An Analyses on the Human-Natural Environment Relationships at the David Dunlap Observatory Forest

Green Space Fieldwork: Final Report

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ENV 4113: Selected Topics in Environmental Studies

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Introduction

The David Dunlap Observatory is located in the heart of the Town of Richmond Hill in Ontario Canada and its lands hold a significant amount of human and natural history (see images A1, A2 and A3). Over this time the natural environment at this location has both thrived and been impacted by human actions. In the last decade, nearly half of the remaining natural environment was cleared for building, leaving a degraded environment. The goal of the fieldwork was to assess the human-environment two-way relationship in the DDO Park. From general knowledge about the deforestation that has occurred in the DDO forest, it can be hypothesized prior that humans have over exceeded the natural environment's limits and need to leave it be for it restore.

History of the Observatory

As of 2023, the DDO Park spans 189 acres (0.765 km^2) and is bordered by Hillsview Drive, Bayview Avenue, 16th Avenue, and the CNR Train tracks (see figure. B1) (Rosenberg et al. 4). Due to increasing light pollution in downtown Toronto during the 1930s, plans were made by the University of Toronto to establish a new observatory north of the city (Rosenberg et al. 4). The new location was a former farm with a brick farmhouse, orchards, and fields, situated at a higher topographic position (Rosenberg et al. 4). The land was generously gifted to the University by Jessie Donalda Dunlap in memory of her husband, David Dunlap, a University of Toronto astronomer (Rosenberg et al. 4). By 1935 the new observatory was built with the largest reflector telescope in the world at the time and remains the largest in Canada (see image. A4) (Rosenberg et al. 4). Adjacent to the observatory, an administration building was also constructed, housing three smaller telescopes (see image A5). The observatory has made significant contributions to Canadian astronomical research, including advancements in radio

astronomy and the identification of star Cygnus X-1 as a black hole (Rosenberg 4). It continues to be a local community attraction (see image A6).

History of the forest

As Toronto flooded into rural Richmond Hill, the observatory started to deal with light pollution in the 1940s so belts of coniferous trees and other experimental plantations of trees and shrubs were planted surrounding the observatory and all over the property (Rosenberg et al. 4). These lands became thriving natural ecosystems, as the agricultural fields turned into dense forests and meadows over the last 90 years. Due to advances in astronomy, technology, and significant light pollution in Richmond Hill, the university conducted research at other facilities (Rosenberg et al. 4). In 2008, the University of Toronto sold the land to Corsica Developments Inc.; a housing developer. Corsica's plan to demolish the observatory and clear the forest sparked protests and advocacy from the Richmond Hill community. In response, the Town implemented a heritage designation by-law in 2009 to protect the property's cultural significance (Rosenberg et al. 4). Following appeals and negotiations, Corsica agreed to transfer half of the property to the Town for public use, preserving it as DDO Park Lands (Rosenberg et al. 4). However, the surrounding forest experienced significant deforestation due to the urbanization/land development, losing approximately 75 acres (0.30 km2) in 2015-2016 (Rosenberg et al. 4). Now the city of Richmond Hill's 'Master Plan' is to turn the remaining natural environment in their ownership, into an interactive park with trails, skating rinks, parking lots, and recreational buildings.

Methodology

Conducting the fieldwork consisted of four visits; each around a week apart and with a different objective. The initial visit was to record and develop a sense of the place and space at

the DDO park and to get familiar with the natural ecosystem and human interactions which occur. During visit number two the site was analyzed through the perspective of human well-being and their interactions in/with the space. To conduct relevant observations, criteria were used to examine what makes a "restorative environment" in theory for humans. Visit three focused on assessing the ecosystem's health by conducting field surveys to identify the presence of plant, animal and insect species. An application, *PictureThis – Plant Identifier* was used to conduct these findings quickly in the field. The last visit considered the integrated and reciprocal health perspective of the park, recording perceptions, and experiences, and contemplating the past, present, and future of the site. To further get data on the DDO deforestation, habitat loss and land patching at the site were investigated over time. To do this past analysis, satellite imagery and aerial photographs (taken from aircraft) from the City of Toronto's Archive database, and Google Earth were utilized to compare the natural environment area and clearing over 100 years in the surrounding areas as well, (see image A7). Using Google Earth's polygonal measuring tool, the amount of cleared land and number of patches every 5 years since 1935 was measured and recorded (predicting about 1.5 years into the future according to Richmond Hill's DDO Park 'Master Plan'). The percent of habitat loss and fragmentation over time was able to be calculated and graphed to model and reveal patterns and trends in the deforestation that happened.

Results

A Sense of Place

During the initial visit to the David Dunlap Observatory, there was a vibrant sense of place for the community, bustling with human activities and wildlife. New trails with city signs, guided visitors through the forest and meadow providing opportunities for exploration and

engagement with nature. Plans were outlined on signs, like in the city's “Master Plan” which includes the expansion of trails joining through the north-western coniferous forest, aiming to transform the area into a high-volume park (see figure B2) (Rosenberg et al. 4, 15). While there was some sadness associated with the presence of extensive forest loss, it was positive to see efforts being made to restore the ecological integrity through new tree plantations. The park's unique characteristics add to its allure, including the fresh-crisp air and oxygen provided by the dense forests, the diverse soundscape of honey bees, birds, frogs, and human conversations, and the historic buildings marked with a large Canadian flag. Natural textures, such as the intricate grains on different trees and the varied shapes and types of leaves and branches, further enhanced the area's distinctiveness. Overall, the visit to the DDO area revealed a strong connection between the natural environment's resources and their importance to the local community, encompassing cultural and historical value, aesthetic landscapes, recreational areas, and inviting trails.

Restorative Environment Assessment

According to the American Psychological Association, a restorative environment is, “an environment-often a natural setting that rejuvenates a person and can help restore depleted attention resources or reduce emotional and psychophysiological stress” (American Psychological Association). After being away for about a week, spring has peaked and trees and flowers are fully blooming. This attracts more people from the community to come and spend time in the space. The site was found to have many areas separated from each other; both private and open to the public. These areas and the trail which connects them provide opportunities for people to sit on benches or the ground, let their dogs run, have picnics, play sports, walk and bike. During the afternoons the site can be very busy yet quiet, as everyone respects the sound

levels. The idea and fascination with the space can be due to the interesting buildings and heritage which offer locals a different place and take breaks in their day, unlike other places in Richmond Hill; a large criterion that makes it a restorative environment (American Psychological Association). The extent of environmental engagement for humans is not too significant. There are not many elements that are interactive with the space such as jungle gyms, tennis or basketball courts, gardens, tree planting, etc. Some workshops and tours can take members of the town into the observatory and administration building but suppose to that, there are not many built opportunities at the park for learning or engaging with the natural environment other than with trails and benches.

Ecological Health – Biotic Elements

On day three biodiversity and complexity were observed at the site. First, plant and tree species were recorded. A large variety of 36 different types of plant species were discovered and each finding was recorded (see table B1). Later the list was organized into Figure B3, to further classify and group the species to find patterns and trends. It was found that there was a large number (19) of different tree species compared to 7 herbaceous, 4 shrubs, 3 vine species 2 grass, and 1 moss. This variety could be found all over the DDO property in the meadows, experimental forests, coniferous forests, and the main areas landscaping. It provides the area with a lush variety and complex diversity of plant life; a large part of the ecosystem. However, it was also found alongside the newly paved trails, there was a large amount of dead plant and tree material decomposing in the forests. It appeared many of the tree roots were simply being ripped from gravity due to the moist ground not supporting the root systems. Many areas with such occuring did not appear very healthy and looked as if the areas along the tracks were affected by the tree/branch debris that was not cleaned up from the clearing of the paths.

In addition, surveys were done to get more insight into the biodiversity of animal and insect species. First looking at the animal species found (table B2.); there was a fairly high species richness calculated using the Shannon-Wiener diversity index and the Simpson index. A vast amount of animal species were found, some in a large abundance like the gray squirrels, Canadian geese, black-capped chickadees, and a family of four black-tail deers (see images A8 and A9). Note, this also included humans who were dominant at the park. Many humans were also partnered alongside different types of pet dogs (*Canis familiaris*). The majority of the wild animals were looking for food. For example, deer grazing the meadow, squirrels searching trees ducks, dunking heads for prey in ponds and even bees pollinating followers. In addition, insect species were separately surveyed in approximately a one-by-one-metre area (see table B3). A large rock in the area was also later lifted to get a better observation and to find a large variety of insects crawling above and below the soil (see image A10). Many red and black ants were found in colonies in the area and appeared to retreat below the ground fast as human activity occurred. Above the surveying location in the air, two types of butterflies were spotted; the monarch and the 'cabbage' butterfly. It was also found on this microscopic scale that there is a fairly high species richness of insects too. It is also significant to point out that these two surveys (animal and insect) produced very similar index results, which can confirm the measurements of the species richness in the DDO natural environment were relatively accurate.

Ecological Health – Abiotic Elements

On day three many abiotic elements were analyzed too. It was noted that throughout the majority of the natural environment, there were extremely high amounts of saturation throughout the forest areas, meadows and fields (see image A11). As well it appeared there was a significant amount of runoff along the trails which did not have much drainage (image A12). It was very

clear that over-saturation appeared to be the cause for many large and medium trees in the forest to be ripped from the roots, even when the root systems appeared to be well developed (images A13 and A14). This seemed to be caused much of the tree life to be dying, resulting in a large amount of decaying trees and plant material on the forest floor. Not to mention the land was over-saturated every four visits, even when the rain had not occurred within 48 hours prior. This went to show the extent and significance of the issue occurring at the site; the soil is not draining. Along the trials also appeared to be some sort of white-yellow nutrients or other substance accumulating throughout (see images A15 and A16). On the eastern part of the property where the forest borders the new house development, there was a large portion of land outcropping made from the land re-levelling (see image). This area's man-made slope provided conditions for much of the over-saturation from the environment to runoff into the construction site creating a pond of polluted and muddy water (image A9). Where the construction site meets the edge of the forest there was much construction debris, and trash spread in the vegetation and even in the mud/soil (image A17). At this slope where runoff was occurring, many large sedimentary rocks were outcropping and/or excavated from the housing developments. On many of these rocks, a white mineral build-up was evident on all different types of rocks near this wet and muddy area (image A18).

Integrated-reciprocal Wellbeing

On the final day at the site, time was used to reflect and further look into humans' impact on the natural environment. It appeared human actions have generally changed the natural environment over time using the land's resources to build housing communities and recreational resources like landscaped park space. What efforts the city has been putting in to restore the ecological integrity after the deforestation, such as planting more trees and removing invasive

species had not seemed to be very successful. Many newer plantations of trees are located in the "reforested trail" areas (see Figure B2). However, when assessing their health, it appeared the majority were in the extremely over-saturated ground and have died/were not reblooming at all. It was very clear that the town has been planting these trees in poor soil conditions and in areas that are/were not ever forested, such as in the meadows.

Deforestation can affect an individual's emotions and perceptions about the site. Considering how much this green space still means to the culture of Richmond Hill after so much was destroyed, someone with knowledge about the history can easily be upset and saddened to be aware that so much natural environment was torn down. The site has appeared to offer the town a go-to pace for green space activities. However, humans do not seem to be offering anything back to the natural environment besides building more (trails, courts, parking, etc).

