Monitoring of Ecological Recovery in Wesleyville (Northumberland County, ON)

Includes:

Final Report

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Completed for: Wesleyville Joint Working Group

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DEVELOPMENT OF A RESTORATION MONITORING PLAN FOR WESLEYVILLE

ERSC 3160 Final Report

By

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For Host Organization

Joint Working Group – Wesleyville

(Willow Beach Field Naturalists and Northumberland Land Trust)

Faculty Supervisor: Dr. Shaun Watmough

Trent Community Research Centre Supervisor: Brittany Finnigan

April 12, 2024

Acknowledgements

As guests on the land where we live and work, before proceeding with this report, the authors would like to take the time to acknowledge our place as colonial settlers. We recognize that Trent University which we are affiliated with and where this work has been facilitated is on the traditional territory of the Michi Saagiig Anishnaabeg. We also recognize that the lands which this report is based on are also located in the traditional territory of the Michi Saagiig Anishnaabeg and have been occupied by the Huron-Wendat, Haudenosaunee, Metis, and Anishnaabeg people. All these lands are within the boundaries of the once disputed Williams Treaties, resolved in the Williams Treaties First Nations Settlement Agreement.

Additionally, we wish to thank our host organization, Joint Working Group Wesleyville for their commitment to environmental advocacy, maintaining our natural heritage, and their willingness to partner with Trent University to foster learning and growth. We appreciate Jennifer Jackman, Thomas Jackman, and Bill Newell for facilitating an informative site visit to Wesleyville. We also thank Cameco Corporation, Hydro One, and Ontario Power Generation for granting us access to the Wesleyville properties to learn about and explore the natural environment, which has helped inform this report.

Lastly, we offer many thanks to the faculty and staff from Trent University. To Dr. Shaun Watmough, the course instructor and project supervisor, for guiding us through the various assignments that have culminated in this report, providing helpful feedback, and ensuring the successful delivery of a monitoring plan for our host. Also, thank you to Brittany Finigan from the Trent Community Research Centre who coordinated this project, she prepared us for

success by facilitating meetings, drafting the project agreement, and overseeing the design and presentation of the research poster for the Annual Celebration of Community-Based Research.

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Introduction

History and Value of Wesleyville

Wesleyville Ontario is a small ghost town surrounded by a rural settlement area directly west of Port Hope Ontario, situated on the Lake Ontario coast. The town of Wesleyville has been uninhabited since the 1970s after the southern portion of the site was purchased by Ontario Hydro in preparation for the construction of an oil-fired generating station (Gregory, 2003). Following the cancellation of the plant construction due to the oil crisis of the 1970s, the site was left undeveloped, with it finding fewer intensive uses over time. Today, the site is divided between several separate landowners including Ontario Power Generation (OPG) and Hydro One –who together own the southern portion, Cameco Corporation –who largely own the northern portion, and several private landowners, as seen in Figure 4.

Since the land has been procured by its latest owners, the environmental health of Wesleyville has primarily been monitored by Ontario Power Generation and Hydro One as part of their corporate biodiversity conservation programs. In addition, supplementary monitoring has been pursued more recently by Wesleyville Joint Working Group (JWG), which is a working collaboration between the Willow Beach Field Naturalists and The Northumberland Land Trust (JWG, 2022). In collaboration with the different property owners, as well as outside conservation bodies, the JWG members have worked to combat environmental degradation due to trespassing, and better characterize the different ecosystem components of the site.

Through the efforts of JWG, the property owners, and several external conservation groups, the environmental significance of the site has been outlined in detail. Wesleyville's history has left a well-preserved landscape. This area's significance is indicated by three areas of

natural and scientific interest, a provincially significant wetland, old-growth forest, and other natural heritage features including meadows with significant plant communities (Gregory, 2003; JWG, 2022). As such, it represents an important environmental component on the Lake Ontario shoreline, providing substantial habitat for many terrestrial and aquatic species.

The Issue

Such diversity is rare on the shore of Lake Ontario, which increases the overall significance of this degradation. The site represents a threat to one of the final vestiges of these ecosystems in the region. Given this situation, the most direct path to the protection and restoration of the different ecosystems in Wesleyville is increased protection status for the site within the region or province. Wesleyville is currently facing serious issues of physical degradation caused by the illegal use of off-road vehicles on the property, Figure 6. Because of the uncertain conservation status of the site, alongside its splintered ownership, there are fewer protections in place against this kind of damage than would be ideal. The potential consequences of this damage are significant. Results of said damage can be seen through the evidence of increased erosion and damaged vegetation (Gregory, 2003). These resultant pressures can impact both aquatic and terrestrial organisms through disruption of and damage to habitat and can make it possible for invasive species to infiltrate an ecosystem with increased ease (Luong et al., 2023). Beginning in 2023, improved security measures have helped mitigate further damage including installing new gates and contracting a security company to monitor trespassing.

Joint Working Group Wesleyville

As previously stated, Joint working Group Wesleyville (JWG) is a partnership between the Willow Beach Field Naturalists and the Northumberland Land Trust that works to monitor the natural ecosystem in Wesleyville. While JWG does report directly to its respective boards of directors, it also maintains a history of regional partnership within and beyond the confines of Wesleyville itself. The group's cooperation with OPG, Cameco, Hydro-One, and the other private landowners of the site is essential for addressing issues ranging from access for monitoring and surveys, to more complex matters such as site security, and broader policy moving forward. Additionally, cooperation with conservation groups such as the Ganaraska Region Conservation Authority, and Nature Conservancy Canada has permitted the creation of well-developed profiles of the different ecozones on the property in addition to JWG initiating a biological inventory of the fauna and flora therein. Finally, the group's cooperation with educational institutions including Fleming College and Trent University has furthered its mission of conservation, in part through the access to student resources offered by these collaborations.

