

# Urban Forests and Historic Land Use Change

University of British Columbia (UBC) SEEDS Sustainability Program-Mapping Campus Landscape Change Over Time.

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**Hello! I am a UBC student pursuing an undergraduate degree in Urban Forestry. Here I am inside a tree, moments before reaching the**

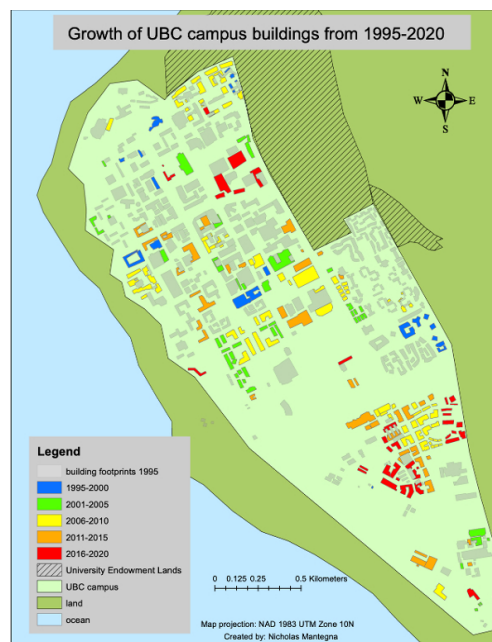
## summit of Dog Mountain on the North Shore of Vancouver, British Columbia.



Earthstar Geographics

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## Let's travel from Dog Mountain to the University of British Columbia



## Outline

- Importance of Urban Forestry on the UBC campus

- Timeline of Land Use Policy Shifts from 1908-1994
- Changes in building footprint area from 1995-2020
- Highlights of UBC Climate Action Plan 2020 and UBC Land Use Plan 2015
- Recommendations and mechanisms for action to inform urban biodiversity planning
- Potential future SEEDS projects



I was drawn to the natural beauty of the UBC campus as a first year student in 2018. Since then, I have learned in class about the reciprocal relationship between urban forests and the UBC community.

Urban forests increase biodiversity by providing habitats for a rich array of flora and fauna. Buildings decrease in monetary value overtime, whereas an urban forest increases in value by

providing more ecosystem services as the urban forest grows older. Many of the heritage trees on campus help protect the UBC community from the consequences of climate change. Trees can help mitigate climate change through ecosystem resilience, carbon sequestration and flood water mitigation.



The urban forest at UBC also provides mental health benefits by lowering stress levels in students and increasing social well being. In my opinion, the most beneficial service that urban forests provide to the UBC community is a welcoming environment that brings people together and fosters social ties. A student goes to a University to feel like they are part of a whole, part of the school, part of the university identity. Not only can urban forests mitigate and help us adapt to the impacts of climate change on the UBC campus, they also can restore and create a sense of community among UBC faculty and students.

**I am deeply concerned that the combination of**

**climate change and rapid grey infrastructure development occurring right now on the UBC campus is weakening the urban forest. Dry summers in Vancouver are becoming the new normal, therefore our trees are now more vulnerable to biotic and abiotic disturbances such as disease, pests and wind throw. We are at risk of losing many of the benefits that urban forests provide to the UBC community. We need to increase the resiliency of the UBC urban forests to disturbances by strengthening biodiversity locally on campus.**

**Before we make plans for the future of the UBC urban forest, let us look at the major land use policy shifts that have occurred throughout the history of UBC. How has UBC's built landscape changed over time since 1908?**



University of British Columbia. (2014, June 30). Sharp and Thompson proposed plan for UBC's new campus [P]. doi:<https://doi.org/10.14288/1.0020254>

## 1908

University Act established. The roles of Chancellor, President and Board of Governors were created.

*Section 19.1 of the University Act states, "The members of the board of a university must act in the best interests of the university."*

## 1914

Point grey campus plan established. As you can see to the right, the campus plan did not leave any room for urban biodiversity planning. At this point in time, the public eye did not acknowledge the benefits of urban forests. The creators of this campus plan (Sharp and Thompson) were abiding by section 19.1 of the University Act because it likely was not in the "best interest" of UBC to include urban forestry in the campus plan. The value of urban forests likely had not been measured or acknowledged yet.



Royal Canadian Mounted, 1914, 10 September, Aerial view of campus.