After reflecting in the field, and returned. Past visual geographic information was used to get a different largescale/macroscopic perspective over the last century. By calculating the amount of natural environment cleared and also turned into patches over time common trends within the data were visible (table B4). First, figure B4. can be used to display how much land was cleared in five years over the last 100 years. Easily visible, a large amount of land was cleared for the built environment in the 1980s when Richmond Hill became more populated and agricultural land turned into the suburbs. As well, it is visible that from 2010 to 2015 there was the largest amount of the original natural environment cleared over the last hundred years. To add, figure B5. displays the relationship between the natural environment of the DDO lands and the built environment surrounding them (enclosing in on property). Figure B5 shows how the natural environment decreased as a result of the built environment increasing over time. It also

shows the point where the built environment exceeds the natural environment at about 1986. In Figure B6. The gap displays the direct relationship between how the increasing amount of land cleared every 5 years, increases the total built environment and thus decreases the natural environment of the DDO property over the last century. Using the data, the percentages of the natural environment cleared over time were also graphed, revealing three quadratic trends/shapes, with maximums increasing and time horizontally compressing each curve, as the years increase. In other words, this means that there as time goes on, the amount of land clearing is increasing but the rate at which it is being cleared is decreasing (clearing in a faster period). Figure B8 displays the general pattern of land fragmentation that occurs as the built environment increases over time. When graphed a general model and trend of habitat loss and patch configuration can be seen throughout and related to mean patch size over time, mean nearest neighbour distance and the total edge of habitat (figure B9). As the number of patches increases, there can only be so many patches until the area reaches its limit and the number of patches decreases. This can be seen in Figure B10 as well, with a limit of 6 patches. The quadratic trend line is also displayed in the graph to help present the common trend occurring with patching and fragmentation over time.

Discussion

Human's Need For The Natural Environment

To make sense of this data, many geographical and ecological concepts can be used to explain the state of the human-natural environment relationship occurring at the DDO park area. Overall, the results revealed various aspects of the DDO environment, including a strong sense of place and criteria which make it a restorative environment. It is a hub of Richmond Hill. The presence of other humans and activities, wildlife, and the new trail system, all contributed to an

engaging environment for the community. The park's historical significance, aesthetic landscape, and recreational opportunities added to its appeal. The assessment of a restorative environment indicated that while the DDO park offered opportunities for relaxation and contemplation, there were limited interactive elements that engaged people with the natural surroundings. The absence of built features such as gardens or educational spaces hindered deeper engagement with the ecosystem. Incorporating more interactive elements could enhance the restorative qualities of the environment and foster a stronger connection between humans and nature.

Biodiversity

The field surveys conducted to assess biodiversity revealed a high species richness of both animal and insect species. “Species richness is the easiest way to quantify diversity and is a simple tally of the numbers of unique species in a collection or set of observations” (Cardinale 62). The Simpson diversity index ranges on a scale of 0 to 1 and between the two surveys (macro and microscopic), the DDO area has an average index of 0.92 (Cardinale et al. 64). The Shannon diversity index is not nessicarily compared to a scale, but to other shannon diversity indexes (Cardinale et al. 64). When comparing, the animal/macroscopic survey has a slightly higher shannon diversity index than the insect’s index (table B2). The soil and ground were very over saturated which could be some reason for this. As well, considering the decreased size of the deforested environment, it was very interesting there was such a strong animal and insect biodiversity that remained in good health and was resilient like the deer population. Important to highlight that animal and insect biodiversity may be strong, but plant biodiversity is as well. The vast amounts of plants that remain after deforestation provide the ecosystem with much habitat area. However, much of this ‘variety’ of plants are invasive species. For instance, hogweeds, horseweeds, which are mainly taking over the meadow/field areas, and garlic mustard invading

the entire floor of the forested areas. As well, much of the eastern forests were overpowered by common buckthorns which can be invasive species and outcompete native plants and reduce biodiversity (Invasive Species Centre).

Soil Degradation – Oversaturation

Signs of land and soil degradation were also analyzed. The over-saturation of the soil that was occurring throughout the forests and meadow can be a result of the nearby deforestation in 2015 for the houses and paved the way for the trails.

> Vegetation shelters the soil surface, thereby preventing or limiting soil compaction (and erosion) by rain splash, while plant roots provide preferential pathways for water flow into the ground. Macropore formation resulting from the decay of dead roots and bioturbation by other soil organisms further enhances the soil infiltration capacity in forested watersheds (Runyan 45).

Christiane Runyan in her work *Global Deforestation,* discusses how deforestation exposes the soil surface even in nearby areas to a higher volume of rain splash and overland flow erosion (46). Making trails raised with poor drainage causes rain to pool and oversaturate the ground causing water to collect and run down paths. Ruyan states how the consequent loss of forest makes the watershed prone to infiltration-excess, and runoff, particularly during intense weather. There is a marsh nearby attached to the south-east part of the property and the marsh was reformed/landscaped and cut off from the forests by the houses. It makes sense then that the watershed is prone to 'infiltration-excess runoff' that was occuring in the meadow. Runyan also states how the construction of forest roads and compacted soils results in faster pathways of water flow during high-intensity storms, but in this case, the water has nowhere to go but into the housing community (47). The findings related to the accumulation of substances along the trails

can indicate the presence of an algal bloom (Cardinale 280). When the water contains algae overflows onto nearby trails or surfaces, leaves behind a residue buildup. Certain types of harmful algal blooms can produce toxins that are detrimental to aquatic ecosystems and can be harmful to humans, animals, and plants (Cardinale 280). This can be initiating the process of eutrophication if the area gets enough build-up of algae. However, this is a process not common in forests or areas that are not bodies of water (Cardinale 280).

The mineral built on the rock discovered can be referred to as efflorescence. It mainly is the evaporation residue of salts and calcium-rich minerals within the water that comes into contact with the rocks (Dai et al. 106323). Over time, the minerals accumulate to form the white, crystalline deposit seen in Image A18. Efflorescence is commonly observed in areas where there is high water content such as constant over-saturated land like at the DDO and is an indication of excessive moisture or water infiltration (Dai et al 106323). Therefore further evidence this has been frequently occuring over time and there is land degradation throughout the environment.

Humans Reciprocal

The findings from this study at the DDO park can serve as a microcosm of the larger global issue of anthropogenic forces exceeding the limits of local ecosystems. The case of deforestation and land degradation in the DDO area reflects a broader trend seen in many other regions. The results of the fieldwork underscored the complex interplay between human actions and the natural environment at the DDO park. While efforts were being made to restore the ecological integrity of the site, such as through new plantations, there were still challenges that needed to be addressed, including drainage issues and the potential impact of ongoing development plans. Additionally, the presence of runoff and pollution from nearby construction highlighted the need for better management practices to mitigate the negative impacts on the

environment. The presence of construction debris and trash near the forest edge emphasized the need for proper waste management and the prevention of pollution from nearby human activities (construction). Balancing human activities and environmental preservation is crucial to ensure the long-term sustainability and well-being of the DDO ecosystem.

Fragmentation

The results of the deforestation analysis provide valuable insights into the transformation of natural environments into built environments. The findings indicate significant land clearing in the 1980s during a period of population growth and suburban expansion. Moreover, the data highlights the most concerning trend of increased clearing from 2010 to 2015, resulting in the largest loss of natural habitat (figure B6). The relationship between the natural and built environment demonstrates a steady decrease in the former as the years continue, with a notable shift occurring around 1986. The study also reveals quadratic trends in land clearing (figure B7.) percentages, suggesting an increase in the amount of clearing over time but at a faster rate of clearing each time. Interestingly enough it can be found that fragmentation can have positive impacts on biodiversity, even as the effects of habitat loss are generally negative for the ecosystem (Cardinale 270). By benefitting some population sizes with the presence of certain types of organisms biodiversity can tend to thrive after a landscape is heavily altered (Cardinale 270). In fact, for larger-bodied animals like deer, as long as their extinction threshold is not met (the habitat's patch size is large enough), their populations increase (Cardinale 270). This can be seen at the DDO park, over time the number of patches decreased by 2023 and turned back into one large patch. The minimum space available for large-bodied animals creates an ecological trap for other smaller species reducing their survival and reproduction in the area (Cardinale 276). Highly mobile species like birds and insects do not easily get affected by this ecological

shift, which can explain why the species diversity at the DDO is relatively high still (Cardinale 276). Due to the large amount of highly-mobile animals, and larger bodies of animals, the species richness and biodiversity result in a higher value (see table B2).

Conclusion – *Paying Back the DDO Natural Environment*

In conclusion, the fieldwork conducted at the David Dunlap Observatory provided valuable insights into the intricate human-environment relationship and the current state of the natural ecosystem. The findings provide hard evidence which makes it clear humans have over exceeded the natural environment's limits and need to help it restore in proper ways. For one, instead of further developing the built facilities like more trails, courts and buildings, efforts need to be made to preserve the ecological integrity of the park for the community. This can occur by getting Richmond Hill locals and the city involved in the natural restoration process, like removing invasive species, planting trees, garbage cleaning, dead tree removal, community gardens and finding better drainage solutions. By understanding and addressing these issues at a small scale, we can contribute to the broader global efforts of promoting sustainable practices and preserving the health and well-being of ecosystems worldwide. This is a microscopic scale that can be applied to a vast amount of areas being logged, deforests for the resources, or for the land the ecosystems occupy. This local event in the town of Richmond Hill is only one small example of how anthropogenic forces have a direct relationship with the natural environment and the effects of what can happen when humans exceed the limits of a local ecosystem.

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Appendix A

Images/Photos

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ENV 4113: Selected Topics in Environmental Studies

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June 19th, 2023

Source: Kuthe, Kyle. *David Dunlap Observatory*. May 5th, 2023.

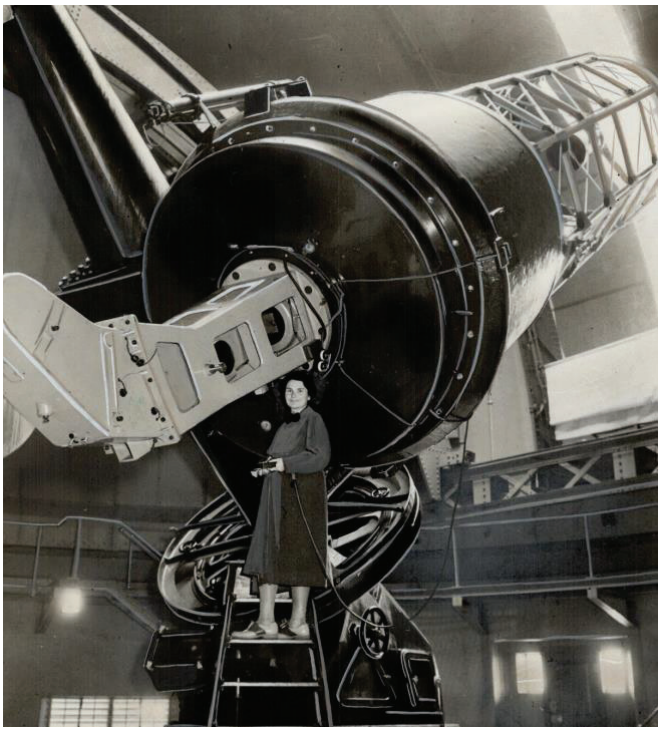
Image A1. The David Dunlap Observatory with dense coniferous forest surrounding. The photo was taken during visit one.

Source: Kuthe, Kyle. *David Dunlap Administration Building.* May 5th, 2023.

Image A2. The David Dunlap administration building. The photo was taken during visit one.

Source: Kuthe, Kyle. *David Dunlap Observatory and Administration Building.* May 14th, 2023.

Image A3. The David Dunlap Observatory and administration building just off to the side. The photo was taken during visit two.



Source: Toronto Star. *The Richmond Hill telescope, now the third largest in the world, will slip into fourth place when the 200-inch telescope at Mt. Palomar, in southern C(...).* February 17th 1940.