Study Background

Following the establishment of communication between this group of students from Trent University and the JWG, as well as the undertaking of a preliminary site visit to get firsthand observations of the Wesleyville site, it was decided that the most direct method of combatting current issues faced by the site would be to work towards increasing its conservation status within the region or province. To this end, this group has opted to focus on the grasslands present in Wesleyville as they are somewhat under-represented in terms of

observations, monitoring, and subsequent reports in comparison to the site's more sizeable features namely the ravines, forests, and wetlands. Additionally, grassland ecosystems are critically threatened in Ontario. Grasslands support unique fauna and flora, several of which have been observed in Wesleyville, being consequently threatened as well (Nature Conservancy Canada, 2021). The goal of this study is to develop a set of effective long-term monitoring methods for creating a profile and assessing the health of the grassland areas present on the site.

Objectives

This report outlines a simple yet effective, focused monitoring plan of sorts with clear instruction, goals, and intended interpretation. This plan outlines methods by which the results can be clearly communicated. The plan communicated must also be obtainable in multiple aspects time wise for the student body and accessible for the JWG. Throughout the entire project, communications with the JWG contact took place to have them be an active participant in our research, allowing the student body to tweak the scope of the project given their input.

Methods

Study Region

Wesleyville is located approximately 7.5 kilometers west of Port Hope, Ontario. The site and the surrounding region are within the Rice Lake Plains Natural Area, Figure 1 (Deziel, 2021). These plains contain remnants of Canada’s easternmost tallgrass prairies and savannas which were once much more extensive. The Rice Lake Plains lie north of Lake Ontario and south of Rice Lake, on the eastern portion of the morainal deposit known as the Oak Ridges Moraine (Farell et al., 2014). More specifically, Wesleyville is in the Lake Iroquois Plains, Figure 1 (Deziel,

2021). This area is classified as the Lake Simcoe-Rideau ecoregion (6E) and the Oshawa-Coburg ecodistrict (6E-13) and features gently rolling hills and bluffs along the north shore of Lake Ontario. Approximately 12,000 years ago, glacial Lake Iroquois deposited glaciolacustrine material over the Paleozoic bedrock, conditions influenced by Lake Ontario's warming effect have resulted in the formation of Grey Brown Luvisols that overlay these glacial materials (MNRF, 2018b). Generally, the climate is mild, summers are cooler, and winters are warmer because of Lake Ontario's moderating effect. The mean annual temperature ranges from 4.9°C to 7.8°C while precipitation ranges from 759 to 1087 mm on average with summer rainfall only comprising 198 to 281 mm of the average annual precipitation (MNRF, 2018a). The surrounding area has largely been converted into agricultural cropland or pasture, with over three quarters of the 6E-13 ecodistrict having been cleared for these and other purposes such as roads and developments, approximately 26% of this area remains forested, Figure 2 (MNRF, 2018b).

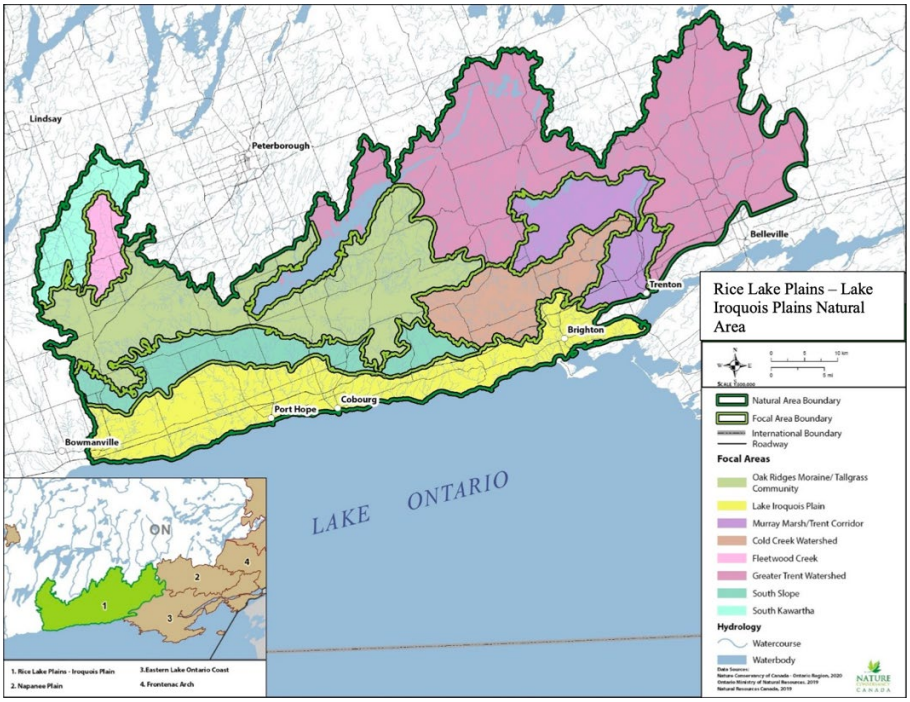

Figure 1: Rice Lake Plains Natural Area and Focal Areas (Deziel, 2021).

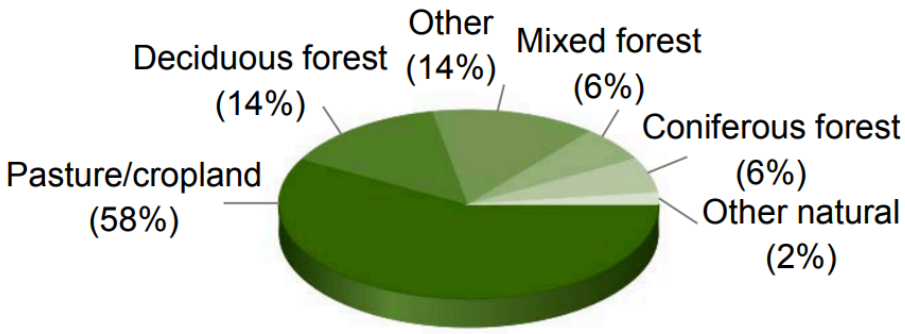

Figure 2: Ecodistrict 6E-13 land cover types (MNRF, 2018b).