## 1922

Due to the large influx of students after WW1, classrooms became overcrowded. UBC students started the "Build the University Campaign" as a response to the overcrowded classrooms. After receiving 56,000 signature to build the university, the provincial government funded the construction of UBC.

## 1945

UBC develops Faculty of Law and various new programs to accommodate influx of students post WW2. Airforce camps (huts) get shipped to Point Grey campus to be used as residences, classrooms and laboratories.

Total undergraduate and graduate enrollment surpasses 3,000



## 1958

Creation of UBC Development Fund. The fund included public capital and government funding, leading to \$35 million for UBC campus growth.

## **1963**

President John B. MacDonald releases the report “Higher Education in British Columbia and a Plan For the Future.” The report was created in response to the large increase in demand for higher education among British Columbians.

## **1964**

Dr. P.A. Woodward gives \$3.5 million in funding for building projects such as the UBC health sciences center.

## **1965**

Construction of south campus research area (largest expansion in history so far).

H.R. McMillan gives \$3 million for construction of 13 libraries on campus and in Vancouver.



## **1915-1973**



\$173 million invested in UBC buildings on campus

## 1974

Senate committee passes the construction plans for 16 building projects, costing \$35 million

## 1976

Total undergraduate and graduate enrollment exceeds 24,000



## 1988

Creation of UBC Real Estate Corporation to manage and develop real estate on the UBC campus. Developed “University Town.”

## 1989

Beginning of “The UBC Campaign.” \$262 million raised from the campaign's private, corporate and provincial partners for

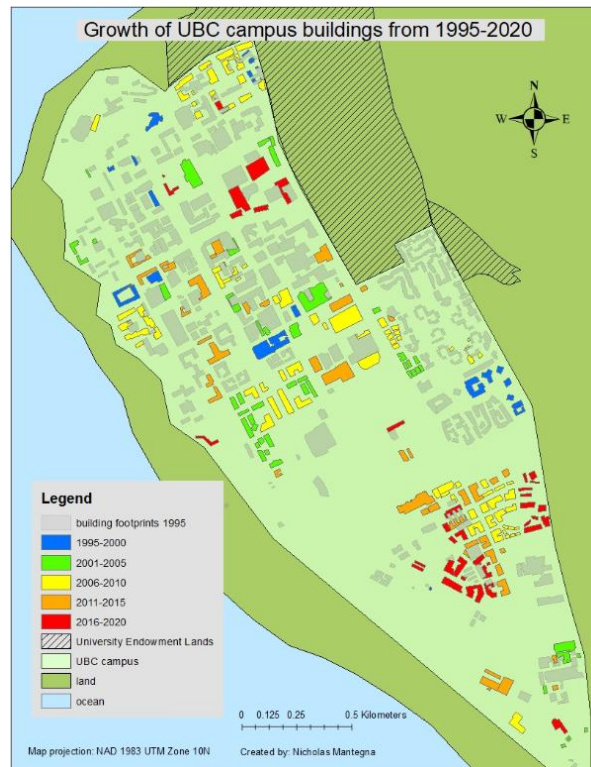
the construction of new buildings, programs, facilities and scholarships.



With the goal in mind of visualizing landscape change over time on the UBC campus, I imported an orthoimage of the campus landscape from the year 1995 into ArcGIS.

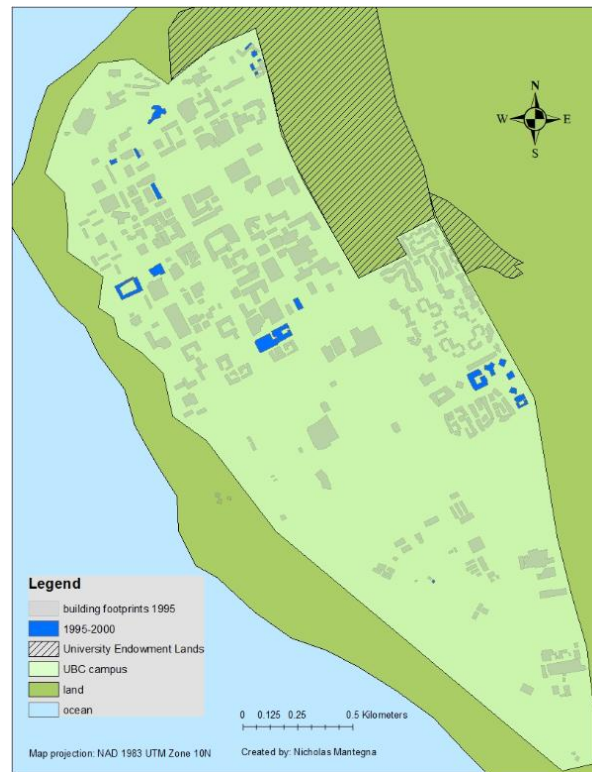


Then I drew polygons over all the building footprints in the 1995 image. After this, I imported an orthoimage of the UBC campus from 2020, georeferenced it and drew polygons in purple on all the building footprints that sprung up between 1995-2020.