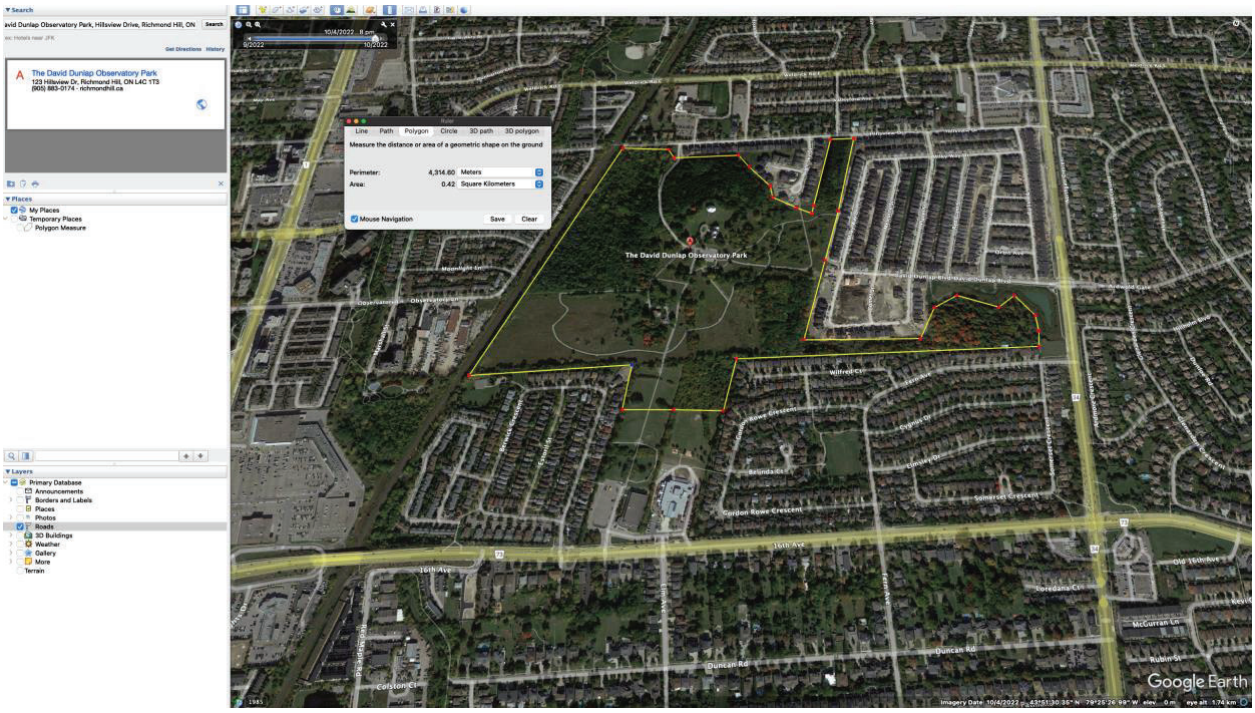
Image A4. The David Dunlap Observatory telescope.

Source: Salmon, James V. and the University of Toronto. *Observatory (1935, David Dunlap Observatory)*, Richmond Hill. April 13th, 1955.

Image A5. The David Dunlap Observatory in 1955.

Source: Toronto Star. *Observatory at Richmond Hil.* June 1st, 1935.

Image A6. Guests line up to take a look at the 74-inch telescope on the opening day in 1935.



Source: Google Earth. *The David Dunlap Observatory Park.* May 17st, 2023

Image A7. A screen capture measuring the area of the DDO park in 2023, using the polygon measuring tool in Google Earth.

Source: Kuthe, Kyle. *David Dunlap Observatory Deer*. May 27th, 2023.

Image A8. Black-tail deer grazing. The photo was taken during visit three.

Source: Kuthe, Kyle. *David Dunlap Observatory Ducks*. May 27th, 2023.

Image A9. Millard ducks dunking their heads for food on the flooded construction site. The photo was taken during visit three.

Source: Kuthe, Kyle. *Under a Rock*. May 27th, 2023.

Image A10. Underneath a medium size rock to survey insect species. This was in the one-by-one metre area that insect species were surveyed in. The photo was taken during visit three.

Source: Kuthe, Kyle. *Forest oversaturation*. May 5th, 2023.

Image A11. Oversaturation in the forest. The photo was taken during visit one.

Source: Kuthe, Kyle. *Meadow Oversaturation* May 27th, 2023.

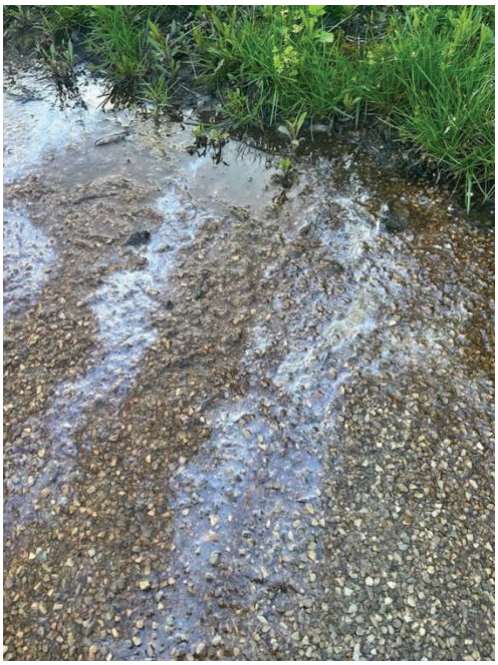
Image A12. Oversaturation in the meadow area. The photo was taken during visit three.

Source: Kuthe, Kyle. *Tree Roots A.* May 27th, 2023.

Image A13. Tree roots ripped from the ground. The photo was taken during visit three.

Source: Kuthe, Kyle. *Tree Roots B.* May 27th, 2023.

Image A14. Tree roots ripped from the ground. The photo was taken during visit three.



Source: Kuthe, Kyle. *Trail Runoff A.* May 27th, 2023.

Image A15. Oversaturation and mysterious substances build up along tails. The photo was taken during visit three.

Source: Kuthe, Kyle. *Trail Runoff B.* May 27th, 2023.

Image A16. Mysterious yellow-green substances build up long tails. The photo was taken during visit three.

Source: Kuthe, Kyle. *Garbage.* May 27th, 2023.

Image A17. Garbage is littered all over the inside edge of the forest from the construction site and housing development. The photo was taken during visit three.

Source: Kuthe, Kyle. *Mineral build-up on Rock.* May 27th, 2023.

Image A18. Mineral build-up on a rock found at an outcropping portion of land, adjacent to runoff. The photo was taken during visit three.

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Appendix B

Figures & Tables

Kyle Edward Kuthe

Student # 300244760

Department of Geography, Environment and Geomatics

ENV 4113: Selected Topics in Environmental Studies

Dr. Renate Sander-Regier

University of Ottawa
June 19th, 2023

Source: Rosenberg et al. *Master Plan Scope*. 2019

Figure B1. The David Dunlap Observatory property in 2023

Source: Rosenberg et al. *Location of Activities*. 2019

Figure B2. The David Dunlap Observatory areas categroized in Richmond Hills Master Plan.

#	Taxonomic Group	Species Name	Common Name	Genus	Family	Order	Class	Phylum
1	Grass	Digitaria ischaemum	Smooth crabgrass	Digitaria	Poaceae	Poales	Liliopsida	Tracheophyta
2	Grass	Zoysia japonica	Japanese lawngrass	Zoysia	Poaceae	Poales	Liliopsida	Tracheophyta
3	Herb	Hemerocallis fulva	Ditch lily	Hemerocallis	Asphodelaceae	Asparagales	Liliopsida	Tracheophyta
4	Herb	Heracleum Mantegazzianum	Giant hogweed	Heracleum	Apiaceae	Apiales	Magnoliopsida	Tracheophyta
5	Herb	Erigeron canadensis	Horseweed	Erigeron	Asteraceae	Asterales	Magnoliopsida	Tracheophyta
6	Herb	Solidago canadenis	Canada goldenrod	Solidago	Asteraceae	Asterales	Magnoliopsida	Tracheophyta
7	Herb	Tanacetum vulgare	Common tansy	Tanacetum	Asteraceae	Asterales	Magnoliopsida	Tracheophyta
8	Herb	Alliaria petiolata	Garlic mustard	Alliaria	Brassicaceae	Brassicales	Magnoliopsida	Tracheophyta
9	Herb	Caltha palustris	Yellow marigold	Caltha	Ranunculaceae	Ranunculales	Magnoliopsida	Tracheophyta
10	Moss	Bryum argenteum	Silveregreen bryum moss	Bryum	Bryaceae	Bryales	Bryopsida	Bryophyta
11	Shrub	Ilex crenata	Japanese holly	Ilex	Aquifoliaceae	Aquifoliales	Magnoliopsida	Tracheophyta
12	Shrub	Prosopis glandulosa	Honey mesquite	Prosopis	Fabaceae	Fabales	Magnoliopsida	Tracheophyta
13	Shrub	Berberis thunbergii	Japanese barberry	Berberis	Berberidaceae	Ranunculales	Magnoliopsida	Tracheophyta
14	Shrub	Rhamnus cathartica	Common buckthorn	Rhamnus	Rhamnaceae	Rosales	Magnoliopsida	Tracheophyta
15	Trees	Betula populifolia	Gray birch	Betula	Betulac	Fagales	Magnoliopsida	Tracheophyta
16	Trees	Quercus garryana	Oregon white oak	Quercus	Fagaceae	Fagales	Magnoliopsida	Tracheophyta
17	Trees	Quercus macrocarpa	Bur oak	Quercus	Fagaceae	Fagales	Magnoliopsida	Tracheophyta
18	Trees	Quercus reubra	Northern red oak	Quercus	Fagaceae	Fagales	Magnoliopsida	Tracheophyta
19	Tree	Carya cordiformis	Bitternut hickory	Carya	Junglandaceae	Fagales	Magnoliopsida	Tracheophyta
20	Tree	Juglans cinerea	Butternut	Juglands	Junglandaceae	Fagales	Magnoliopsida	Tracheophyta
21	Tree	Fraxinus americana	White ash	Fraxinus	Oleaceae	Lamiales	Magnoliopsida	Tracheophyta
22	Tree	Fraxinus pennsylvanica	Green ash	Fraxinus	Oleaceae	Lamiales	Magnoliopsida	Tracheophyta
23	Tree	Fraxinus quadrangulata	Blue ash	Fraxinus	Oleaceae	Lamiales	Magnoliopsida	Tracheophyta
24	Tree	Ulmus americana	American elm	Ulmus	Ulmaceae	Rosales	Magnoliopsida	Tracheophyta
25	Tree	Rhus typhina	Staghorn sumac	Rhus	Anacardiaceae	Sapindales	Magnoliopsida	Tracheophyta
26	Trees	Acer plantanoidees	Norway maple	Acer	Sapindaceae	Sapindales	Magnoliopsida	Tracheophyta
27	Tree	Ailanthus altissima	Tree of heaven	Ailanthus	Simaroubaceae	Sapindales	Magnoliopsida	Tracheophyta
28	Tree	Larix decidua	European larch	Larix	Pinaceae	Pinales	Pinopsida	Tracheophyta
29	Trees	Picea abies	Norway spruce	Picea	Pinaceae	Pinales	Pinopsida	Tracheophyta
30	Trees	Picea rubens	Red spruce	Picea	Pinaceae	Pinales	Pinopsida	Tracheophyta
31	Trees	Pinus banksiana	Jack pine	Pinus	Pinaceae	Pinales	Pinopsida	Tracheophyta
32	Trees	Pinus rigida	Pitch pine	Pinus	Pinaceae	Pinales	Pinopsida	Tracheophyta
33	Trees	Tsuga canadensis	Eastern hemlock	Tsuga	Pinaceae	Pinales	Pinopsida	Tracheophyta
34	Vine	Tillandsia usneoides	Spanish moss	Tillandsia	Bromeliaceae	Poales	Liliopsida	Tracheophyta
35	Vine	Calastrus orbiculatus	Oriental bittersweet	Celastrus	Celastraceae	Celastrales	Magnoliopsida	Tracheophyta
36	Vine	Vitis riparia	Riverbank grape	Vitis	Vitaceae	Vitales	Magnoliopsida	Tracheophyta

Table B1. A list of plant species at the DDO park, mainly organized by taxonomic group.

