Mapping the biodiversity potential on the University of British Columbia Campus

Caylee Dyck

University of British Columbia

LARC 581B

April 08, 2016

Mapping the biodiversity potential on the University of British Columbia Campus

University of British Columbia SEEDS Sustainability Program
School of Architecture and Landscape Architecture (SALA)
Vancouver, BC

PROJECT MEMBERS

Caylee Dyck, MLA Candidate, SALA Landscape Architecture
Caylee.dyck@gmail.com

Cynthia Girling, Program Chair, SALA Landscape Architecture
cgirling@sala.ubc.ca

Liska Richer, Manager, SEEDS Program, Campus Programs & Animation, Campus + Community Planning
Liska.richer@ubc.ca.

INTRODUCTION

This project was a joint academic/interdisciplinary research project that aimed to collect an understanding of the level of biodiversity on the University of British Columbia Vancouver Campus by mapping the current habitats on campus. The goal of the project was to produce a mapped inventory of habitat features including supportive local landscape systems and the related contexts of water, trees and food. In addition the project produced findings that:

- Can be shared with those involved in day-to-day development and operational management decisions to ensure sensitive growth, and individual site/project responsibilities to improve upon prevailing conditions
- Informs how the campus self-regulates with respect to establishing project goals and ensuring they are implemented.
- Form the baseline for on-going assessment of biodiversity health and provide the information needed to meet Sustainable SITES Initiative criteria for preserving threatened or endangered species and their habitats.

PROJECT OUTLINE

- Literature review on regional habitat types to identify the classification units to be mapped on the UBC Campus and develop criteria for the classification units
- Assessment of existing mapping, including GIS data provided by UBC, aerial photography, and regional data sources
- Map the UBC campus with classification units using existing landscape data, aerial photography and Google street view
- Conduct field inspections of select habitats to verify analysis
- Produce a mapped inventory of habitats present on the campus
- Produce summary visuals and or diagrams of research results
- Identify potential areas for biological enhancement or further research

I LITERATURE REVIEW

Numerous systems of vegetation classification exist for British Columbia (Meidinger and Pojar, 1991). However, the vegetative cover of the Vancouver region has recently been classified as part of a Sensitive Ecosystem Inventory (SEI) completed by Meidinger Ecological Consultants Ltd. and Metro Vancouver (2014). This was a detailed mapping project completed for the Greater Vancouver Region and Abbotsford to produce standardized ecological information for the entire region to support future decision making. Provincial SEI standards were followed to identify and map ecologically significant, unmodified ecosystems (sensitive ecosystems) such as wetlands, older forests and woodlands; as well as modified ecosystems such as seasonally flooded agricultural fields and young forests. Data including existing Terrestrial Ecosystem Mapping (TEM), Vegetation Inventory Resources Inventory (VRI), Canadian Wildlife Service Wetlands, provincial biogeoclimatic information and aerial imagery was used to map the region. This was a highly detail mapping project and report, the content being beyond the scope of this project. Furthermore, the report did not include mapping units for developed areas in the region. Although UBC campus has a large portion of forested land, the majority of the landscape has been modified, therefore additional mapping units were created for the purpose of this project. However similar methodology and mapping units to the SEI were used for this project to allow for consistency and future research opportunities to collect detailed data in the future for UBC.

The following classification units were used for this project:

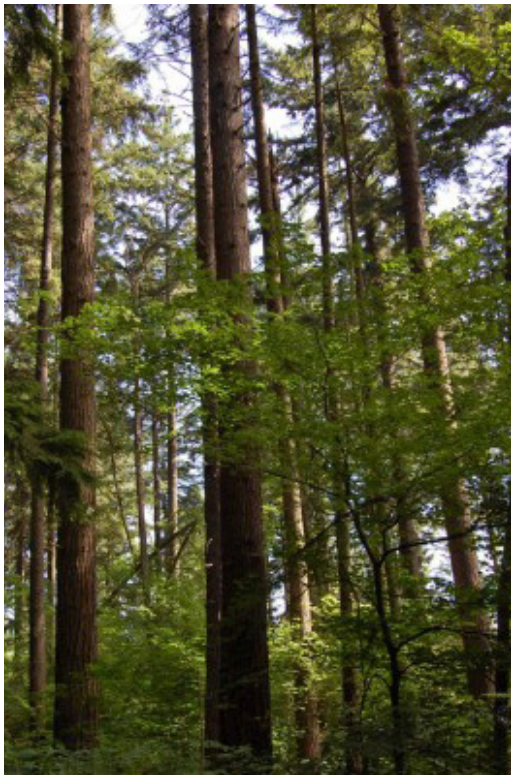
Coniferous Forest

- Forest dominated by coniferous trees (>75% stand composition)
- Dominant tree species include Thuja plicata (western red cedar), Pseudotsuga menziesii (Doulgas fir), Tsuga heterophylla (western hemlock) and Abies grandis (grand fir)
- Representative wildlife species include: black bear, marten, Douglas squirrel, southern red-backed mole, deer mouse, great horned owl, saw-whet owl, barred owl, band-tailed pigeon, northern flicker, chestnut-backed chickadee, winter wren, western toad, pacific treefrog, western red-backed salamander
- Wildlife species at risk include: keen's long-eared myotis, spotted owl, marbled murrelet, Roosevelt elk, grizzly bear, mountain beaver, Townsend's chipmunk, sitka mouse, shrew-mole, Trowbridge's sparrow, bald eagle, tailed frog, pacific giant salamander, clouded salamander
- Included in SEI report in old forest, mature forest and woodland mapping units

Mixed Forest

- Forest dominated by a mix of coniferous and broadleaf trees (<75% conifer and <75% broadleaf stand composition)
- Dominant tree species include Thuja plicata (western red cedar), Tsuga heterophylla (western hemlock), Populus balsamifera ssp. trichocarpa (black cottonwood), Acer macrophyllum (bigleaf maple) and Alnus rubra (red alder)
- Representative wildlife species include: black bear, marten, Douglas squirrel, deer mouse, northern saw-whet owl, hairy woodpecker, pine grosbeak, Townsend's warbler, northern alligator lizard, pacific treefrog, enstania salamander, northwestern salamander
- Wildlife species at risk include: marbled murrelet, Roosevelt elk
- Included in SEI report in old forest, mature forest, young forest and woodland mapping units

Deciduous Forest



- Forest dominated by broadleaf trees (>75% broadleaf stand composition)
- Dominant tree species include Populus balsamifera ssp. trichocarpa (black cottonwood) and Alnus rubra (red alder)
- Representative wildlife species include: black-tailed deer, black bear, gray wolf, cougar, marten, Columbian mouse, deer mouse, great horned owl, barred owl, ruffed grouse, band-tailed pigeon, northern flicker, hairy woodpecker, common raven, gray jay, Stellar's Jay, chestnut-backed chickadee, red-breasted nuthatch, winter wren, varied thrush, western toad, pacific treefrog, western red-backed salamander, enstania salamander, northwestern salamander
- Wildlife species at risk include: Roosevelt elk, grizzly bear
- Included in SEI report in mature forest and young forest mapping units

Old Field

- Land formerly cultivated, grazed etc. and later abandoned. Dominated by tall grasses and herbaceous plants with islands of shrubs of less than 40% cover (ideally 30% or less shrub cover)
- Dominant species include Rubus spectabilis (salmonberry), Salix spp. (willow species) and Malus fusca (Pacific crabapple)
- Representative wildlife species include early seral stage species including coyote, spotted skunk, coast mole, Cooper's hawk, red-tailed hawk, rough-legged hawk, northern harrier, short-eared owl, mew gull, glaucous-winged gull, northwestern crow, brewer's blackbird
- Wildlife species at risk include: shrew-mole, mountain beaver, Townsend's mole, common barn owl, purple martin, Peale's peregrine falcon, rhinocerous auklet, fork-tailed storm-petrel, Leach's storm petrel, tufted puffin, Cassin's auklet
- Included in SEI report as old field