Then I researched the building completion dates and color

coded the building footprints in the 1995-2020 time period into five year intervals.



## 1997

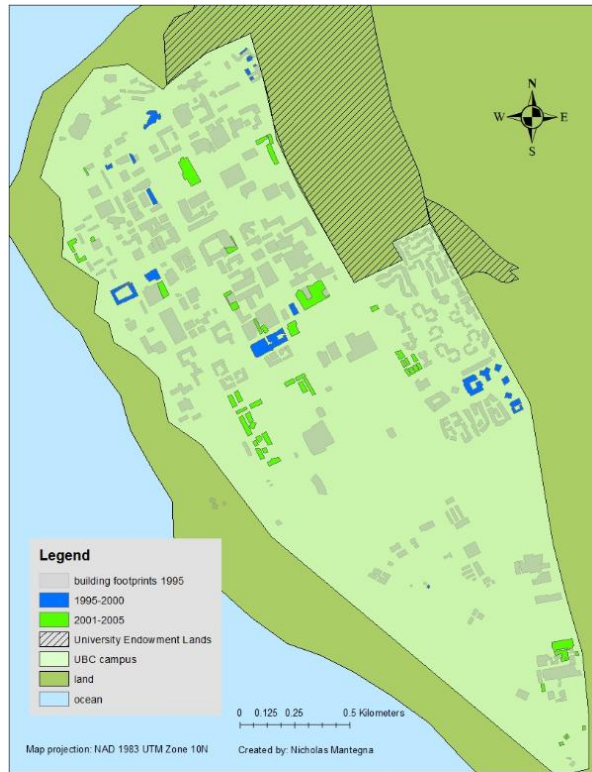
creation of UBC Official Community Plan

## 1998

Annual General Meetings begin to be held on campus to discuss goals for the future, accomplishments and finances.

## 2000

UBC Sustainability Policy #5 "Greening the Campus Initiative" leads to the creation of SEEDS



## 2001

Total undergraduate and graduate enrollment reaches 35,000 students



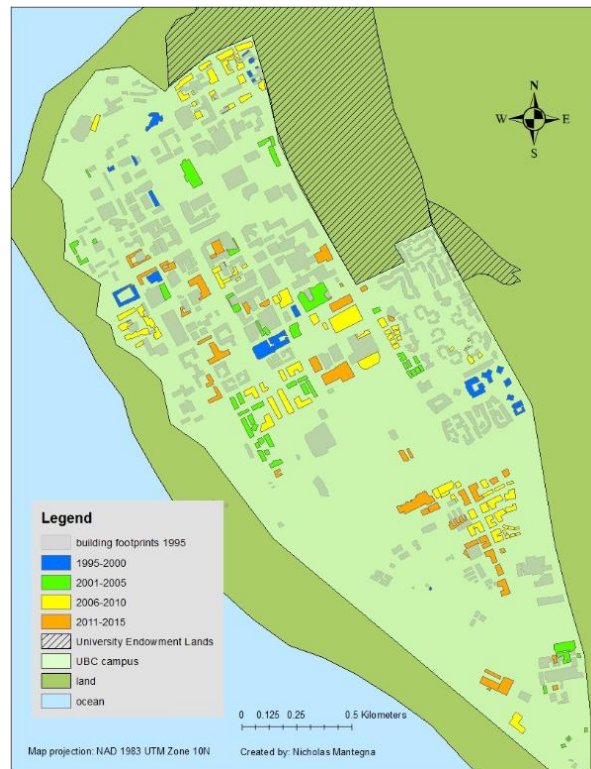
## 2006

Guidelines established for Evaluating Land Acquisitions: "Is the land fundamental and sufficient for maintaining or protecting the physical identity of the University?"

Memorandum of Affiliation is signed between Musqueam First Nation and UBC. Establishes a formal relationship between Musqueam people and UBC and recognizes that campus is located on traditional, ancestral, unceded Musqueam territory.

