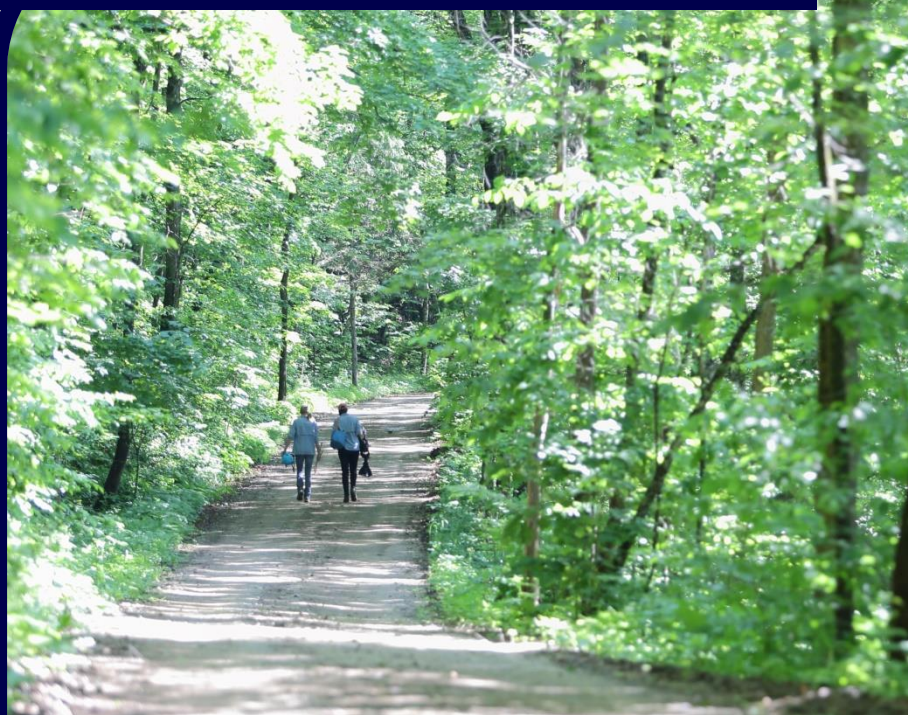




# Kenauk Institute - 2016 Annual Report



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Liane Nowell  
January 13, 2017

## Table of Contents

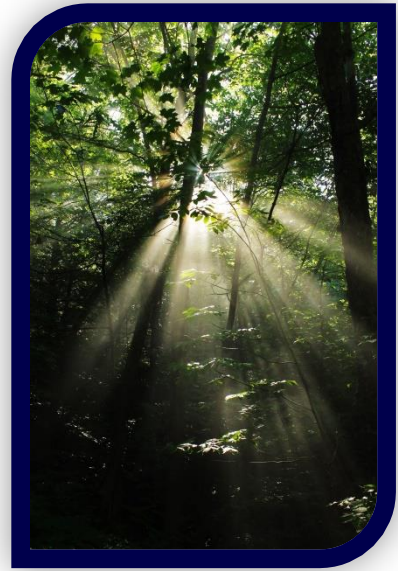
<b>Table of Contents.....</b>	<b>1</b>
<b>Executive Summary and Board of Directors .....</b>	<b>2</b>
<b>Facilities.....</b>	<b>3</b>
<b>Marketing.....</b>	<b>4</b>
<b>2016 Research Projects.....</b>	<b>5</b>
1. Biodiversity Project .....	5
2. Vernal Pool Hydrology and Herpetology Project .....	6
3. Tree Growth and Productivity Project .....	7
4. Forest Resilience Project.....	8
5. Invasive Slug Project .....	9
6. NCC Biodiversity Project .....	10
7. CERFO Vernal Pool Mapping Project.....	11
8. Coyote Scat Project.....	12
9. Looking for the Champlain Sea .....	13
10. Papineau Weir Monitoring Project .....	14
11. McGill Loon Nesting Project.....	15
12. Papineau Lake Water Quality Monitoring Project .....	16
13. Pollinator Project .....	17
<b>2016 Educational Programs.....</b>	<b>18</b>
1. Belgium Program.....	18
2. Outward Bound and YMCA Program .....	18
<b>2017 Upcoming Research Projects.....</b>	<b>19-23</b>
<b>Research Partnerships .....</b>	<b>24</b>

## Executive Summary

The mission of The Kenauk Institute is to support, coordinate and supervise scientific research, involve local schools in environmental education, and connect Kenauk with the broader community. The vision is to establish a baseline inventory of biodiversity and monitor the property with a 100 year time horizon. With time, Kenauk will become a laboratory for monitoring climate change and human impacts.

The Kenauk Institute has been proud to partner with Kenauk Nature and the Nature Conservancy of Canada, using research and conservation to ensure Kenauk's legacy as a pristine wilderness for centuries to come. Kenauk has proven to be an ideal location for a research institute because of its expansive size (65,000 acres), its uniqueness as a pristine watershed and since it acts as a wildlife corridor. The abundance and diversity of flora and fauna in combination with the properties unique history provides endless possibilities for research which has become apparent through the high demand for projects. Thanks to dedicated teams of researchers we are already well on our way to our goal of long term monitoring and conservation.

Throughout 2016, The Kenauk Institute has seen a lot of progress towards becoming an established and permanent center for ecological studies; including the successful completion of 13 research projects, 2 educational programs as well as the continued development of facilities.



## Board of Directors

The Kenauk Institute is honored to have such a dedicated board of directors.

- Mr. Doug Harpur – Chair
- Mr. Patrick Pichette – B.A., M.A.
- Ms. Sara Lydiatt – B.A., M.A.
- Dr. Altaf Kassam – B.Sc., PhD, M.B.A.
- Dr. Christian Messier – B.Sc., M.Sc., PhD
- Dr. David Philipp – B.Sc., M.Sc., PhD
- Dr. Christopher Buddle – B.Sc., M.Sc., PhD

## Research Coordinator

- Liane Nowell – B.Sc., M.Sc.





## Facilities

Our facilities currently include seven pods and one teepee. Creating scientific and educational facilities / accommodations will be the foundation of the Kenauk Institute.

### Teepee

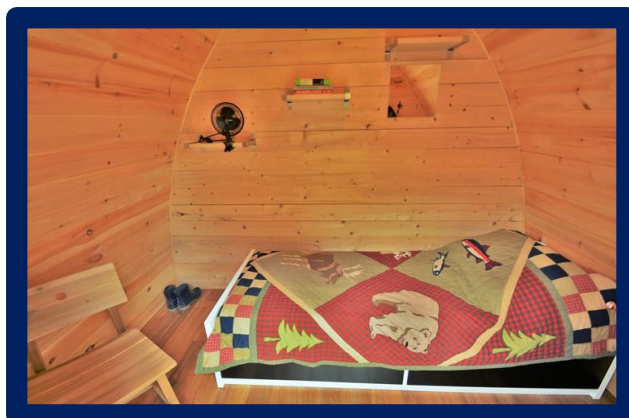
A 24 foot diameter teepee, dubbed our 'teepee of knowledge', serves as an educational hub at Whitefish Lake. It is filled with educational posters and displays for Kenauk clients and visiting hotel guests.

There is also a second identical teepee at the Lac Commandant Auberge in Boileau. This teepee is also filled with educational materials and helps inform local community members of the Kenauk Institutes goal to protect Papineau Lake for long term conservation.



### Pods

Seven pods are installed at Whitefish Lake and act as our researcher accommodations. These pods include 4 professor accommodations and 4 student accommodations (2 pods divided in half) as well as one pod which temporarily acts as a research equipment storage pod. The guide shack (an existing and nearby building) includes the washroom and kitchen facilities. In 2017 a megapod will be purchased and furnished with 8 bunk beds. This pod will help increase our capacity for hosting educational programs.



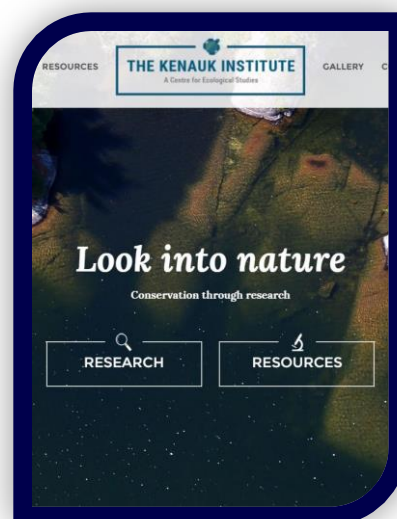
## Marketing

The Kenauk Institute has successful website and facebook pages.

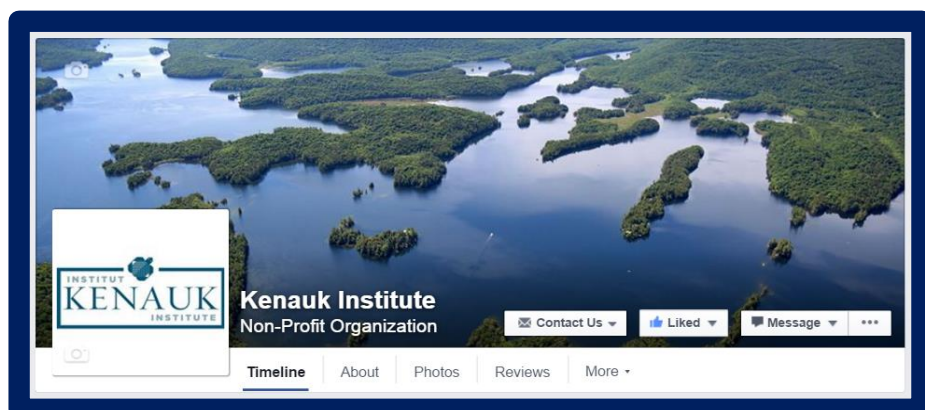
### Website – [www.kenaukinstitute.org](http://www.kenaukinstitute.org)

The website includes: about us, research, resources, gallery, and contact pages. It is also available in French. It is being updated continuously as new information becomes available, such as research project reports and publications as well as maps and species lists.

In 2017 it will be updated with the new research projects and potentially an educational programs section.



### Facebook – [www.facebook.com/kenaukinstitute/](https://www.facebook.com/kenaukinstitute/)



The purpose of the Kenauk Institute facebook page is primarily for education, outreach and awareness. It is being updated with weekly posts about biology related material (ie. fun facts about an animal or event), holidays, and research projects with the Kenauk Institute.

## 2016 Research Projects

Thirteen research projects were successfully completed and/or initiated during the year of 2016.

### Forestry Projects

The first four projects fall under one overarching forestry project with the goal of comparing various forestry techniques (strip cutting vs. selective cutting vs. no cutting) in terms of its impacts on increasing the overall resilience of the forest to global change.

#### 1. Biodiversity Project (component 1 of forestry project)

**Title:** Effects of even-aged versus uneven-aged silviculture and resulting landscape quality on biodiversity.

**University / Organization:** McGill University, Guelph University, and Université de Québec en Outaouais (UQO)

**Researchers:** Dr. Christopher Buddle, Dr. Kyle Elliot and Jessica Turgeon (McGill University), Dr. Alex Smith (Guelph University), Dr. Yann Surget Groba and Dr. David Rivest (UQO), Dr. Christian Messier (UQO/UQAM)

**Description:** Biodiversity is central to human well-being, and to the resilience and health of our ecosystems. This is especially relevant today as we face unprecedented environmental challenges, from climate change to invasive species. In north-eastern North America, forest ecosystems, such as Kenauk, harbor immense biodiversity, much of which is largely unexplored. From insect pollinators to carbon-capturing trees, critical ecosystem functions are provided by the flora and fauna which inhabit Kenauk. As we adapt to our changing environments, and prepare for the future, benchmarking this biodiversity is essential, as is studying the ways this biodiversity is best maintained and conserved for future generations. This research will focus on quantifying how the biodiversity of flora and fauna at Kenauk has adapted to past harvesting (ie. strip cutting), and is positioned for future changes in the forest. Surveys will be completed in permanent sample plots, which will be the basis for long-term ecological monitoring at Kenauk. The focal study organisms for the first phase of this research will include arthropods (insects and spiders) living from the forest floor to the canopy.

#### Results Summary:

- Data analysis is ongoing for this project, but to date as part of the beetle analysis, 726 individuals representing 129 species have been identified. Families with the most species include: Elateridae (click beetles) with 30 species, Cerambycidae (longhorned beetles) with 16 species, and Carabidae (ground beetles) with 14 species.
- Spider analysis is ongoing but so far the most common species identified is *Neoantistea magna* in the family Hahniidae, the rarest species in this family.

**Next Steps / Deliverables:** Data collection for this project will continue through 2017.

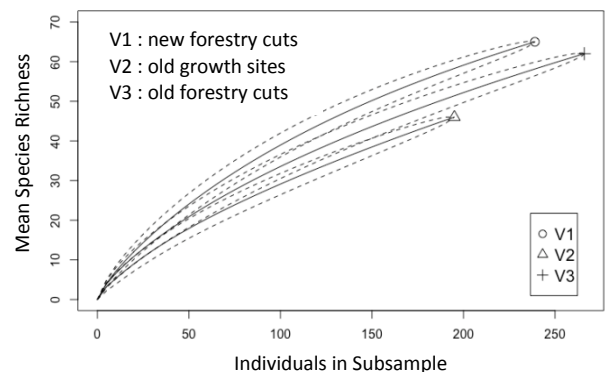


Figure 1. Rarefaction curves for the three treatments (heights are pooled). The old cut sites seem to be an intermediate between the old growth sites and the newly cut sites in terms of species richness and abundance!



## 2. Vernal Pool Hydrology and Herpetology Project (component 2 of forestry project)

**Title:** Effects of even-aged versus uneven-aged silviculture and resulting landscape quality on the hydrology and biodiversity of vernal pools.

**University / Organization:** Université de Québec en Montréal (UQAM) and Université de Québec en Outaouais (UQO)

**Researchers:** Dr. Marie Larocque (UQAM), Dr. Angélique Dupuch and Dr. Yann Surget Groba (UQO)

**Description:** Vernal pools consist of very rich ecosystems and are essential to the life cycle of many organisms including threatened amphibians. Despite their ecological importance, these habitats are generally not mapped and are not taken into account in management plans because of their small size and temporary state. Similarly, their hydrologic dynamics across different geomorphologic contexts are poorly documented. Forestry can seriously affect sources of water, water quality and temperature, as well as connectivity among vernal pools. Currently the effect of these changes on vernal pool hydrology and herpetofauna are unknown. The objectives include: 1) quantify the hydrological dynamics of vernal pools across different geomorphological contexts; 2) evaluate the impact of even-aged and uneven-aged silviculture on vernal pool hydrological dynamics, herpetofauna diversity, abundance and connectivity; and 3) provide recommendations to decrease the impact of silviculture on vernal pools and their associated herpetofauna. Fifty vernal pools will be selected for this study (10 in each site): unexploited forests, young (10-15 year-old harvest) and older sites (25-30 year-old harvest) with even-aged silviculture, as well as young and older sites with uneven-aged silviculture. All the pools will be surveyed for their size and depth and will be visited regularly to identify their hydroperiod. At all the sites, environmental DNA will be analysed to estimate herpetofauna diversity (via a metabarcoding approach) and abundance (via quantitative PCR). Functional connectivity among the vernal pools will be estimated using a landscape genetic approach (to estimate gene-flow among sites) and a capture-mark-recapture study of the most common species. Among the 50 sites, a subset will be equipped with different sensors (water level, water temperature and water electrical conductivity, air temperature, precipitation) to assess the temporal evolution of their water budget and water quality.

### Results Summary:

- Figure 2 (left) herpetology vernal pool sites
- Figure 3 (right) water budget and hydroperiod vernal pool sites

**Next Steps / Deliverables:** Data collection for this project will continue through 2017.

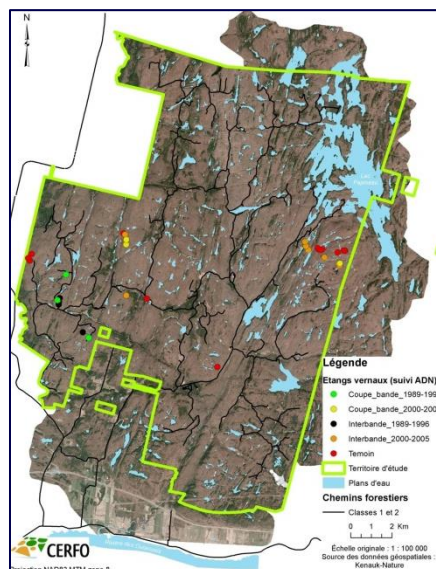
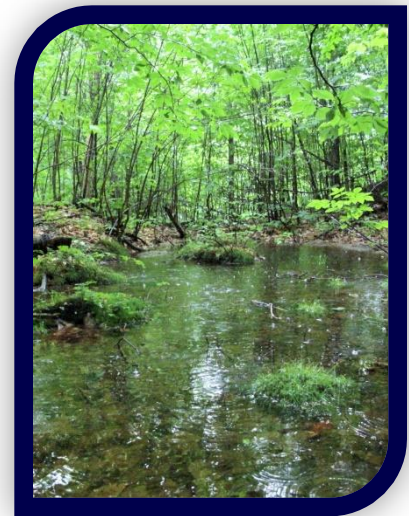


Figure 2. Herpetology vernal pool sites.

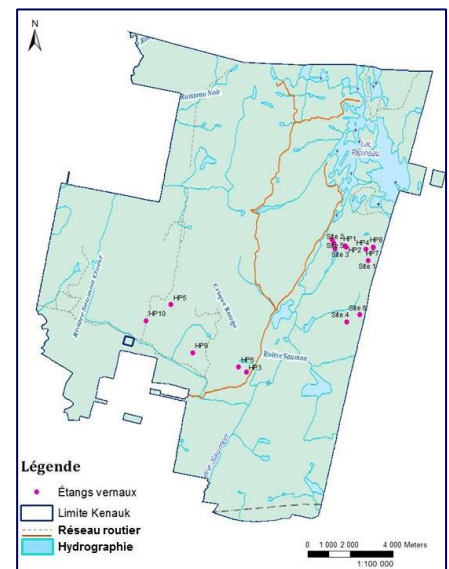


Figure 3. Hydrology vernal pool sites.

### 3. Tree Growth and Productivity Project (component 3 of forestry project)

**Title:** Effects of even-aged versus uneven-aged silviculture on tree growth and forest productivity.

**University / Organization:** Université de Québec en Montréal (UQAM), Université de Québec en Outaouais (UQO) and Centre d'Enseignement et de Recherche en Foresterie de Sainte-Foy (CERFO)

**Researchers:** Philippe Nolet (UQO), Guy Lessard (CERFO), Dr. Christian Messier (UQO/UQAM)

**Description:** The objectives of this project include: 1) assess the effects of both forestry approaches (even vs uneven) on forest productivity and regeneration and compare them to unmanaged stands; 2) assess the effects of both approaches on floristic and soil biodiversity with a comparison to unmanaged stands; 3) verify whether forest productivity and regeneration (Obj. 1) is related to floristic and soil biodiversity (Obj. 2); and 4) identify the advantages of each approach in terms of forest resilience to global change. This project will contribute to the permanent sample plots network to be installed on Kenauk's territory. Each plot of the network will provide detailed information of the various parameters identified in Objectives 1 and 2. More specifically, forest productivity will be assessed through growth ring analyses and resilience through an evaluation of functional diversity and tolerance to drought (the most important risk related to climate change) of the seedlings found in the permanent sample plots.



#### Results Summary:

- Tree surveys for this project have been initiated throughout the property.
- The network of permanent sample plots has been established! See diagram below (figure 4) for plot configuration. Every permanent sample plot consists of 4 neighboring sites.

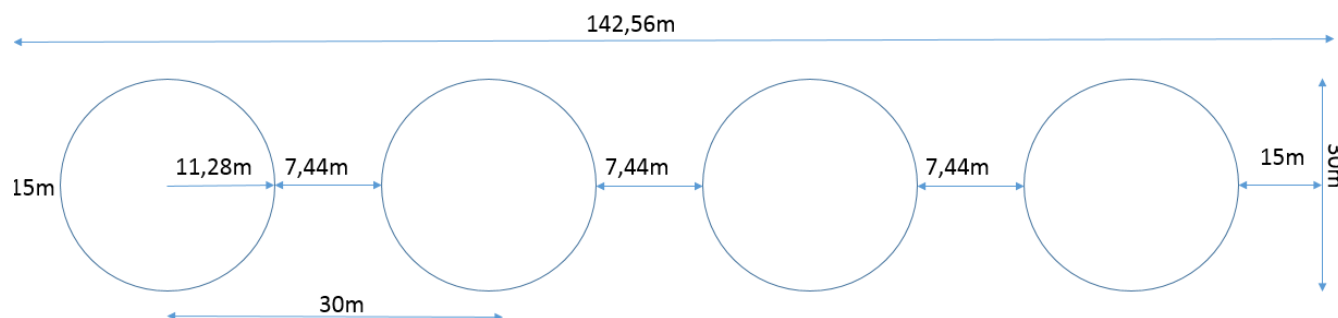


Figure 4. Permanent sample plot diagram.

**Next Steps / Deliverables:** Data collection for this project will continue through 2017.



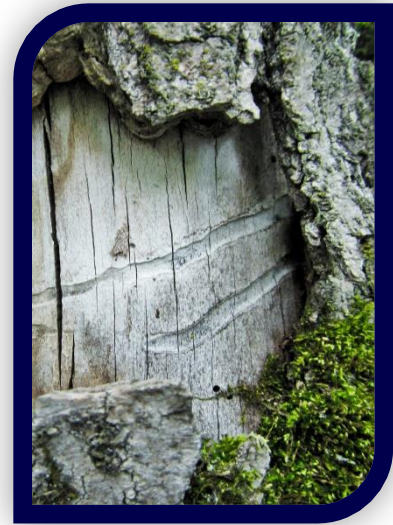
#### 4. Forest Resilience Project (component 4 of forestry project)

Title: Assessing the best management strategies in relation to increasing the overall resilience of forests to invasive pests, disease and climate change.

University / Organization: Université de Québec en Montréal (UQAM), Université de Québec en Outaouais (UQO) and Centre d'Enseignement et de Recherche en Foresterie de Sainte-Foy (CERFO)

Researchers: Dr. Christian Messier (UQO/UQAM), Dr. Frédérick Doyon and Philippe Nolet (UQO), Guy Lessard (CERFO)

Description / Goals: Forests are increasingly being managed for a multitude of ecosystem services occurring at both the stand and landscape scales. However, these services are being threatened by rapidly changing biotic and abiotic factors such as invasive diseases, insects and climate change. For example, in the last 40 years the Kenauk forests have been invaded by dutch elm and beech bark diseases and more recently the ash-bore epidemic which are decimating important tree species. Many more insects and diseases, already found in the north-eastern US, are also likely to move into Kenauk in the next 40 years. This is occurring simultaneously with rapidly changing climates and increasing human demands. To respond to these challenges, forest managers are required to develop new management strategies aimed at maintaining or increasing the overall resilience of the forest so as to maintain its ability to continue providing vital ecosystem services. Based on the theory of complexity science, this project will evaluate at the stand and landscape scales, using simulation models, the best management strategies to insure forests will continue providing ecosystem services. To ensure an effective adaptation strategy, the following steps will be followed: 1) develop a vulnerability assessment for invasive diseases, insects and climate change; 2) plan and develop long-term scenarios using new analytical tools and models that specifically acknowledge the prevalence of highly uncertain social, economic, climatic, and ecological conditions; and 3) test silvicultural practices that favour as high a tree species diversity as possible with the right balance of functioning traits to insure as high a resilience to disturbances and stressors that are predicted for this region.



#### Results Summary:

- As per project #3, the network of permanent sample plots has been established for this project.

Next Steps / Deliverables: Data collection for this project will continue through 2017.

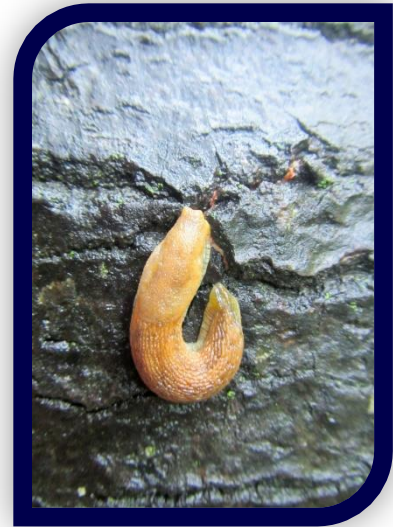
## 5. Invasive Slug Project

Title: How to explain the invasive success of introduced species in disturbed habitats?

University / Organization: Université de Québec en Outaouais (UQO)

Researchers: Dr. Angélique Dupuch, Anna Mazaleyra (UQO)

Description / Goals: The goal of this project is to determine the ecological factors that facilitate the successful invasion of non-indigenous slugs. In Canada there are 36 species of slugs, 17 of which are introduced non-indigenous species. This project will test whether disturbances, like logging, help invasive species proliferate by doing a comparison of the presence of native versus non-native slugs in the Outaouais region. On the property of Kenauk there are 4 slug species, 3 of which are native and 1 of which is invasive. Slugs are highly sensitive species to factors such as temperature and humidity, which results in specific preferred habitats. It is hypothesized that invasive species have wider behavioral and physiological tolerances compared to native species, allowing them to withstand the more extreme thermal and moisture conditions found in logging areas. This project will have three components: 1) an inventory of slug species in logged vs undisturbed forests; 2) vegetation surveys; and 3) determining slug displacement and feeding behaviors. Slug communities will be characterized using three methods: pit fall traps with ethanol, wooden planks that attract slugs, and active searching for slugs after rain.



### Results Summary:

- The species of slugs identified so far at Kenauk include: *Palifera dorsalis*, *Deroceras leave*, *Phylomicus carolinianus* (indigenous), and *Arion fuscus* (invasive). Note these are pending genetic confirmation.
- See figure 5 below for hypothesis and methods diagram. Preliminary results verify the hypothesis that invasive species have wider behavioral and physiological tolerances compared to indigenous species.

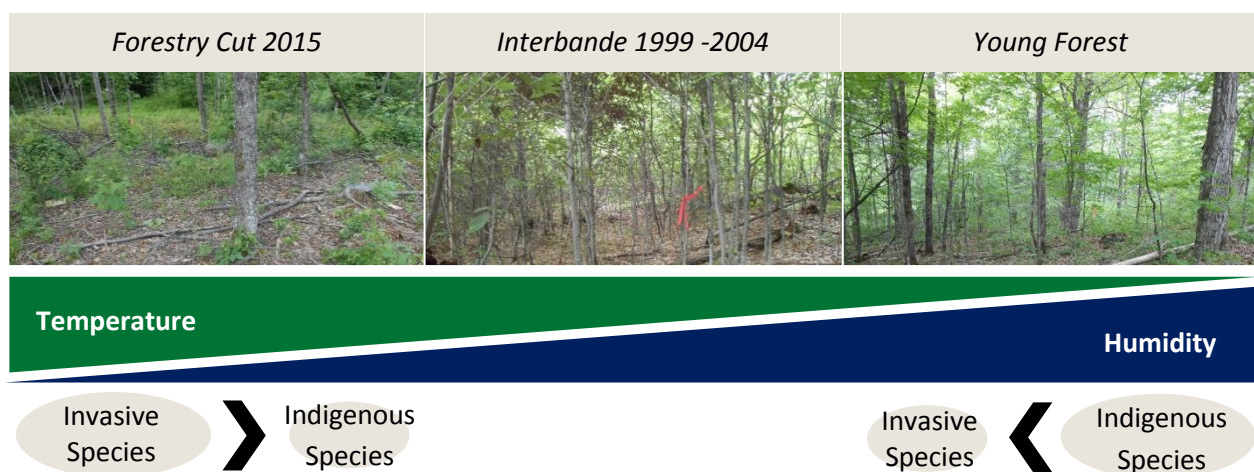


Figure 5. Characterizing slug communities in forest stands with various levels of forestry disturbance.

Next Steps / Deliverables: Data collection for this project will continue through 2017.

## 6. NCC Biodiversity Inventory

Title: NCC Biodiversity Inventory.

University / Organization: The Nature Conservancy of Canada.

Researchers: Marie-Andrée Tougas-Tellier and Joel Bonin

Description: In 2014, the Nature Conservancy of Canada (NCC) began a series of inventories on the territory of Kenauk. This work aims to document the rich biodiversity of this vast and iconic property, to exemplify its value and manage it accordingly (e.g., identification of areas with high conservation potential, establishment of forest corridors, etc.). Research conducted in collaboration with botanists, zoologists, ornithologists, forest professionals and ecologists have confirmed the exceptional ecological richness of this site. The initial results of this inventory and a review of the scientific literature have allowed NCC to produce a synthesis of knowledge on the flora and fauna of this sector and the needs of each species in terms of habitat. This territory inventory is accompanied by a list of concrete recommendations for land stewardship and the management of its natural resources. This document will serve as a framework for planning target species management and conservation action plans for the entire territory of Kenauk and will guide future inventories that will continue in 2016 and 2017.



NCC is also prioritizing the preservation of Kenauk's ecological features to ensure its dynamic role within the landscape-scale ecosystem. Kenauks' conservation planning will therefore include a larger scale objective to protect the Kinonge watershed (figure 6) and the wildlife corridor to the North (figure 7). The continuous forest cover to the North of Kenauk provides suitable conditions for wildlife movement and migration. Primary species of interest include moose and wolves, and secondary targets include other terrestrial non-game species. Continuous forest is also important for forest interior birds, indigenous plants and amphibians with limited dispersal capacity. The objective is to maintain landscape connectivity for free dispersal of those different target groups.

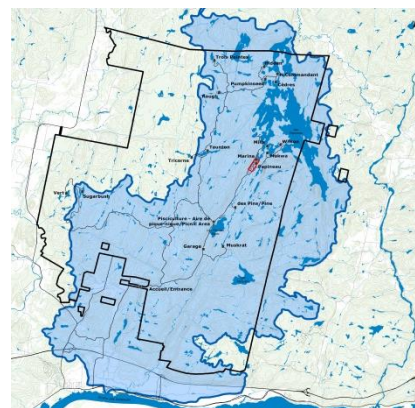


Figure 6. Kinonge watershed and Kenauk.

### Results Summary:

- So far the presence of 28 species at risk has been validated, including *Conopholis Americana*, the four-toed salamander, and the largest black maple stand listed in the province of Quebec.
- Old forest fragments that foster several bird species such as the Canada warbler and the wood thrush were also identified.
- In terms of fish, channel darters were also found, an indicator species for the quality of the riparian environment.

Next Steps / Deliverables: This inventory will continue in 2017. Extensive species lists of flora and fauna have been created which will facilitate long term monitoring, conservation and future research. Species lists are posted on the website and will continue to be updated.

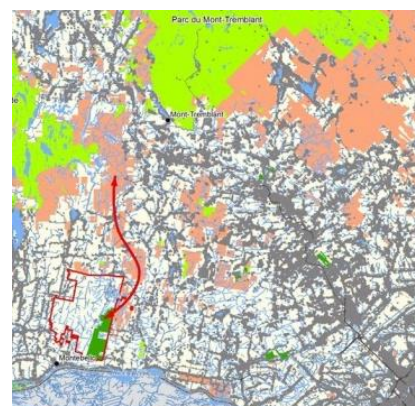


Figure 7. The wildlife corridor.



## 7. CERFO Vernal Pool Mapping Project

**Title:** The development of a mapping method for vernal pools using LiDAR and multispectral satellite images.

**University / Organization:** CERFO – Centre d’Enseignement et de Recherche en Foresterie de Sainte-Foy.

**Researchers:** Jean Fink, biologist; Mathieu Varin, geomatichian, M.Sc.; Philippe Bournival, forestry engineer, M.Sc.; Jason Beaulieu, geomatichian.

**Description:** Vernal pools perform many ecological functions. Unstable because of their short hydroperiod, they are formed by a depression in the land where water temporarily accumulates on a seasonal basis. As a result, they are specialized wildlife habitats due to their isolation from water systems. This gives them an increasingly recognized importance, especially as breeding habitats for invertebrates, amphibians and reptiles as well as foraging grounds for waterfowl. Some species at risk are also known to inhabit these environments which are a priority for protection and maintaining their ecological functions. Vernal pools are small in size (<0.1 ha) and temporary, making them difficult to identify and therefore protect. They are usually mapped by photo interpretation, a tedious and expensive technology when applied regionally. Often hidden by the forest canopy, they are difficult to spot despite the use of pictures taken during the spring, when leaves still aren’t present. One approach for identifying vernal pools quickly is the use of semi-automated satellite imagery which has the potential to accurately identify and map them, and ultimately, make sure they are taken into account in biodiversity conservation strategies.



### Results Summary:

- Validation of a method for wetland identification required LiDAR, aerial photos and satellite images.
- 447 potential vernal pools were identified on the property of Kenauk (figure 8).
- 8 criteria exist for identifying vernal pools: surface area ( $50.1000\text{m}^2$ ), isolation ( $>10\text{m}$ ), depth ( $>0.1\text{m}$ ), drainage ( $50.5000\text{m}^2$ ), spring water presence, summer water absence, average NDVI (Normalized Difference Vegetation Index) (ANOVA) and max NDWI (Normalized Difference Water Index) (ANOVA). The last 2 criteria were identified by this project.

**Next Steps / Deliverables:** This project started in 2015 and is now complete. This project provided an accurate method for mapping vernal pools as well as detailed maps of the vernal pools, wetlands and hydrology at Kenauk which will facilitate conservation, management and future research projects.

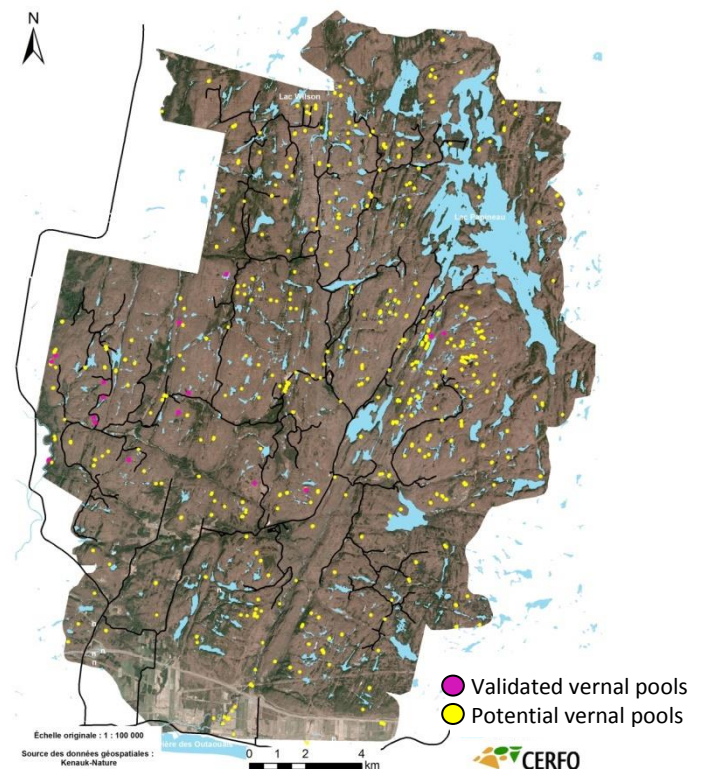


Figure 8. Map of vernal pools at Kenauk.

## 8. Coyote Scat Project

Title: Diet comparison and hybridization analysis between coyotes and wolves using DNA scat analysis.

University / Organization: The Kenauk Institute, McGill University, Trent University, and Guelph University

Researchers: Dr. Murray Humphries and Juliana Balluffi-Fry (McGill)

Description / Goals: The formerly western stricken coyote (*Canis latrans*) has only recently become abundant in the east following the region's gray wolf (*Canis lupus*) eradication. The eastern coyote's heredity is disputed; recent studies suggest that this demographic descends from hybridization between the arriving coyote and the then sparsely distributed wolf, so it is likely that their wolf-coyote proportions may differ by location. What is better understood is their diet which, having been predominantly studied using the identification of undigested fecal content, varies with food availability. The goal of this project is to determine the hybridization and detailed summertime feeding habits of coyotes in southwestern Quebec through both fecal microsatellite analysis and the newly developed fecal DNA metabarcoding respectively. With this data, it can be determined if hybridization ratios affect feeding habit, and how generalist these canids are by comparing their prey proportions to prey camera trap-derived abundances. Lastly, a method comparison will be completed for diet identification between the molecular scat analyses and the more traditional, morphological, approach. This project will be useful in helping Kenauk determine their canid populations, for conservation and to inform management decisions related to the properties hunting activities.



### Results Summary:

- Results are still pending from the fecal microsatellite analysis by Trent University to determine hybridization.
- However the Canadian Centre for DNA Barcoding at Guelph University has performed a dietary analysis on 28 homogenized canine fecal samples from Kenauk. A total of 196 prey items were detected representing at least 11 distinct species. The most common prey detected was moose, beaver, and cow (figure 9).
- Preliminary analysis of predator gene sequences suggests that the maternal origins of all 28 samples are coyote (*Canis latrans*).

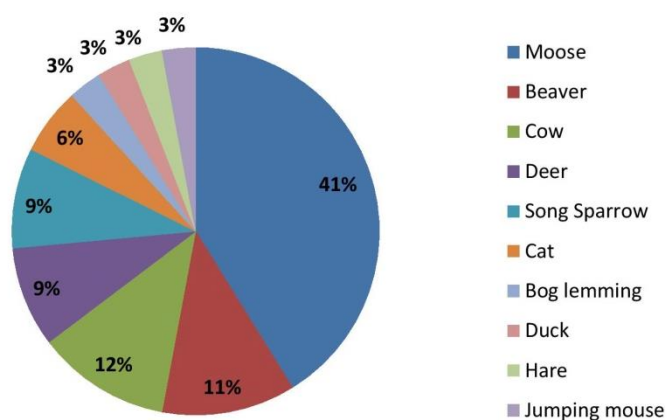


Figure 9. Proportion of summertime prey detected across all samples.

Next Steps / Deliverables: While summertime diet analysis is complete we hope to expand the results year round, therefore coyote scat collection will continue into 2017.

## 9. Looking for the Champlain Sea

University / Organization: The Kenauk Institute

Researchers: Dr. Peter Fransham

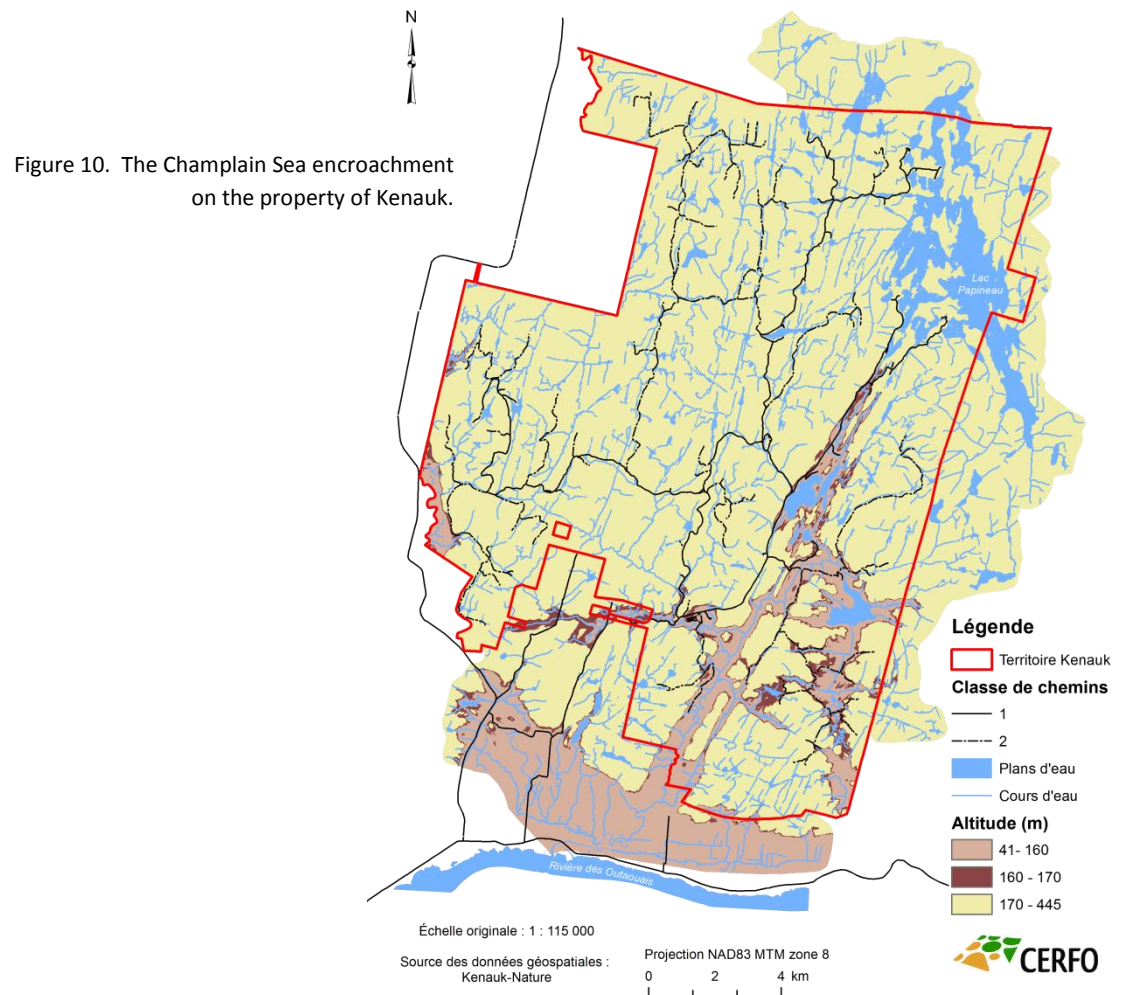
Description / Goals: The goal of this project is to identify the extent of the Champlain Sea encroachment on the property of Kenauk and classify geological sites of interest for exploration. Mapping the shoreline of the Champlain Sea could be used as part of educational programs and an interpretive walking trail.

### Results Summary:

- The Champlain Sea is estimated to have had an altitude of 165 meters. See map below (figure 10) for the encroachment of the Champlain Sea on the property of Kenauk.



Next Steps / Deliverables: This project will continue sparingly into 2017 pending researcher participation.



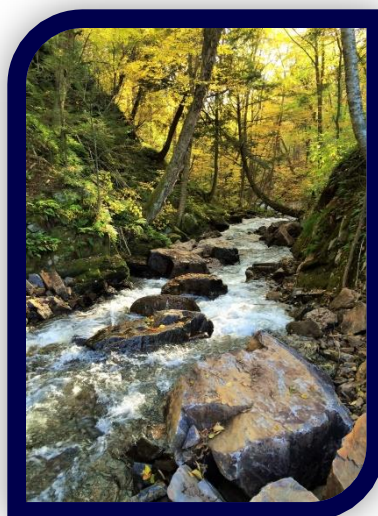


## 10. Papineau Weir Monitoring Project

University / Organization: Department of Fisheries and Oceans

Researchers: The Kenauk Institute

Description / Goals: In 2015 the Papineau lake dam was converted into a weir to improve fish access and aquatic habitats. A weir is a low dam structure used to locally modify the hydraulic characteristics of rivers. They can be used to increase the availability of quality habitats for fish reproduction, foraging, and spawning by facilitating fish passage while still maintaining water levels. This weir will improve the physical and chemical condition of the river for fish spawning and circulation in terms of ideal flow rates, water depths, oxygenation and habitat diversity. The goals of this project include: 1) allow fish movement between the Kinonge River and Papineau Lake, 2) improve spawning grounds, 3) increase the number of fish that return to Papineau Lake and 4) improve fish circulation and sustainability. In order to monitor the success of the weir in maintaining water levels a probe has been installed above the weir that measures water depth hourly throughout the year. Comparisons between water level fluctuations before and after the weir installation will allow Kenauk to monitor the effectiveness of the weir as well as contribute to the overall monitoring of the Kinonge watershed.



### Results Summary:

- By comparing water levels before and after the weir installation we can monitor its effectiveness. See figure 11 for the water depth and temperature above the weir in 2016 as measured by a probe.

### Next Steps / Deliverables:

Data collection for this project will continue through 2017.

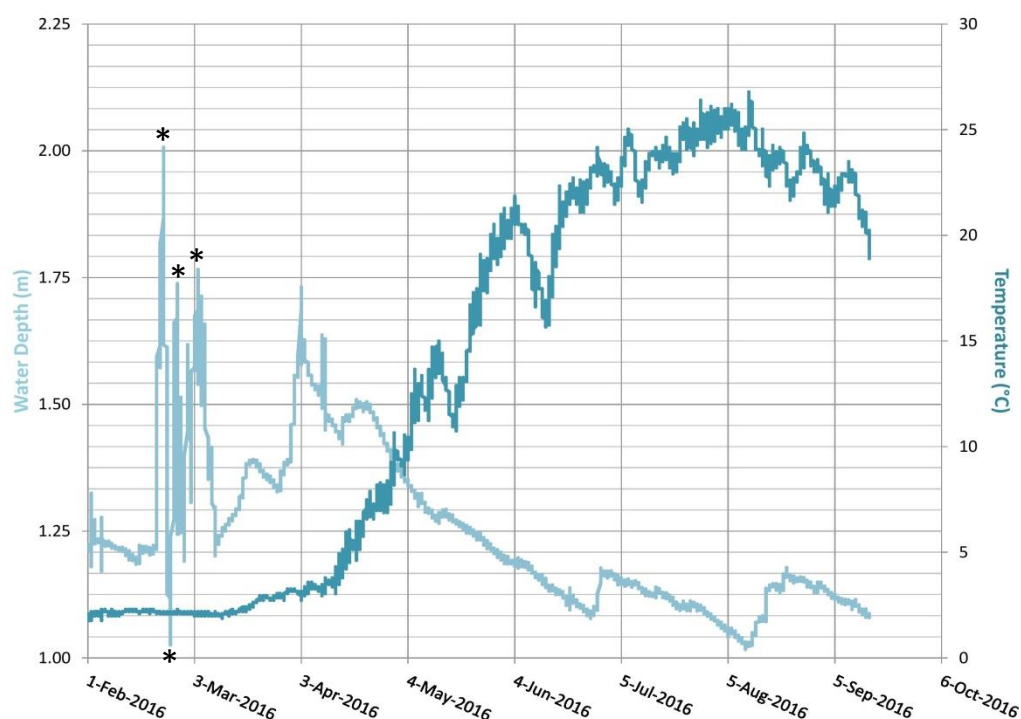


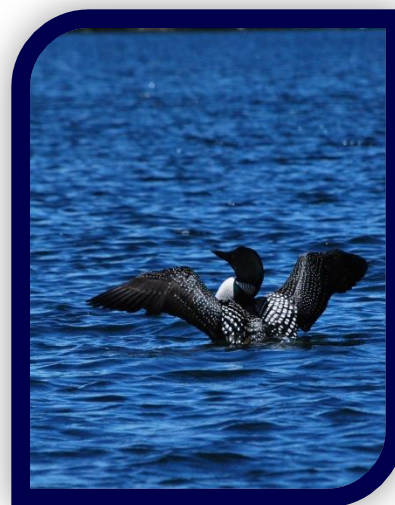
Figure 11. The water depth and temperature above the weir in 2016. Water depth was compensated for barometric pressure; however extreme storm events in February and March still affected data. \*Note that these spikes in water depth are exaggerated.

## 11. McGill Loon Nesting Project

University / Organization: McGill University

Researchers: Liane Nowell and Kenauk Institute interns

Description: While loon populations are currently stable, a number of threats loom, including human encroachment and pollution. Regional declines have occurred at the southern edge of their range and in the Midwest of the United States loons have disappeared from breeding sites entirely. Loons are particularly sensitive to boat traffic while nesting since their nests are placed so close to shorelines. Male loons select nest sites in quiet, protected areas along lakeshores and often reuse the same nesting site annually. By mapping the nesting loons on Papineau Lake, we hope to protect those sites from extensive boat traffic.



### Results Summary:

- 16 loon pairs and nesting sites were identified and mapped on Papineau Lake (compared to the 11 loon pairs identified in 2015).
- An educational poster showcasing these sites and their importance was created (figure 12).

Next Steps / Deliverables: This inventory and mapping will continue in 2017 and will be incorporated into the 2017 Papineau hydrology project. Nesting sites and numbers will continue to be mapped for long term monitoring. Creating awareness on Papineau Lake of vulnerable loon nesting sites is a priority.

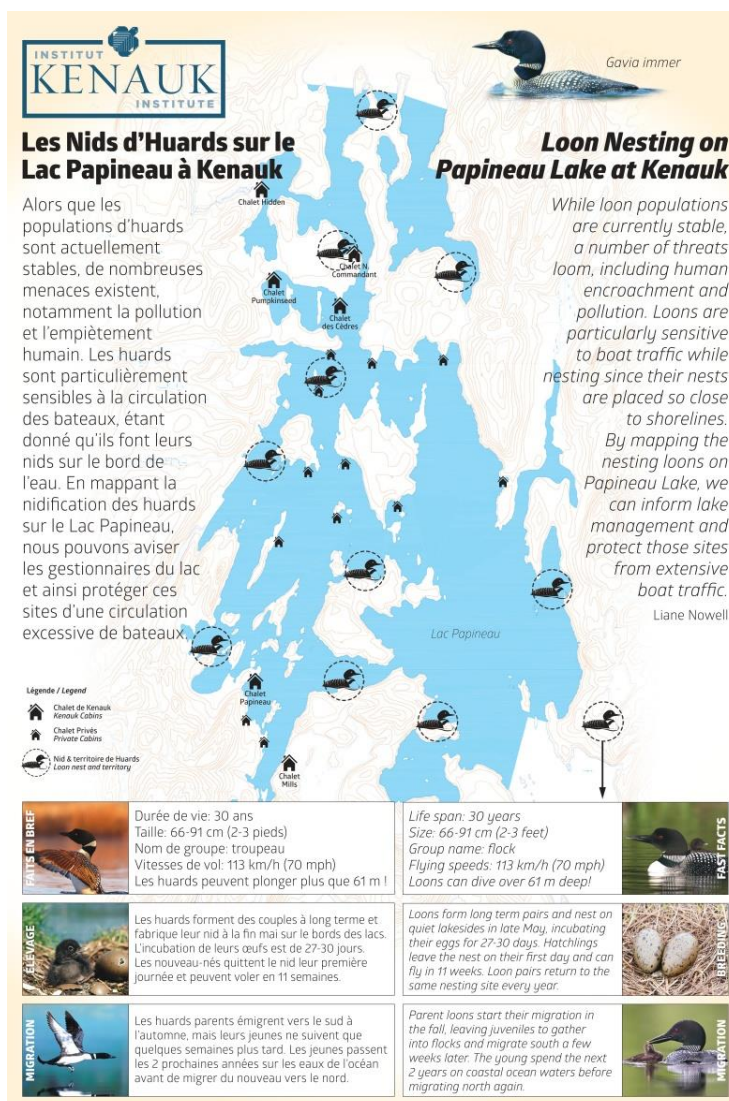


Figure 12. Educational loon poster.

## 12. Papineau Lake Water Quality Monitoring Project

University / Organization: Government of Quebec and Organisme des Bassins Versant

Researchers: Liane Nowell and Kenauk Institute interns

Description / Goals: Papineau Lake is a member of the Volunteer Lake Monitoring Program (VLMP) with the Government of Quebec. The Kenauk Institute will periodically take water samples (e.g. secchi readings for water clarity, fecal coliforms, phosphorus, and chlorophyll a) throughout each summer and establish a long term monitoring protocol for water quality with annual comparisons. The goal of this project is to continue the long term monitoring of water quality in Papineau Lake.



### Results Summary:

- By comparing water quality parameters every year we can monitor Papineau Lake long term.
- See table 1 for past water quality indicators. 2016 results are pending.

Table 1. Water quality parameters for Papineau Lake.

Year	Chlorophyll a ( µg/L)	Phosphorus (µg/L)	Fecal Coliforms (UFC/100ml)	Temperature (°C)	Secchi (m)
2015	0.87	5.18	2.00	22.80	6.20
2014	1.30	6.00	1.67	21.00	6.13
2012		13.50		25.33	6.87

Next Steps / Deliverables: Data collection for this project will continue through 2017.



### 13. Pollinator Project

**Title:** How forestry management practices impact pollinators and their interaction with wild flowers.

**University / Organization:** Bates University and McGill University

**Researchers:** Dr. Carla Essenberg and Celine Pichette (Bates), Dr. Christopher Buddle and Katrina Di Bacco (McGill)

**Description / Goals:** Pollinators can be used as indicators of biodiversity, because most plants and animals depend on them to survive. The goal of this project was to determine if forestry management practices impact pollinators and how they interact with plants. At Kenauk, three forest management techniques have been practiced, creating three types of habitat, old growth areas which have never been disturbed, strip cut areas where logged and forested strips are alternated as well as recent clear cut areas (to manage a failing plantation of non-native species). The objectives of this project included: 1) to create an inventory of pollinator species at Kenauk and 2) to determine how different forestry techniques impact pollinators and plant-pollinator interactions. Two methods were used to reach these objectives, a passive method using yellow pan traps and an active method with netting.



#### Results Summary:

- See figures 13 and 14 below for pan trap and netting data respectively.
- Pollinators were collected on 30 different species of wild flowers during netting, most of which were native except for 9 non-native species in the clear cut sites.
- The old growth and strip cut sites have more pollinators and a higher diversity of flowers according to the pan traps, but clear cuts have more pollinators according to the netting. This may be due to the abundance of non-native wildflowers in clear cuts, a distraction for pollinators from native flowers.

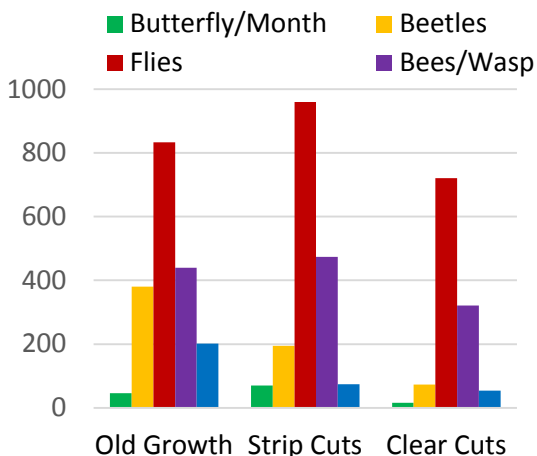


Figure 13. Number of pollinators collected in pan traps.

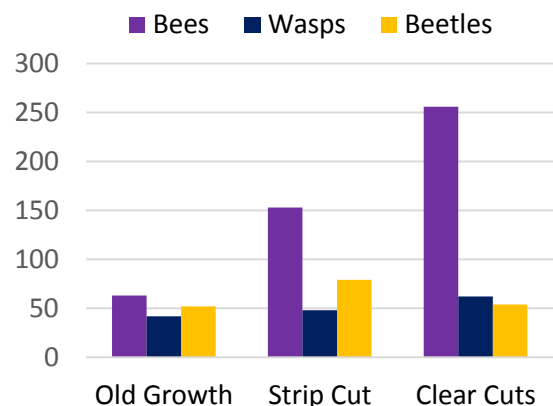


Figure 14. Number of pollinators collected by netting.

**Next Steps / Deliverables:** This project is now complete. Pollinator species lists are being created which will facilitate long term monitoring, conservation and future research at Kenauk.

## 2016 Educational Programs

Two educational programs were successfully completed in 2016.

### 1. Belgium Program

Description: The Belgium group was a group of 20 students that spent 5 days working with the Kenauk Institute. They spent mornings clearing hiking trails and installing thunder boxes in preparation for the upcoming Outward Bound program as well as future educational programs. It was a successful and very helpful group. This group stayed in the Boileau Auberge which worked very well for a group of their size.



### 2. Outward Bound and YMCA Program

Description: The Outward Bound/YMCA program was a youth at risk group of 10 students which participated in a 10 day hiking expedition at Kenauk. Their program included a long hiking excursion, a canoe and portage portion, solos and a research/service day with the Kenauk Institute. This day was spent planting trees, climbing trees and talking to the students about the research projects involved with the institute. This program was extremely successful and will be repeated in 2017 with a possibility for an expansion.



## 2017 Upcoming Research Projects

Fifteen research projects are planned for the summer of 2017, most of which are continuations of our 2016 projects. Some projects are still tentative due to grant approval.

### 1. Biodiversity Project (continuation)

Title: Effects of even-aged versus uneven-aged silviculture and resulting landscape quality on understory plants, insects, soil microbes and bird diversity.

University / Organization: McGill University, Guelph University, and Université de Québec en Outaouais (UQO)

Researchers: Dr. Christopher Buddle and Dr. Kyle Elliot (McGill University), Dr. Alex Smith (Guelph University), Dr. Yann Surget Groba and Dr. David Rivest (UQO), Dr. Christian Messier (UQO/UQAM)

Description / Goals: This research will focus on quantifying how the biodiversity of flora and fauna at Kenauk has adapted to past harvesting, and is positioned for future changes in the forest. In 2017 data collection will continue on the focal study organisms for the first phase of this project which includes arthropods (insects and spiders) living from the forest floor to the canopy.

### 2. Vernal Pool Hydrology and Herpetology Project (continuation)

Title: Effects of even-aged versus uneven-aged silviculture and resulting landscape quality on the hydrology and biodiversity of vernal pools.

University / Organization: Université de Québec en Montréal (UQAM) and Université de Québec en Outaouais (UQO)

Researchers: Dr. Marie Larocque (UQAM), Dr. Angélique Dupuch and Dr. Yann Surget Groba (UQO)

Description / Goals: Vernal pools consist of very rich ecosystems and are essential to the life cycle of many organisms including threatened amphibians. In 2017 vernal pools previously selected as study sites will continue to be monitored for their hydrological dynamics, herpetofauna diversity, abundance and connectivity.

### 3. Tree Growth and Productivity Project (continuation)

Title: Effects of even-aged versus uneven-aged silviculture on tree growth and forest productivity.

University / Organization: Université de Québec en Montréal (UQAM), Université de Québec en Outaouais (UQO) and Centre d'Enseignement et de Recherche en Foresterie de Sainte-Foy (CERFO)

Researchers: Philippe Nolet (UQO), Guy Lessard (CERFO), Dr. Christian Messier (UQO/UQAM)





Description / Goals: In 2017 this project will use the established permanent sample plots to assess forest productivity through tree growth ring analyses and resilience through an evaluation of functional diversity and tolerance to drought (the most important risk related to climate change).

#### **4. Forest Resilience Project (continuation)**

Title: Assessing the best management strategies in relation to increasing the overall resilience of forests to invasive pests, disease and climate change.

University / Organization: Université de Québec en Montréal (UQAM), Université de Québec en Outaouais (UQO) and Centre d'Enseignement et de Recherche en Foresterie de Sainte-Foy (CERFO)

Researchers: Dr. Christian Messier (UQO/UQAM), Dr. Frédérick Doyon and Philippe Nolet (UQO), Guy Lessard (CERFO)

Description / Goals: Forests are increasingly being managed for a multitude of ecosystem services occurring at both the stand and landscape scales. However, these services are being threatened by rapidly changing biotic and abiotic factors such as invasive diseases, insects and climate change. This project will evaluate at the stand and landscape scales, using simulation models, the best management strategies to insure forests will continue providing ecosystem services.

#### **5. Invasive Slug Project (continuation)**

Title: How to explain the invasive success of introduced species in disturbed habitats?

University / Organization: Université de Québec en Outaouais (UQO)

Researchers: Dr. Angélique Dupuch (UQO)

Description / Goals: In 2017 the slug inventory at Kenauk will continue as well as vegetation surveys and slug displacement and feeding behavior assessments.

#### **6. NCC Biodiversity Inventory (continuation)**

University / Organization: The Nature Conservancy of Canada

Researchers: Marie-Andrée Tougas-Tellier and Joel Bonin (NCC)

Description / Goals: In 2014, the Nature Conservancy of Canada (NCC) began a series of inventories on the territory of Kenauk which will continue in 2017. This work aims to document the rich biodiversity of this vast and iconic property, to exemplify its value and manage it accordingly.

## 7. Coyote Scat Project (continuation)

Title: Diet comparison and hybridization analysis between coyotes and wolves using DNA scat analysis.

University / Organization: The Kenauk Institute, McGill University, Trent University, and Guelph University

Researchers: Juliana Balluffi-Fry and Dr. Murray Humphries

Description / Goals: The goal of this project is to determine the hybridization and detailed annual feeding habits of coyotes at Kenauk through both fecal microsatellite analysis and fecal DNA metabarcoding respectively. Coyote scat will continue to be collected throughout the seasons to get an accurate description of coyote diets.

## 8. Papineau Weir Monitoring Project (continuation)

University / Organization: Department of Fisheries and Oceans

Researchers: The Kenauk Institute

Description / Goals: In 2015 the Papineau Lake dam was converted into a weir to improve fish access and aquatic habitats. A weir is a low dam structure that can be used to increase the availability of quality habitats for fish reproduction, foraging, and spawning by facilitating fish passage while still maintaining water levels. In order to monitor the effectiveness of the weir, water levels will continuously be measured above the weir using a probe.

## 9. McGill Loon Nesting Project (continuation)

University / Organization: McGill University

Researchers: Liane Nowell and Kenauk Institute interns

Description / Goals: Since loons are particularly sensitive to boat traffic while nesting and often reuse the same nesting site annually, this project will continue with long term monitoring. By mapping the nesting loons on Papineau Lake, we can hopefully protect those sites from extensive boat traffic and monitoring annual differences in loon nesting.

## 10. Papineau Lake Water Quality Monitoring Project (continuation)

University / Organization: Government of Quebec and Organisme des Bassins Versant

Researchers: Liane Nowell and Kenauk Institute interns

Description / Goals: Papineau Lake is a member of the Volunteer Lake Monitoring Program (VLMP) with the Government of Quebec. As such, the Kenauk Institute will periodically take water samples (e.g. secchi readings, fecal coliforms, phosphorus, chlorophyll a) throughout each summer and establish a long term monitoring protocol for water quality with annual comparisons.

## 11. Papineau Lake Hydrology Project

University / Organization: Université de Québec en Montréal (UQAM) and Université de Québec à Trois Rivières (UQTR)

Researchers: Dr. Marie Larocque (UQAM), Dr. Stéphanie Pellerin, Dr. Raphaël Proulx (UQTR)

Description / Goals: The goal of this project is to understand the hydrologic dynamics of Papineau Lake and how those dynamics are related to shoreline wetlands. Three specific objectives will contribute to this goal. 1) Establish a monitoring network and hydrological alert system around Papineau Lake. Quantifying the lakes hydrodynamics will allow an estimation of how the lake will be affected in the long-term by land use changes and climate change. Probes that measure water levels and inflow/outflow volumes will be installed throughout the lake for long term monitoring as well as a weather station. This objective will also include developing a hydrological model of the watershed for simulating future scenarios, such as climate change. 2) Locate and characterize the lakes coastal wetlands and identify the anthropogenic pressures they face. This objective would be achieved in collaboration with Stéphanie Pellerin who specializes in coastal wetlands and Ducks Unlimited with their wetland mapping data. Indicator species, species at risk and insect bioacoustics signatures will be identified in these areas so as to designate them as protection zones. The natural and anthropogenic pressures these wetlands face will be identified, with a specific focus on shoreline thermal regimes and shoreline erosion by waves. 3) Create a list of recommendations to prevent / mitigate the negative effects of these pressures on the wetlands of Papineau Lake. An eco-nautical map of Papineau showing areas of specific concern would be created along with a set of regulations to help reinforce the conservation of the entire lake and watershed.

## 12. Moose Project

University / Organization: CERFO – Centre d’Enseignement et de Recherche en Foresterie de Sainte-Foy and MLLP with the Government of Quebec

Researchers: Jean Fink, biologist; Mathieu Varin, geomatitician, M.Sc.; Philippe Bournival, forestry engineer, M.Sc.; Martin Dupuis, professor, M.Sc., Cégep de Sainte-Foy

Description / Goals: This project is still dependent on successful funding. This project aims to determine the optimal density for moose on the property of Kenauk. It will determine appropriate forest management strategies to maintain these healthy populations in terms of food availability and covered shelter. It will also determine habitat connectivity using spatial analyses and the potential for wildlife corridors, both on small and large scales. The many objectives include: 1) evaluate the density and distribution of moose across Kenauk; 2) measure the demographics of this population (male, female and calve ratios); 3) measure the amount of food available; 4) evaluate the utilization of available foraging grounds during the winter; and 5) determine the optimal density for moose on the property. This will be accomplished using aerial and vegetation surveys in partnership with the MFFP (Ministère des Forêts, de la Faune et des Parcs).



### 13. Impacts of Invasive Bass on Mussel Diversity and Dispersal Project

University / Organization: Nature Museum of Canada

Researchers: Dr. André Martel (Nature Museum of Canada)

Description / Goals: The goal of this project is to assess how mussels use different species of fish to disperse their eggs within a lake. The effect of invasive bass species on mussel diversity and abundance will also be identified. A baseline of mussel species present in the various lakes at Kenauk will be inventoried in conjunction with our biodiversity project.

### 14. Archeology Project

University / Organization: The Kenauk Institute

Researchers: Dr. Pierre Desrosiers

Description / Goals: The Kenauk Institute not only strives to preserve the flora and fauna of Kenauk but also the properties cultural heritage. The goal of this project is therefore to preserve the cultural heritage of Kenauk by identifying and registering archaeological sites of interest on the property. In addition to the identification of archeological sites, this project will also aim to document the paleoenvironmental evolution of Kenauk. This project will include archaeological inventories/surveys as well as the identification of potential interesting sites for excavation. Sites will be recorded using a GPS and any artefacts found throughout sampling will be preserved carefully. In connection with historical human occupation, the evolution of the environment will be reconstructed using found artefacts, soil samples and archeological sites of interest. These archeological surveys will be concentrated on the shoreline of lakes and rivers with a specific focus on the Papineau Lake islands.

### 15. MITACS Project

Title: Ecosystem Value Accounts - Tools to Advance the Green Economy and Sustainability Agenda

University / Organization: Dalhousie University, Concordia University, MITACS

Researchers: Dr. Jeffrey Wilson (Dalhousie University) and Dr. Raymond Paquin (Concordia University); MITACS grant in partnership with Kenauk Canada ULC.

Description: The project will develop a series of biophysical based economic accounts to explore non-monetary approaches to value ecosystem goods and services as a basis to inform planning and management decisions. Approaches under consideration include: net primary productivity, biocapacity accounts, and ecosystem service indicators. The emphasis on quantifying ecosystem value using non-monetary approaches is a deliberate attempt to create a value framework independent of pricing limitations. The project will also contribute to economic and sustainability discourse by exploring the normative underpinnings of how we assign and determine ecosystem value.

## Research Partnerships