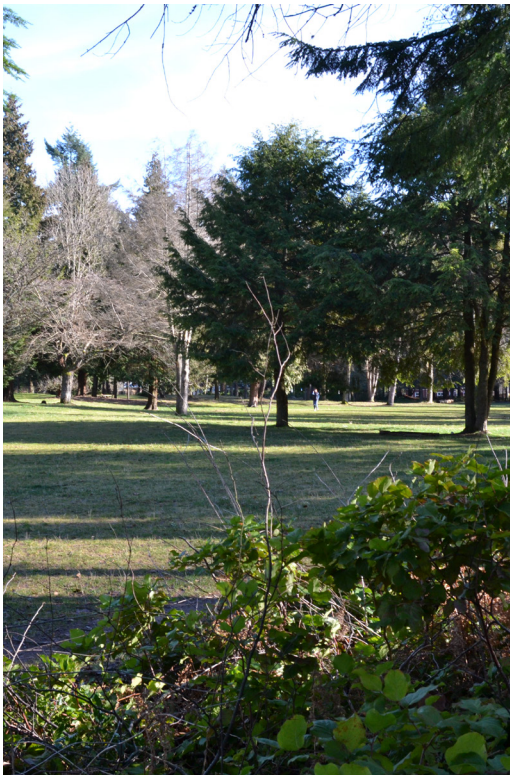
Meadow

- Open area dominated by herbaceous species and grasses
- Dominant species include Dactylis golmerata (orchard grass), Fescue arundinacea (tall fescue), Phleum pretense (timothy), Festuca rubra subsp. commutata (chewing's fescue), Festuca rubra (creeping red fescue), Trifolium spp. (clover), Apiaceae spp (carrot or parsley species), Lomatium spp (lomatium species), Solidago spp (goldenrod species), Lupinus spp. (lupine family)
- Representative wildlife species include coyote, spotted skunk, coast mole, Cooper's hawk, red-tailed hawk, rough-legged hawk, northern harrier, short-eared owl, northern saw-whet owl, Lincoln sparrow, mew gull, glaucous-winged gull, northwestern crow, brewer's blackbird
- Wildlife species at risk include: shrew-mole, mountain beaver, Townsend's mole, common barn owl, purple martin, least sandpiper, Peale's peregrine falcon, rhinocerous auklet, fork-tailed storm-petrel, Leach's storm petrel, tufted puffin, Cassin's auklet
- Included in SEI report in herbaceous and wetland (wet meadow subclass)

Hedgerow or Deciduous Shrub

- Linear patch of shrubby plants or thicket ideally 5 m in width and containing mixed, small trees and large shrubs with a diversity of species. Typically adjacent to open grassy area
- Dominant species include Alnus rubra (red alder), Rubus discolour (Himalayan blackberry), Rubus lactinus (evergreen blackberry)
- Representative wildlife species include coyote, spotted skunk, coast mole, Cooper's hawk, red-tailed hawk, rough-legged hawk, northern harrier, short-eared owl, mew gull, glaucous-winged gull, northwestern crow, brewer's blackbird
- Wildlife species at risk include: near ocean: Peale's peregrine falcon, rhinocerous auklet, fork-tailed storm-petrel, Leach's storm petrel, tufted puffin, Cassin's auklet
- not included in SEI report

Park



- Large area of open mown grass with islands of mixed trees and shrubs with a high diversity. Ideally adjacent to forest.
- Dominant species include Quercus rubra (red oak), Acer spp (maple species), Sorbus spp. (mountain ash species), Gaultheria shallon (salal), Holodiscus discolor (ocean spray), Ameliancher alnifolia (service berry), Mahonia aquifolium (Oregon grape), turfgrass
- Representative wildlife species include early seral stage species and urban adapters including coyote, spotted skunk, coast mole, Cooper's hawk, red-tailed hawk, rough-legged hawk, northern harrier, short-eared owl, mew gull, glaucous-winged gull, northwestern crow, brewer's blackbird
- Wildlife species at risk include: shrew-mole, mountain beaver, Townsend's mole, common barn owl, purple martin
- Not included in SEI report

Urban park

- Open mown grass with scattering of deciduous trees (lack of shrub layer and diversity of species)
- Dominant species include Quercus rubra (red oak), Acer spp (maple species) and turfgrass
- Representative wildlife species include early seral stage species and urban adapters including coyote, spotted skunk, coast mole, Cooper's hawk, red-tailed hawk, rough-legged hawk, northern harrier, short-eared owl, mew gull, glaucous-winged gull, northwestern crow, brewer's blackbird
- Not included in SEI report

