodiversity conservation. Alongside UBC's climate action leadership, both Metro Vancouver and the City of Vancouver have also demonstrated bold initiative in responding to climate change. Respective policies have accomplished this by pursuing a carbon neutral region by 2050 and by ensuring that the infrastructure, ecosystems, and communities are resilient to the impact of climate change.





Case Study: Metro Vancouver

Regionally, cities are leading the change in climate action and biodiversity conservation.

Metro Vancouver published its [Climate 2050 Strategic Framework](#) to guide climate policy and action in the region until 2050 as well as an [Ecological Health Framework](#), a document that includes principles, goals, and strategies for ecological health in the region. The Ecological Health Framework focuses on ecosystem services and green infrastructure that will provide the foundation for a healthy and resilient urban environment. Both frameworks follow the Strategic Directions for Biodiversity Conservation in the Metro Vancouver Region (2008), a plan to integrate biodiversity into land-use policies, programs, and plans. This publication supports regional conservation collaborations and efforts happening on the ground to protect a diverse network of protected watersheds, parks and conservation areas, and designated agricultural lands.

Adopted in 2018, the Metro Vancouver Ecological Health Framework also highlights three goals for the management of natural systems in the city:

→ **Goal 1: Build ecological resilience and minimize impacts**

→ **Goal 2: Protect natural areas and conserve ecosystem services**

→ **Goal 3: Nurture nature within communities**

Since 2011, six Metro Vancouver municipalities have developed strategies and plans to address biodiversity and habitat including: Burnaby (2016), New Westminster (in progress), Port Coquitlam (2011), Richmond (2015), Surrey (2014), and the City of Vancouver (2016). Metro Vancouver has also assembled an incredibly useful and [comprehensive series of materials](#), designed to help adapt its urban forests to climate change. These include a toolkit that explores regional street tree regulations and a guide for species selection when planning new urban greenspaces.



Case Study: City of Vancouver

In 2011, The City of Vancouver committed and made progress on implementing the [Greenest City 2020 Action Plan](#) and the [Renewable City Strategy and Action Plans](#), which set ambitious targets around climate and biodiversity including:

- **Before 2050** 100% of the energy used in Vancouver is derived from renewable sources. (Renewable City Strategy)
- Biodiversity Strategy to **protect, enhance, and restore biodiversity** throughout our parks and landscapes.
- **By 2030**, restoration work will be completed on enough forest and coastal ecosystems in Vancouver and the surrounding region to remove one million tons of carbon pollution annually by 2060

The City of Vancouver also implemented a city-wide [Biodiversity Strategy](#), which aims to provide a foundation for protecting and restoring natural areas, species, and ecological processes, and for improving access to nature in all of Vancouver's neighbourhoods.



Case Study: University of British Columbia (UBC) Vancouver Campus

Post-secondary institutions around the world are making bold commitments to climate action.

Locally, recent extreme weather events of the past summer's heat wave and winter flooding have highlighted the need for resilient, biodiverse landscapes. UBC recognizes the importance of biodiverse ecosystems for climate resiliency. In December 2021, UBC launched its [Climate Action Plan 2030](#), which contains "Biodiversity, Adaptation and Resilience" (p. 45-46) as a Complementary Actions and eight associated Actions (p.45-46). Short Term Actions (by 2024) including:

- **Develop a Climate Adaptation, Resiliency and Biodiversity Strategy that is an 'umbrella' strategy that incorporates other UBC plans, policies and initiatives, with specific actions to maintain and enhance urban biodiversity as a tool for climate action through nature-based solutions.**
- **Adopt biodiversity metrics as a key indicator of climate resilience on campus.**
- **Leverage and expand established interdisciplinary research initiatives, student and faculty led research to advance climate mitigation, adaptation and biodiversity solutions, in service of community health and wellbeing (e.g. reducing climate anxiety, addressing health impacts from forest fire smoke, etc.) (p.45.)**



Case Study: University of British Columbia (UBC) Vancouver Campus

UBC has a number of campus policies, plans and initiatives relevant to urban biodiversity and climate, including:

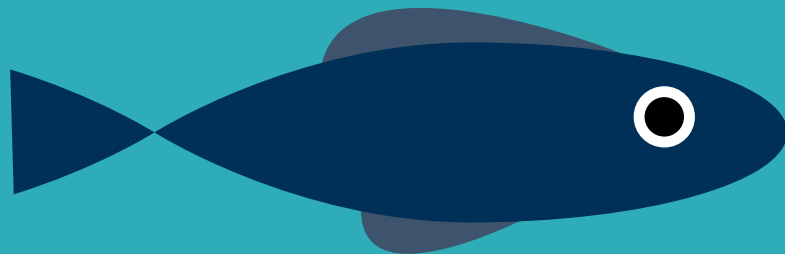
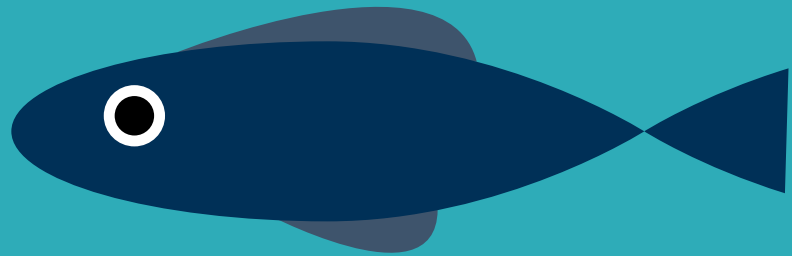
- **The Green Building Action Plan, which includes a Biodiversity Component Area, devoted to targets and indicators for biodiversity and healthy ecosystems. The plan also outlines the direction for a future campus-wide Biodiversity Strategy (p. 31).**
- **The Water Action Plan which addresses water management at UBC's Vancouver campus, and includes collaboration with the University Neighbourhood Association (UNA) and other on-campus partners.**
- **The Integrated Stormwater Management Plan, which includes green roofs and associated green infrastructure among its implementation recommendations**

Most recently, the emerging Campus Vision 2050 ([Terms of Reference and Website](#)) highlights the importance of campus biodiversity in a changing climate:

“Urbanization, land use and climate change can threaten biodiversity and the systems that support human and ecological wellbeing. With these threats in mind, the challenge, and the opportunity, is to create an urban environment that protects and enriches biodiversity.” (p.18).

Through these existing and emerging plans, UBC's approach to climate action recognizes the deeply connected nature of climate change and biodiversity loss, and the importance of maintenance and enhancement of biological diversity in the campus ecosystem.

Research Mobilization Toolkits: Overview

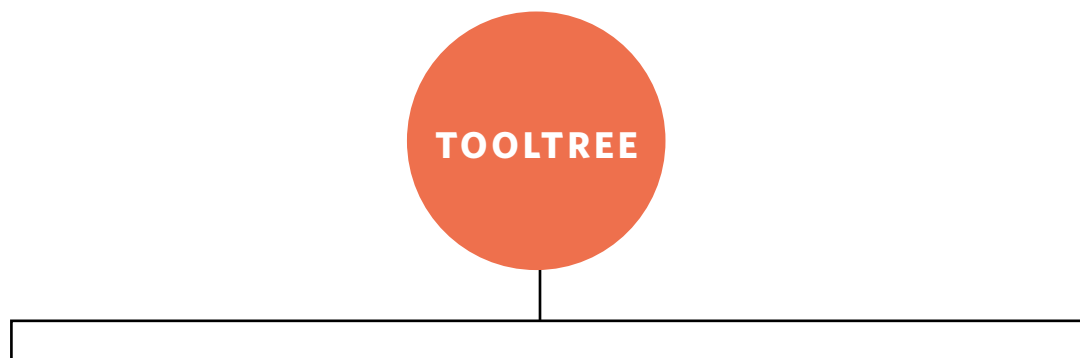


This Urban Biodiversity in a Changing Climate ToolTree contains a series of Toolkits, spanning critical topic areas that relate to the larger themes of urban biodiversity and climate change.