## 2010

Approval of UBC Land Use Plan

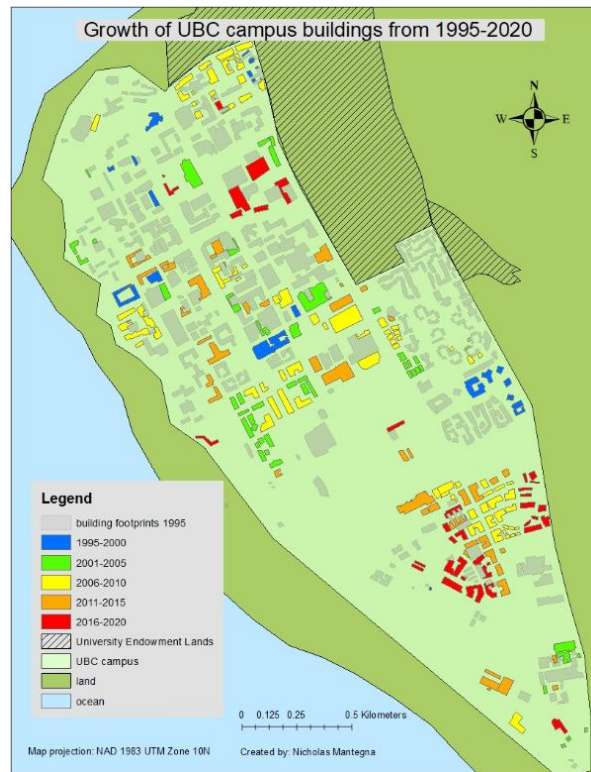


## 2014

Publication of the UBC Vancouver Campus 20-Year Sustainability Strategy. The report provides sustainability frameworks and goals for the year 2035.

## 2015

Total undergraduate and graduate enrollment exceeds 52,000 students

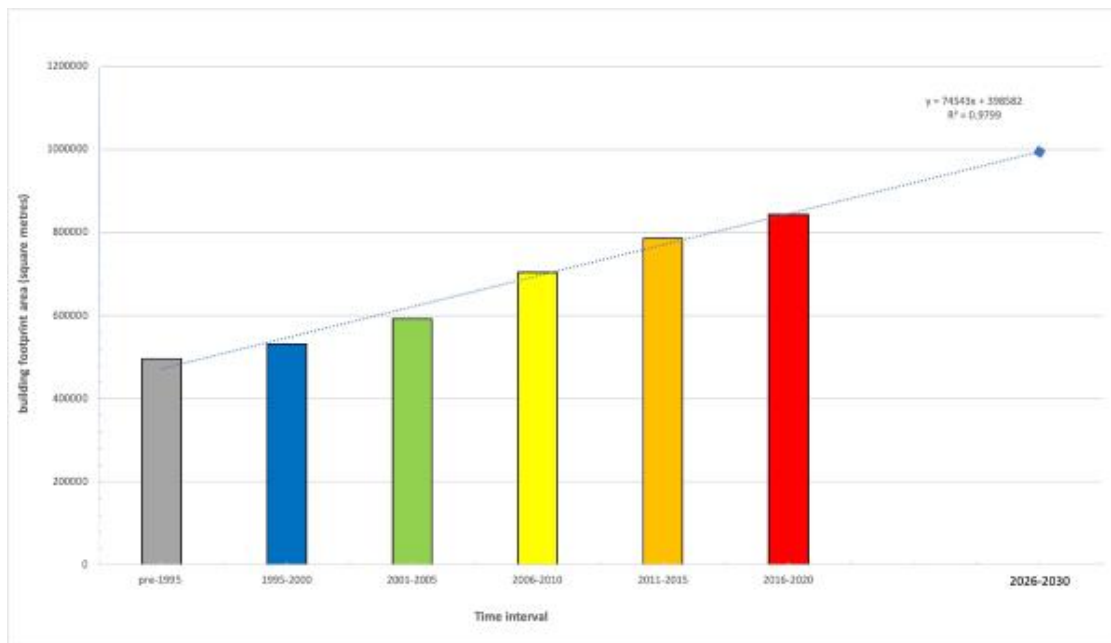


## 2019

President Santa J. Ono approves the Declaration on the Climate Emergency

## 2020

Creation of the Board of Governors "Sustainability and Climate Action Committee"



I was also recording the area, measured in square metres ( $m^2$ ), of every building footprint I drew in ArcGIS. After importing the area measurements into Microsoft Excel, I calculated the total building footprint area on the UBC campus pre-1995:  $\sim 497,002 m^2$ . The total building footprint area by 2020 was  $\sim 843,590 m^2$ .