Urban Old Field

- Open mown grass with shrub and small tree cover
- Distinguished from urban park by smaller open mown area
- Dominant species include Lonicera pileata (box honeysuckle), Taxus spp. (yew species), Buxus sempervirens (boxwood)
- Representative wildlife species include early seral stage species and urban adapters including coyote, spotted skunk, coast mole, Cooper's hawk, red-tailed hawk, rough-legged hawk, northern harrier, short-eared owl, mew gull, glaucous-winged gull, northwestern crow, brewer's blackbird
- Not included in SEI report

Freshwater reservoir

- Modified ponds or wetlands that are not naturally occurring
- Dominant species include Carex spp. (sedge species), Scirpus spp. (rush species), Juncus spp (rush species), Typha spp. (cattail species)
- Representative wildlife species include deer mouse, mink, wandering shrew
- Wildlife species at risk include: Pacific jumping mouse, Pacific water shrew, bald eagle, Great blue heron, green-backed heron, yellow-headed blackbird, purple martin, tailed frog, Pacific giant salamander
- included in SEI report as freshwater reservoir

Cliff or Sparsely Vegetated

- Areas of low vascular vegetation cover, generally 5-10% (rocky cliffs or constructed elements such as concrete walls and building facades)
- Dominant species include mosses, lichens and liverworts
- Representative wildlife species include little brown myotis, northwestern chipmunk, bushy-tailed woodrat
- Wildlife species at risk include: Keen's long-eared myotis
- Included in SEI report as sparsely vegetated

Habitat criteria was based on information obtained in the SEI report compiled by Meidinger Ecological Consultants Ltd. and Metro Vancouver (2014) and Urban Songbird Habitat: Landscape Design Guidelines compiled by Holland Barrs Planning Group, Patrick Mooney and Don Wuori Design (2007).

Wildlife information was based on the report Ecosystems of British Columbia compiled by Del Meidinger and Jim Pojar (1991).

II EXISTING DATA

GIS data and aerial imagery for the UBC campus was provided by UBC Planning: Development Services, GIS and Data Systems. Data that was relevant to this project included:

- street network
- pathways and sidewalks
- landscaped area (classified as wild/forested, planting bed or lawn)
- buildings
- campus boundary
- parking lots
- existing trees (not recently updated)
- water features

SEI data for the Vancouver was obtained from Metro Vancouver.

III MAPPING NEW CLASSIFICATION UNITS

The existing landscape data polygons provided by UBC were used to map the habitat classification units. This new shapefile, as well as the SEI from Metro Vancouver has been provided to SEEDS as part of the project package.

Habitat types on campus were mapped using aerial imagery, Google street view, field visits and the SEI data which mapped the adjacent areas. The most common application of street view was to assist in interpreting deciduous, mixed and coniferous forests; and for further detailed information including the number of vegetation structural layers, the presence of natives and to determine vegetation type (deciduous, evergreen or mixed). The more detailed information was only collected for some of the polygons as it was labour intensive and obtaining a full dataset was not achievable in the timeframe of the project.

It should be noted that there was no assessment of habitat quality during this mapping exercise.

In addition to the classification units listed above, the following units were also included in the mapping exercise:

Check
This unit was assigned to polygons that still require field checking to determine the habitat type due to discrepancies in aerial imagery and landscape polygon data or the habitat type could not be confirmed with street view.

Developed
This unit was assigned to polygons that have undergone development or are undergoing development and the landscape polygon is no longer relevant. New landscape data and habitat classification needs to be developed for these areas.

Hardscape
This unit was assigned to landscape polygons that are currently hardscape.

Turfgrass
This unit was assigned to landscape polygons that are largely dominated by turfgrass (i.e., athletic fields) and can not be classified as any of the other habitat types.

IV FIELD REVIEWS

Field reviews were conducted after the habitats were classified. A select number of polygons were verified for classification. Some polygons that were not classifiable from aerial imagery or street view were field checked but a large number of these still need checking.