#	Species Name	Common Name	Genus	Family	Order	Class	Phylum	Taxonomic Group
1	Digitaria ischaemum	Smooth crabgrass	Digitaria	Poaceae	Poales	Liliopsida	Tracheophyta	Grass
2	Zoysia japonica	Japanese lawngrass	Zoysia					
3	Hemerocallis fulva	Ditch lily	Hemerocallis	Asphodelaceae	Asparagales	Liliopsida	Tracheophyta	Herb
4	Heracleum Mantegazzianum	Giant hogweed	Heracleum	Apiaceae	Apiales	Magnoliopsida		
5	Erigeron canadensis	Horseweed	Erigeron	Asteraceae	Asterales			
6	Solidago canadenis	Canada goldenrod	Solidago					
7	Tanacetum vulgare	Common tansy	Tanacetum					
8	Alliaria petiolata	Garlic mustard	Alliaria	Brassicaceae	Brassicales			
9	Caltha palustris	Yellow marigold	Caltha	Ranunculaceae	Ranunculales			
10	Bryum argenteum	Silveregreen bryum moss	Bryum	Bryaceae	Bryales	Bryopsida	Bryophyta	Moss
11	Ilex crenata	Japanese holly	Ilex	Aquifoliaceae	Aquifoliales	Magnoliopsida	Tracheophyta	Shrub
12	Prosopis glandulosa	Honey mesquite	Prosopis	Fabaceae	Fabales			
13	Berberis thunbergii	Japanese barberry	Berberis	Berberidaceae	Ranunculales			
14	Rhamnus cathartica	Common buckthorn	Rhamnus	Rhamnaceae	Rosales			
15	Betula populifolia	Gray birch	Betula	Betulac	Fagales	Magnoliopsida	Tracheophyta	Tree
16	Quercus garryana	Oregon white oak	Quercus	Fagaceae				
17	Quercus macrocarpa	Bur oak						
18	Quercus reubra	Northern red oak						
19	Carya cordiformis	Bitternut hickory	Carya	Junglandaceae				
20	Juglans cinerea	Butternut	Juglands					
21	Fraxinus americana	White ash	Fraxinus	Oleaceae	Lamiales			
22	Fraxinus pennsylvanica	Green ash						
23	Fraxinus quadrangulata	Blue ash						
24	Ulmus americana	American elm	Ulmus	Ulmaceae	Rosales			
25	Rhus typhina	Staghorn sumac	Rhus	Anacardiaceae	Sapindales			
26	Acer plantanoidees	Norway maple	Acer	Sapindaceae				
27	Ailanthus altissima	Tree of heaven	Ailanthus	Simaroubaceae				
28	Larix decidua	European larch	Larix	Pinaceae	Pinales	Pinopsida		
29	Picea abies	Norway spruce	Picea					
30	Picea rubens	Red spruce						
31	Pinus banksiana	Jack pine	Pinus					
32	Pinus rigida	Pitch pine						
33	Tsuga canadensis	Eastern hemlock	Tsuga					
34	Tillandsia usneoides	Spanish moss	Tillandsia	Bromeliaceae	Poales	Liliopsida	Tracheophyta	Vine
35	Calastrus orbiculatus	Oriental bittersweet	Celastrus	Celastraceae	Celastrales	Magnoliopsida		
36	Vitis riparia	Riverbank grape	Vitis	Vitaceae	Vitales			

Figure B3. Plant species organized into a chart to display trends/patterns in species discovered.

Common Name	*Species*	*Abundance (n_i)*	*H' Calc*	*D Calc*
Gray squirrel	*Sciurus carolinenesis*	6	-0.11611	0.00699
Black tail deer	*Odocoileus hemionus*	4	-0.16990	0.00280
Rabbit	*Oryctolagus cuniculus*	3	-0.14050	0.00140
Chipmunk	*Tamias*	2	-0.10595	0.00047
Canada goose	*Branta canadensis*	6	-0.21799	0.00699
Mallard duck	*Anas platyrhynchos*	2	-0.10595	0.00047
Cardinal	*Cardinalis cardinalis*	2	-0.10595	0.00047
Blue jay	*Cyanocitta cristata*	1	-0.06348	0.00000
monarch butterfly	*Danaus plexippus*	1	-0.06348	0.00000
Red Robin	*Erithacus rubecula*	1	-0.06348	0.00000
Raven	*Corvus corax*	2	-0.10595	0.00047
Pileated Woodpecker	*Dryocopus pileatus*	1	-0.06348	0.00000
Owl	*Strigiformes*	1	-0.06348	0.00000
White('cabbage") butter fly	*Pieris rapae*	2	-0.10595	0.00047
Black squirrel	*Scieurus meridionalis*	2	-0.10595	0.00047
Humming bird	*Archilochus colubris*	1	-0.06348	0.00000
Hawk	*Buteo regalis*	1	-0.06348	0.00000
Black-capped chickadee	*Poecile atricapillus*	7	-0.23797	0.00979
Human	*Homo sapiens*	12	-0.30995	0.03077
Dog	*Canis familiaris*	9	-0.27170	0.01678
		66	2.54421	0.92168
		N = 66	**H'= 2.54**	**D = 0.922**

Table B2. Animal species discovered at the DDO park and their recorded abundance. The abundance (n_i) was used to calculate species richness using two indexes; the Shannon-Wiener diversity index (*H*') and the Simpson index (*D*).

Common Name	*Species*	*Abundance (n_i)*	*H' Calc*	*D Calc*
Dragon Fly	*Anisoptera*	1	-0.11611	0.00000
Monarch Butterfly	*Danaus plexippus*	1	-0.11611	0.00000
Cabbage Butter fly	*Pieris rapae*	2	-0.18442	0.00246
Honey Bee	*Anthophila*	3	-0.23469	0.00739
Lady Bug	*Coccinellidae*	2	-0.18442	0.00246
Milipede	*Diplopoda*	1	-0.11611	0.00000
Earthworm	*Lumbricina*	2	-0.18442	0.00246
Red Ant	*Solenopsis*	7	-0.34309	0.05172
Small Black Ant	*Monomorium minimum*	3	-0.23469	0.00739
Garden Ant	*Lasius niger*	2	-0.18442	0.00246
Yellow snail	*Cepaea hortensis*	2	-0.18442	0.00246
Centipede	*Scutigera coleoptrata*	1	-0.11611	0.00000
Slug	*Deroceras laeve*	2	-0.18442	0.00246
		29	2.38347	0.91872
		N= 29	**H'= 2.38**	**D= 0.919**

Table B3. Insect species discovered at the DDO park in a one-by-one metre area and their recorded abundance. The abundance (n_i) was used to calculate species richness using two indexes; the Shannon-Wiener diversity index (*H*') and the Simpson index (*D*).

Year	Land cleared in time (including given year)	Built Env. on Surround Area (km2)	Natural Env. Remaining (km2)	% of Habitat Lost	# of Patches
1930	0.00	0.00	1.77	0.00%	**2**
1935	0.01	0.01	1.76	0.56%	**2**
1940	0.00	0.01	1.76	0.00%	**2**
1945	0.00	0.01	1.76	0.00%	**3**
1950	0.00	0.01	1.76	0.00%	**3**
1955	0.05	0.06	1.71	2.84%	**4**
1960	0.09	0.15	1.62	5.26%	**5**
1965	0.03	0.18	1.59	1.85%	**5**
1970	0.00	0.18	1.59	0.00%	**5**
1975	0.11	0.29	1.48	6.92%	**6**
1980	0.30	0.59	1.18	20.27%	**6**
1985	0.27	0.86	0.91	22.88%	**5**
1990	0.14	1.00	0.77	15.38%	**5**
1995	0.00	1.00	0.77	0.00%	**4**
2000	0.00	1.00	0.77	0.00%	**4**
2005	0.00	1.00	0.77	0.00%	**4**
2010	0.00	1.00	0.77	0.00%	**4**
2015	0.32	1.32	0.45	41.56%	**5**
2020	0.02	1.34	0.43	4.44%	**3**
2025	0.01	1.35	0.42	2.33%	**2**
2030	0.00	1.35	0.42	0.00%	**2**
				Natural Environment Cleared	
				76.27%	
				Natural Environment Remaining	
				23.73%	

Tabel B4. Measures of DDO land cleared for building over 100 years time (measured in km^2). From these values, the total built environment on the initial property and the natural environment remaining every 5 years could be found. The percentage of habitat (or natural environment) was also then able to be calculated. In addition, the number of patches created from land fragmentation was also counted every 5 years. Last, the predicted percentage of natural environment remaining by 2030 was calculated according to Richmond Hills DDO Park Master Plan (Rosenberg 12).

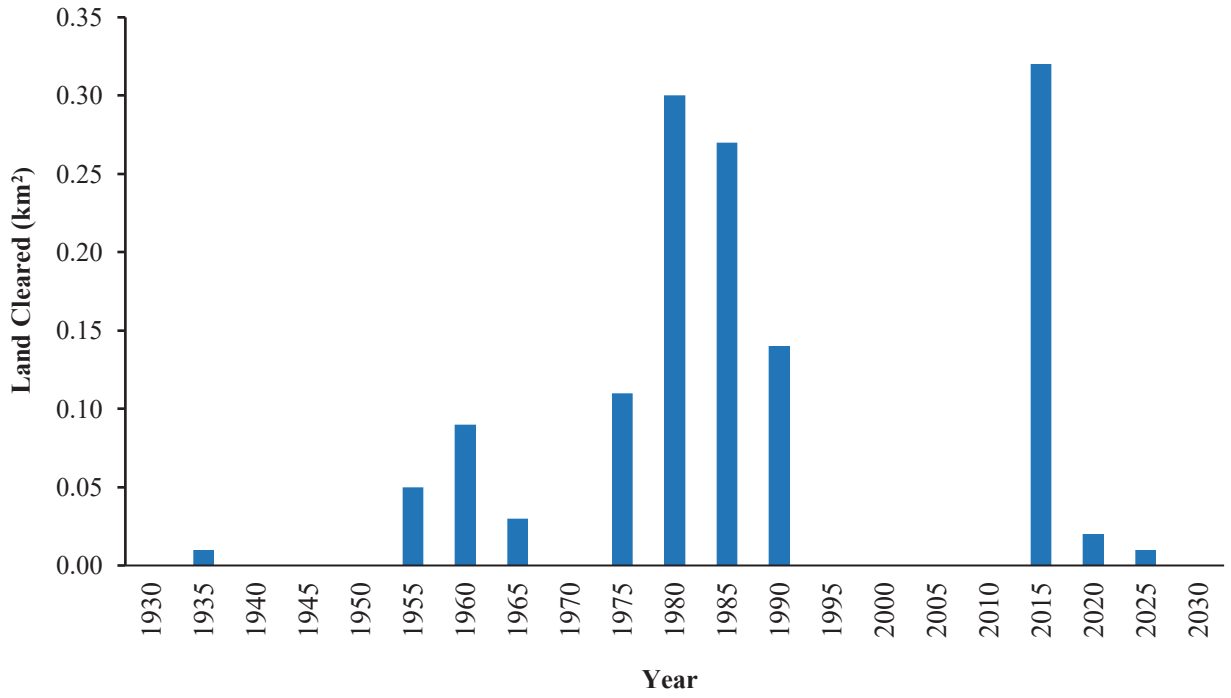


Figure B4. Graph of the amount of DDO land cleared (km^2) every 5 years from 1930 to 2030.

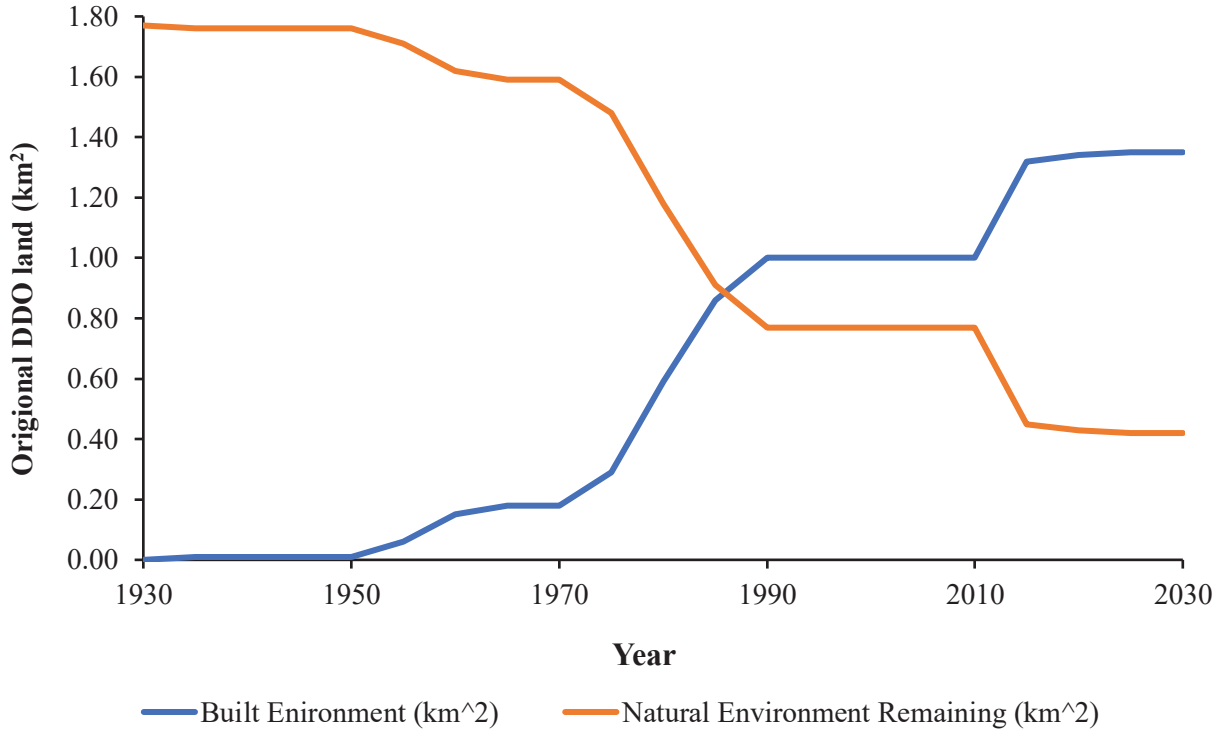


Figure B5. Graph of the built environment on the original DDO property increasing. Thus causing the natural environment to decrease over 100 years (km^2).

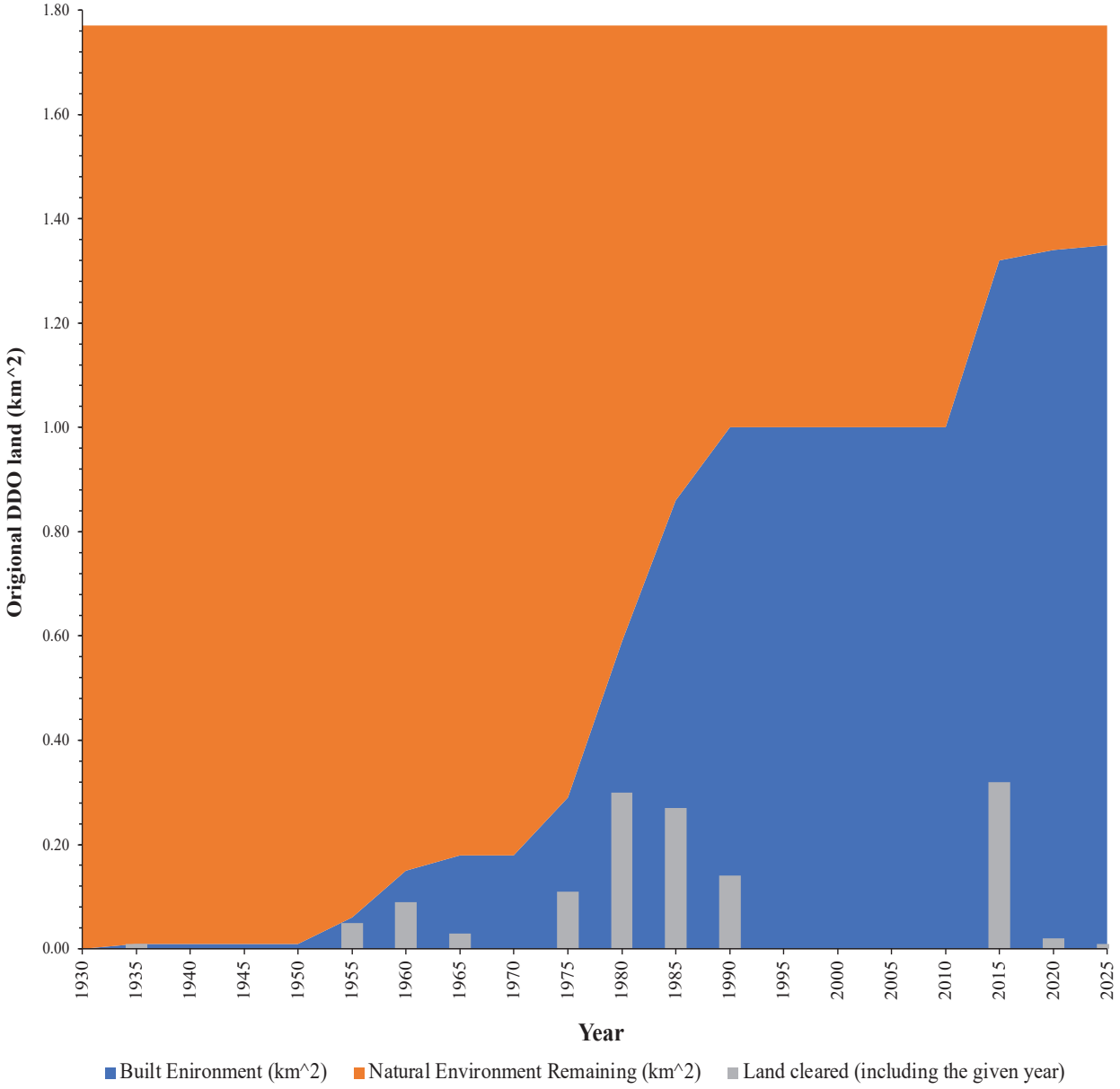


Figure B6. Graph reevealing the relationship between the amount of land cleared every 5 years, the total built environment and the total natural environment of the DDO property over the last century.

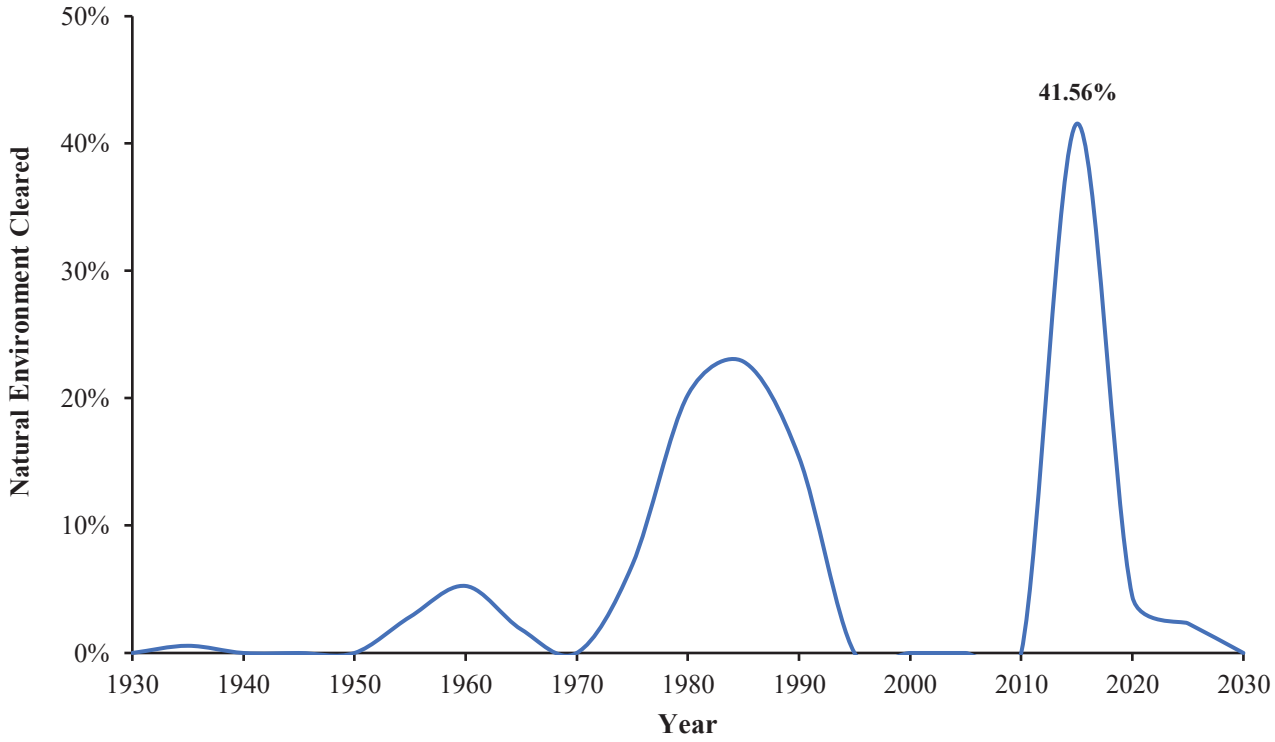
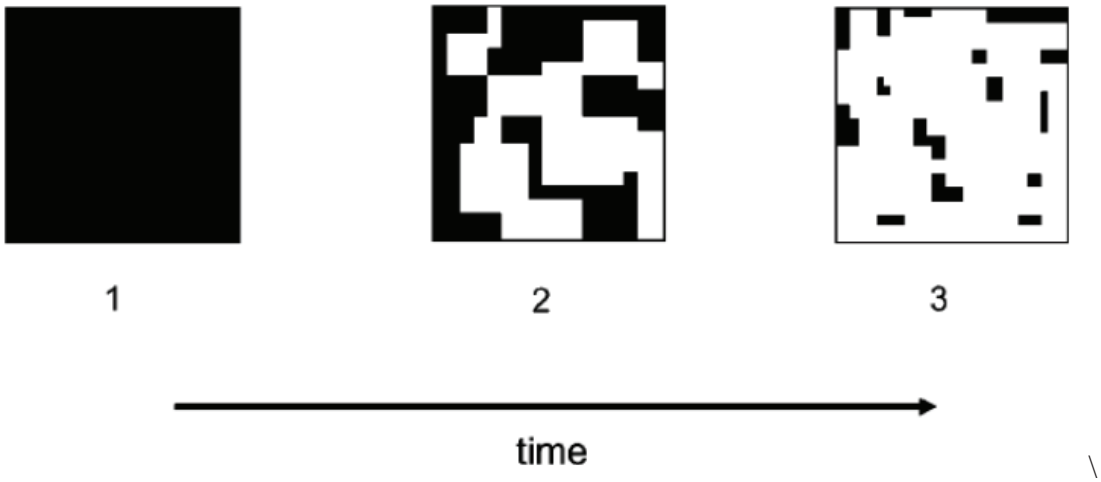
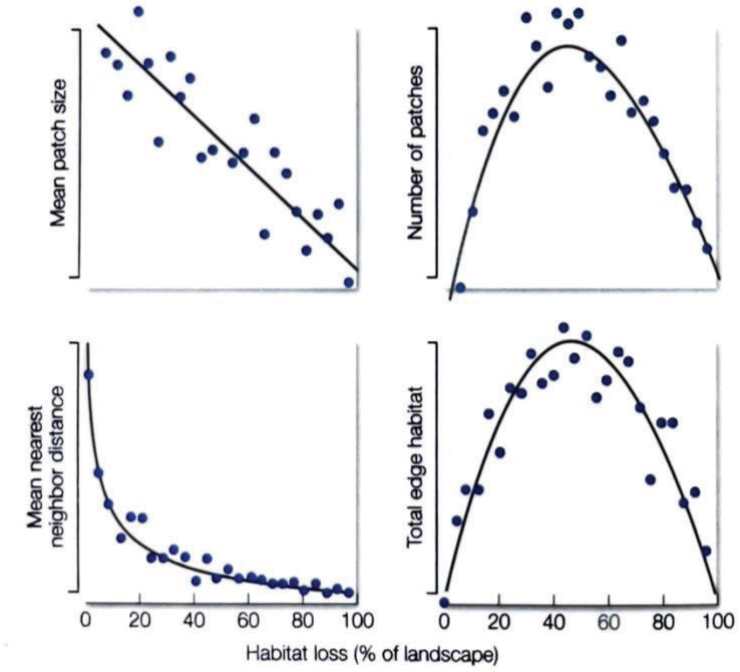


Figure B7. A graph displaying the amount of natural environment cleared every 5 years, over the last 100 years. This illustration reveals the trends and patterns of deforestation that occurred.



Source: Fahrig, Lenore. *The Process of Habitat Fragmentation.* November 2003.

Figure B8. A hypothetical and genereal illustrating the process and effect of habitat loss, specifcially fragmentation over time. The black repreeseeents the natural environment and the white the built environment.



Source: Cardinale et al. *Habitat Loss and Patch Configuration*. 2020.

Figure B9. General model and trend of habitat loss and patch configuration. The four illustrations display how each aspect of patch configuration relate to habitat loss in a landscape (Cardinale et al. 270).

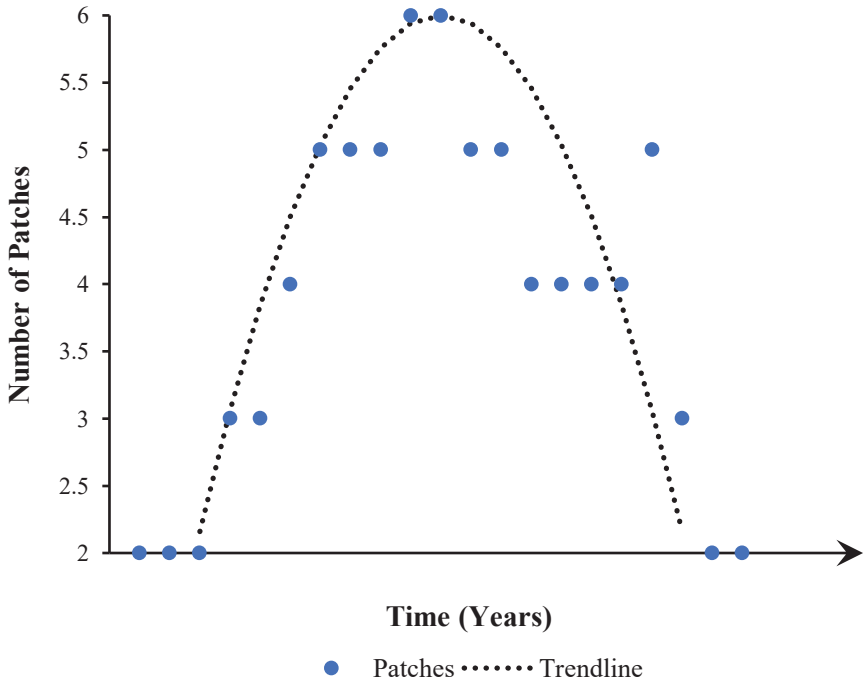


Figure B10. A graph revealing the common trend of habitat loss and configuration over time. The number of patches increases over time until a specific limiting factor/maximum, causing the number of patches to decrease.

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Appendix C

Field Notes

Kyle Edward Kuthe

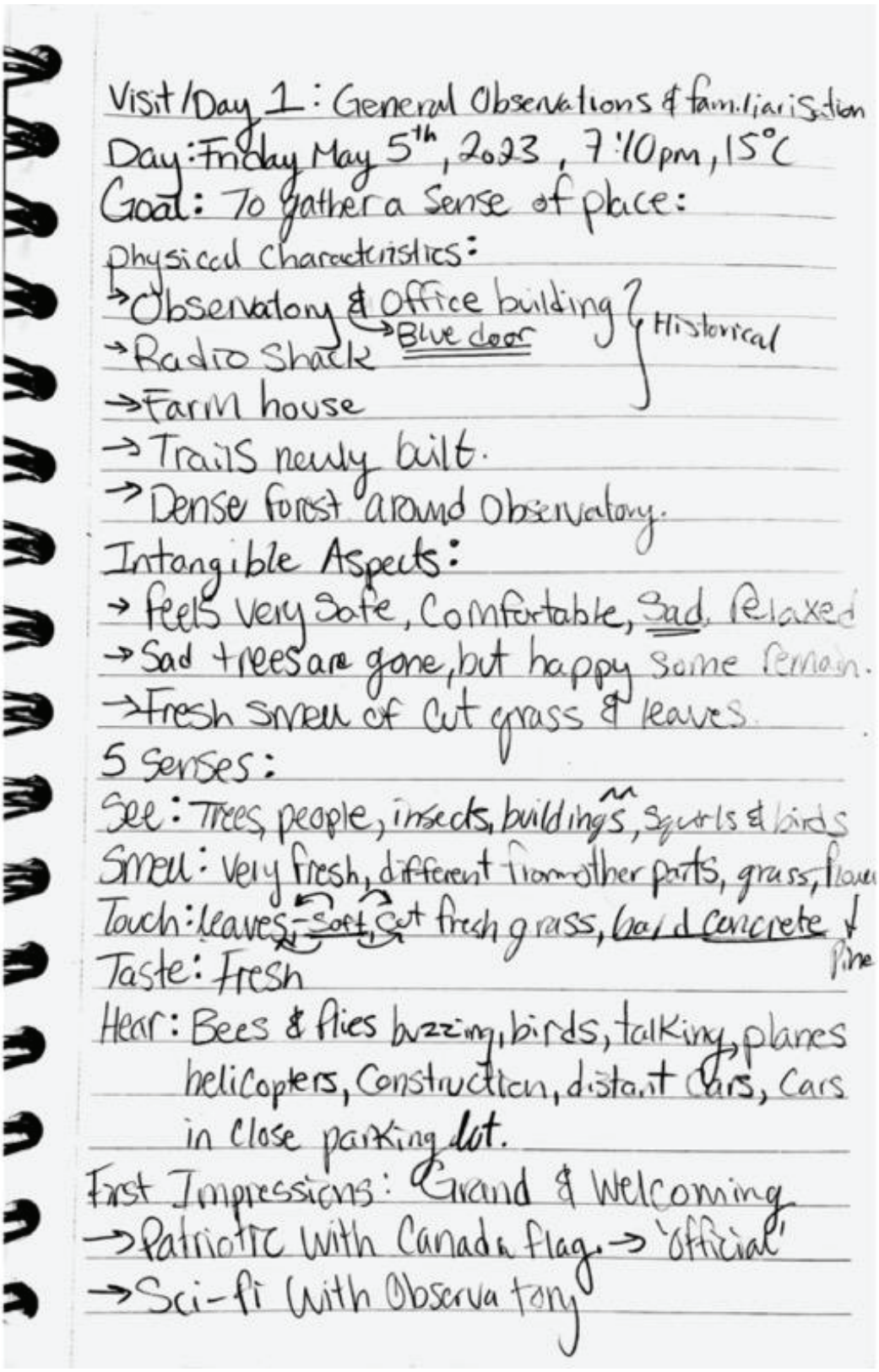
Student # 300244760

Department of Geography, Environment and Geomatics

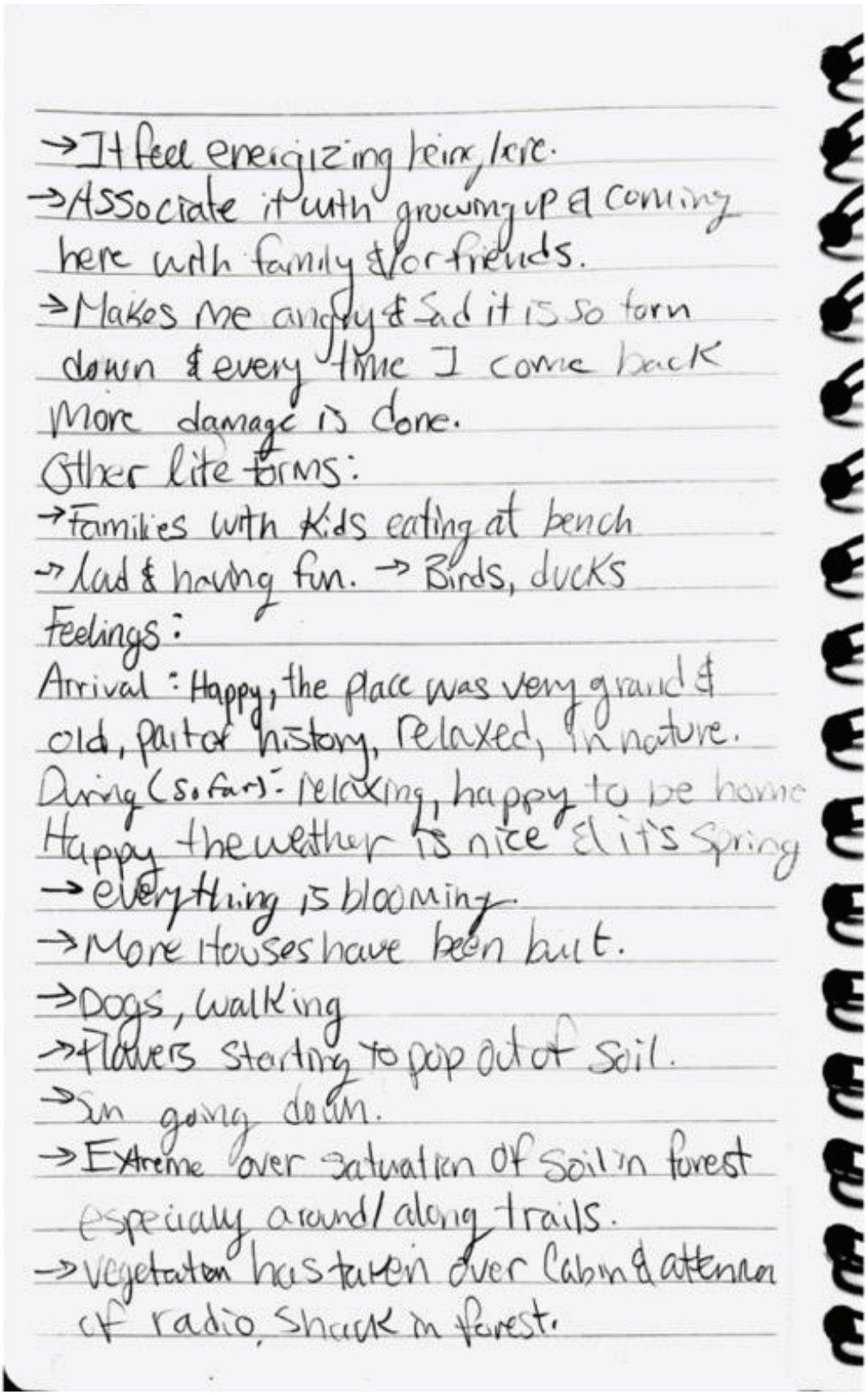
ENV 4113: Selected Topics in Environmental Studies

Dr. Renate Sander-Regier

University of Ottawa
June 19th, 2023



Visit/Day 1: General Observations & familiarisation
Day: Friday May 5th, 2023, 7:10pm, 15°C
Goal: To gather a sense of place:
Physical Characteristics:
→ Observatory & Office building? → Blue door } Historical
→ Radio Shack
→ Farm house
→ Trails newly built.
→ Dense forest around Observatory.
Intangible Aspects:
→ feels very safe, Comfortable, Sad, Relaxed
→ Sad trees are gone, but happy some remain.
→ Fresh smell of cut grass & leaves.
5 Senses:
See: Trees, people, insects, buildings, squirls & birds
Smell: very fresh, different from other parts, grass, flowers
Touch: leaves - soft, cut fresh grass, hard concrete, Pine
Taste: Fresh
Hear: Bees & flies buzzing, birds, talking, planes helicopters, Construction, distant cars, cars in close parking lot.
First Impressions: Grand & Welcoming
→ Patriotic with Canada flag. → 'official'
→ Sci-fi with Observatory



→ It feel energizing here, love.
→ Associate it with growing up & coming here with family &/or friends.
→ Makes me angry & sad it is so torn down & every time I come back more damage is done.
Other life forms:
→ Families with kids eating at bench
→ Lad & having fun. → Birds, ducks
Feelings:
Arrival: Happy, the place was very grand & old, part of history, relaxed, in nature.
During (so far): relaxing, happy to be home Happy the weather is nice & it's Spring
→ everything is blooming
→ More houses have been built.
→ Dogs, walking
→ Flowers starting to pop out of soil.
→ Sun going down.
→ Extreme over saturation of soil in forest especially around/along trails.
→ vegetation has taken over Cabin & attention of radio, Shack in forest.

Weather: Sun, light at still, Cooling down with wind. 15°C

Soil Conditions: Flowers & trees blooming but also alot dead & over Saturated from rain ~~days~~ ago.

Trails 7:30pm
→ They were recently added.
→ lots of dead trees along trails.
→ Ground very moist.
→ Maintained
→ lots of bugs & mesquitos
→ Attna erodivy
→ lots of garbage in forest
→ Bunny rabbits
→ Animal tracks
→ smells very moist, lots of water runnoff.
→ trees they planted died & not blooming??
→ So much water & weird Chemicals along trails.

→ Sad to see so much construction
→ Lots of houses suddenly appearing on trails is sad.
↳ use to be forest.
→ Leaving: Sad, angry, healthy, like I connected with nature.

Visit 2: Human Wellbeing, restorative Env.
May 14th 2023, 3:00 pm, 17°C
General Observations:
→ Forests & flowers more full with spring.
→ More people outside
→ People walking dogs
→ Walking on trails
→ Eating at Picnic Benches
(More ppl atside w warm weather)
→ everyone seems very happy to be outside, enjoying the nature.
→ Nice to be outside with the sun
Weather: Sunny, hot, no Wind
→ Soil seems to be very saturated Still
"Restorative Env" Observations: (theory)
Being Away: Site appear to be more bloomed with Spring, more full trees
→ Many more flowers.
→ More lively with insects than last time
→ Busier with people walking.
→ Different from every day life in Rhill
→ Allows people to Distance selves out & get a piece of nature

Privacy Control: lots of little area, nooks & crannys in forest. Mebw is spread out
→ Much forest destoryed, removed hiding dense forest for animalls.
→ Buildings for humans, only pirmitted with tour.
Fascination: Observatory creates historical significance & fascination for me & is what makes the sense of place here so strong for me. Attracts lots of people in the town, community, attracts animals & lots of birds.
→ 1930's architecture make Administration building so unique & detailed.
→ 1800's farm house as well makes the property more Historic.
Extent: not too much engagement ability. Mostly walks, trails, some Field area for recreational activities.
→ There is a community program, advertised toy to walk around the observatory & engage further later in the semester

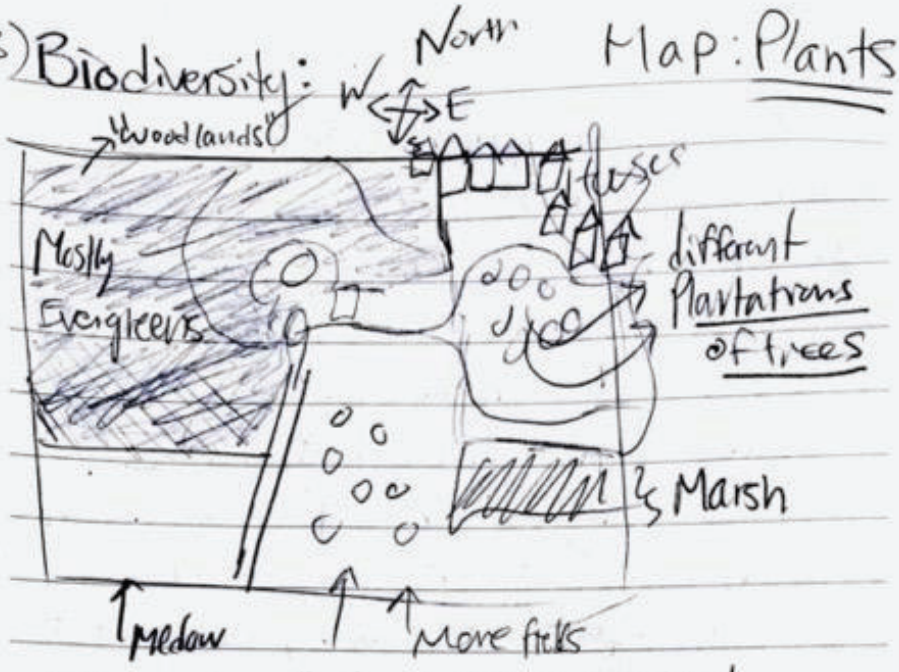
Social Support: Gives people in the Community a place to be around greenary & forest.
→ Has fresh trails
→ Tours & programs again.
→ benches, garbage bins, Parking lot
→ Trail & forest Signs
→ Historical plaques for Observatory
→ Picnic benches → many families ↳ 3-4
→ Trails open up into new Community allowing more ppl to come.

Physical Activity & Engagement:
→ Trails are the extent of thing supporting physical activity.
→ Programs listed on Signs infront of Observatory.
  → Camps
  → Tours
  → Week programs
  → Workshops
} Community Engagement
→ Shows brief project "master plans".

Day 3: Healthy Ecosystem
May 20th, 2023, 21°C, 6:02pm
A) General Observations:
→ Appears half destroyed, cleared for houses, → almost obvious
→ Hous feel artificial & intrusive.
→ Area around Observatory is continuously well-maintained, trails are out.
→ Diverse trees & vegetation inside
↳ lots of dead tree & plant material
→ Forest looks unhealthy ^^.
→ Rocks along cut cropped portion of land for the housing development.
→ Running off → lots of white minerals found on the Rocks??
→ cut cropped by Humans, in 2015??
→ literal runoff made pond
→ eco-system for ducks
→ Deer tracks
→ lots of insects under Rocks, see pictures for more identification
→ Lots of trees - they planted have died, seen in over saturated soil once again.

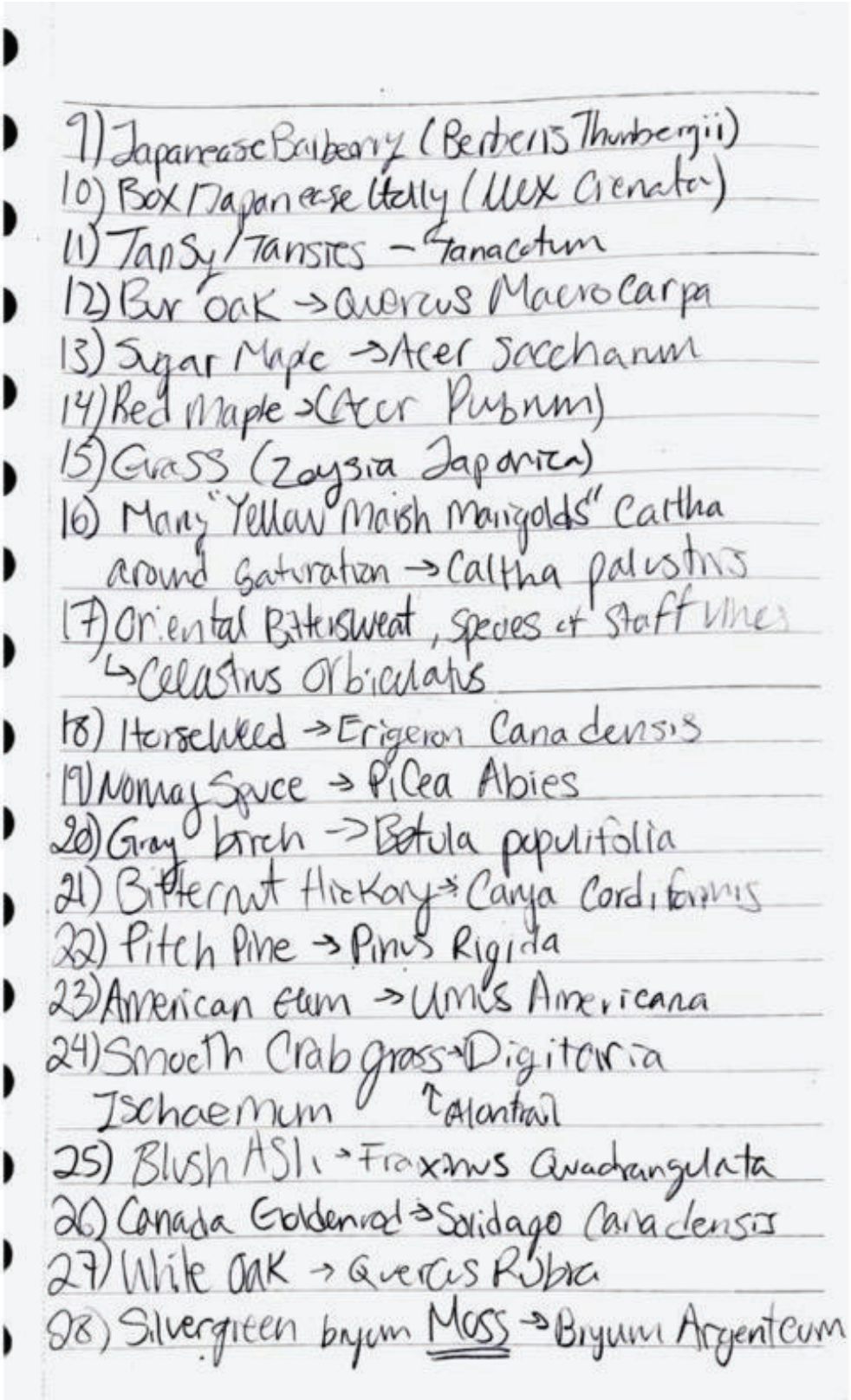
→Root systems Shallow & ripped right at the ground in many diff locations, especially along trails
→Decaying wood, home for more insects & decomposers.
→Garbage & building material garbage found throughout land & edge of the forest.
→Lots of bugs & flies hovering over moist land.
→Bunny Rabbit going into neighborhood.
→Plastics in Mud & Soil (Scrapes)
→Lots of large Rocks unearthed at outcrop/landslide
→Dead Snails → from Moisture?
→Duck dink heads in pond food? Worm rich?
^Polluted water tho.
→Many deer tracks from moist ground.
-Landform: Highest Hill: Observatory

B) Biodiversity: Map: Plants

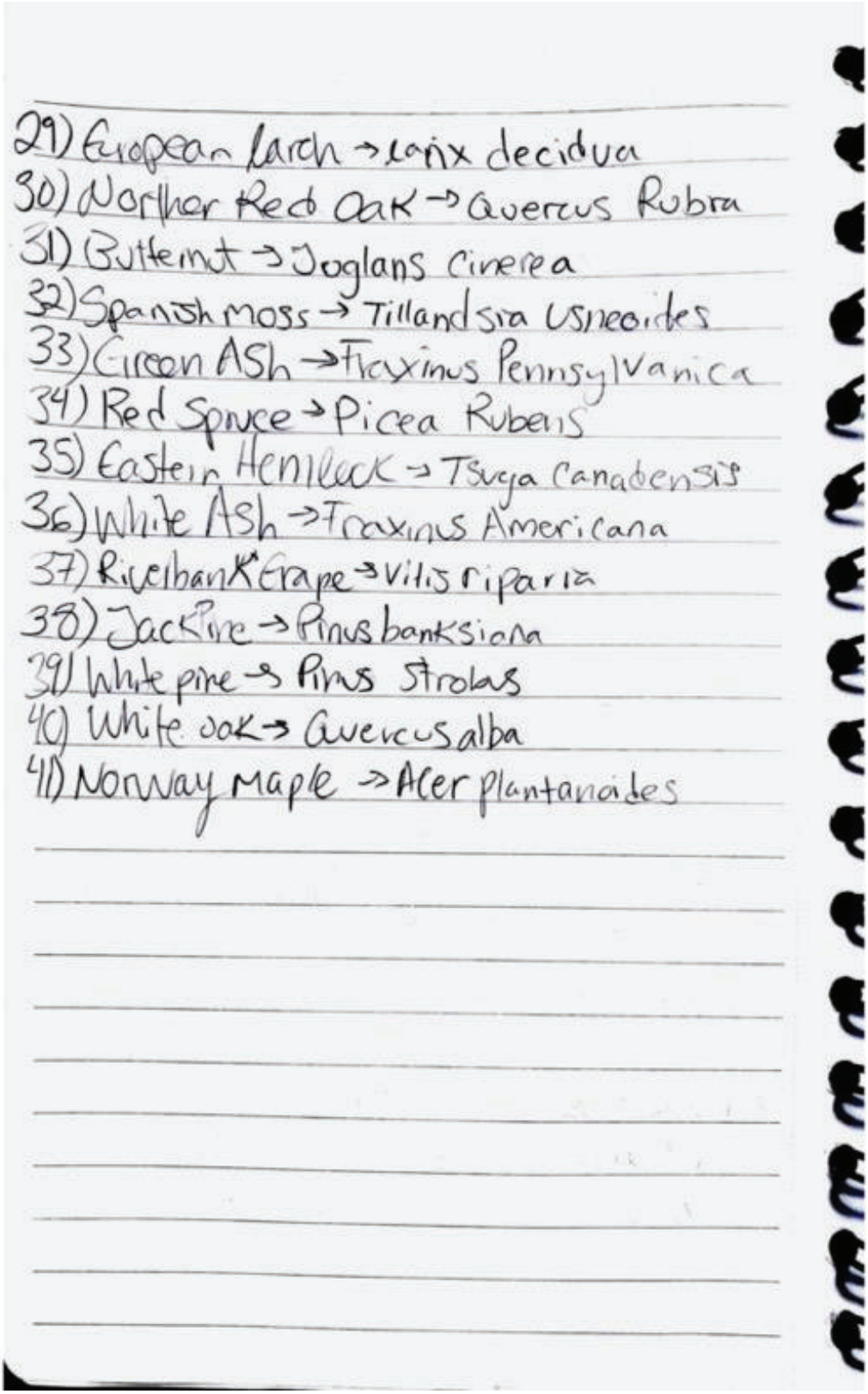


→ grasses → field
Newly planted trees → dead

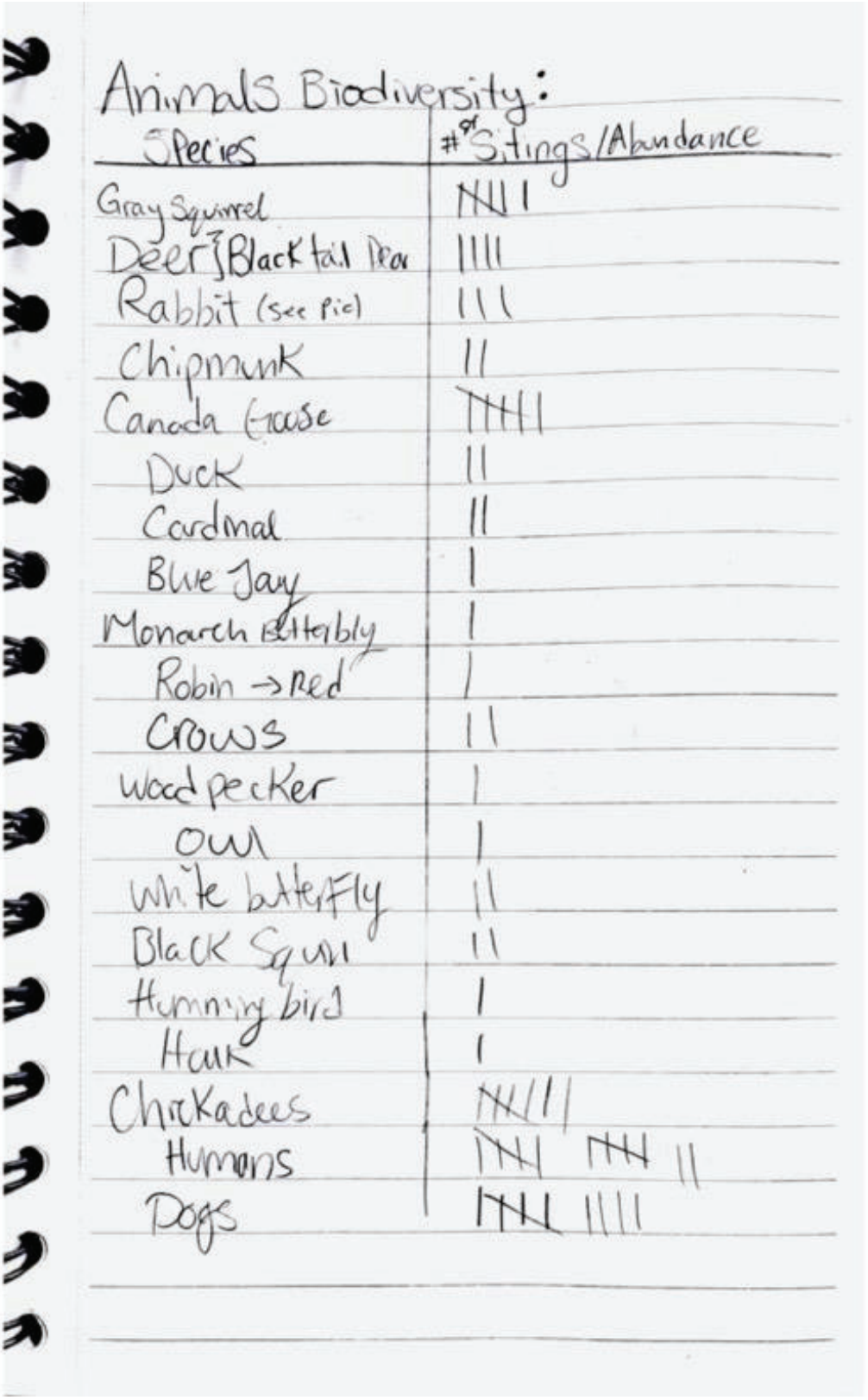
→ Tall Coniferous/evergreen trees
→ lots of one plant see photo (A.→)
Types of Plants Found
1). Conifers: } Main area around buildings.
2). Grass }
3) Maple trees - Acers (Acers)
4) Dandelions
5) Norway Maple - Acer platanoides
6) "Garlic Mustard", lots (A) on ground of forest
↳ Alliaria Petiolata ↳ invasive?
7) Lily ("Ditchlily) - Daylily (Hemerocallis) fulva
8) Buckthorns - Rhamnus



7) Japanease Barberry (Berberis Thunbergii)
10) Box / Japanese Holly (Ilex Crenata)
11) Tansy / Tansies - Tanacetum
12) Bur oak → Quercus Macrocarpa
13) Sugar Maple → Acer Saccharum
14) Red Maple → (Acer Rubrum)
15) Grass (Zoysia Japonica)
16) Many "Yellow Marsh Marigolds" Caltha around Saturation → Caltha palustris
17) Oriental Bittersweat, species of Staff Vine
↳ Celastrus Orbiculatus
18) Horseweed → Erigeron Canadensis
19) Norway Spruce → Picea Abies
20) Gray birch → Betula populifolia
21) Bitternut Hickory → Carya Cordiformis
22) Pitch Pine → Pinus Rigida
23) American Elm → Ulmus Americana
24) Smooth Crab grass → Digitaria Ischaemum ↑ Alantail
25) Blush Ash → Fraxinus Quadrangulata
26) Canada Goldenrod → Solidago Canadensis
27) White Oak → Quercus Rubra
28) Silvergreen bryum Moss → Bryum Argenteum



29) European larch → Larix decidua
30) Northern Red Oak → Quercus Rubra
31) Butternut → Juglans Cinerea
32) Spanish moss → Tillandsia Usneoides
33) Green Ash → Fraxinus Pennsylvanica
34) Red Spruce → Picea Rubens
35) Eastern Hemlock → Tsuga Canadensis
36) White Ash → Fraxinus Americana
37) Riverbank Grape → Vitis riparia
38) Jack Pine → Pinus banksiana
39) White pine → Pinus Strobus
40) White oak → Quercus alba
41) Norway Maple → Acer plantanoides



Animals Biodiversity:

Species	# of Sitings/Abundance
Gray Squirrel	𝍸 I
Deer/Black tail Dear	IIII
Rabbit (see Pic)	III
Chipmunk	II
Canada Geese	𝍸 I
Duck	II
Cardinal	II
Blue Jay	I
Monarch Butterbly	I
Robin → Red	I
Crows	II
Woodpecker	I
Owl	I
White butterfly	II
Black Squi	II
Humming bird	I
Hawk	I
Chickadees	𝍸 II
Humans	𝍸 𝍸 II
Dogs	𝍸 IIII

Insects/Small Creature BioDiversity

Species	Siting /Abundance
DragonFly	I
Monarch Butterfly	I
White Butterfly	II
Honey Bee	III
Lady Bug	II
Millipede	I
Earthworm	II
Ants Red	~~IIII~~ II
yellow Snail	II
Slug	II
Centipede	I
Black Ant (small)	III
large Black Ant	II

Other Notes: /Complexity ↑↑

→Rock Lifted ~ 1m × 1m Area looked out.

→Not much insects around over-saturation

→Needed to find dry(er) place/Site.

→ Ducks drink from polluted pond ↑(see pic)

→Deer sitings & tracks, hide in dense trees.

Day 4: Integrated- Reciprocal Wellbeing.
May 27th, 2023, 24°, 12:00pm
My preceptions & experiences:
→ Going into nature helped my well-being;
  → Mostly physical Activity
→ Saddens me in ways, emotionally that so much forest & natural environment has been cleared & what remains is degredating.
→ Happy when I arrive to be in nature, but by the time I leave I'm left feeling angry about the issue.
→ Other people seem to benifit
  → by walking, (w dogs too)
  → Spends time doing outdoor activities
  → Learning / going on tours
* → Construction Benifits framework & #
→ It feels like the natural environment's limits have been exceed by humans yet they keep taking.
→ This place has always inspired me to go into Science / Geography, due to the anger from the deforestation. Thus, I have a strong personal connection.

→ The Natural env is degraded & is continuing to, even tho there is "ecological" restoration occuring".

B) Reciprocity: (What needs to be done)
→ People need to let it restore on its own
→ plant proper species in proper areas
→ not insert more trails & further fragment the environment.
→ Not continue to build not Conserved Land.
→ Remove Invasive Species
→ Introduce more native plant & animal species
→ Connect fragmented parts of forest
→ insert proper / better drainage.
→ Further educate & use the natural env to learn, not just take for recreation.
→ Advocate & make programs to plant & do community ecosystem work (get ppl involved)
→ City is responsible for your care & plan for the area.
→ city needs better restore forests