I extrapolated the data with a trend line to make predictions about the projected building footprint area if UBC were to keep developing at the same rate it has been for the past 25 years. The diamond at the end of the trend line shows that UBC is projected to reach a total building footprint area of  $\sim 1,000,000 m^2$  by the time interval 2026-2030. The y-intercept of the trend line is  $398,582 m^2$ . The slope of the trend line is  $74,543 m^2$  per 5 year time interval. The  $R^2$  value of the trend line is 0.9799. Given the data I gathered from ArcGIS of building footprint area from the 1995-2020 timeframe, every 5 year interval the building cover area of UBC has been increasing by approximately  $74,543 m^2$ .





**It is difficult to visualize how large of an area  
74,543 m<sup>2</sup> is.**

**The average area of a professional size soccer field  
is 7,140 m<sup>2</sup>. Since 1995, UBC has been  
expanding its building cover area at an average  
rate analogous to 10 soccer fields every 5 years.**

**A takeaway from my findings is that UBC is  
changing its landscape to grey infrastructure at an  
alarming rate. Between 2026-2030, UBC will likely  
**double** its building footprint area relative to 1995  
levels. The UBC built landscape does not expand  
into empty space, it expands into a thriving  
ecosystem that has intrinsic value and benefits to  
the UBC campus identity. If we be patient and slow  
down the rate of campus growth, the UBC urban  
forest will increase in value over time and become**

**more resilient to disturbances triggered by climate change.**

**The UBC Land Use Plan 2015 and the UBC Climate Action Plan 2020 both possess biodiversity policy and planning recommendations that complement this project.**



## **UBC Land Use Plan highlights**

One of the goals of the Greater Vancouver Regional District (GVRD) is “to protect and maintain the viability of the ‘Green Zone’.”

UBC is committed to “meet GVRD’s Livable Regional Strategic Plan and to help sustain UBC’s academic mission.”

Regional Growth Strategy (RGS) goal number 1: "Create a compact Urban Area."

Goal number 3: "Protect the environment and respond to climate change impacts."

# UBC Climate Action Plan highlights

## 2.1 Policy context and the case for action

"In 2010, UBC became the first Canadian university to announce bold greenhouse gas reduction targets putting it on course to be net zero emissions by 2050."

## 5.2 priority actions

Utilize existing space more efficiently.

- a. Increase intensity of space use as part of major renovations, where possible.
- b. Utilize occupancy data to enhance facilities planning and increase space utilization.

**5.8 complementary opportunities** Actions to reduce GHG emissions that UBC has little control over:

Transportation to and from campus, business air travel for UBC staff and faculty, solid waste management, building lifecycle.

## **Recommendations to inform future urban biodiversity policy and planning:**

**We need strict enforcement of Land Use Plan RGS goal numbers one and three. A strong emphasis on protecting green zones and utilizing space more efficiently will help prevent urban sprawl on campus.**

**An addition to section 5.8 of the Climate Action Plan 2030 could be, "Strengthening and protecting biodiversity on campus for climate change and ecological resiliency." Or phrased differently, "Increasing the resiliency of the UBC urban forests to disturbances by strengthening biodiversity locally on campus." A method of fulfilling this recommendation is to adhere to section 5.2 of the Climate Action Plan 2020.**

**UBC allocated financial funds in the past from private and corporate entities into the creation of more buildings on campus, fueling an increase in building footprint area overtime. UBC should instead reallocate said funds into replacing low density and energy inefficient buildings with high density energy efficient buildings wherever appropriate so that campus growth needs can be met on a smaller footprint. Not only will UBC reduce its building footprint area by replacing and retrofitting old buildings, the institution will also reduce its carbon footprint, therefore putting UBC on a better track to reach the net zero Green House Gas emission targets for the year 2050.**

### **Key mechanisms for action:**

**The Board of Governors Sustainability and Climate Action Committee is the most effective and needed tool to outfit UBC with a proper response**

**to the climate emergency while simultaneously strengthening biodiversity locally on campus.**

**Action 14 of the 2018 Musqueam First Nation Comprehensive Community Plan is to "Exercise Land Management Jurisdiction." UBC needs to be listening and learning from Indigenous Land Use knowledge and practices through continuing the process of reconciliation between Musqueam First Nation and UBC.**

**Former UBC President John B. MacDonald's report "Higher Education in British Columbia and a Plan For the Future" opened with this quote:**

*Experience shows that a society, however successful it may have been in the past, will no longer survive if it cannot cope with the tasks of a new era. For this reason every civilized society tends to develop institutions which will enable it to acquire, digest, and advance knowledge relevant to the tasks which, it is thought, will confront it in the future. Of these institutions, the university is the most important." -Eric Ashby:  
Universities Under Siege*



UBC has a history of responding to the voices of their students. As we learned from the timeline, UBC expanded its built landscape in the past as a response to:

- The "Build the University Campaign" in 1922.
- The increase in demand for higher education in the 1960s.
- Funding in the 1980s and 1990s fueled by private, corporate and provincial entities.

In the past decade, I believe that the voice of the students has changed. The Eric Ashby quote reminds me that change is inevitably coming to the UBC campus as a response to the climate and ecological crises. In December 2019 the Board of Governors declared a climate emergency, then a month later committed to full fossil fuel divestment in response to student run UBC climate action organizations and a hunger strike by brave UBC students.

UBC prides itself in being a role model and leader on the world stage for sustainability. UBC will successfully achieve this status only when the university can lead by example through acknowledging the trend of sprawling grey infrastructure growth occurring right **now** on campus. The

current tension between balancing biodiversity initiatives and grey infrastructure growth on the UBC campus is a complex, multi-faceted issue with no easy solution. My data visualization and graph showing the startling trend of building cover change over time is just the beginning of a growing state of knowledge surrounding the socio-ecological affects of transitioning urban forest to grey infrastructure.

**I would like to thank Laura Arango, Emma Luker, Tara Moreau and Paul Pickell for overseeing and providing feedback for this project. I appreciate it!**

A student interested in building off the themes I laid out in this story map should consider the following SEEDS project ideas.

This project did not touch on the increase in Green House Gas (GHG) emissions that will result from the expansion of the UBC campus in the near future. A SEEDS project could examine how GHG emissions have been correlated with building cover area over time on campus. The project could also examine what the projected increase in GHG emissions is on the UBC campus given the rate of building footprint change calculated in this SEEDS report.

The hardest part of this project was creating an informative method for visualizing campus landscape change overtime. This project did not directly measure canopy cover change. A SEEDS report could show the diversity and value of the UBC urban forest being removed over a period of time as a result of grey infrastructure development. The data visualizations in this project showed what is being added on the UBC campus (buildings), whereas a future SEEDS project could use building

footprint data to symbolize what is being removed (canopy cover/biodiversity).

Once the UBC Vancouver campus tree inventory is complete, many more variables of the entire UBC urban forest will be available for assessment such as: Diameter at Breast Height (DBH), tree height, crown width, species composition, etc... Empirical attempts of measuring biodiversity common among conservationists such as genetic diversity, species diversity, species abundance, alpha diversity, beta diversity and gamma diversity will also be available for analysis once the tree inventory is complete. There are endless methods for visualizing data in ArcGIS. A future SEEDS report could use UBC tree inventory data in ArcGIS to make predictions about the composition of the UBC urban forest in the past and future.

The COVID-19 pandemic will inevitably influence future land use policy. There could be a dramatic decrease in students that go to physical classes in the near future. A SEEDS report could examine how UBC land use policy has shifted in the past as a result of exogenous shocks to society such as WW1 or WW2. The project could use my visualizations of building cover area overtime to make predictions about what landscape changes may occur in the near future as a response to the pandemic.

If you have any questions or comments, feel free to contact me at: [nickm9@student.ubc.ca](mailto:nickm9@student.ubc.ca)

## **References**

A Brief History of UBC. (n.d.). Retrieved from <https://archives.library.ubc.ca/general-history/a-brief-history-of-ubc/>



Archives, U. O. (2015, February 11). Aerial view of campus 19 September 1925. Retrieved from <https://www.flickr.com/photos/ubcarchives/16317540420/>

Canada, N. R. (2020, August 07). Government of Canada. Retrieved from <https://www.nrcan.gc.ca/our-natural-resources/forests-forestry/state-canadas-forests-report/articles/urban-forests-connection-through-time/22290>

Chapter 3. Benefits of Urban Forests. (n.d.). Retrieved from <https://treecanada.ca/resources/canadian-urban-forest-compendium/3-benefits-of-urban-forests/>

Climate Action Plan. (2020, July 16). Retrieved from <https://sustain.ubc.ca/campus/climate-action/climate-action-plan>

Forests and Sustainable Cities. (n.d.). Retrieved from <http://www.fao.org/3/I8838EN/i8838en.pdf>

George Allen Aerial Photos Ltd. (1983, January 1). Aerial view of campus [P]. doi:<http://dx.doi.org/10.14288/1.016252>

George Allen Aerial Photos Ltd. (1973, February 5). Aerial view of the campus and North Shore [P]. doi:<http://dx.doi.org/10.14288/1.0030053>

Kardan, O., Gozdyra, P., Misic, B., Moola, F., Palmer, L. J., Paus, T., & Berman, M. G. (2015). Neighborhood greenspace and health in a large urban center. *Scientific Reports*, 5(1). doi:10.1038/srep11610

Land Use Plan. (n.d.). Retrieved from <https://planning.ubc.ca/planning-development/policies-and-plans/campus-land-use-planning/land-use-plan>

McElhanney Consulting Services Ltd., 2020-05-11, "[Orthophotos, University of British Columbia

Vancouver Campus], 2020",  
<http://hdl.handle.net.ezproxy.library.ubc.ca/11272/10787>  
University of British Columbia [Distributor] V3 [Version]

Musqueam CCP Actions Handbook 2018. (n.d.). Retrieved from  
[https://www.musqueam.bc.ca/wp-content/uploads/2019/01/CCPUpdate\\_Handbook\\_2018\\_FINAL.pdf](https://www.musqueam.bc.ca/wp-content/uploads/2019/01/CCPUpdate_Handbook_2018_FINAL.pdf)

Plans, Policies and Reports. (2020, July 22). Retrieved from  
<https://www.sustain.ubc.ca/about/plans-policies-and-reports>

“Replace low density energy inefficient buildings with high density energy efficient buildings” “diversity and value of the UBC urban forest being removed over a period of time as a result of grey infrastructure development” (Gudaitis, Lia, Senior Planner for UBC Campus and Community Planning, personal communication, August 31st 2020).

Repository of Board of Governors Policies, Procedures, Rules, and Guidelines. (n.d.). Retrieved from  
<https://universitycounsel.ubc.ca/board-of-governors-policies-procedures-rules-and-guidelines/policies/>

Sandström, U., Angelstam, P., & Mikusiński, G. (2006). Ecological diversity of birds in relation to the structure of urban green space. *Landscape and Urban Planning*, 77(1-2), 39-53. doi:10.1016/j.landurbplan.2005.01.004

Student Enrolment Figures. (n.d.). Retrieved from  
<https://archives.library.ubc.ca/general-history/student-enrolment/>

Sustainability & Climate Action Committee. (n.d.). Retrieved from <https://bog.ubc.ca/board-committees/sustainability-committee/>

UBC Buildings – Alphabetical. (n.d.). Retrieved from

<https://archives.library.ubc.ca/buildings-grounds/ubc-buildings-alphabetical/>

UBC Properties Trust. (n.d.). Retrieved from <https://www.ubcproperties.com/>

Understanding the University Act. (n.d.). Retrieved from [https://universitycounsel.ubc.ca/homepage/guides-and-resources/univ\\_act/](https://universitycounsel.ubc.ca/homepage/guides-and-resources/univ_act/)

University of British Columbia. (n.d.). Retrieved from <http://pair2016.sites.olt.ubc.ca/files/2016/04/2015-Enrolment-Report.pdf>

" University Archives " General History A Brief History of the University of British Columbia. (n.d.). Retrieved from [https://www.library.ubc.ca/archives/hist\\_ubc.html](https://www.library.ubc.ca/archives/hist_ubc.html)

[unknown]. (1914, June 30). Sharp and Thompson proposed plan for Point Grey campus  
[P]. doi:<http://dx.doi.org/10.14288/1.0020255>

[unknown]. (1958). Aerial view of campus looking northeast  
[P]. doi:<http://dx.doi.org/10.14288/1.0029145>

2011-02-19, "Colour Digital Orthophotos on CD. Greater Vancouver and Fraser Valley. Region Vancouver",  
<http://hdl.handle.net/11272/H5PY2 V1> [Version]