V FINAL MAP + DATA

As stated above, two new GIS data layers were produced as part of the this mapping project (Habitat Classification and SEI). The SEI data classification types were more detailed than the classification types for UBC. Therefore a new column was added to the SEI data table that would allow the UBC data and the SEI data to be used together. These layers can be added to the UBC GIS dataset and used in future research and projects.

Figure 1 includes a graph detailing the amount of each habitat on campus. Figure 2 is the map depicting habitat classification on campus and on adjacent land. Figure 3 is a summary table of the habitat information. It should be noted that these are reduced size graphics and full size documents have been provided in addition to the ones below.

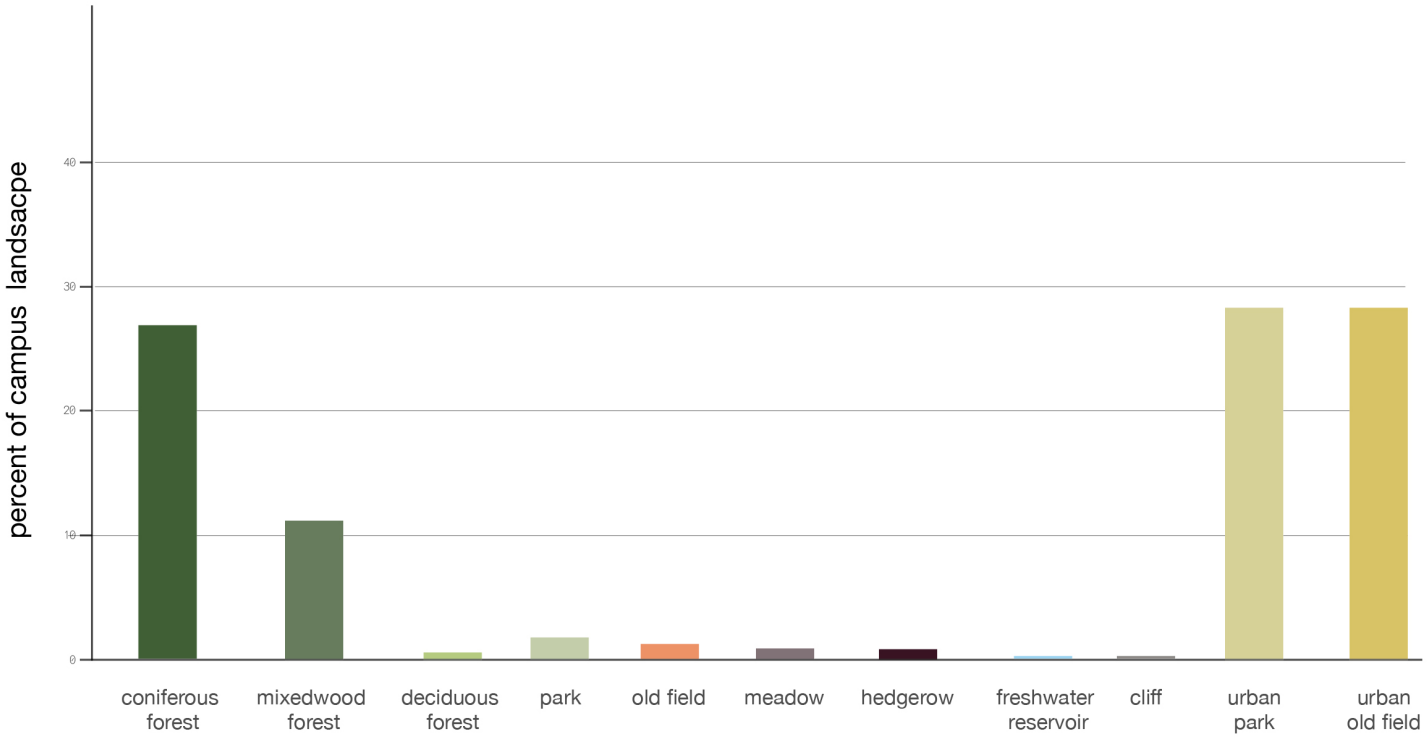


Figure 1: a quantity analysis of the current habitats present on campus

Figure 2: map depicting habitat classifcation on campus and on adjacent land

Figure 3: summary table of the habitat information

		canopy cover	vertical stratification	species richness	management conisderations	dominant species
deciduous forest		60-90% canopy cover with areas of 0-40% canopy cover	high - at least 4 layers groundcover, grass/forb, shrub and canopy	high	low maintenance for safety purposes only (i.e, removal of hazard trees)	 alnus rubra  populus balsamifera ssp. trichocarpa  rubus spectabilis  oemleria cerasiformis  rubus discolor
mixedwood forest		30-50% conifer canopy coverage	high - at least 4 layers groundcover, shrub, sub-canopy and canopy	high	low maintenance for safety purposes only (i.e, removal of hazard trees)	 tsuga heterophylla  thuja plicata  acer macrophyllum  alnus rubra  rubus spectabilis  oemleria cerasiformis  rubus parviflorus  vaccinium parvifolium
coniferous forest		50-100% conifer canopy coverage	moderate - at least 2 layers groundcover and canopy	moderate-low	low maintenance for safety purposes only (i.e, removal of hazard trees)	 tsuga heterophylla  pseudotsuga menziesii  thuja plicata  abies grandis  polystichum munitum  vaccinium parvifolium
park		3-20% canopy coverage, mown grass with islands of trees and shrubs	moderate - 3 vertical layers turfgrass/grass, shrub and canopy	moderate	low; requires repression of natural forest succession	 pseudotsuga menziesii  quercus rubra  sorbus acuparia  gaultheria shallon  arbutus unedo  sambucus racemosa  buddleja davidii  turfgrass