Each Toolkit aims to support applied student-led research projects in partnership with UBC faculty and staff in ways that can inform UBC’s sustainability commitments. They also can serve as accessible resources to increase awareness, knowledge and action, and improve resilience to climate change, through biodiversity and other nature-based solutions on campus and beyond.

Each toolkit includes resources that have been adapted from previous SEEDS student-led research projects, and should not be construed as an official position of the University.

The reader should bear in mind that these documents are a compilation of student research conducted on the topic of urban forests and should not be construed as an official position of the University.





CITIZEN SCIENCE TOOLKIT

What is Citizen Science?

Citizen science is the practice of conducting scientific research in collaboration between members of the trained scientists scientific community and interested Public stakeholders to increase scientific knowledge, education and outreach, while contributing to address societal concerns. Founded upon the idea of collaborations between researchers and interested community members, citizen science has become an incredibly valuable tool to researchers around the world in recent years.

Why is this Toolkit Included?

Biodiversity is a challenging topic to understand, and even more difficult to measure. By engaging in Citizen science programs, community members can benefit from an increased connection to their local environment, and exposure to scientific topics and research. Citizen science is also an effective tool for ecosystem monitoring, allowing researchers to analyze ecosystems at a larger scale than otherwise thought.

What does this Toolkit include?

This Toolkit gives an overview of the guiding principles of citizen science, what it means for your research, and most importantly — how to do it using a case study from UBC's Vancouver Campus!! The toolkit also includes a comprehensive table that lists many of the tools used for citizen science research and analysis, that can be used in the classroom, the lab in your backyard!

[Download the Citizen Science Toolkit](#)



TREE INVENTORY TOOLKIT

What is a Tree Inventory?

A tree inventory is the process of collecting and logging information about the trees of an urban forest. The inventory of the trees within UBC's diverse urban forest has been supported by many student researchers working in conjunction with UBC faculty and staff over the past few years, and this toolkit is the compilation of what has been learned from that process.

Why is this Toolkit Included?

Urban trees are an incredible asset to both biodiversity and climate action. They provide a multitude of ecosystem services such as shading, carbon sequestration, food provisioning, mental and physical health — they are essential to a healthy urban community in a changing climate. By understanding our urban forests, we can gain insight into the ecosystem functions and better understand the risks of a changing climate.

What does this Toolkit Include?

This Toolkit synthesizes the process and learnings from the campus tree inventory conducted to date. It contains an overview of methodologies, a description of the attributes that were measured, and several accompanying GIS web maps, in order to share the process with others and inspire similar projects. This toolkit also includes a case study describing the procedure undertaken for the UBC Vancouver Student Led Tree Inventory

[Download the Tree Inventory Toolkit](#)



UBC ECOLOGICAL CONNECTIVITY TOOLKIT

What is Ecological Connectivity?

Ecological Connectivity is the degree to which green spaces allow for the movement of life between them, whether by humans or other flora & fauna. As a general rule, greenspaces that form “networks” by being connected closely together, allow life to move more freely throughout the urban forest. Ecological connectivity is an important part of a healthy ecosystem that can often go unnoticed — the design, structure and placement of urban greenspaces can have a strong effect on the function of an urban ecosystem.

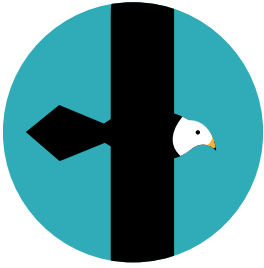
Why is this Toolkit Included?

An urban ecosystem with a high degree of connectivity, where patches of green space are placed closely to allow life to move freely, is generally more able to foster biodiversity, and resilience to climate change and other stressors. Planning, designing and managing landscapes for ecological connectivity is an essential part of building climate resilience.

What does this Toolkit Include?

This Toolkit gives an overview of the guiding principles of ecological connectivity, examples of areas on campus with high and low connectivity, and most importantly — examples of landscape interventions that can be used to design for connectivity! The toolkit also includes a link to an interactive model of ecological connectivity on UBC’s Vancouver campus case study reviewing of the methods that were used in its development.

[Download the UBC Ecological Connectivity Toolkit](#)



GREEN CAREER TOOLKIT

What do we mean by Green Careers?

“Green” careers refer to a wide range of jobs that relate to the diversity of sustainability challenges faced by people and the planet (such as climate change, biodiversity loss and water management). Pursuing a green career can enable positive change and foster hope in the context of increasingly complex sustainability challenges - while building your network and developing professional skills.

Why is this Toolkit Included?

As more resources are allocated to address solutions for sustainability challenges - more work opportunities appear too. By helping to support younger professionals transition into jobs relating to sustainability, we can help mobilize action on climate and biodiversity.

What does this Toolkit Include?

A centralized virtual platform to support students in curricular or co-curricular (volunteer) applied research pertaining to biodiversity in a changing climate, including resources to support research skills development, project management skills, knowledge exchange and experience in issues affecting biodiversity in a changing climate.

[Download the Green Career Toolkit](#)

Additional Resources:



SEEDS SUSTAINABILITY PROGRAM

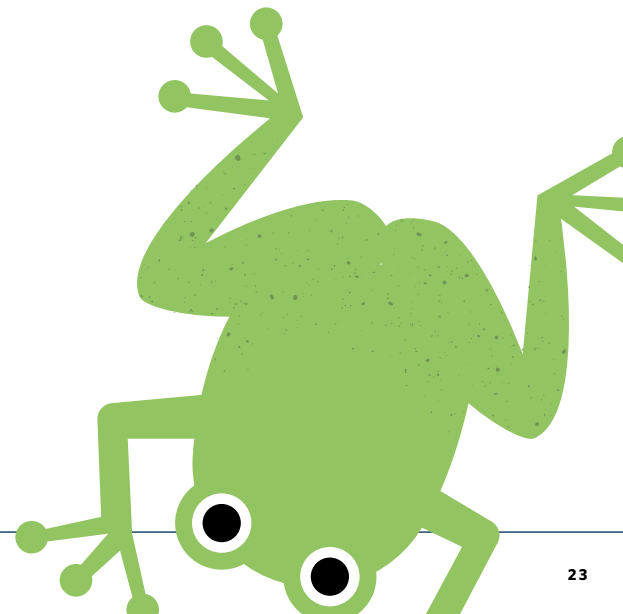
From urban biodiversity to food security and climate action, we invite you to explore this Research and Data Portal to learn about sustainability research, data and initiatives happening across the UBC Vancouver Campus and opportunities to collaborate. This Portal serves as a directory to reference the knowledge, tools and other resources that have been identified and developed to advance UBC sustainability commitments. On this page, you can learn about the biodiverse ecosystems and food systems that exist on our campus through interactive visual resources, and how they are being conducted by student researchers and other members of the UBC community.

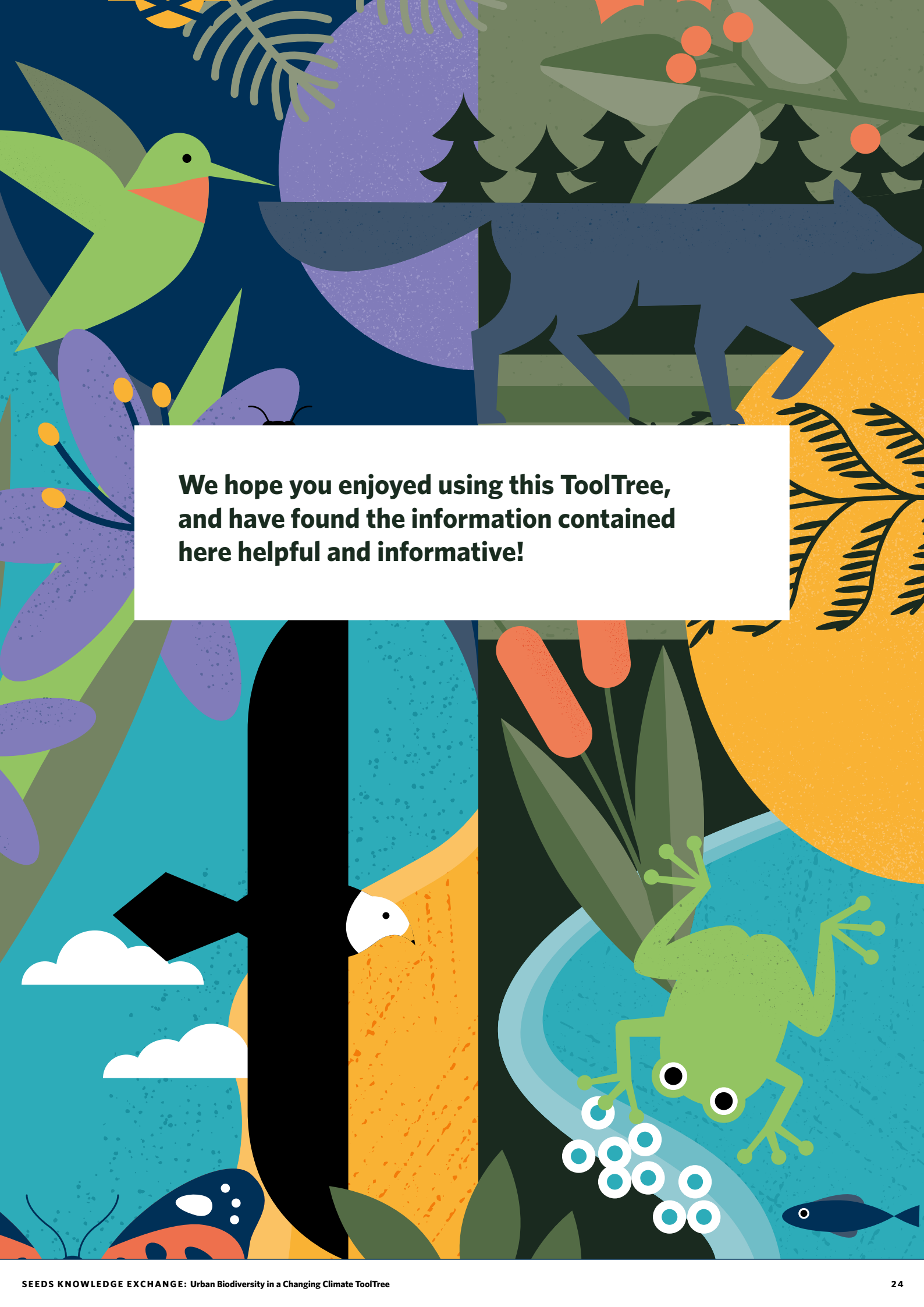
UBC URBAN FORESTRY RESEARCH HUB:

These emerging initiatives, developed by the UBC Faculty of Forestry, seeks to connect Bachelor of Urban Forestry students to multiple different research labs and Urban forestry projects both on and off UBC's Vancouver campus. Through this, students will be able to participate in high-level research projects that improve the quality of their educational experience, spike interest in graduate level research, and advance the science of urban forestry and the stewardship of urban ecosystems.

KUMU MAP — BIODIVERSITY STAKEHOLDERS AND KNOWLEDGE NETWORKS

Stewarded by the Campus Biodiversity Initiative: Research and Demonstration (CBIRD), and Climate Crisis in Urban Biodiversity (CCUB), interdisciplinary hubs for connecting academics, practitioners and the wider community in collaborative applied research to advance scalable urban biodiversity ideas, policies and actions on campus and urban solutions to the interconnected climate and biodiversity crises. This map provides centralized information about people (practitioners, researchers, instructors, students), networks and initiatives connected to urban biodiversity conservation and stewardship.





**We hope you enjoyed using this ToolTree,
and have found the information contained
here helpful and informative!**