Study Site

The site is a rural settlement area in the southwestern corner of Northumberland County. The settlement area is about 1100 hectares, divided into three primary parcels of ownership, namely Cameco Corporation, Hydro One, and Ontario Power Generation, Figure 3. Wesleyville is bordered along the northern extent by the provincial Highway 401, running east-west, where there is an ONroute rest stop just east of Wesleyville, on the south side of the highway. To the east is Wesleyville Road and to the west is Stacy Road, both running north-south. Naturally, the shore of Lake Ontario makes up the southern extent of the site. Essentially dividing the site in two halves, two rail lines run east-west, one operated by Canadian National Railway for freight and passenger trains, and the other operated by Canadian Pacific Railway for solely freight (MNRF, 2017). The site is mostly fenced around the perimeter, and there are various access points for service vehicles connecting to the surrounding municipal roads. In the southeast portion of the site along the lake shoreline stands the partly constructed power

generation facility. In the same area, one of the smaller buildings is actively used for fire safety training and associated administrative needs (Gregory, 2003).

Throughout the properties, there are 23 small forest plantations totaling 57 hectares, mainly in the disturbed area between the east and west ravines. These could provide a forested link between these natural areas. There are additional plantations around the marsh-swamp area in the southwestern portion of the settlement area. These were planted by Ontario Power Generation to reforest some of the fallow land. These plantations were planted with silver maple, red pine, white pine, Scots pine, or white spruce. Some parts of the land are still rented by the respective owners for agricultural cultivation, including corn and soybeans (Gregory, 2003). The natural ecosystems of Wesleyville are characterized by coastal wetlands, old-growth hemlock forest, cold-water creeks, and grasslands (Joint Working Group Wesleyville, 2022; Gregory, 2003). The map in Figure 2 defines the boundaries of all the natural areas at the site. One of the two coastal marshes has been evaluated and designated as a Provincially Significant Wetland under the Southern Ontario Wetland Evaluation System. An ecological land classification was conducted in 2003, to classify the land based on dominant physical and biological features. The main classifications identified at the site were cultural meadows, deciduous and coniferous plantations, deciduous and coniferous swamp, cedar treed fen, meadow or cattail marsh, and many denominations of forest ranging from coniferous to deciduous, and dry to moist. The forest classifications of Wesleyville were generally dominated by paper birch, American beech, ironwood, sugar maple, eastern hemlock, white pine, and/or white cedar (Gregory, 2003).

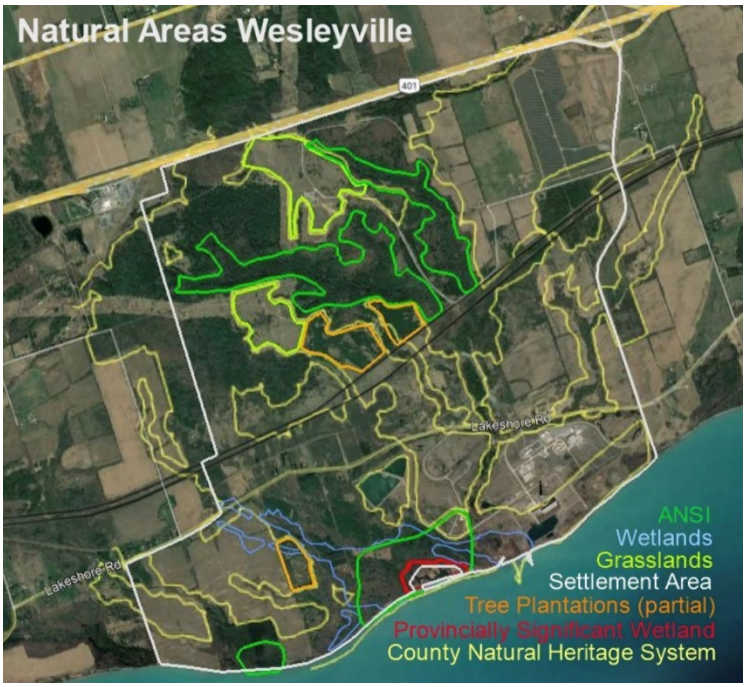

Figure 3: Natural areas of the Wesleyville rural settlement area within the broader Northumberland County Natural Heritage System, (JWG, 2022).

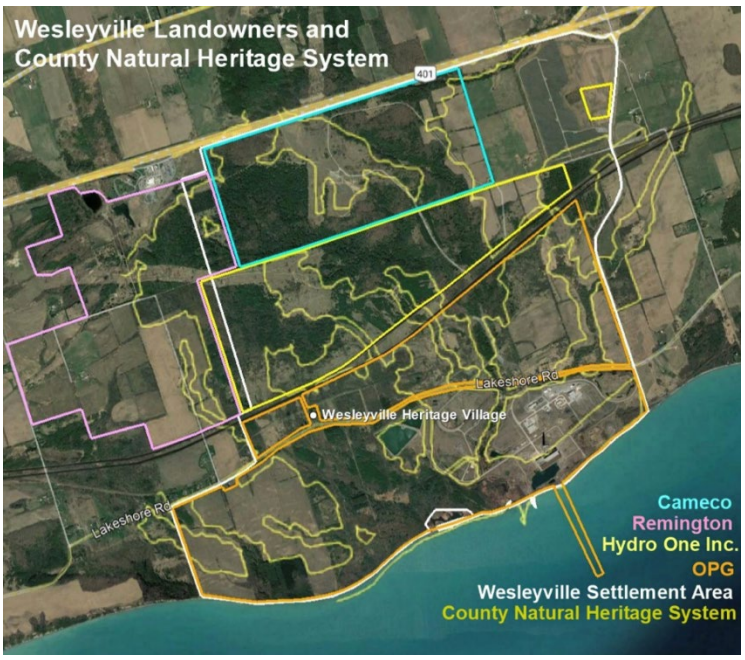

Figure 4: Land parcels of Wesleyville and their respective owners, the larger grassland area is within the center of the Cameco Corporation parcel and the smaller grassland area is within the west end of the Hydro One parcel (JWG, 2022).

Grassland Monitoring

Following an initial meeting with the host group, various files were reviewed containing reports, photographs, and spreadsheets to understand the results of past monitoring initiatives. During this process, gaps, or areas of improvement in current or past monitoring methods were recorded which helped direct a literature review. In the past, the JWG in collaboration with the Willow Beach Field Naturalists and other partners have organized and conducted other flora and fauna surveys including bird counts, forest surveys, grasslands walks in 2021 and 2022, and passive observation using trail cameras and acoustic monitoring devices. Many of these observations have been compiled using the iNaturalist platform. This is done as an ongoing iNaturalist project called Wesleyville Biological Inventory where observations of a wide range of species are added as they are observed during site visits. Observations from larger collection endeavors like the annual bird counts which have been held every year in both June and November since 2019 and acoustic monitoring devices in the wetlands and ravines which have been deployed annually since 2021 provide important contributions to this database.

Two large tracts of grasslands occur within the site -the largest being 40 hectares, both falling just south of Highway 401. These are found on relatively flat tablelands bisected by the steep forested banks of the East and West Ravines. The JWG has observed about 20 prairie indicator species here, and it has been hypothesized that at one time Indigenous peoples may have burned these areas creating a niche space for these species. This is supported by evidence of an Iroquoian village in proximity to Wesleyville that was unearthed in the 1970's by archeologists (Garter-Lee Limited, 2003). Historically, these grasslands were cleared of forest for agricultural use and have been left to regenerate since around 1975. The grasslands in the

northern extent, within the Cameco Corporation property (Figure 2) are exposed to contaminants such as saltwater runoff from Highway 401, which runs east-west. The 2021 Grasslands report for the Wesleyville site records flora and fauna observations, that demonstrate the site still contains significant species despite off-road vehicle trespassing and damage that remains a persistent issue (Deziel, 2021).

With preliminary research completed, it was determined that the student body needed a site visit to better understand the property and the scale of Wesleyville. A visit to the site was organized and took place on February 13, 2024, to observe the various ecosystems. Students were guided by Jennifer Jackman and Thomas Jackman from Mail Road through various stretches of the East Ravine area, the large section of grassland -comprised of zone one through four, Figure 5- and finally the coastal marsh. Upon visiting the site, it became clear there were many vastly different ecosystems. This meant that there was almost unlimited potential for the direction of this report. Following a group meeting and discussion with the project supervisor Dr. Shaun Watmough it was decided to focus monitoring efforts on the grasslands which have not been monitored thoroughly in the past. With this focus, comparisons were made between published literature and the current monitoring efforts.

After undertaking a literature review to research potential monitoring methods a list of potential monitoring methods was compiled. These methods for data collection and monitoring were considered but were ultimately narrowed to a smaller list due to various practical considerations, Table 1. Time constraints play into what the JWG can accomplish within the seasonal window to see specific species, the methods should not require a prolonged amount of time, beyond a few hours on a single day. In addition, the proposed methods should not

involve specialized equipment that requires training or expenses that make it inaccessible to most people. Ultimately, the monitoring methods should not be too demanding when considering the labor requirements given that all the efforts are volunteer based. Lastly, the methods should be adaptable for both small and large groups depending on availability, which varies.

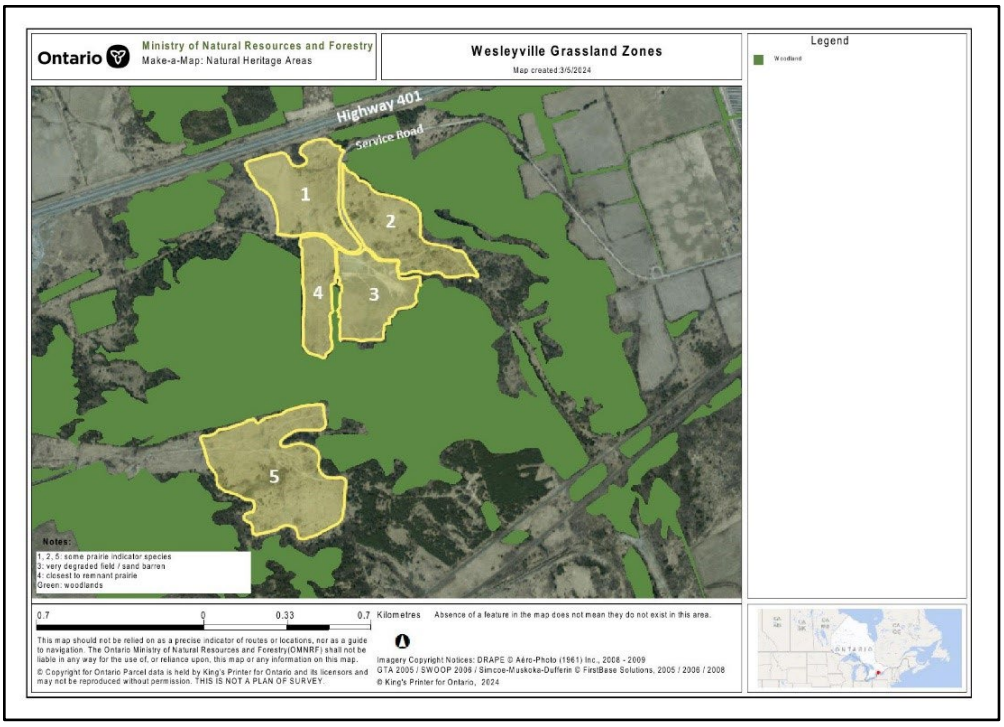

Figure 5: Grassland zones of Wesleyville.

Figure 6: Off-road vehicle damage on a Wesleyville grassland site.

Table 1: Rationale for eliminating specific researched methods from the final recommendations.

Monitoring Method	Reason for Elimination
Gigliotti, F. N., Franzem, T. P., & Ferguson, P. F. B. (2023). Rapid, recurring, structured survey versus bioblitz for generating biodiversity data and analysis with a multispecies abundance model. *Conservation Biology*, *37*(2), e13996-n/a. https://doi.org/10.1111/cobi.13996	• Requires more time commitment than a traditional bioblitz • Requires specialized sampling skills • Less comprehensive taxonomically
O'Brien, J. M., Thorne, J. H., Rosenzweig, M. L., & Shapiro, A. M. (2011). Once-yearly sampling for the detection of trends in biodiversity: The case of Willow Slough, California. *Biological Conservation*, 144(7), 2012–2019. https://doi.org/10.1016/j.biocon.2011.04.023	• Requires specialized sampling skills • Less comprehensive taxonomically
Ray, A. M., Hossack, B. R., Gould, W. R., Patla, D. A., Spear, S. F., Klaver, R. W., Bartelt, P. E., et al. (2022). Multi-species amphibian monitoring across a protected landscape: Critical reflections on 15 years of wetland monitoring in Grand Teton and Yellowstone national parks. *Ecological indicators*, *135*, 108519-. Elsevier Ltd.	• Requires specialized equipment such as remote sensing technology • Requires complex statistical analysis
Just, M. G., & Frank, S. D. (2019). Evaluation of an easy-to-install, low-cost dendrometer band for citizen-science tree research. *Journal of Forestry*,	• Requires specialized equipment • Not specific to grassland species

117(4), 317–322. https://doi.org/10.1093/jofore/fvz026	
Klingbeil, B. T., & Willig, M. R. (2015). Bird biodiversity assessments in temperate forest: the value of point count versus acoustic monitoring protocols. *PeerJ*, *3*, e973. https://link-gale-com.proxy1.lib.trentu.ca/apps/doc/A543485941/AONE?u=ocul_thomas&sid=bookmark-AONE&xid=60cebbbb	• Already being perused in addition to acoustic monitoring

Data Collection and Sources

The sources used in this report are a combination of grey literature and peer-reviewed sources. Grey literature was sourced primarily from files compiled by the JWG. These sources include unpublished reports by the JWG and its associated members, the Nature Conservancy Canada, Fleming College, the Ontario Ministry of Natural Resources, and the landowners including Cameco Corporation, Hydro One, and Ontario Power Generation. Grey literature external from the JWG files such as blog posts, reports, and news articles were avoided to avoid outdated or inaccurate information. Peer reviewed sources were used to inform the monitoring recommendations in this report. These were acquired from databases including Trent University OMNI and Google Scholar using key search terms. Some of the search terms that yielded results included ecosystem services, conservation, biodiversity, modified bioblitz, indicator species, remnant ecosystems, landscape change, ecological monitoring, community monitoring, and citizen science monitoring.

Results

Species Indicators

Potential ecological indicators for the grasslands at Wesleyville should include those that have been previously sighted on the property and species that are typical of grasslands in

Eastern North America (Vickery & Herkert, 1999). The indicator species that should be focused on through monitoring efforts on the Wesleyville site are those that suggest the presence of a grassland or prairie ecosystem on the property. Indicators previously sighted on the property are included in Table 2 (Nature Conservancy Canada, 2021). All the species documented in Table 2 have been sighted on the Wesleyville property and are indicators of a tallgrass prairie ecosystem, with many being currently threatened by huge habitat loss across North America. Their continued presence on site alongside the discovery of any additional species recognized to be indicators of this kind of ecosystem would be an excellent indication of a functional potential for the grasslands to support tallgrass prairie ecosystem, threatened in Ontario.

Table 2: Taxonomy of prairie indicator species previously sighted in grasslands of Wesleyville.

Guild	**Scientific Name**	**Common Name**
Birds	*Ammodramus savannarum*	Grasshopper sparrow
	Dolichonyx oryzivorus	Bobolink
	Spitzella pallida	Clay coloured Sparrow
	Spizella pusilla	Field sparrow
	Sturnella magna	Eastern meadowlark
	Passerculus sandwichensis	Savannah sparrow
	Pooecetes gramineus	Vesper sparrow
Insects	*Danaus plexippus*	Monarch butterfly
Plants	*Anaphalis margaritacea*	Pearly everlasting
	Anemone cylindrica	Candle anemone
	Carex siccata	Dry spike sedge
	Juniperus communis	Common juniper
	Lespedeza capitata	Round-headed bush clover
	Oenothera biennis	Common evening-primrose
	Pteridium aquilinum	Eagle fern
	Quercus rubra	Red oak

	Rudbeckia hirta	Black-eyed Susan
	Shepherdia canadensis	Canada buffaloberry
	Symphyotrichum ericoides	White heath aster
	Verbena stricta	Hoary vervain

Bird Indicators

Birds are widely studied and provide excellent ecological indicators of habitat conditions, depending on their tenacity (McNicholl, 1988; Vickery & Herkert, 1999). It is important to also consider species that have not been observed but are still associated with grasslands. As more indicator species are recorded, trends may be observed based on their habitat preferences, range, or habits (breeding, migrating, wintering). Grassland birds nesting methods are adapted to their environments which are usually devoid of vertical structure. Often this means nesting in low shrubs, ground nesting, or burrowing (McNicholl, 1988). Given the nature of the grasslands at Wesleyville being subject to disturbance by off road vehicles, this may discourage ground nesting species from utilizing the site. When the land was in production, farm machinery may have had a similar effect due to the compaction and tilling associated with commercial agriculture. Studies have shown strong positive correlation between higher densities and nesting success in untilled land and fewer occurrences of predation in areas with more cover (McNicholl, 1988). This could suggest a long history of poor nesting habitat for grassland birds at Wesleyville, dating back to before 1975 when the land was in production. Grassland bird species that are typical of Eastern North America are outlined in Tables 3 and 4 adapted from Vickery & Herkert, 1999, some are not frequently observed as far north or east as Wesleyville, however, some have been observed at Wesleyville according to the observations recorded in Table 2. Along with their scientific name and common name are

their habitat preferences and ecological basis for their presence. Grassland birds are species dependent on large open grasslands, dominated by grasses and forbs, with minimal woody vegetation. Savanna birds are species dependent on somewhat open grasslands with scattered trees and/or shrubs (Vickery & Herkert, 1999).

Table 3: Grassland bird species information adapted from Vickery & Herkert (1999).

Grassland Habitat Bird Species		
Scientific Name	**Common Name**	**Ecological Basis**
Circus cyaneus	Northern harrier	Hunts over grasslands and pastures during the daytime, usually not vocal (Fisher, 1996).
Bartramia longicauda	Upland sandpiper	Selects treeless areas to nest, mainly grassy areas with nearby perches for males to guard their nests (Fisher, 1996).
Eremophila alpestris	Horned lark	Grazing and cultivation tenacity (McNicholl, 1988).
Spiza americana	Dickcissel	Often found outside their breeding range, dependent on rainfall. Nests in fields, meadows, and prairies (Audobon, 2024).
Pooectes gramineus	Vesper sparrow	Found nesting in shrubland (McNicholl, 1988).
Chondestes grammacus	Lark sparrow	Prefers open areas with sand barrens and shrubs for nesting such as fields and roadsides (Audobon, 2024).
Passerculus sandwichensis	Savannah sparrow	High tenacity, breeds in various open habitats, avoids heavily disturbed areas and cropland (McNicholl, 1988).
Ammodramus savannarum	Grasshopper sparrow	Prefers short grasses, and more open areas compared to savannah sparrow, avoids heavily disturbed areas and cropland (Mcnicholl, 1988).
Ammodramus henslowii	Henslow's sparrow	Breeds occasionally in southern Ontario (McNicholl, 1988).
Spizella pallida	Clay-colored sparrow	Found in scrub-edge habitat, likes weedy edges, does not nest in heavily

		cultivated fields or grasslands (McNicholl, 1988).
Dolichonyx oryzivorus	Bobolink	Nests on the ground of grasslands and hayfields with abundant in invertebrates and seed sources (Fisher, 1996).
Sturnella magna	Eastern meadowlark	Nests in large open grasslands and pastures foraging on invertebrates and seeds (Fisher, 1996).

Table 4 Savannah bird species information adapted from Vickery & Herkert (1999).

Savannah Habitat Bird Species		
Scientific Name	**Common Name**	**Ecological Basis**
Sialia sialis	Eastern bluebird	Forages along edges, breeds in grasslands (McNicholl, 1988).
Lanius ludovicianus	Loggerhead shrike	Feeds from a perch on small mammals, birds, and invertebrates. Nests in grasslands and pasture with nearby hedgerows with dense shrubs or thickets (Fisher, 1996).
Carduelis tristis	American goldfinch	Feeds on thistle and dandelion seeds in weedy fields, pastures, and forest edges. Nests in low shrubs in open areas (Fisher, 1996).

Recommendations

Bioblitz

A bioblitz is a simplified sampling method to gather occurrence data efficiently. The data can be useful to inform conservation or restoration decisions based on the species composition of the ecosystem (Park et al., 2018). A bioblitz requires few materials, such as notetaking supplies and a camera for flora and fauna observations (Haywood & Unger, 2019). Other equipment may include identification guides, as necessary. A bioblitz will serve as a starting

point to help inform long term monitoring and restoration efforts, especially in areas of the grasslands that are less understood or frequented.

In the context of recommendations to the Joint Working Group, at least one bioblitz event should be held in the grassland ecosystem each year. Conducting a bioblitz in the summer months of July and August may be the ideal time, as this is when many forb species are blooming, as well as the time when many insect species are active in both larval and adult stages. However, it may not be ideal for getting a species inventory of the birds living on site. The specific logistics regarding which grassland areas should be surveyed are at the discretion of the organizers, based on the availability of volunteers. An effective method of recording and storing observations would be to have participants photograph their species observations and submit them to iNaturalist.

Included in the recommendations to the JWG is a template Excel spreadsheet on how the observation data could be sorted for later use or interpretation. Observations on iNaturalist can be downloaded as a CSV file, where it can be organized and manipulated in Microsoft Excel. If there is an abundance of observers and lots of observations are anticipated, it is recommended that a new iNaturalist project, like the existing Wesleyville Biological Inventory project, is created for each bioblitz event. Alternatively, the current project could be used to store these observations ongoingly. Up to a few weeks should be allowed for observations by volunteers to be upgraded from 'Needs ID' to Research Grade to allow time for the iNaturalist community to verify observations. This will result in the most useful set of data. After this period, observations can then be downloaded into Microsoft Excel. Additional information at

the time of the bioblitz should be recorded, as it can impact the results of the event. Weather information, survey effort, date, and time should be recorded.

Figure 7 is a sample from the template using previous iNaturalist submissions to the Wesleyville Biological Inventory iNaturalist Project and the bar chart shows a way in which this data can be displayed. Specific instructions on how to download iNaturalist project data and manipulate it in Excel are to be provided.

Insects				
Common Name	**Scientific Name**	**Iconic Taxa Name**	**Taxon Order**	**Quality Grade**
Common Tree Crickets	Oecanthus	Insecta	Orthoptera	needs_id
Painted Skimmer	Libellula semifasciata	Insecta	Odonata	research
Black-tipped Darner	Aeshna tuberculifera	Insecta	Odonata	research
Black Saddlebags	Tramea lacerata	Insecta	Odonata	research
Eastern Amberwing	Perithemis tenera	Insecta	Odonata	research
Common Whitetail	Plathemis lydia	Insecta	Odonata	research
Ebony Jewelwing	Calopteryx maculata	Insecta	Odonata	research
Halloween Pennant	Celithemis eponina	Insecta	Odonata	research
Common Whitetail	Plathemis lydia	Insecta	Odonata	research
Bluets	Enallagma	Insecta	Odonata	needs_id

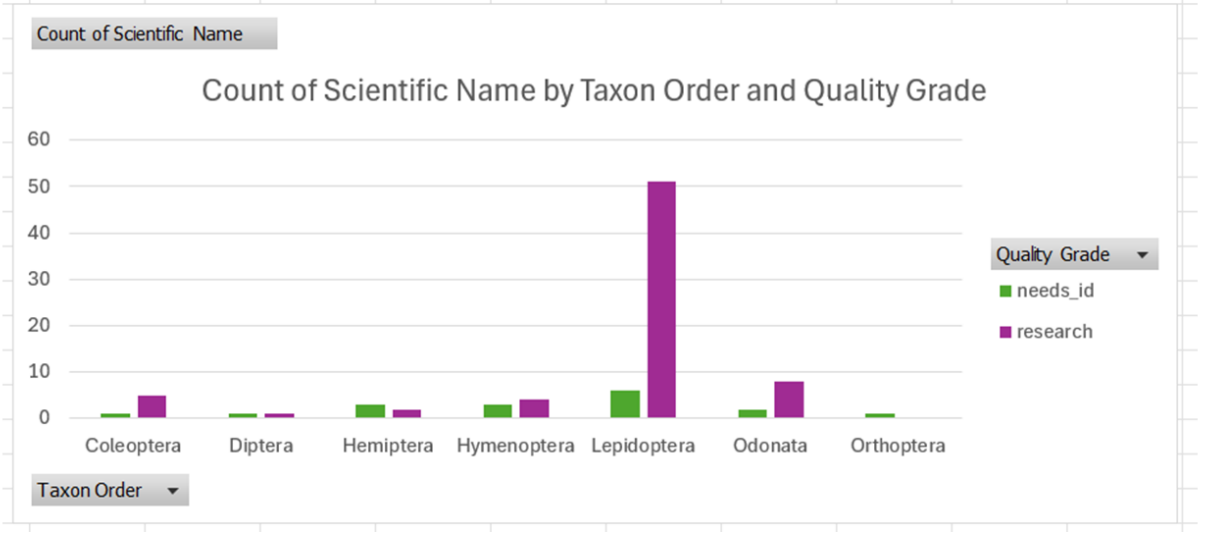

Figure 7: A screen clipping from the template Excel spreadsheet. The chart's layout allows for sorting and filtering of features of the data. The bar graph below is an example of how the data can be displayed or interpreted, should this data be included in a report or publication.

In Figure 7, the table's headings are attributes of iNaturalist observation data. When updated to Research Grade, an organism observation's identification has been confirmed by others. A Research Grade observation is widely accepted as reputable, and of use for research and data analysis. A "Needs ID" observation is yet to be amply confirmed, and thus they are generally less reputable. The scientific taxon classifications, such as scientific name, iconic taxa name, and taxon order as seen in Figure 7, are automatically assigned to an iNaturalist observation upon submission and confirmation. There are many more attributes of observations which can be downloaded from iNaturalist that are not included in this table. However, these are the recommended minimum that the JWG use to analyze data. Note that the table format allows for filtering and sorting of the data. For instance, if only Research Grade observations are desired, a filter can be placed so that the Needs ID observations are removed.

Ultimately, data interpretation can take many forms and depends on the desired product of bioblitz results. Figure 7 shows an example bar chart displaying the number of observations of each type of insect family. A general report about a bioblitz event may include a graph like the one in Figure 7 to reflect on which taxa may need more survey effort in future bioblitz events. For instance, there is a considerable amount of Lepidoptera (butterflies and moths) observations compared to orthoptera (grasshoppers, katydids, and crickets). Over several bioblitz events, these data numbers could be compiled to gain a long-term understanding of which taxa are being found during bioblitz events. Other examples of data analyses which could be conducted on this data set include selecting specific species of interest (such as prairie indicators) to examine their presence in different regions of the grasslands, or to examine whether observations of them are declining or increasing over time.

Acoustics

Acoustic monitoring is a valuable tool for monitoring the presence of indicator species, especially those difficult to detect using traditional methods. Acoustic monitoring is a method used to monitor wildlife. In this method, recording devices are deployed in natural environments and record ambient sound periodically. The benefit of conducting acoustic monitoring is that the recordings can be saved and reviewed for later use, they limit human identification error, and can reduce logistical conflicts with dawn and dusk bird surveying (Klingbeil & Willig, 2015). The JWG has previously implemented acoustic monitoring, in the East Ravine (2022 and 2023) and the marsh habitat (2021 and 2022), as discussed previously in meetings and during the site visit. The results of these monitoring efforts are published in a report form manually for circulation and added to the Wesleyville Biological Inventory iNaturalist project. These materials have informed the decision to include acoustic monitoring as part of the monitoring plan recommendations to the JWG. Materials required for this method are the autonomous recording units and computer software to analyze the recording files with, which are two assets already available to the JWG. In addition, knowledge about acoustic monitoring programs has been supplemented by published literature, such as Klingbeil & Willig (2015) which provides an understanding of the benefits and drawbacks of acoustic monitoring programs.

Acoustic monitoring in grasslands requires different considerations for the placement of the device and timing of recording, as opposed to a forest or wetland, Tables 3 and 4. Grassland bird species willingly use perches if they are available for both singing and displaying themselves. Although, flight songs are more typical of some species such as the horned lark and

bobolink, compared to bird species with an affinity to forests which are not usually heard singing during flight (McNicholl, 1988).

Long-term Photography

Long-term photography is another method of environmental monitoring. In essence, this method compiles pictures taken of a landscape or natural feature over time and examines these pictures for changes. In the past, there has been photography monitoring efforts in the East Ravine old-growth forest to document erosion. During site visits and meetings, concerns were raised by the JWG about the challenges of compiling photos consistently and using them for long-term monitoring. After literature review to investigate other uses of photographic monitoring, a paper by Pérez et al. (2024) was found to discuss the methodology and results of a long-term photography study which gathered decades of images of a natural monument in Texas that is a popular tourist attraction. From this article, an understanding of the methodology used, and the efficacy of this initiative will inform the recommendation of this method to JWG Wesleyville.

Photography has been identified as a useful method to monitor landscape-level changes including tall grass prairie characteristics, disturbance, and succession of the grassland in the long-term. The use of a user-friendly mobile application is recommended to address the challenges of compiling photos over an extended period. Avenza Maps is a mobile application created by Avenza Systems Incorporated. This application can be used for accessing maps and creating geographically referenced data layers. These functions can be executed on mobile devices for recreation or fieldwork. In the context of photographic monitoring, Avenza Maps can be used for establishing plotted points on map layers at locations where the photographer

would stand to take the photographs. Each point is associated with a set of GPS coordinates that can be revisited to capture photographs. Each point stores metadata including a name for that location, the azimuth the photo should be taken from, and a description which can be amended as needed to log notes from each return. The points are also associated with the photographs taken from that GPS coordinate and as the photographer returns new photos can be added to the same point in real time.

Regarding the capturing of photographs, having an individual stand in the frame at a specific landmark or known coordinate is helpful for establishing scale. Alternatively, a reference object could be used for establishing scale such as a two-meter stake that is brightly painted, or a shovel with a visible handle that can be staked in each picture. If a coordinate is used for the location of the reference object, this can be recorded and stored in the point metadata on Avenza Maps for reference. Having an object in the frame allows more opportunities for observation to be made. Especially at sites surrounding the edges of the grasslands, woody encroachment is more apparent with a reference object. In addition, returning to take the photo would be made easier by placing stakes at the coordinate where the original image was captured, and the photographer is to stand upon return. If there is risk of machinery or vehicles utilizing that area, fiberglass or plastic stakes are more flexible and less prone to long-term damage compared to a wooden stake that could break, or a metal stake that could cause damage to a vehicle. Regarding frequency, the more images that are compiled, the better. Ideally, photos will be taken when foliage is fully present, within the months of June, July, August, and September.

In addition to the images as qualitative observations, a quantitative measure that can be associated with the images is the distance from the point of capture to the nearest tree or shrub with a diameter greater than 10 centimeters. These values can be recorded with a measuring tape and stored in the notes of each point in Avenza Maps. Overtime, these measurements can be plotted on a graph of time in years (independent variable) to distance of nearest tree (dependent variable) to determine the rate of woody encroachment. In association with the compiled images, this is a useful monitoring method that can capture long-term change.

Discussion

Interpretation

Through the execution of the modified bioblitz, acoustic monitoring, and long-term photographic monitoring, the objective of this project is to create a detailed inventory of the flora and fauna of the five distinct Wesleyville grassland sites (Figure 5), as well as any potential changes to their scope, composition, or integrity. Towards this purpose, the undertaking of acoustic monitoring and a bioblitz are complimentary steps in creating a detailed wildlife profile of the site, with the potential to compare this to pre-existing data sets from established grasslands within Ontario and the surrounding region. In addition to the potential for the use of results derived from the bioblitz and acoustic monitoring, the execution of regular and consistent photographic monitoring would provide a graphic record of the future development of the grassland, tracking any possible increase in forb and grass density or the encroachment of any of the surrounding woodlands.

The establishment of these statistics would hopefully aid in future classification of the two Wesleyville sites of interest as provincially significant, through avenues such as their animal and plant species composition, as well as their potential to provide habitat for important grassland organisms including birds, insects, and plant species. The presence of species including the North American badger, butterfly milkweed, the bobolink, and round-headed bush clover could all suggest the presence of a functional tallgrass prairie, particularly if such species are present in a breeding capacity (iNaturalist, 2024). Further the long-term monitoring of the site using regular photography could help JWG representatives to track the development of the grassland areas over time. Together, the comparison of species composition with that of pre-existing grassland habitat, and long-term photographic monitoring of the site can be used to ascertain overall habitat viability for different grassland indicator species, regardless of their presence in the initial bioblitz or ongoing acoustic monitoring. Tall grass prairie once covered approximately 1000 km^2 in Ontario and currently less than 3% remains (Tallgrass Ontario, n.d.). Should the site be identified as a tall grass prairie, it would be far less likely to be developed, not only through provincial significance, but through a conservation easement as well. The company that owns the property acknowledged in an ecological assessment that there was potential and benefits to conserving this property. To have this land placed into a conservation easement so that it is fully protected is the long-term goal of this project. This can only be achieved through clear evidence of a tall grass prairie ecosystem or the identification of a well-established endangered species habitat. As urban expansion continues it is paramount that the few remaining natural sites along the north shore of Lake Ontario, such as the Wesleyville site, be protected and conserved at all costs.

These monitoring protocols were selected for their relationship with citizen science, they are what is best suited to the group we are working with and achieve an ideal balance between a user-friendly study design and one that will obtain useful results. An essential factor of this study design is that it can be communicated and understood by the variety of organizations we are working with no matter their background. The value of citizen science cannot be overstated, and we have aimed to fully incorporate this invaluable resource into our study design.

Table 5: Sample species comparison chart for grassland assessment.

Scientific Name	Common Name	Sightings	Incidence in Grasslands		
Taxidea taxus	American badger				
Asclepias tuberosa	Butterfly milkweed				
Dolichonyx oryzivorus	Bobolink				
Lespedeza capitata	Round-headed bush clover				

Our research alone cannot address all that needs to be accomplished at this site. With the other ecosystems like the forests and wetlands, there is still much work to be done including remediation and additional monitoring. In the future this document could further aid in the monitoring and assessment of the different ecosystems on the property. All the studies and information concerning this site's various ecosystems would likely need to be compiled and organized into one coherent document. Our methods and study design will ideally be built on in future assessments to continue collecting invaluable ecological data. The hope is that what has been outlined here in this document will create another important steppingstone towards the entire site, from the lake shore to its northernmost parts, being protected.

Conclusion

The Wesleyville site is a beautiful area with unique ecosystems and treasured landscape. The monitoring protocol we have designed will hopefully provide the necessary tools to protect and conserve this area so that it may continue to flourish. This has and always will be the goal.

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