urban park		mown grass with low density of shade trees	low - 2 vertical layers turfgrass and canopy	low	moderate to high, requires regular mowing and tree maintenance	 quercus rubra  liquidambar styraciflua  acer rubrum  turfgrass
old field		dominated by a matrix of grass and forb cover with patches of woody shrub and tree vegetation, 30-40% cover; mown very little	high - at least 3 layers groundcover, grass/forb, shrub and canopy	high	low; requires repression of natural forest succession	 salix spp.  rubus spectabilis  grasses forbs
urban old field		turfgrass/hardscape dominated with patches of ornamental woody shrub and tree vegetation, 30-40% cover; mown regularly	moderate - 3 layers grass, shrub and canopy	high	moderate to high; requires irrigation, regular mowing and ornamental tree/shrub maintenance	acer spp evergreen hedges rhododendron spp. prunus spp. turfgrass
hedgerow		3-5 m wide and 2-3 m tall of dense canopy coverage	high - 3-5 vertical layers groundcover, grass/forb, shrub	high	low; requires repression of natural forest succession	alnus rubra rubus discolor rubus laciniatus
meadow		grasses and herbacous plants and little or no woody vegetation, mown very little	low-moderate - 2 vertical layers groundcover, grass/forb	high	low; unmown for 3-5 years	grasses forbs carex spp.
freshwater wetland		open water surrounded by emergent vegetation	low - 1-2 vertical layers	moderate-high	moderate; mostly mechanical maintenance	cornus spp. typha spp. scirpus spp. juncus spp. carex spp.

VI FUTURE RESEARCH OPPORTUNITIES

The completion of this mapping project has created oppurtunies for future projects and research. Some potential projects include:

- Further classify the existing habitat units in more detail (i.e., consistent with SEI: coniferous forest can be further classified into old forest, mature forest, young forest etc.) using historical data and detailed field reviews
- Further detailed study on proportion of native and non-native species on campus
- Assessment of habitat quality of the more sensitive ecosystems
- Research on wildlife on campus with a focus on specific habitats

REFERENCES

Meidinger, Del and Jim Pojar. February 1991. Ecosystems of British Columbia. Research Branch, B.C. Ministry of Forests, Victoria, BC.

Meidinger Ecological Consultants Inc. and Metro Vancouver. January 2014. Sensitive Ecosystem Inventory for Metro Vancouver and Abbotsford, 2010-2012. Metro Vancouver, Burnaby, BC.

Holland Barrs Planning Group, Patrick Mooney and Don Wuori Design. 2007. Urban Songbird Habitat: