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Ashland, Wisconsin

Implementation of Long-term Vegetation Monitoring Program at Grand Portage National Monument

Great Lakes Network Report GLKN/2008/07 July 2008

ON THE COVER
The Pigeon River separating Grand Portage National Monument (foreground) from Canada (background).
Photograph by: Sam Smyrk

Implementation of a Long-term Vegetation Monitoring Program at Grand Portage, National Monument

Great Lakes Network Report GLKN/2008/07

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Contents

Page

Introduction 1

Methods 1

Results 3

Discussion 10

Ecology and Interpretation 10

Implementation: Problems, Logistics and Plans 11

Acknowledgements 12

Literature Cited 13

Appendix A: Field Site Maps 15

Appendix B: Complete List of Species Sampled 57

Appendix C: Individual Plot Data 63

Figures

Page

Figure 1. Diagram of hybrid plot 2

Figure 2. Twenty permanent plot locations at GRPO 3

Figure 3. Density-diameter graph for selected hardwoods at GRPO 4

Figure 4. Density-diameter graph for conifers at GRPO 5

Figure 5. Density-diameter graph of dead trees at GRPO. 7

Tables

Page

Table 1. Basal area and density of live trees at GRPO 6

Table 2. Basal area and density of dead trees at GRPO..... 7

Table 3. Tree sapling density at GRPO 8

Table 4. Shrub cover at GRPO 9

Table 5. Coarse woody material volume and density 9

Introduction

Long-term forest monitoring provides an assessment of forest health by showing the status of plant communities at the time of each sampling event and elucidating how these communities change over time. Despite this value, large-scale monitoring programs for forest health with regularly scheduled return intervals are not common (for an exception, see U. S. Department of Agriculture 2005).

In 2007, the Great Lakes Inventory & Monitoring Network of the National Park Service initiated a long-term forest vegetation monitoring program for nine national parks in the Great Lakes Region. The general goals of this program are to monitor forest vegetation to gain a better understanding of its dynamics, and to compare, ultimately, vegetation indices to baseline (2007) conditions. The summer of 2007 was the initiation of the program and plots were established at three of the nine Network parks: Indiana Dunes National Lakeshore (INDU), Grand Portage National Monument (GRPO), and the St. Croix National Scenic River (SACN). As this was the initial year of data collection at these sites, and no comparisons between time intervals can be made. Nonetheless, meaningful data were obtained to demonstrate the current status of forests in these parks.

The goals of the long-term vegetation monitoring effort during the first sampling year are to obtain baseline data on the status of park forests. Here, we report on this effort at GRPO. Specifically, we wanted to answer the following questions: 1) What is the relationship between density and stem diameter for key tree species? 2) What is the basal area of both individual tree species and all species collectively? 3) What is the density of saplings? 4) What is the percentage of shrub cover, by species?

Methods

Sampling was conducted at GRPO from June 18-July 19, 2007. Site locations were selected using a generalized random-tessellation stratified design (GRTS, Stevens and Olsen 2005), ensuring that sites are both randomly located, but also spatially balanced throughout the park. All potential sites were overlain on an aerial photography layer using GIS prior to visiting the site in the field. In this way, we were able to eliminate any potential sites that did not meet the minimum 10% forest cover requirement. Potential sites that were partially outside of the park boundary, or that did not meet the minimum 10% cover requirement, were moved the shortest distance possible, to a maximum of 100 m, so that they fell within the park boundary or within the desired amount of cover. If a potential site could not be moved ≤ 100 m to meet the criteria for acceptance, it was not sampled. Maps of individual sites are presented in Appendix A.

Sites were sampled using the hybrid plot (Figure 1), developed specifically for the Great Lakes Network long-term vegetation monitoring needs (Johnson et al. 2006, Johnson et al. 2008). This plot is composed of three parallel transects oriented east-west. Tree data were collected in a 6 m wide band along the length of each transect. Data collected included species, diameter at breast height (DBH), whether the tree was alive, and any evident damage or disease. Trees are defined as having a DBH of ≥ 2.6 cm (1 in). Groundlayer vegetation was collected in 1m^2 quadrats placed every 5 meters along each transect (n = 30 per plot). Within each quadrat, all herbaceous,

vine, and shrub species present were recorded, and saplings of each tree species present were counted. Saplings are defined as trees ≤ 2.5 cm DBH, but at least 15 cm (conifers) or 30 cm (hardwoods) in height and showing evidence of growth from the previous year. Shrub abundance was assessed within each of six 2.82 m radius ($25m^2$) shrub circles, located at the transect ends. Here, we visually estimated percent cover of each species present. We measured data on coarse woody materials (CWM) along each of the three transects using the line intercept method (Brown 1974, Woodall and Williams 2005) and recorded the diameter at the point of intercept and the length. Because we defined CWM as having a diameter ≥ 7.6 cm (3 in), the length of a piece was recorded only along where the diameter exceeded this amount. Finally, we performed a half-hour time delimited search of the entire 50 m × 100 m plot area to locate any additional species not previously recorded in any of the sampling.

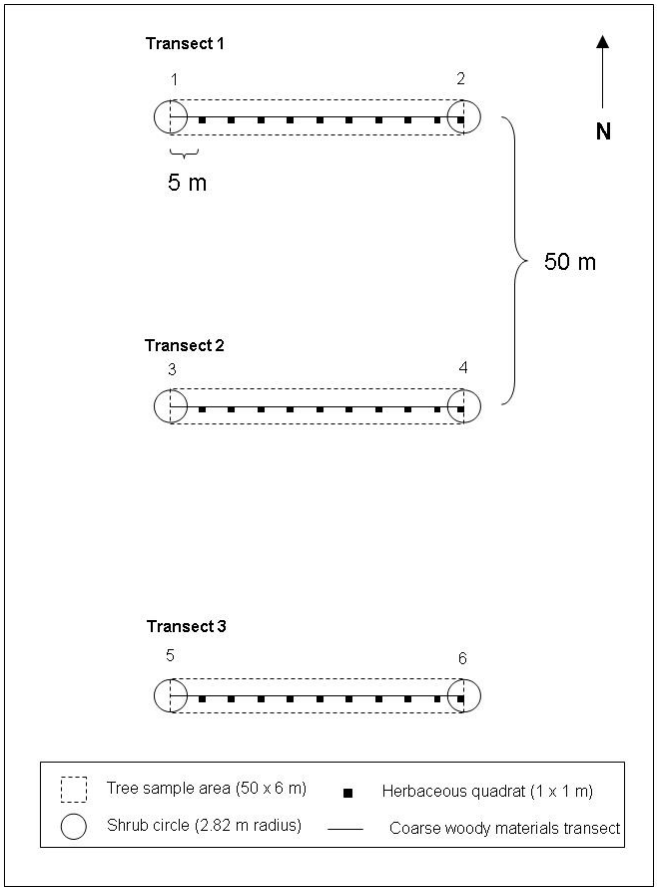

Figure 1. Diagram of hybrid plot.

Because we may want to stratify by forest or habitat type during later analyses, we performed a Kotar classification (Kotar and Burger 2005) at GRPO to place sites into groups of similar moisture level and nutrient availability.

Finally, documenting visual assessment of site change will be as important as statistical documentation, and potentially more informative. Therefore, we took six pictures at each plot.

The six photopoints were located at each of the six transect endpoints, with the camera facing into the plot (i.e., due east at points 1, 3, and 5 and due west at points 2, 4, and 6, Figure 1).

We attempted to identify all plants to the species level in the field. When this was not possible, we typically collected specimens for later identification. In some instances, it is not possible to distinguish between multiple species present in a park, unless they are flowering or fruiting, which often was not the case. In these instances, we made the decision to record to genus instead. Examples of this include *Amelanchier*, *Pilea*, *Impatiens*, and *Crataegus*. In other instances, we were not able to identify certain specimens due to lack of taxonomic expertise. For example, many grasses and sedges were not identified beyond the family or genus level.

Results

Twenty plots at GRPO were sampled (Figure 2) and all were classified as the white spruce-balsam fir-paper birch type. A total of 11 hardwood and five conifer tree species were recorded in the plots (Appendix B). Mean *Abies balsamea* (balsam fir) density at GRPO was 727 individuals/ha (Table 1). Other tree species with mean densities > 200 individuals/ha were *Acer spicatum* (striped maple, 266/ha) and *Populus tremuloides* (trembling aspen, 232/ha).

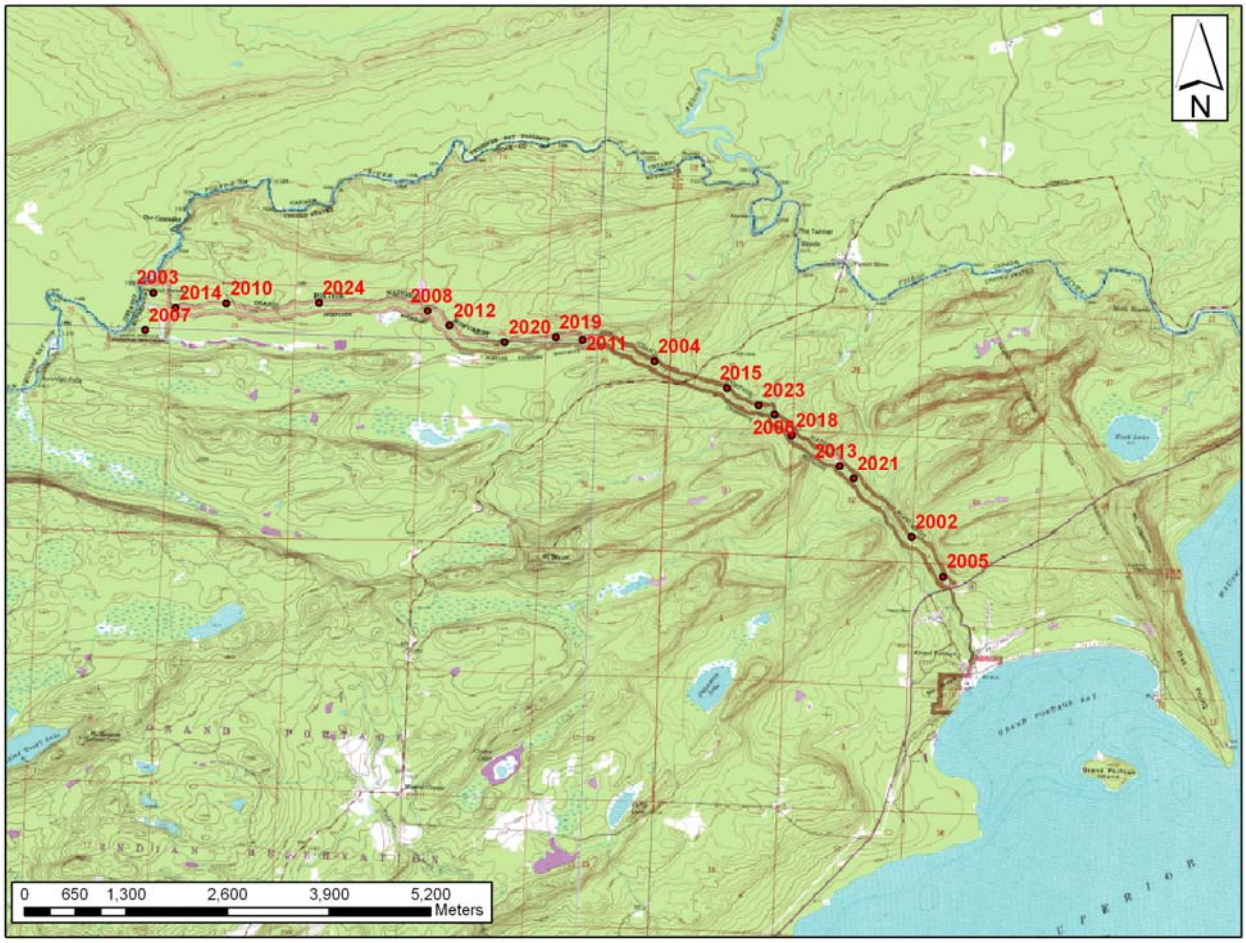

Figure 2. Twenty permanent plot locations at Grand Portage National Monument.

Within individual size classes, 75% of *A. balsamea* individuals were <10 cm DBH. In contrast, no *Pinus strobus* individuals ≤17.5 cm DBH were sampled. Density-diameter graphs (Figures 3, 4) showed that most species exhibited the classic reverse-J distribution with higher density among the lower size classes, although *Betula papyrifera* and *Thuja occidentalis* did not. *Betula papyrifera* density was similar between 2.5 and 20 cm DBH with the density ranging between 8.89 and 12.78 individuals/ha (Figure 3). *Thuja occidentalis* was only abundant in one size class (Figure 4); density was never greater than 2.22 individuals/ha, except for the 5.0-7.5 cm DBH class in which case density was nearly 15 individuals/ha.

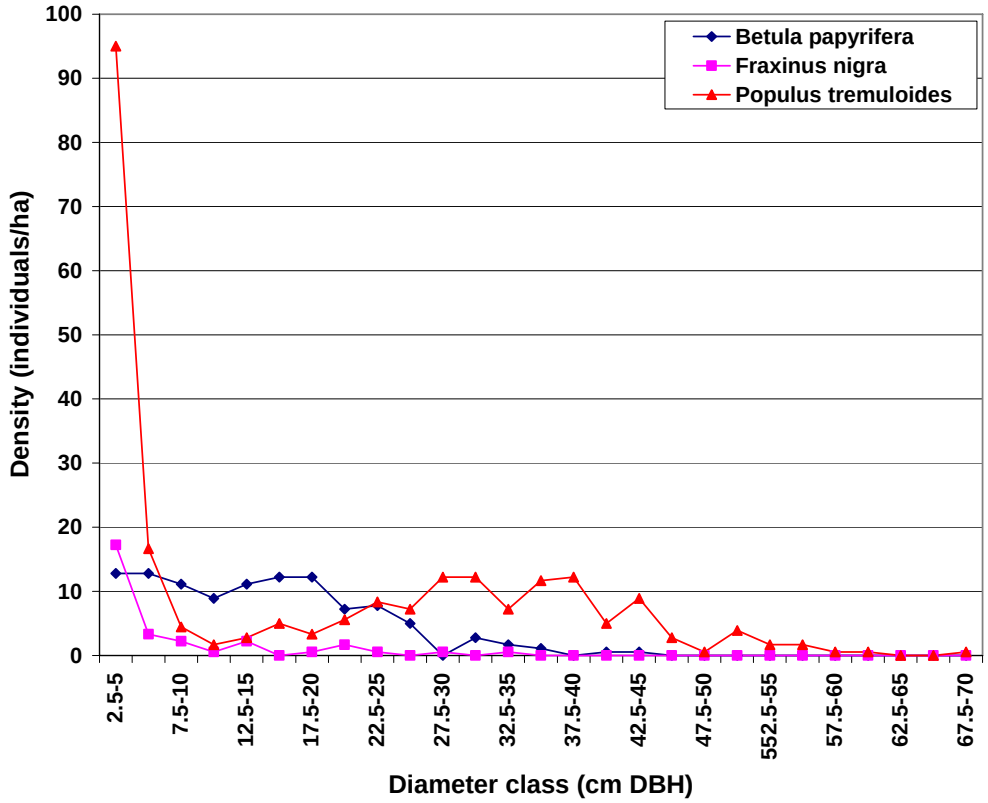

Figure 3. Density-diameter graph for selected hardwoods at GRPO.

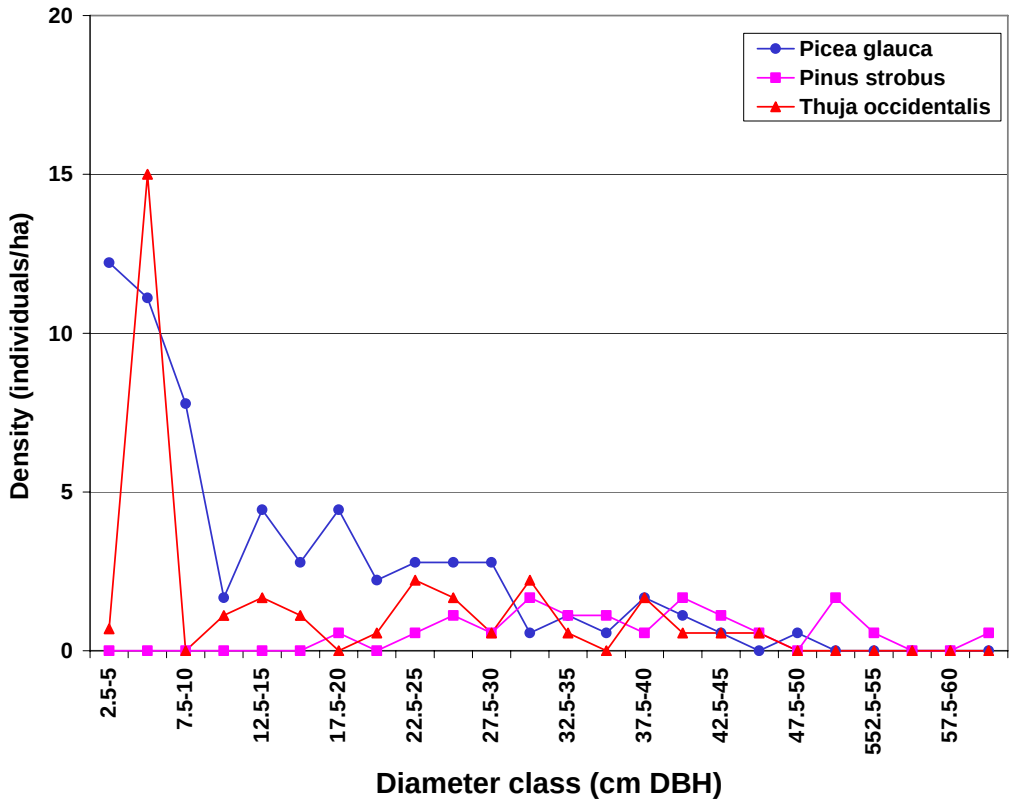

Figure 4. Density-diameter graph for softwoods (excluding *A. balsamea*) at GRPO.

Basal area of *B. papyrifera*, *F. nigra*, and *P. tremuloides* was 2.47, 0.26, and 11.01 m^2/ha, respectively (Table 1). Basal area of *A. balsamea* was 5.72 m/ha. Basal area was < 2 m^2/ha for all other species, including *Picea glauca* (1.63 m^2/ha), *Picea mariana* (0.41 m^2/ha), *Pinus strobus* (1.69 m^2/ha), and *Thuja occidentalis* (0.69 m^2/ha). Density was highest for *A. balsamea* (727 individuals/ha) with only three other species having greater than 100 individuals/ha.

Table 1. Basal area and density of all live tree species located in long-term monitoring plots at GRPO.

Species	Basal area	Density
	m^2/ha	individuals/ha
Hardwoods		
Acer rubrum (red maple)	0.003	3.33
Acer saccharum (sugar maple)	0.001	0.56
Acer spicatum (mountain maple)	0.315	266.11
Betula papyrifera (paper birch)	2.467	107.78
Fraxinus nigra (black ash)	0.257	29.44
Populus balsamifera (balsam poplar)	0.009	0.56
Populus tremuloides (trembling aspen)	11.006	231.67
Prunus virginiana (chokecherry)	0.015	7.78
Salix sp. (willow)	<0.001	1.11
Sorbus decora (mountain ash)	0.003	3.33
Ulmus americana (American elm)	<0.001	0.56
Softwoods		
Abies balsamea (balsam fir)	5.715	726.67
Picea glauca (white spruce)	1.628	61.11
Picea mariana (black spruce)	0.407	9.44
Pinus strobus (white pine)	1.685	13.33
Thuja occidentalis (eastern white cedar)	0.691	15.00
Total	24.204	1477.78

Density of standing dead trees was 307 individuals/ha (Table 2). Although we attempted to identify the species of all standing dead trees, we were only confident about the identity of 75% of the individuals; hence the species of 25% of standing dead trees is listed as "unknown." Among identified standing dead trees, most species (*A. spicatum*, *A. balsamea*, *P. glauca*) displayed highest mortality in the smaller size classes, so that tree mortality paralleled the distribution of live trees. Exceptions to this, however, included *Fraxinus nigra* and *P. tremuloides* (Figure 5). Only a minimal amount of mortality was recorded in *F. nigra* with no standing dead trees <10 cm DBH recorded. *Populus tremuloides* mortality was never higher than 7.22 individuals/ha and was highest between 22.5 DBH and 50 DBH.

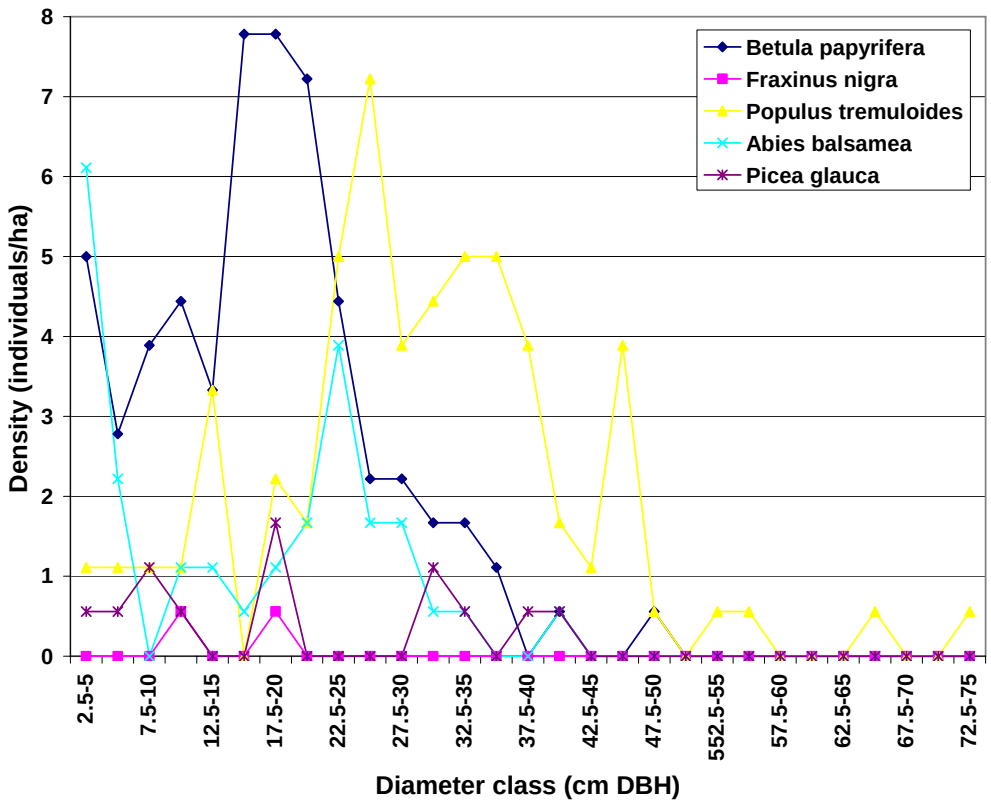

Figure 5. Density-diameter graph of dead trees at GRPO for selected species.

Table 2. Basal area and density of all dead tree species located in long-term monitoring plots at GRPO.

Species	Basal area	Density
	m^2/ha	individuals/ha
Hardwoods		
Acer rubrum (red maple)	0.001	1.670
Acer spicatum (mountain maple)	0.113	81.110
Betula papyrifera (paper birch)	1.790	56.670
Fraxinus nigra (black ash)	0.020	1.110
Populus tremuloides (trembling aspen)	4.674	55.560
Softwoods		
Abies balsamea (balsam fir)	0.667	22.780
Picea glauca (white spruce)	0.342	7.220
Picea mariana (black spruce)	0.075	1.670
Pinus strobus (white pine)	0.214	2.220
unknown species	1.490	77.220
Total	9.386	307.230

Tree saplings density was greater than 1,000 individuals/ha for three species: *Acer spicatum*, *Abies balsamea*, and *Populus tremuloides* (Table 3). Except for *A. balsamea*, density of conifer species saplings was less than 100 individuals/ha. No *Thuja occidentalis* saplings were found in sampling quadrats.

Table 3. Tree sapling density at GRPO. Saplings are defined as ≥ 15 cm (conifers) or ≥ 30 cm (hardwood) tall, but less than 2.6 cm DBH and displaying evidence of second year growth.

Species	Density
	seedlings/ha
Hardwoods	
Acer spicatum (mountain maple)	3733.33
Betula papyrifera (paper birch)	133.33
Fraxinus nigra (black ash)	250.00
Populus balsamifera (balsam poplar)	33.33
Populus tremuloides (trembling aspen)	1633.33
Prunus virginiana (chokecherry)	683.33
Sorbus decora (mountain ash)	166.67
Conifers	
Abies balsamea (balsam fir)	2633.33
Picea glauca (white spruce)	33.33
Picea mariana (black ash)	66.67
Pinus strobus (white pine)	50.00

Shrub density was high at GRPO with most plots having > 40% cover (Table 4). Because we looked at percent cover by individual species, differences in species height and general growth form led to spatial overlap and hence, the possibility of greater than 100% total shrub cover. At least 21 species were recorded (*Amelanchier* and *Salix* were not identified to the species level; in one instance, *Ribes* could not be identified to the species level.). *Taxus canadensis*, a native species heavily browsed by deer and was present in only one plot (2020, Figure 1) and at a fairly low percent cover (3.00%). Shrub species with mean density greater than 4% include *Corylus cornuta* var. *cornuta* (12.31), *Alnus incana* ssp. *rugosa*, (10.01), *Rubus ideaus* ssp. *strigosus* (6.16), *Rubus parviflorus* (5.73), and *Rubus pubescens* (4.02). No non-native shrubs were recorded.

Table 4. Shrub cover at GRPO.

Family	Species	Percent cover
Betulaceae	*Alnus incana* ssp. *rugosa* (speckled alder)	10.01
	Alnus viridis ssp. *crispa* (green alder)	1.41
	Corylus cornuta var. *cornuta* (beaked hazel)	12.31
Caprifoliaceae	*Diervilla lonicera* (bush honeysuckle)	3.88
	Lonicera canadensis (fly honeysuckle)	2.39
	Lonicera hirsuta (hairy honeysuckle)	0.15
	Viburnum rafinesquianum (downy arrowwood)	0.31
Cornaceae	*Cornus sericea* (redosier dogwood)	2.80
Grossulariaceae	*Ribes* sp. (gooseberry, currant)	0.08
	Ribes glandulosum (skunk currant)	0.42
	Ribes hirtellum (hairystem gooseberry)	0.37
	Ribes lacustre (prickly currant)	0.37
	Ribes triste (red currant)	0.86
Rhamnaceae	*Rhamnus alnifolia* (alderleaf buckthorn)	0.01
Rosaceae	*Amelanchier* sp. (serviceberry)	2.52
	Rosa acicularis (prickly rose)	2.33
	Rosa blanda (smooth rose)	0.06
	Rubus idaeus ssp. *strigosus* (red raspberry)	6.16
	Rubus parviflorus (thimbleberry)	5.73
	Rubus pubescens (dwarf red blackberry)	4.02
Salicaceae	*Salix* sp. (willow)	0.18
Taxaceae	*Taxus canadensis* (Canada yew)	0.03
Total		56.4

Coarse woody material (CWM) volume was 91.89 m^3/ha (Table 5) with a mean count of 845 pieces/ha.

Table 5. Coarse woody material volume (m^3/ha) and number of pieces (total and in four size classes (cm diameter at intercept)).

	Pieces/ha in size classes (diam. at line intercept)				
Volume (m^3/ha)	8-20 cm	20-33 cm	33-46 cm	46-60 cm	Total pieces/ha
91.89	652.22	173.06	17.32	2.52	845.12

Discussion

Ecology and Interpretation

Dense stands of balsam fir at GRPO are likely inhibiting regeneration of species with both low and intermediate shade tolerance, including white pine. Specifically, reduced regeneration of white pine, resulting from high balsam fir density, is likely caused by mechanisms operating at multiple developmental levels. Density of white pine saplings (defined in this study as individuals at least 15 cm in height, exhibiting signs of previous year's growth, and less than 2.6 cm DBH) was low: 50 individuals/ha. In a study of white pine regeneration and recruitment in north central Minnesota, Dovčiak et al. (2003) found sapling growth was greatest under a combination of low overstory basal area (<24 m^2/ha) and low overstory shrub density (<55% coverage). In the present study, mean overstory basal area equaled 24 m^2/ha and mean overstory shurb cover was 56%. In contrast to saplings, Dovčiak et al. (2003) found germinant (seedling) density positively related to overstory basal area of living trees and to seed rain. We intentionally did not assess seedling density. This is because seedlings emerge over the course of the summer as sampling progresses. Plots sampled early in the season would likely have fewer seedlings detected while those sampled later would have more. Nonetheless, density of mature, seed producing individuals is low (13.33 individuals/ha). Although we did not test seed rain, low densities of mature, seed producing white pines suggests that seed rain is also a limiting factor.

Dense balsam fir stands were not historically present at GRPO. Prior to human settlement, fire played a much larger role in regulating structure and composition of the near boreal forests such as those at GRPO, where the return interval of ground fires was 20-40 years and crown fires occurred every 150-200 years. These fires eliminate much of the understory and herbaceous layer vegetation, allowing more light and promoting the growth of shade intolerant species.

In addition to white pine, paper birch is also exhibiting signs of regeneration failure by not displaying high densities at the lowest size classes. Evidence suggests, however, that birch abundance may have been artificially inflated due to large numbers of catastrophic fires associated with settlement of the state of Minnesota (1870-1940). Current, observed regeneration of birch may actually be closer to pre-settlement levels. (Brandon Seitz, Grand Portage National Monument, personal communication)

In addition to white pine and paper birch, *Thuja occidentalis* density is also low in all but one size class. On undisturbed areas, seedbeds of decaying (rotten) wood of logs and stumps can account for more than 70% of white cedar seedlings (Cornett et al. 2001). Thus, reduced amounts of coarse woody material (CWM) could hinder germination. At GRPO, the mean CWM volume was 92 m^2/ha. Coarse woody material volume varies widely with stand type, stand age, and management practices. Goodburn and Lorimer (1998) examined coarse woody debris in northern Wisconsin and the upper peninsula of Michigan. In northern hardwood stands, mean coarse woody debris in even-aged stands was 39.2 m^3/ha, while that in old growth stands was 126.9 m^3/ha. While it appears that CWM directly, may not be limiting, it is unclear how important the level of decay is in promoting germination. Unfortunately, we did not classify CWM into decay classes during this first year of monitoring. In all future years, however, this will be done. Nonetheless, it is hoped that, as decay of existing CWM progresses, this will facilitate recruitment of cedar. This contrasts with balsam fir, which has more general requirements for

germination and establishment. Besides germination limitations, both paper birch and eastern white cedar are preferred browse species for white-tailed deer.

Implementation: Problems, Logistics, and Future Plans

My biggest concern this year is that only 20 plots were sampled at Grand Portage NM. Although I feel that this number of plots adequately represents the habitats present in the park, additional plots can increase the statistical power and allow differences to be more readily detected. As part of the original five year sampling rotation, the 2007 field season was spent between three parks, with the other two parks, Indiana Dunes National Lakeshore and Grand Portage National Monument, each having 20 plots installed. We discovered that sampling at three parks in one year is not realistic, however, and will be switching to a six year rotation where one entire field season is spent at Indiana Dunes NL and another split between SACN and GRPO. This will allow additional sampling time at these three parks.

There were a number of problems that we experienced that were directly due to this being the first year of implementation. One of the concerns that I have with the data from this year is the low frequency of pest and pathogen detection. There are several contributing factors to this. At INDU, we sampled from shortly after leaf-out until early summer while at GRPO, we sampled from early to mid summer. Many of the target diseases would not be evident until late summer. This will remain a problem in future years as much of the sampling, regardless of park or year, will take place before disease becomes evident.

A second problem with pest and pathogen damage is the large number of diseases and damage types (49) that were targeted in combination with the lack of forest pathology expertise on the crew. We did devote time to this during the three week training period although, again, this was in May, prior to many diseases becoming evident. Ideally, we should have spent several days training on the new species and diseases each time we went to a new park. The drawback with this is, with the tight schedule, this would have compromised the number of plots completed. As a compromise, we worked on identifying species and diseases as we completed plots.

Despite the lack of disease reported, we did encounter diseased trees not infrequently, although most of these diseases were not on the targeted list. In the majority of cases, the severity of disease on any given tree was not great and this did not appear to be of ecological significance. In the future, we will likely reduce the size of the target list to fewer than 10 species, that will include spruce budworm, white pine blister rust, and tip weevil. We will also send samples (leaves, fruits, etc.) to the U.S. Forest Service disease identification center in St. Paul for identification. This will provide a better assessment of what is happening to the trees, and also be a teaching tool for both myself and the crew.

A second modification that will be made following this year is increased data collection for coarse woody materials. In 2007, we collected the diameter at line intercept and the length, allowing a rough cylindrical volume estimate. In the future, we will record the diameter at both the large and small ends, allowing a more accurate conical estimate of volume. Further, in the future we will also record the species and decay class of the piece. These modifications will allow more refined estimates of CWM volume, as well as promote a better understanding of successional patterns.

A final modification that we will make following this year is that we will not be using PDAs for plot data collection. In 2007, we used Trimble Geo XT GPSs on which the DATABASE Sprint DB Pro was installed. As such, we used the GPSs for recorded plot data, logging GPS coordinates, and navigating, draining the batteries. This was problematic in the backcountry at SACN, and at times at GRPO. Although we brought materials for recharging, these were both heavy and bulky.

A second problem that we experienced with the PDAs, missing data, was not evident until I began checking data after the field season. Among other examples, there were six shrub circles with the species present recorded, but no cover percentages. When data collection is on paper, the crew leader can check the datasheets before leaving a plot to ensure that all parameters have been collected. There were also four plots without any coarse woody materials recorded. I suspect that the CWM was, indeed, collected on these plots, but somehow lost electronically in the downloading or database population process. This, too, will be avoided by using paper data sheets.

Although we did experience some setbacks and are planning some modifications, this data should be valuable to the park for management decision making. Most notably, GRPO staff are working with the University of Minnesota Natural Resources Research Institute to determine locations suitable for white pine reintroduction. Great Lakes Network monitoring data are being used identify conditions where white pine currently grows, and to ascertain other areas where it likely will grow. This project is currently ongoing, with the actual reintroductions occurring before the next monitoring cycle at GRPO.

Acknowledgements

I am grateful for the vegetation monitoring field crew of Jessica Grochowski, Jenna Scheub, and Sam Smyrk. Without their assistance, this project would in no way be possible. I am also indebted to Brandon Seitz and Dave Cooper of Grand Portage National Monument for both planning and logistical assistance. I have also greatly appreciated the assistance of Rebecca Key of the Great Lakes I&M Network for assistance with database development and manipulation.

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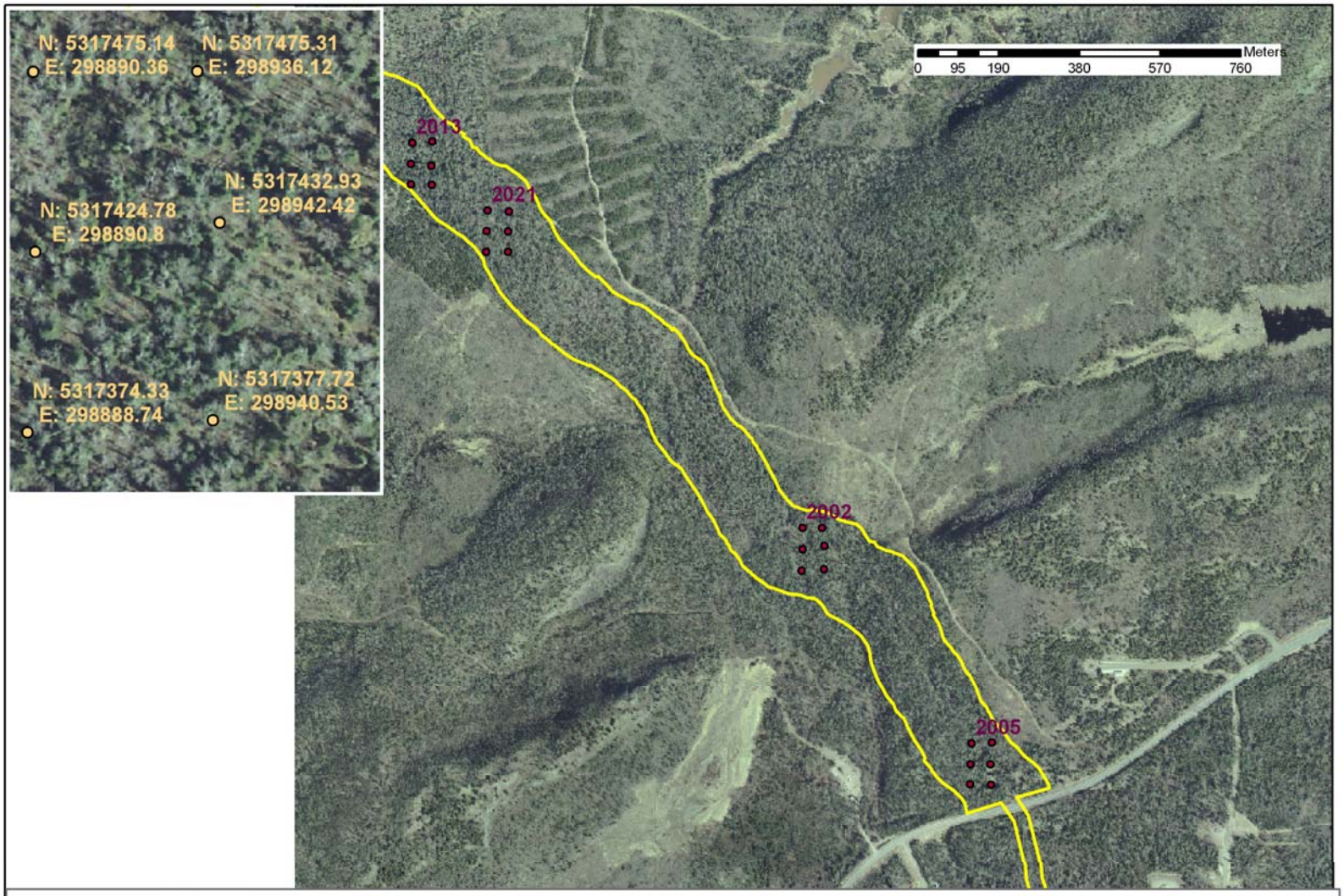
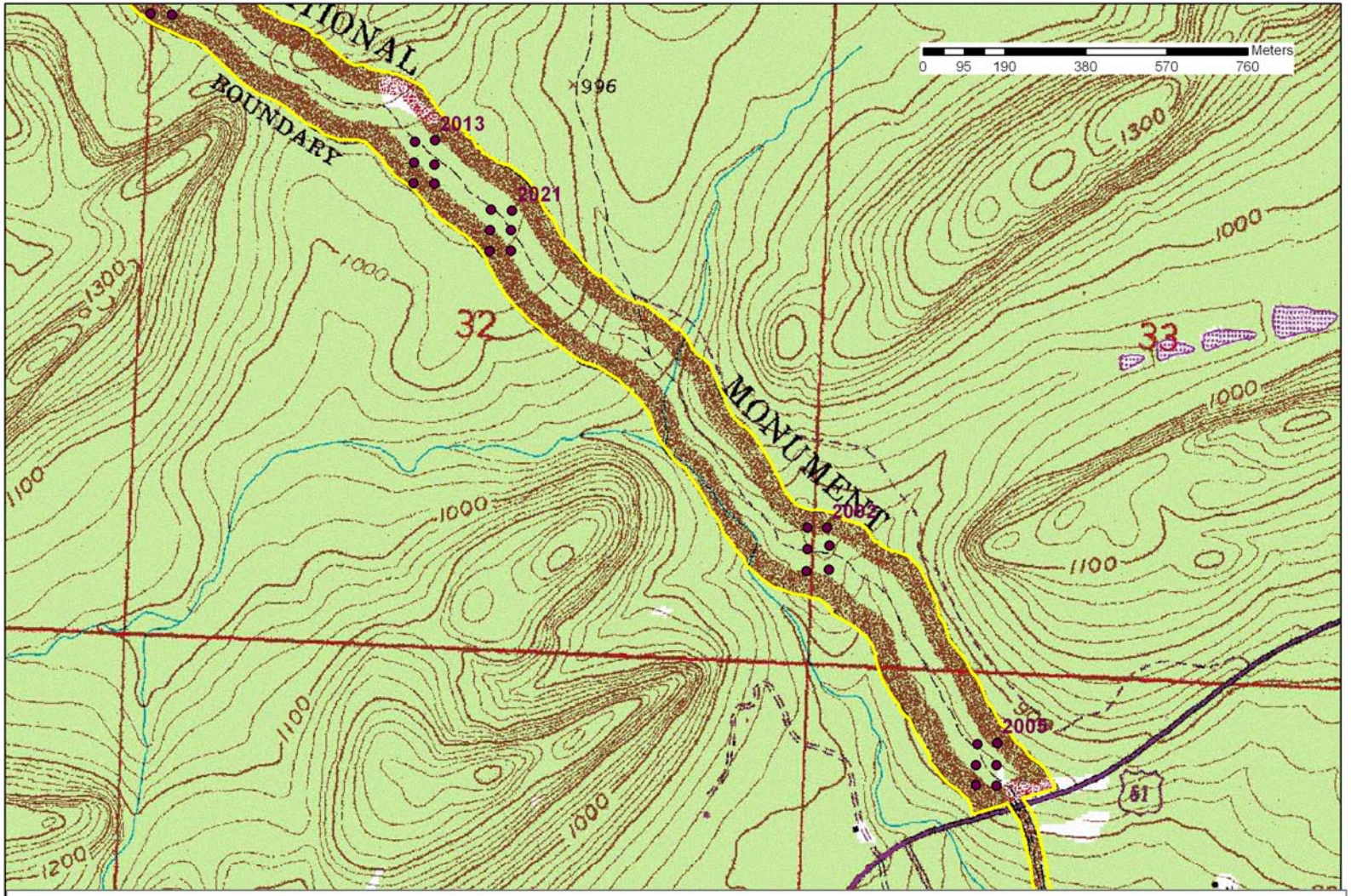
Appendix A

Field Sites Maps



Plot 2002 Kotar Forest Type: AbPiAa (Abies-Picea-Betula/Aralia nudicaulis) Balsam fir-White spruce-Paper birch/Wild sarsaparilla

Compass declination from point 5 to 6 was set at - 3 degrees. Declination was set at 0 degrees for all other points.



Plot 2002 Kotar Forest Type: AbPiAa (Abies-Picea-Betula/Aralia nudicaulis) Balsam fir-White spruce-Paper birch/Wild sarsaparilla

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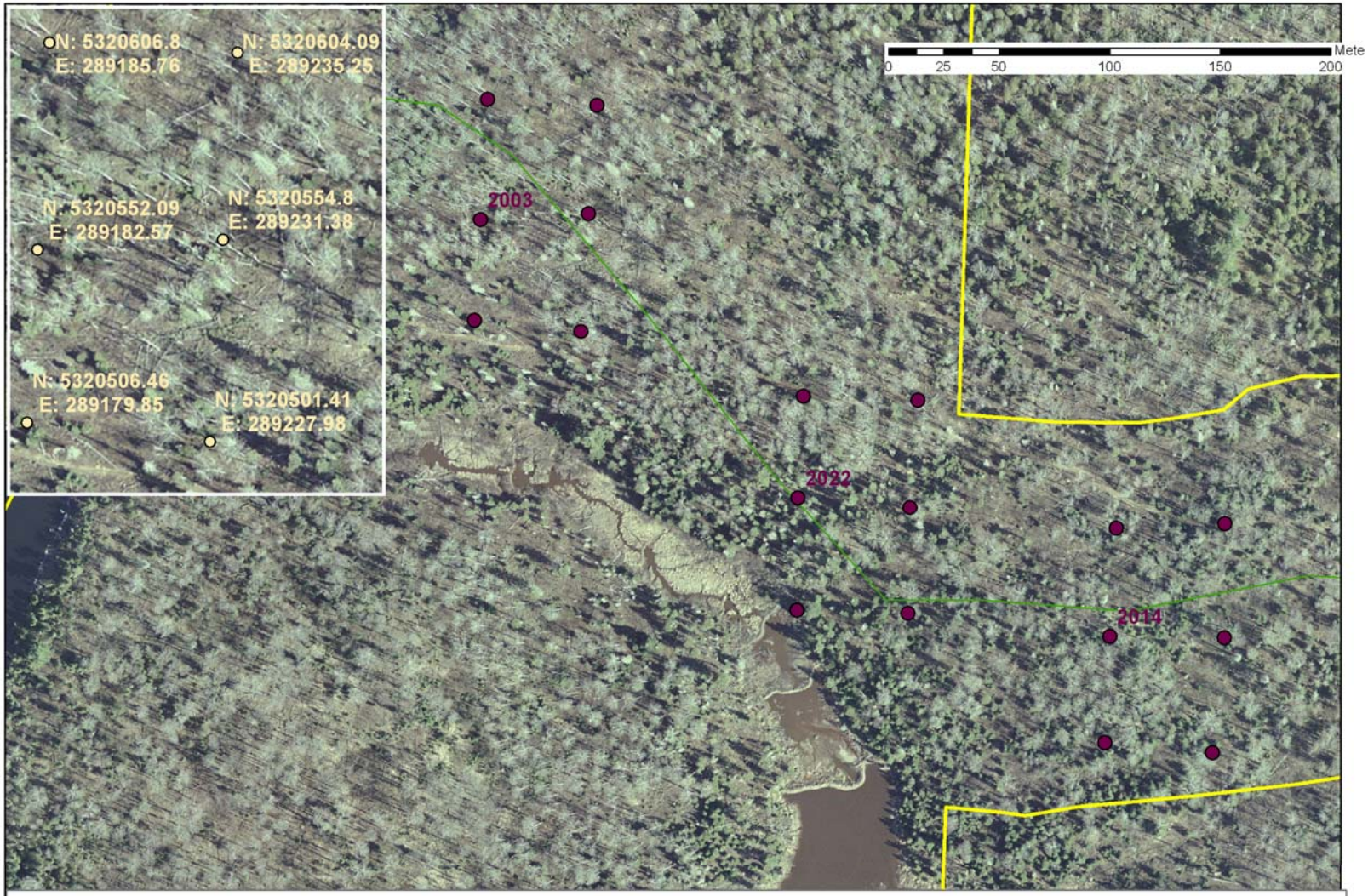
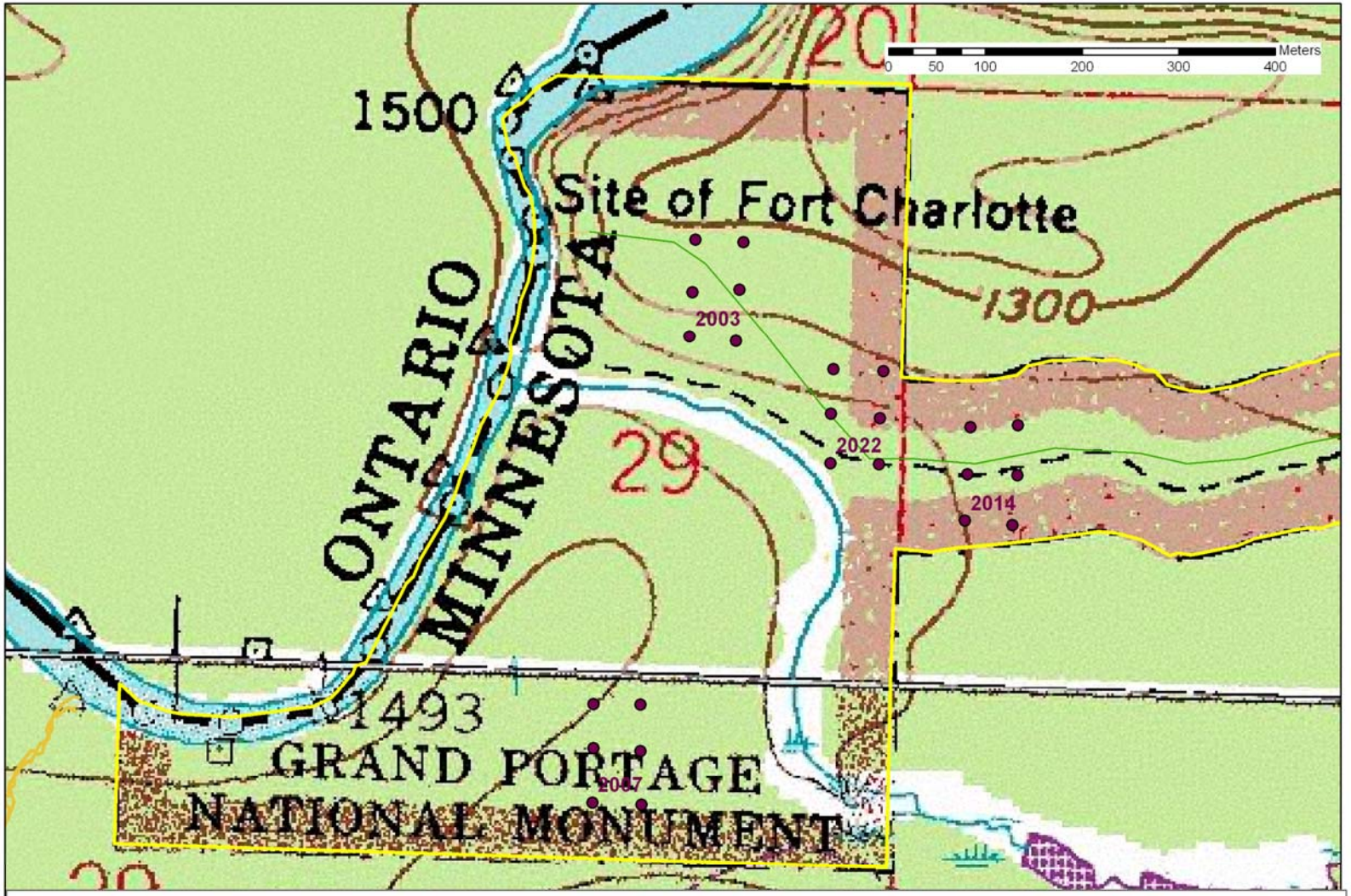
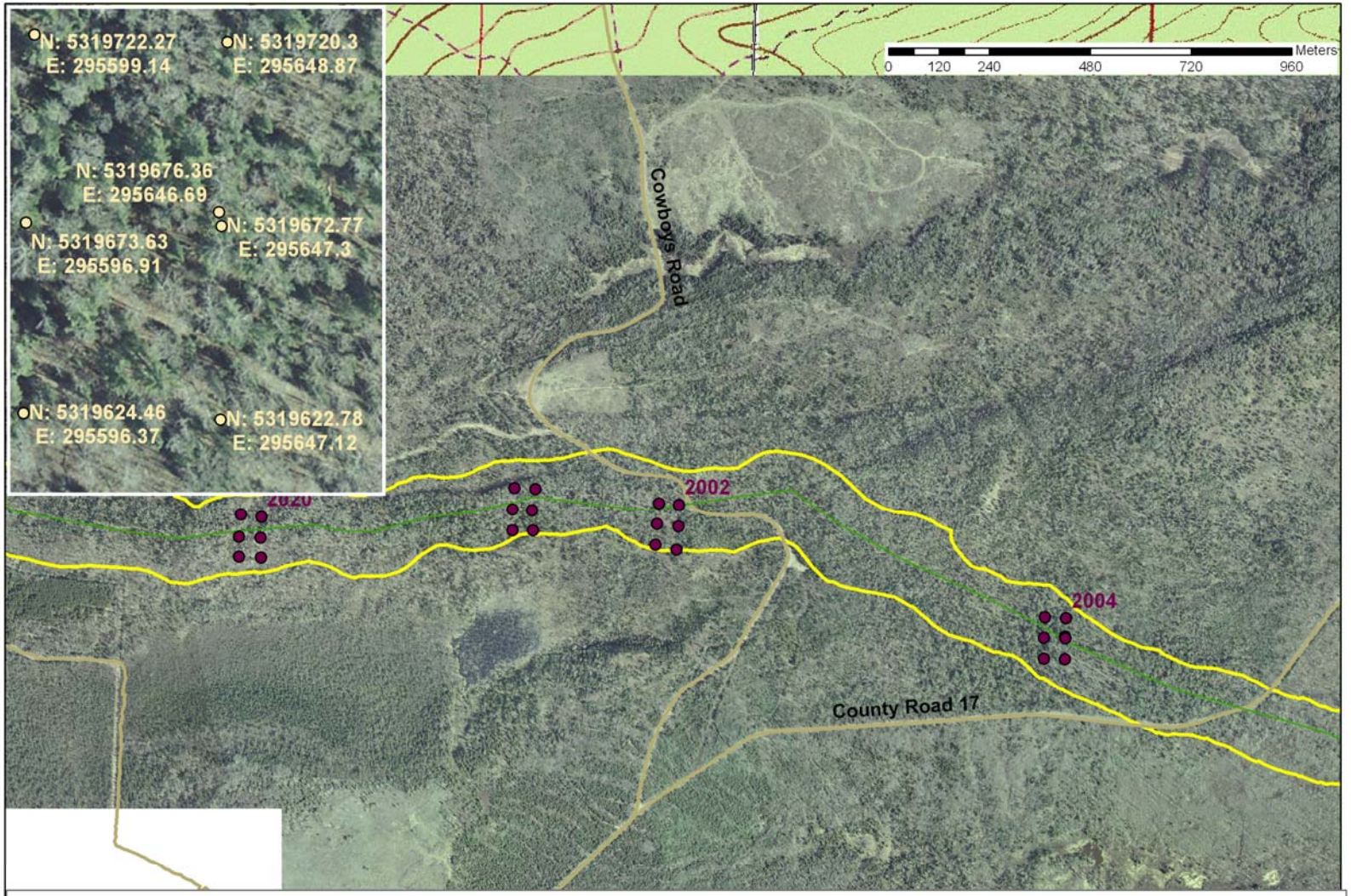


Plot 2003 Kotar Forest Type: AbPiAa (Abies-Picea-Betula/Aralia nudicaulis) Balsam fir-White spruce-Paper birch/Wild sarsaparilla



Plot 2003 Kotar Forest Type: AbPiAa (Abies-Picea-Betula/Aralia nudicaulis) Balsam fir-White spruce-Paper birch/Wild sarsaparilla



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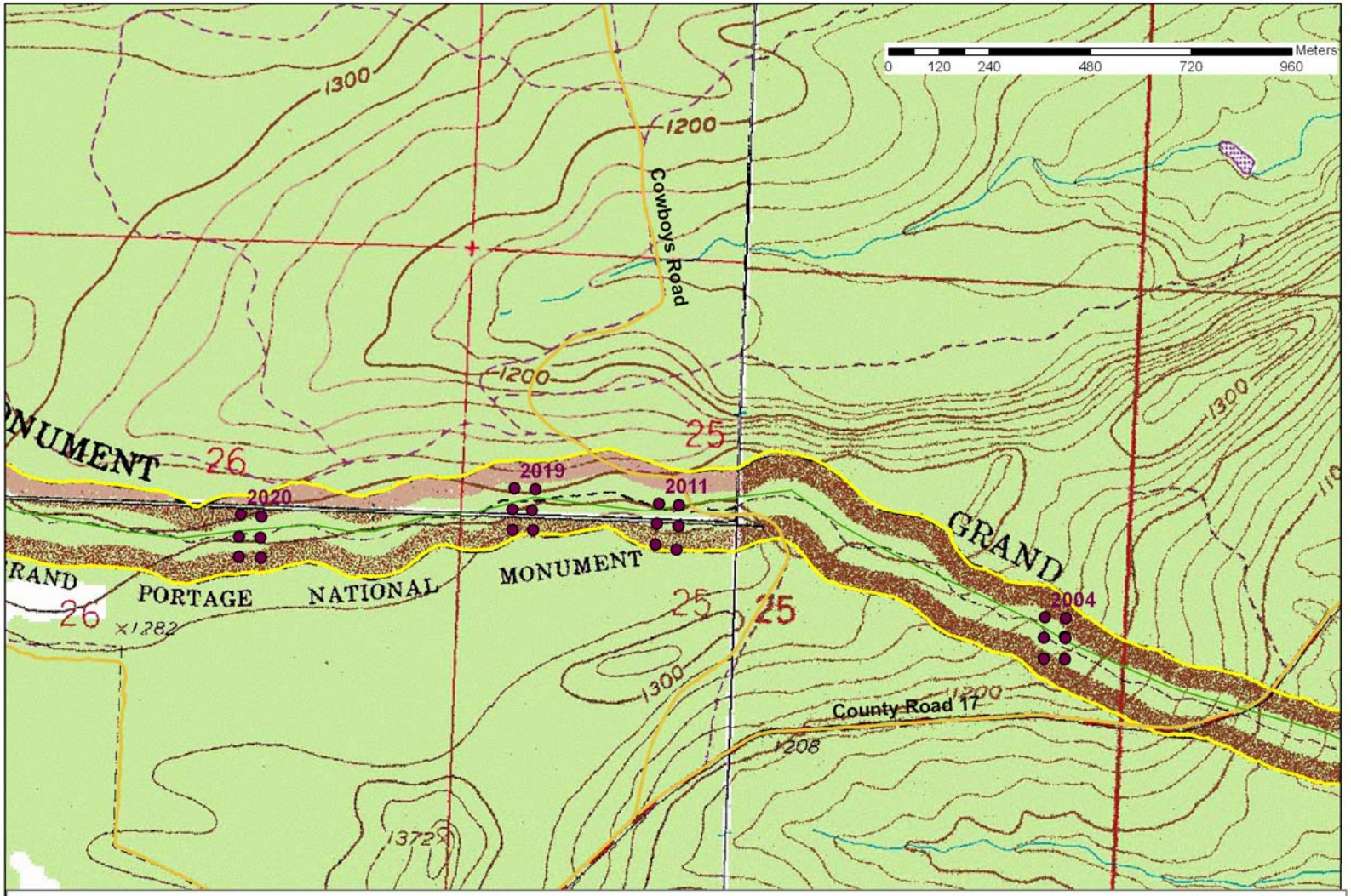
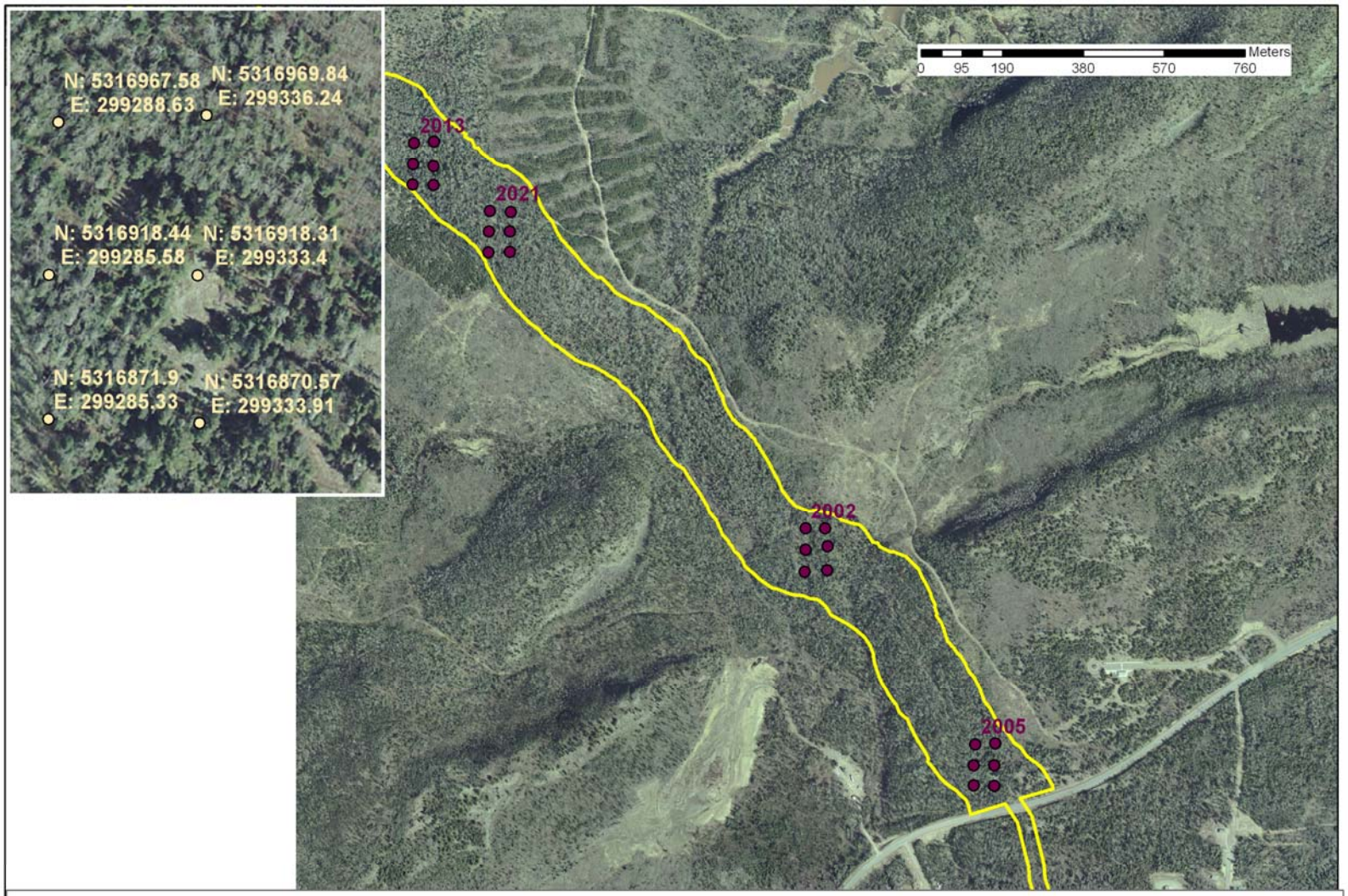
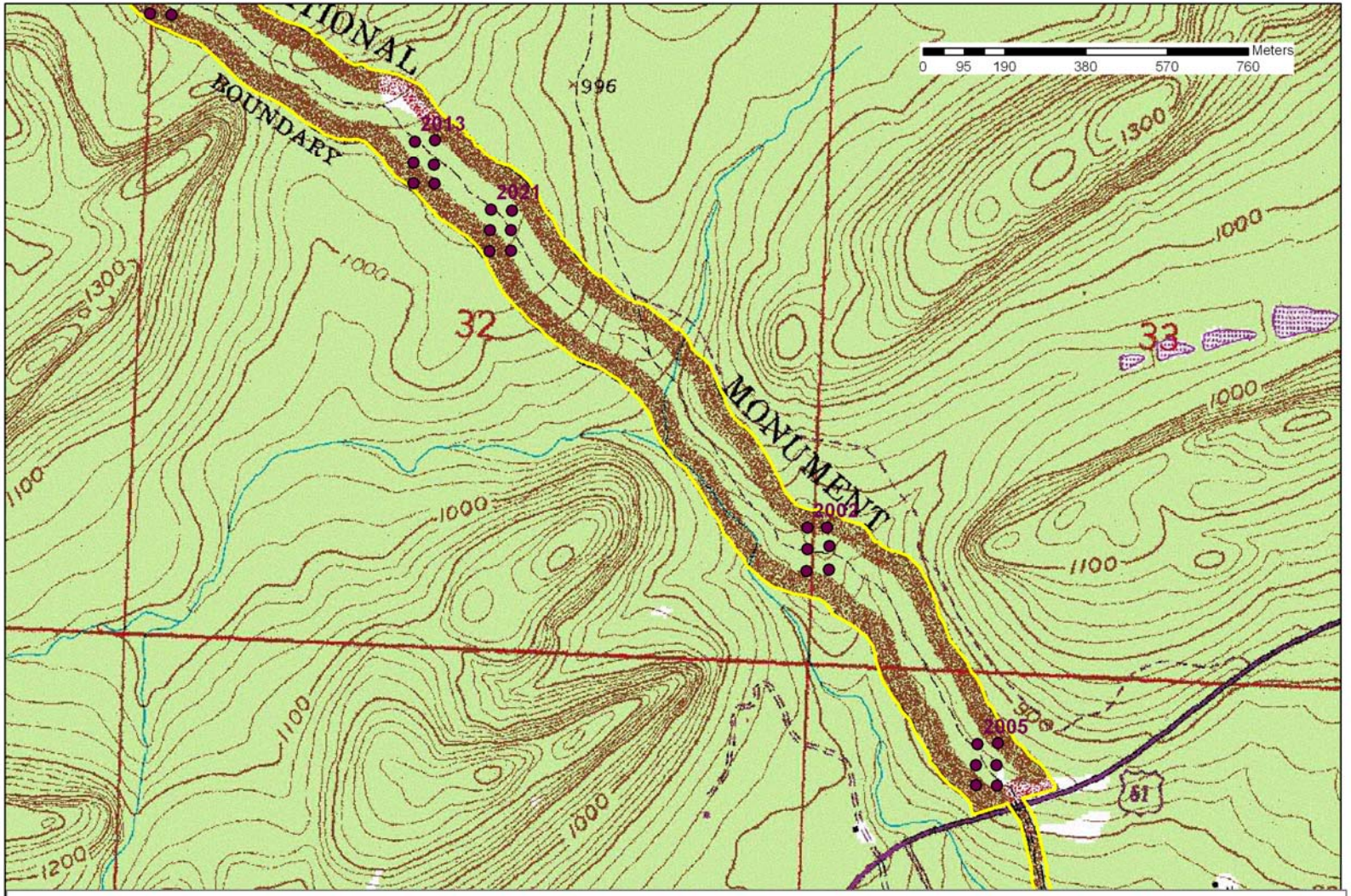


Plot 2004 Kotar Forest Type: AbPiAa (Abies-Picea-Betula/Aralia nudicaulis) Balsam fir-White spruce-Paper birch/Wild sarsaparilla



Plot 2005 Kotar Forest Type: AbPiAa (Abies-Picea-Betula/Aralia nudicaulis) Balsam fir-White spruce-Paper birch/Wild sarsaparilla

This plot contains rocky outcrops and species that were uncommon in other plots. (Juniperis communis var. depressa, Lillium philadelphicum, and Sisyrinchium montanum).



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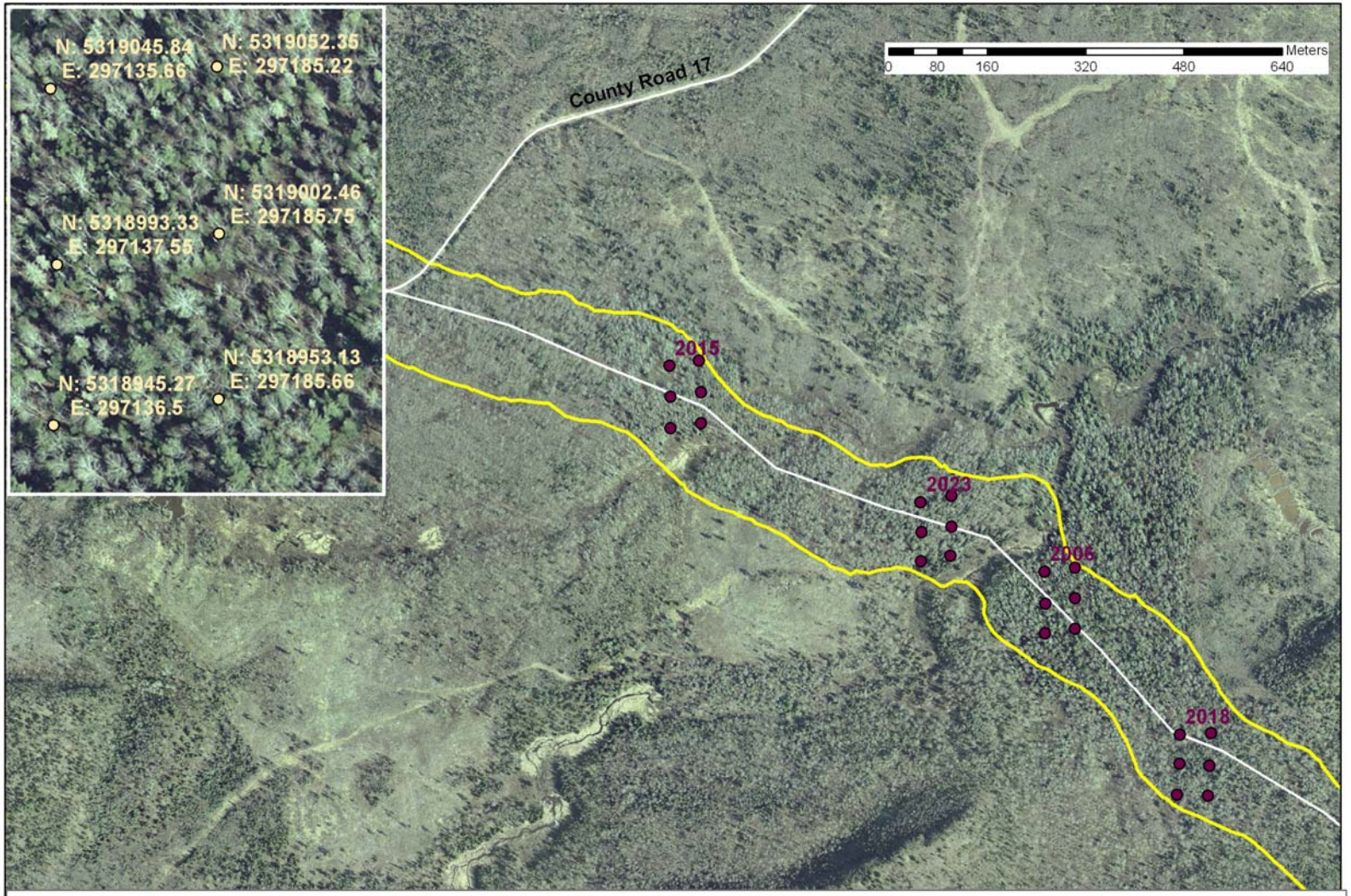
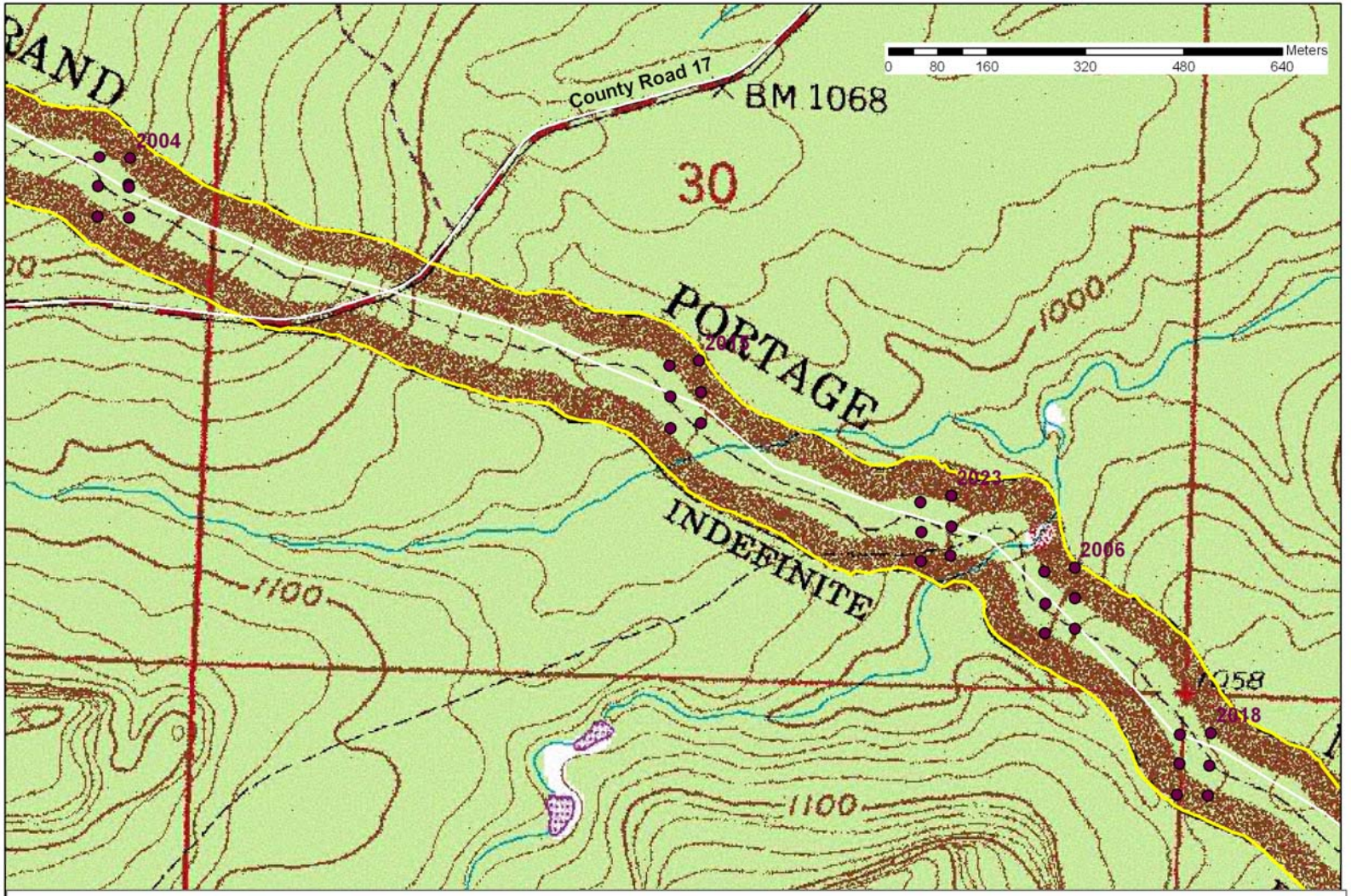


Plot 2006 Kotar Forest Type: AbPiAa (Abies-Picea-Betula/Aralia nudicaulis) Balsam fir-White spruce-Paper birch/Wild sarsaparilla



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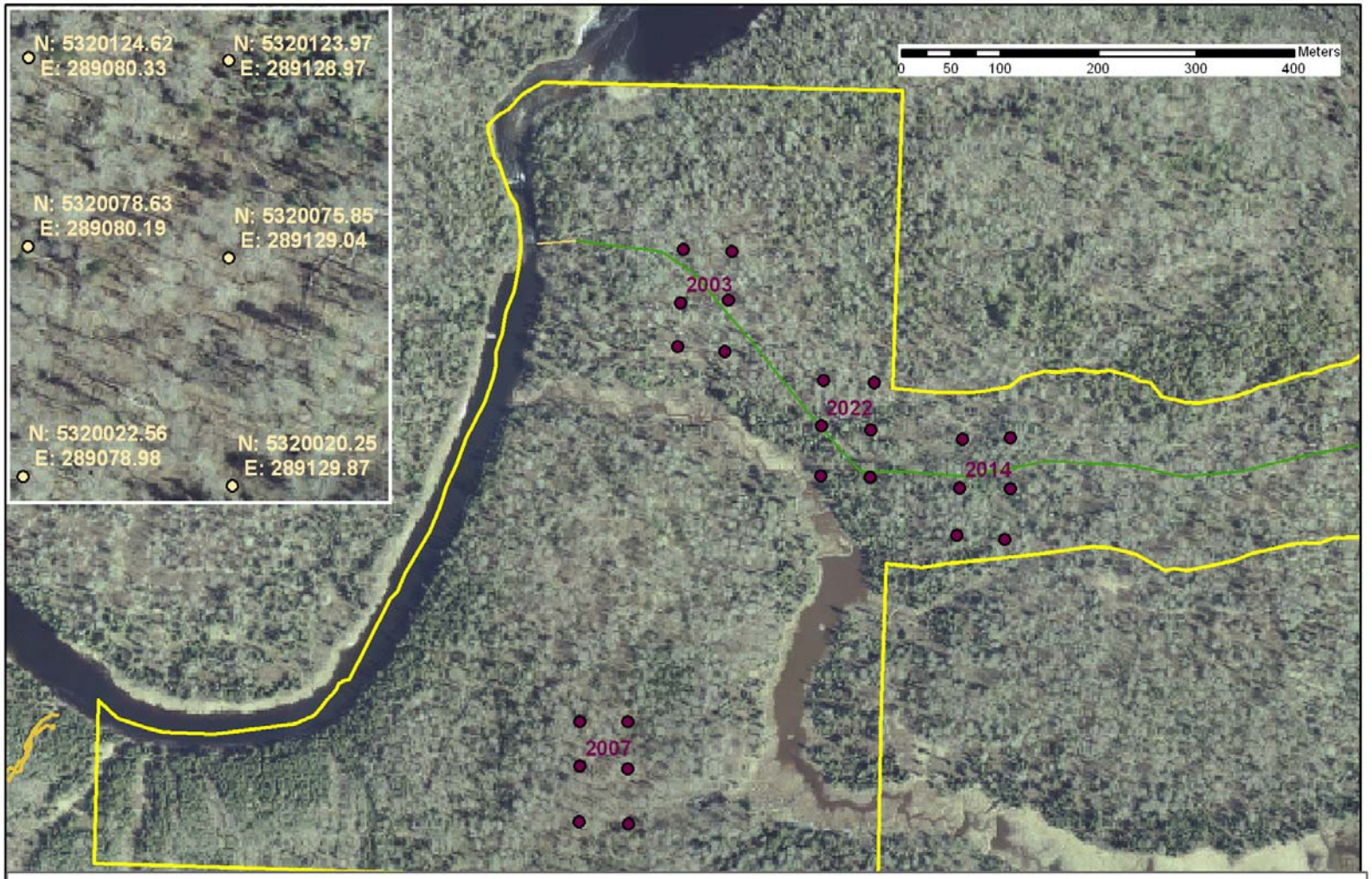
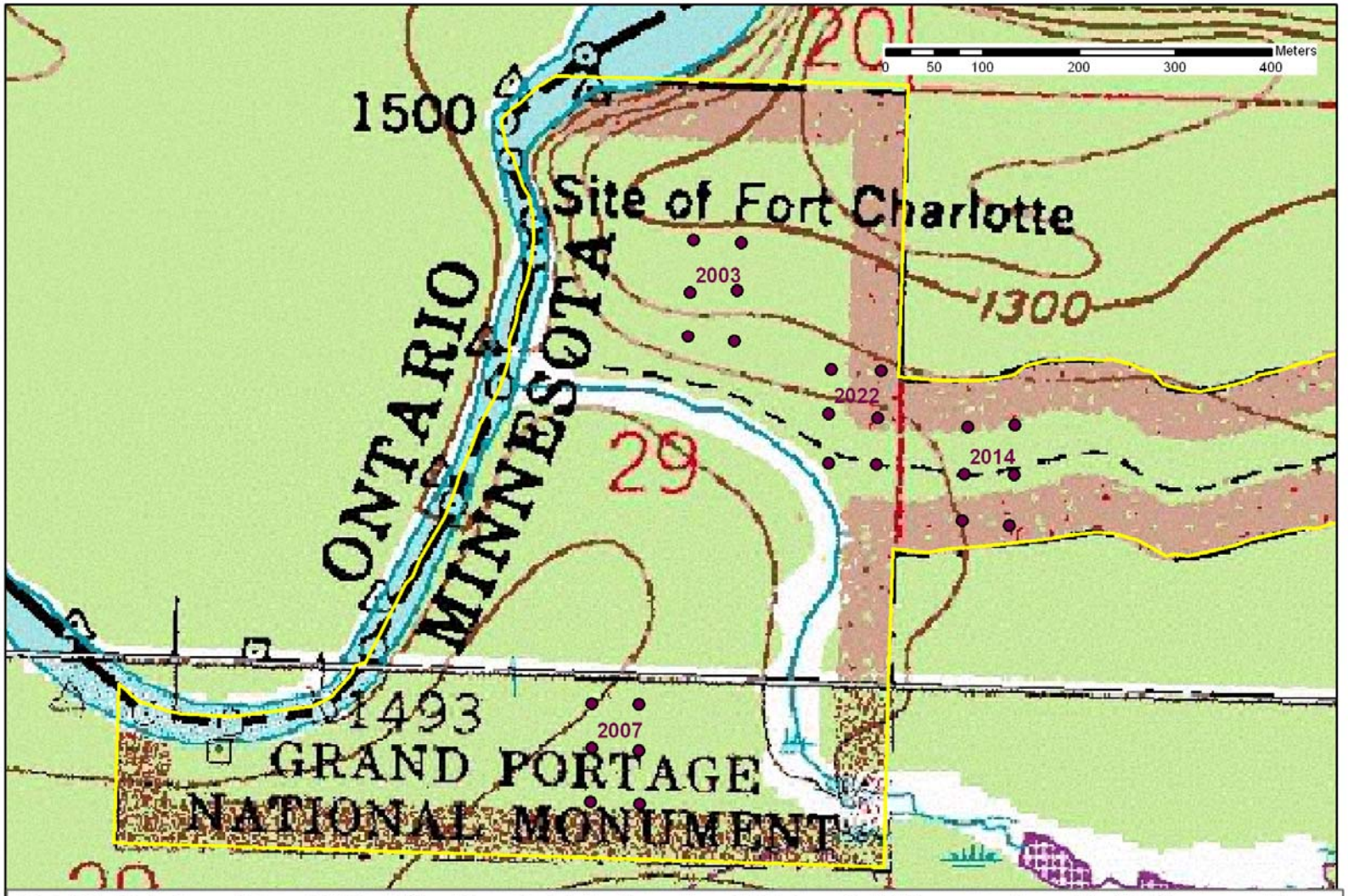


Plot 2007 Kotar Forest Type: AbPiAa (Abies-Picea-Betula/Aralia nudicaulis) Balsam fir-White spruce-Paper birch/Wild sarsaparilla

Transect 3 is in a flood zone/beaver activity area.

Points 5 and 6 did not differentially correct and were added back in to the differentially corrected file. This may decrease the accuracy of the coordinates when trying to relocate the points. There were originally two sets of coordinates for point 4. Displayed here is what looked to be more accurate. The other coordinates are: 5319676.365 (N) and 295646.687 (E).



Plot 2007 Kotar Forest Type: AbPiAa (Abies-Picea-Betula/Aralia nudicaulis) Balsam fir-White spruce-Paper birch/Wild sarsaparilla

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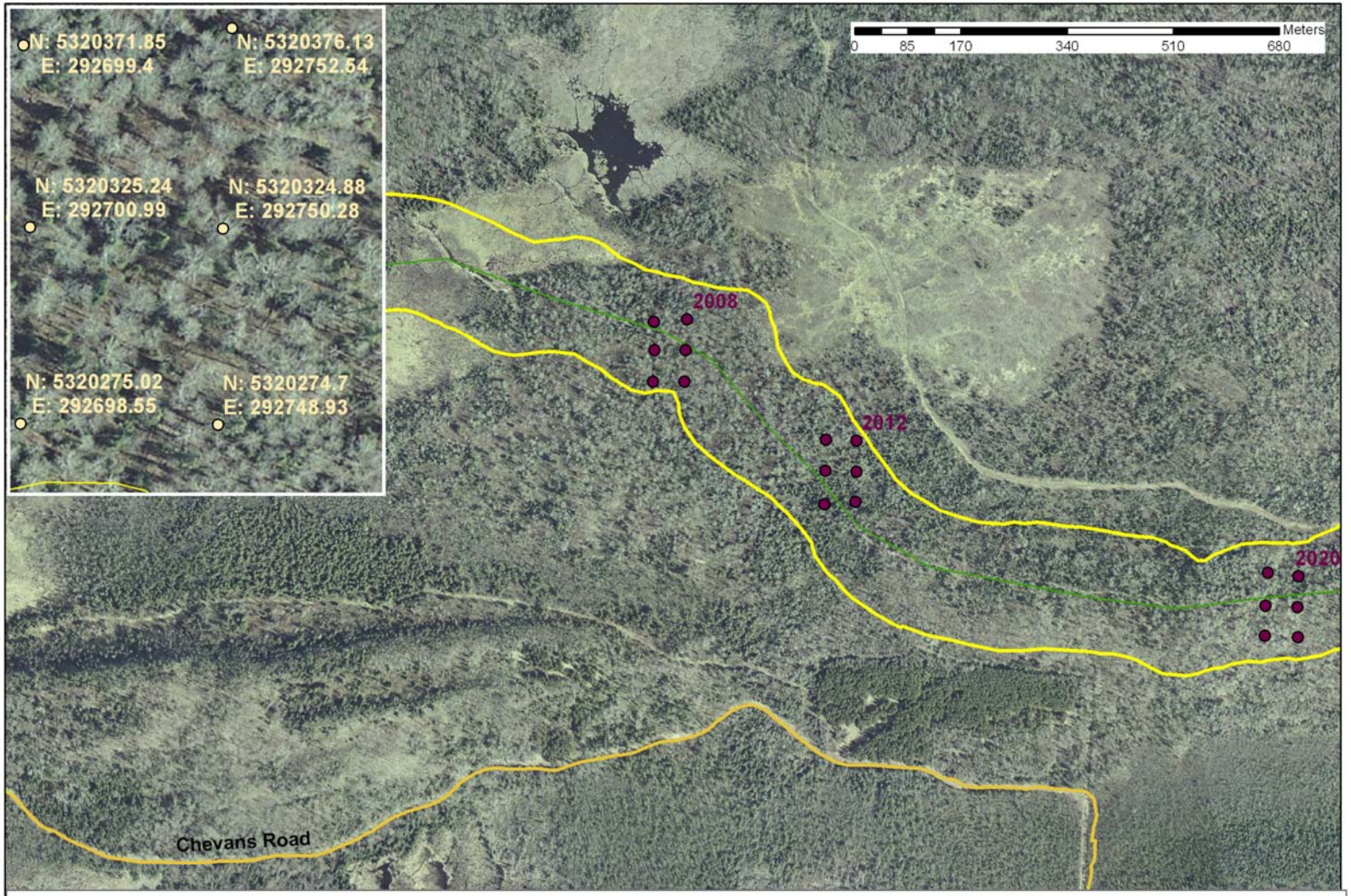
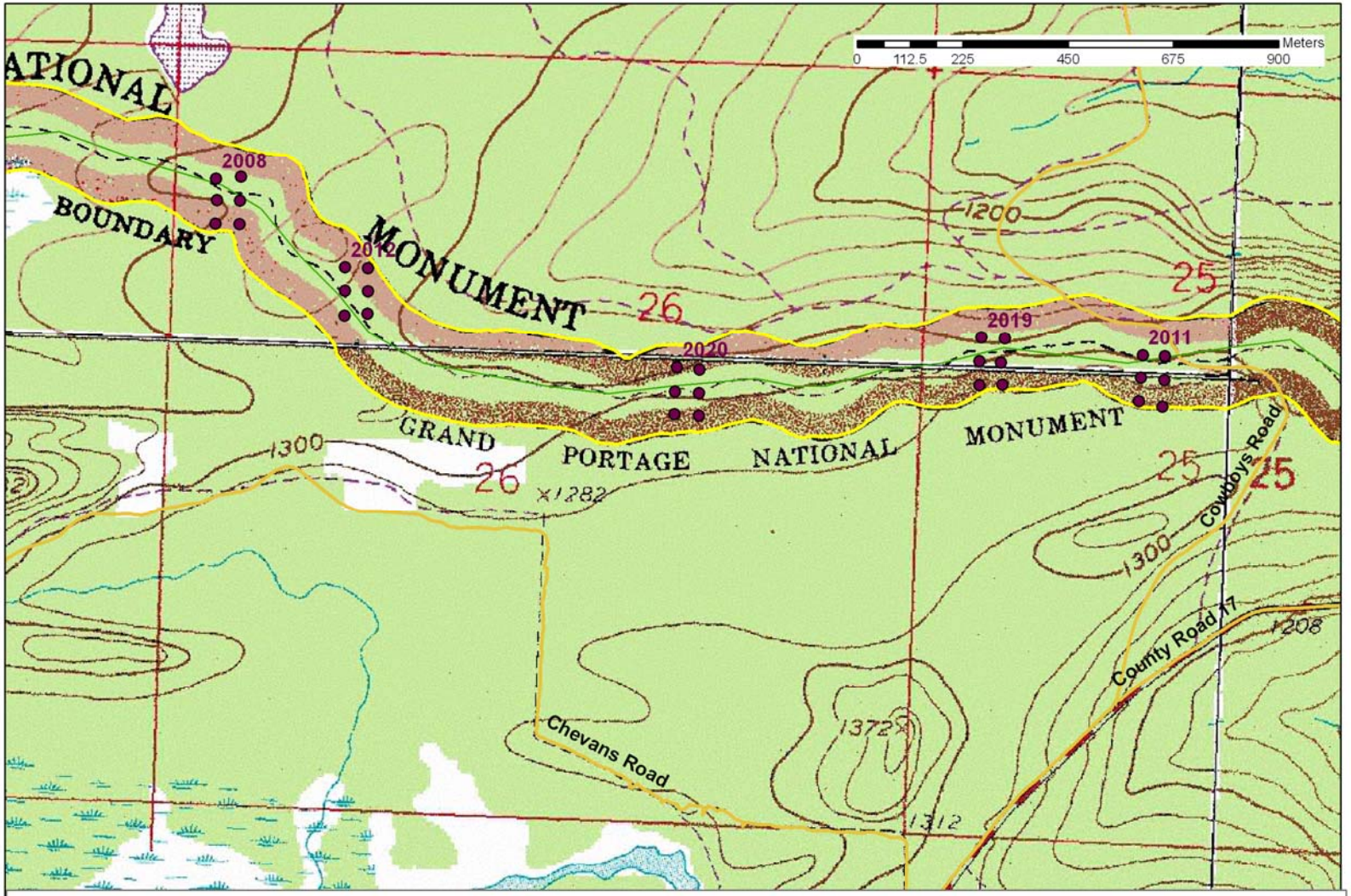
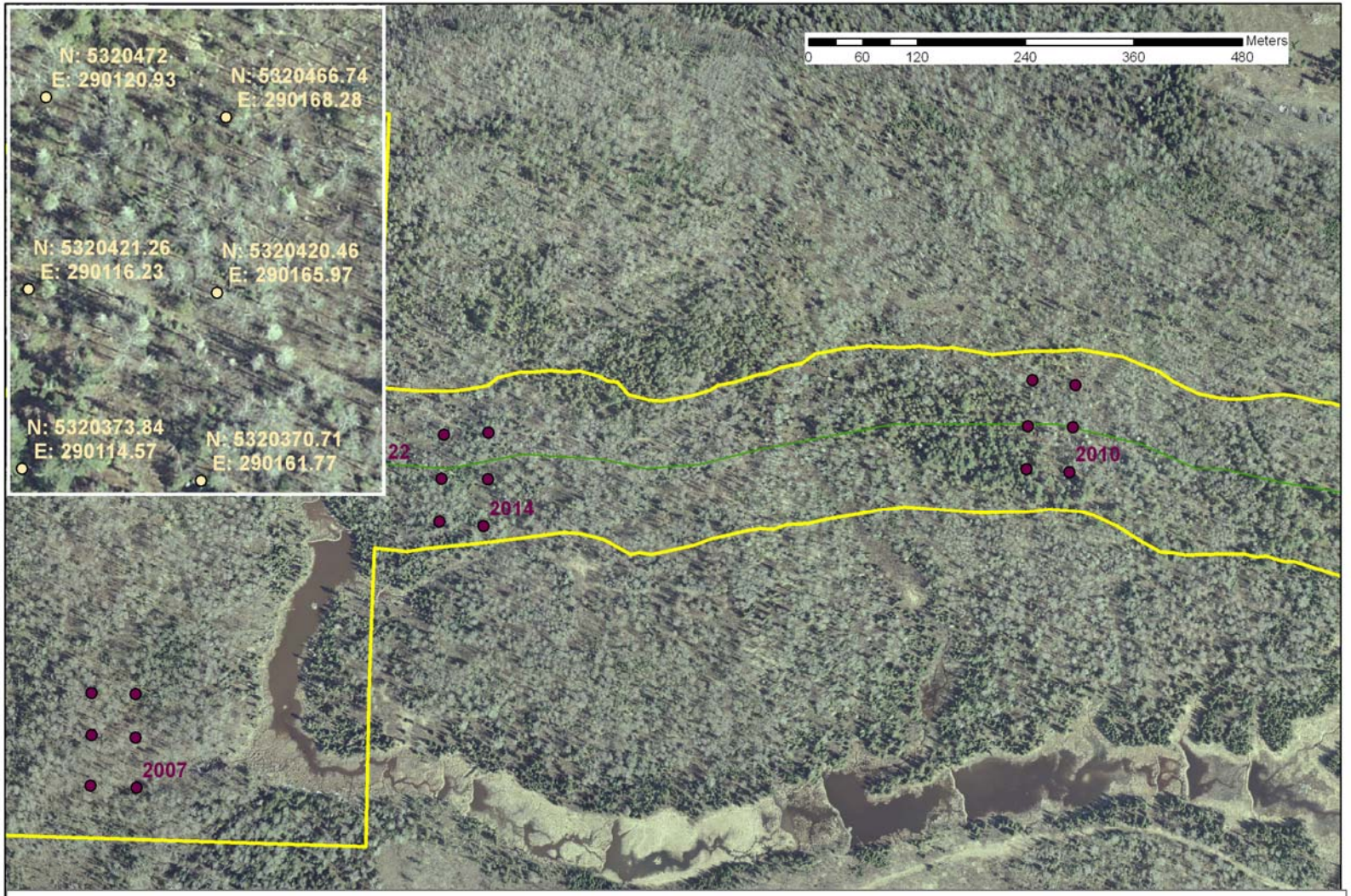


Plot 2008 Kotar Forest Type: AbPiAa (Abies-Picea-Betula/Aralia nudicaulis) Balsam fir-White spruce-Paper birch/Wild sarsaparilla

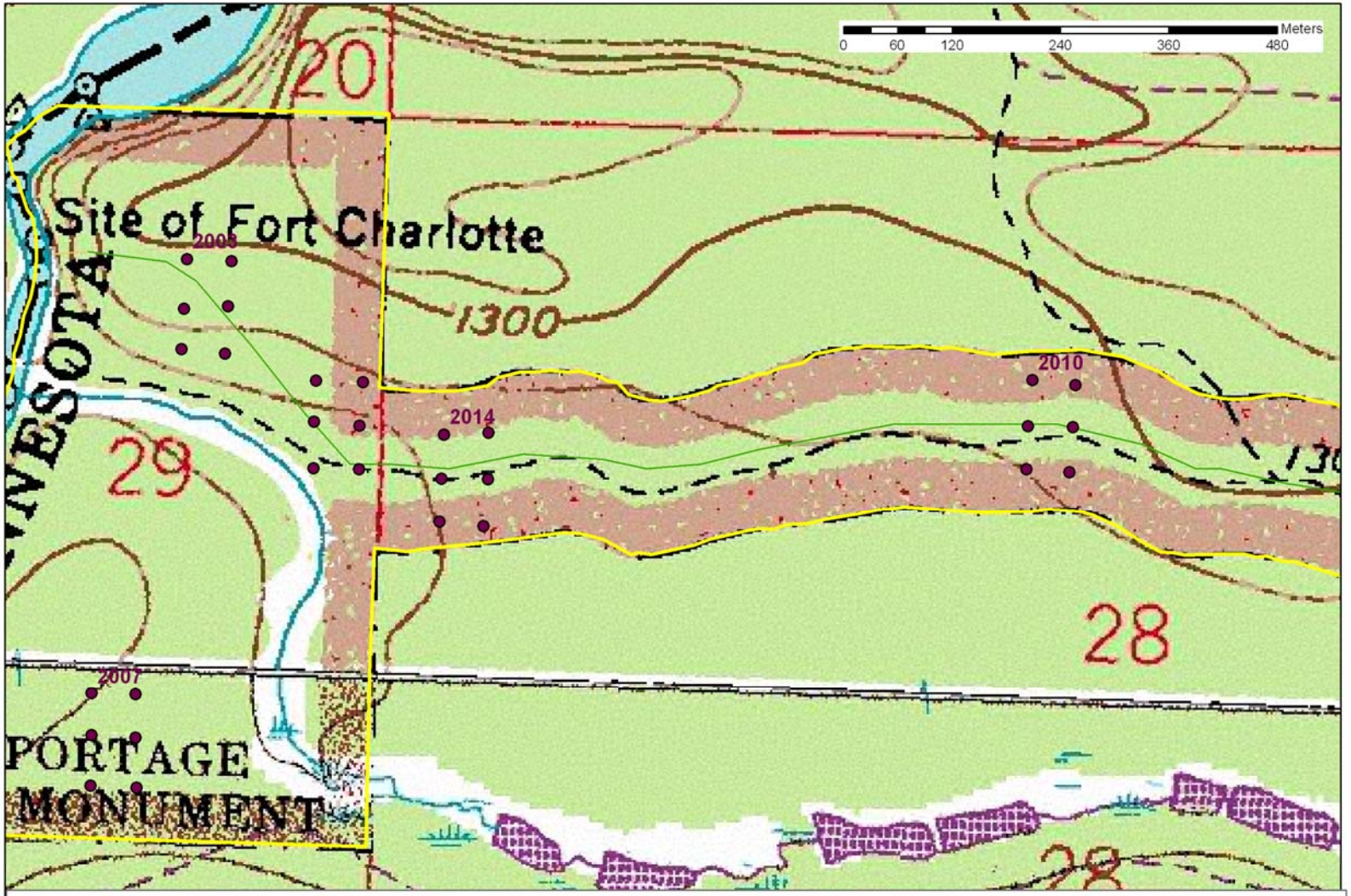


Plot 2008 Kotar Forest Type: AbPiAa (Abies-Picea-Betula/Aralia nudicaulis) Balsam fir-White spruce-Paper birch/Wild sarsaparilla



Plot 2010 Kotar Forest Type: AbPiAa (Abies-Picea-Betula/Aralia nudicaulis) Balsam fir-White spruce-Paper birch/Wild sarsaparilla

Point 5 did not differentially correct and had to be added to the file manually. Thus, the coordinates will not be as accurate as the other points for relocation.



Plot 2010 Kotar Forest Type: AbPiAa (Abies-Picea-Betula/Aralia nudicaulis) Balsam fir-White spruce-Paper birch/Wild sarsaparilla

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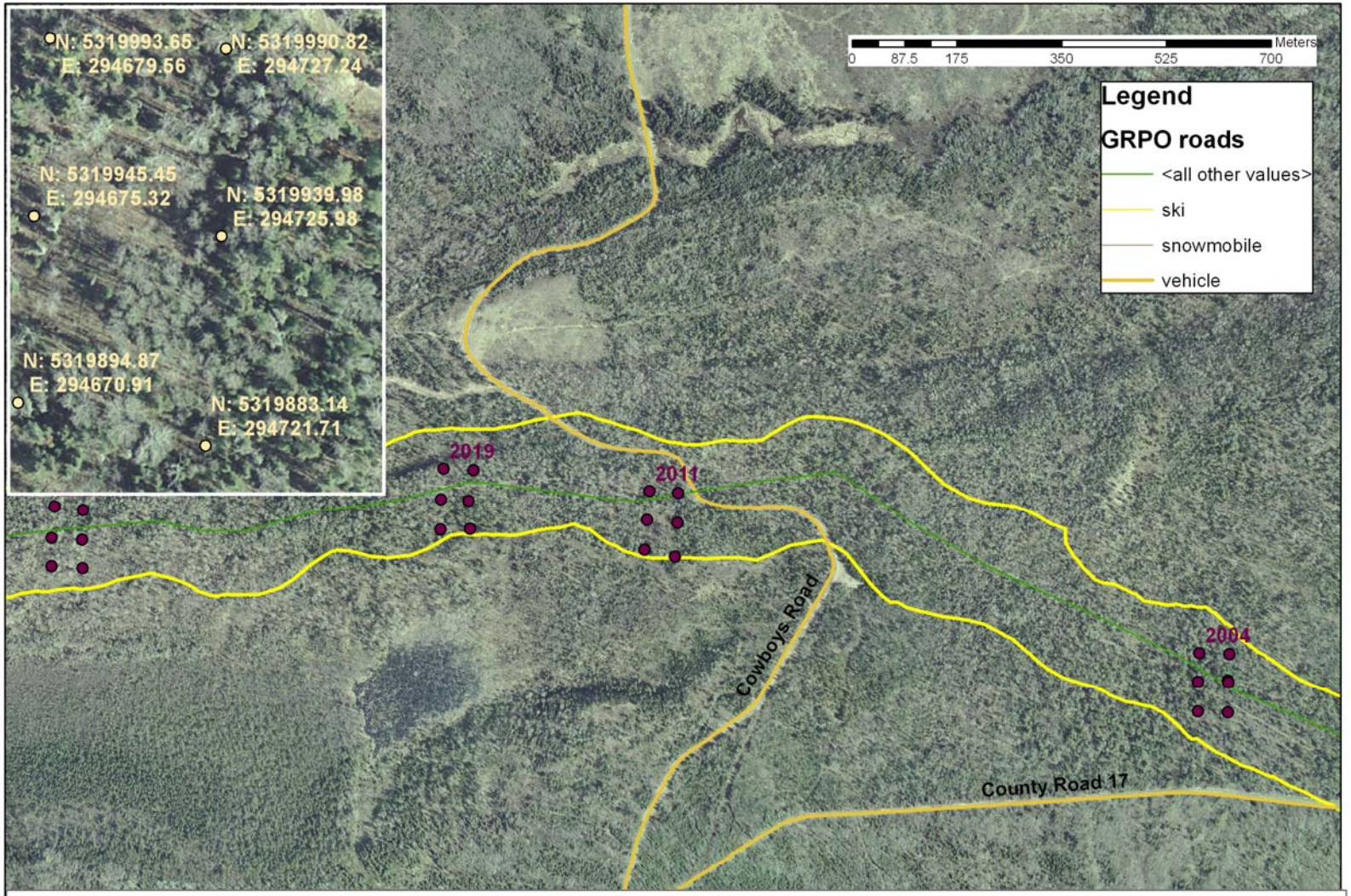
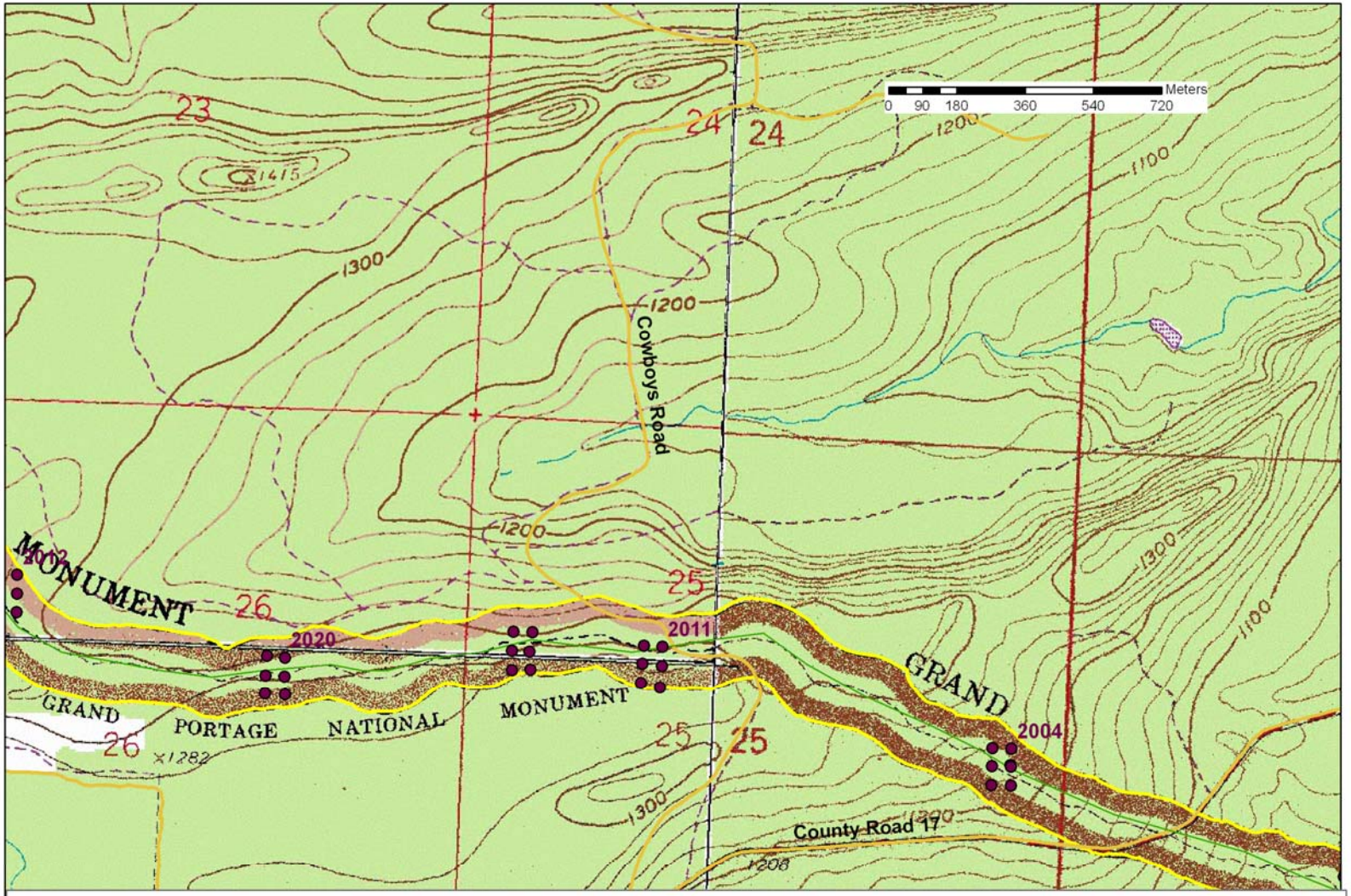
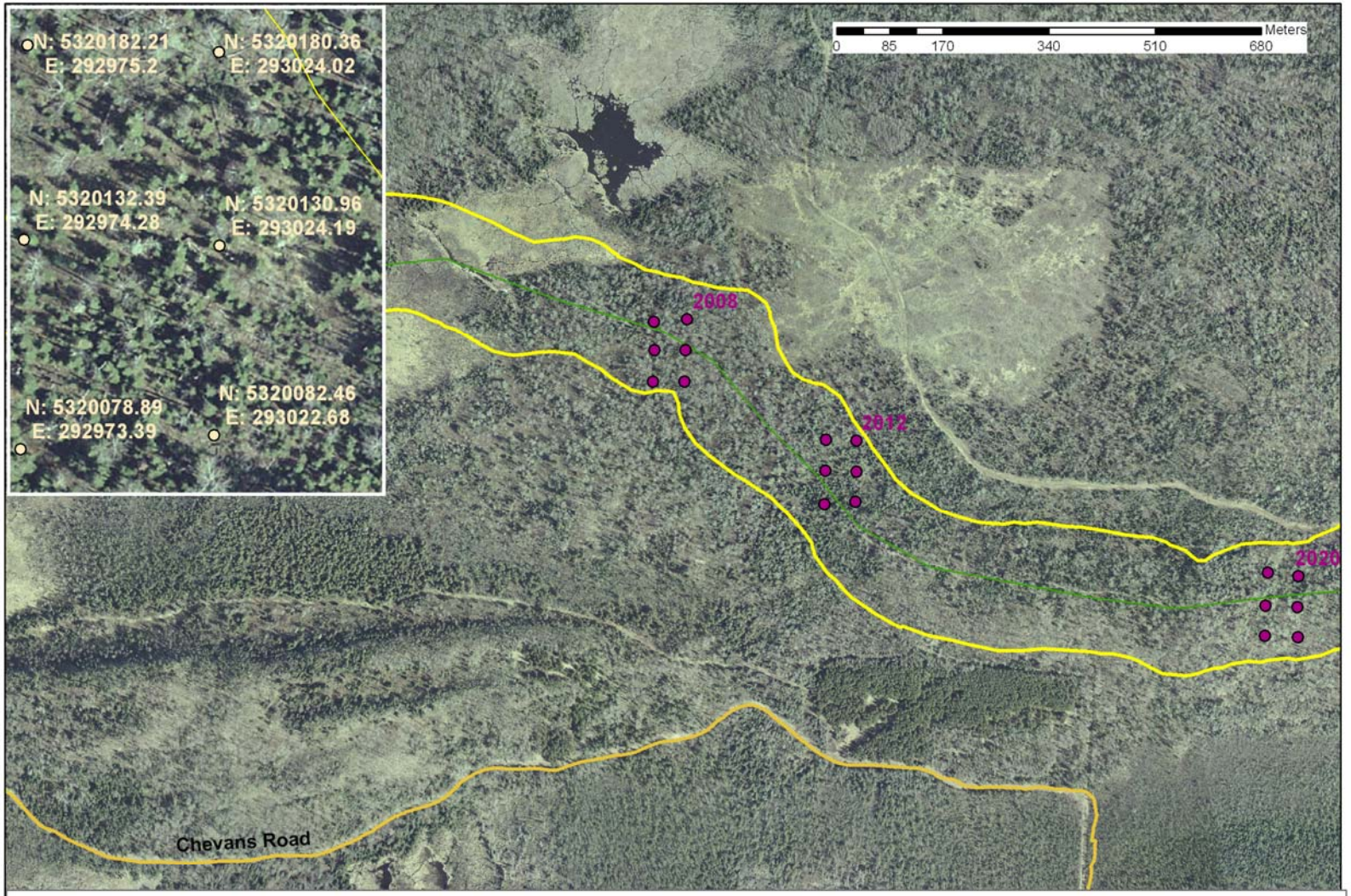


Plot 2011 Kotar Forest Type: AbPiAa (Abies-Picea-Betula/Aralia nudicaulis) Balsam fir-White spruce-Paper birch/Wild sarsaparilla



Plot 2011 Kotar Forest Type: AbPiAa (Abies-Picea-Betula/Aralia nudicaulis) Balsam fir-White spruce-Paper birch/Wild sarsaparilla



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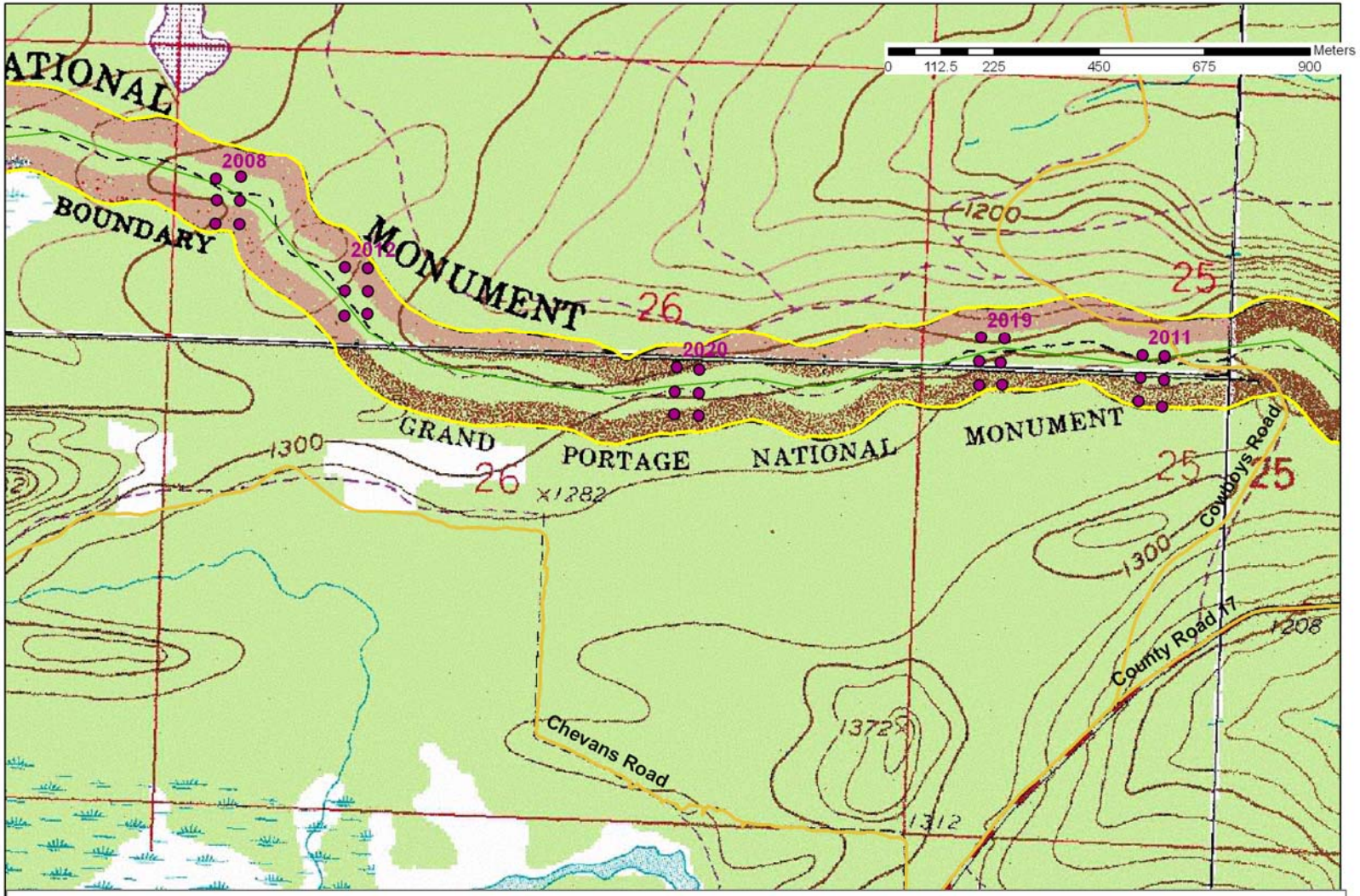

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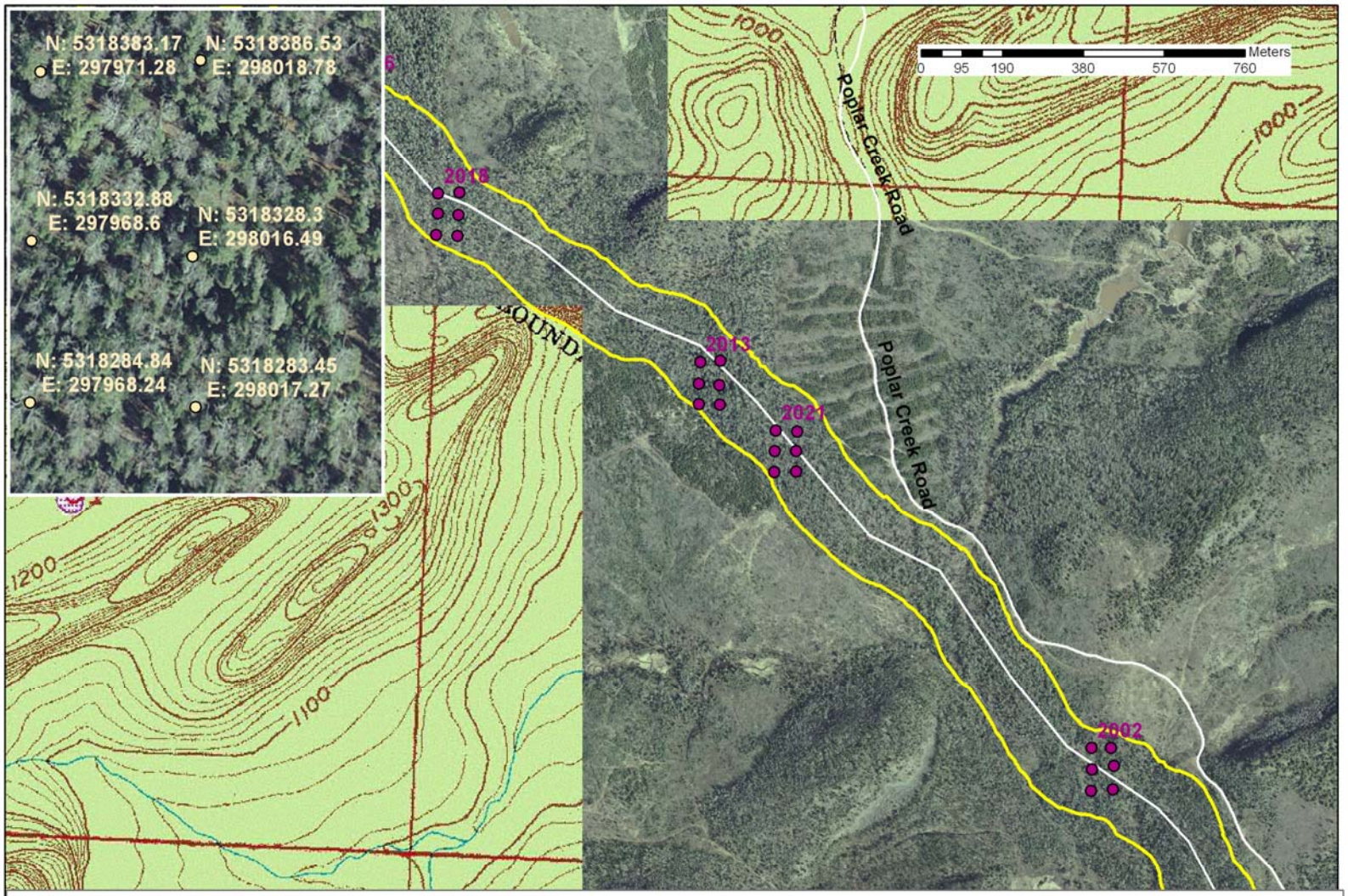
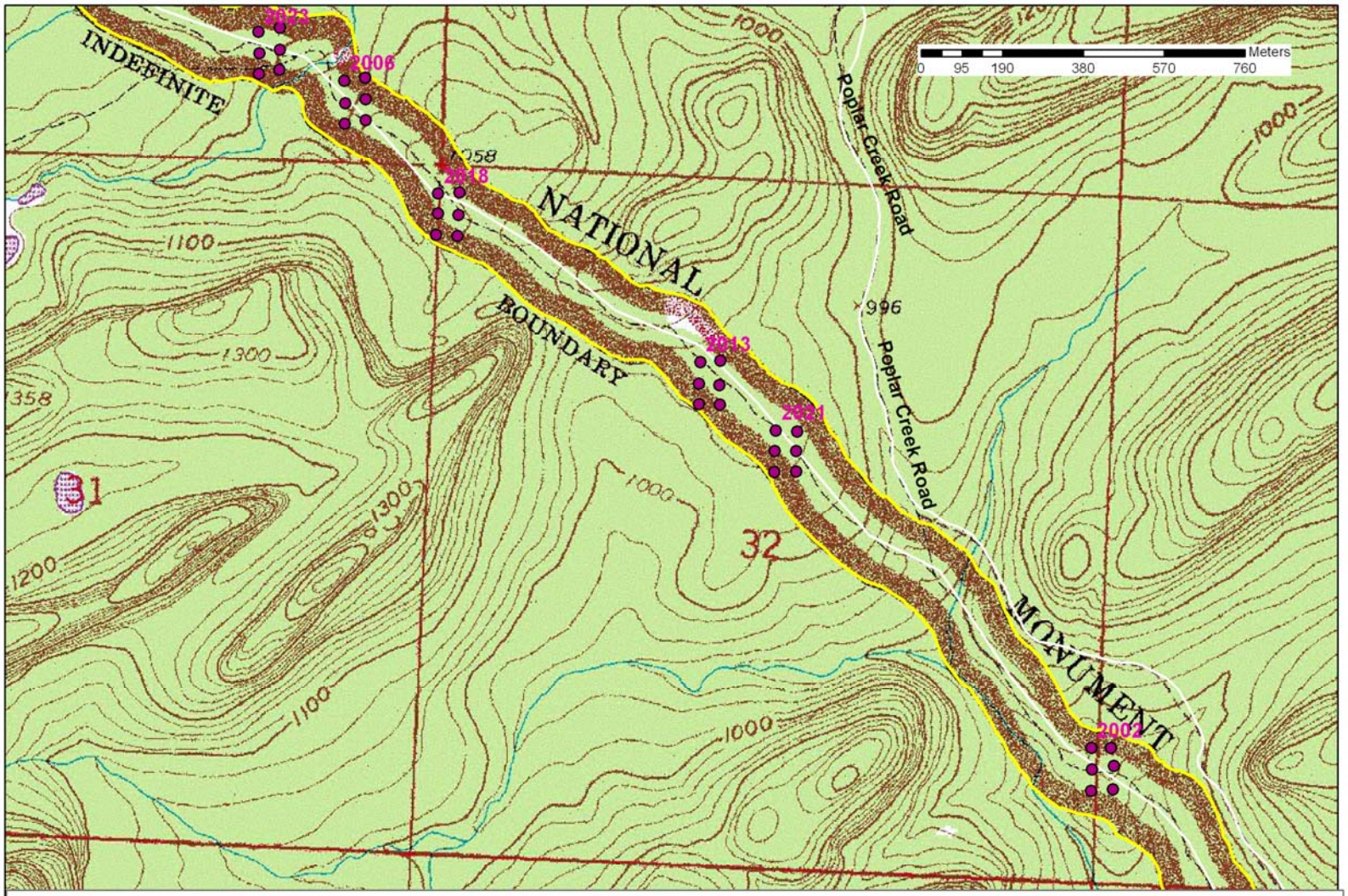


Plot 2013 Kotar Forest Type: AbPiAa (Abies-Picea-Betula/Aralia nudicaulis) Balsam fir-White spruce-Paper birch/Wild sarsaparilla

Navigate to this plot via Poplar Creek Rd.



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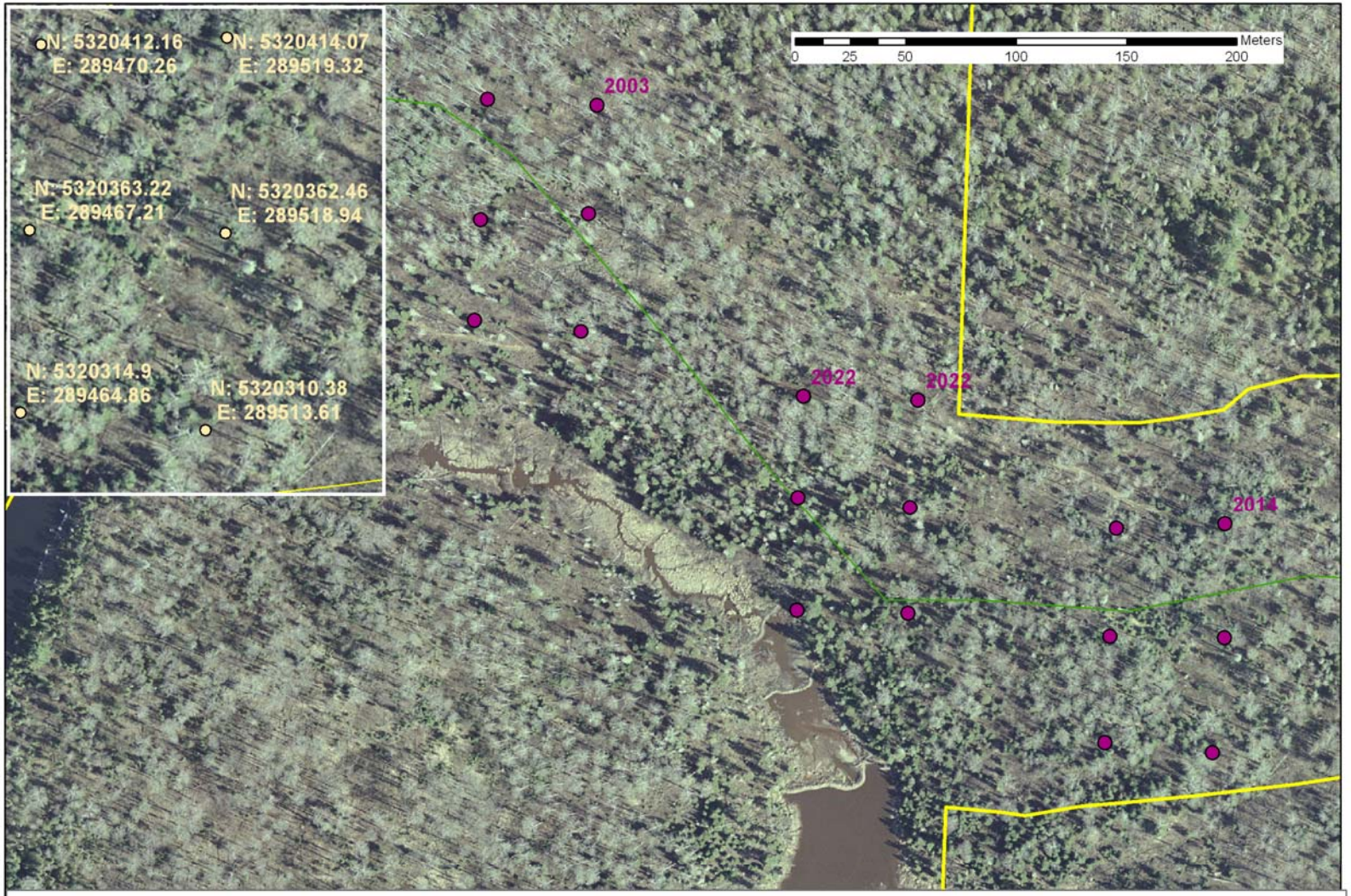

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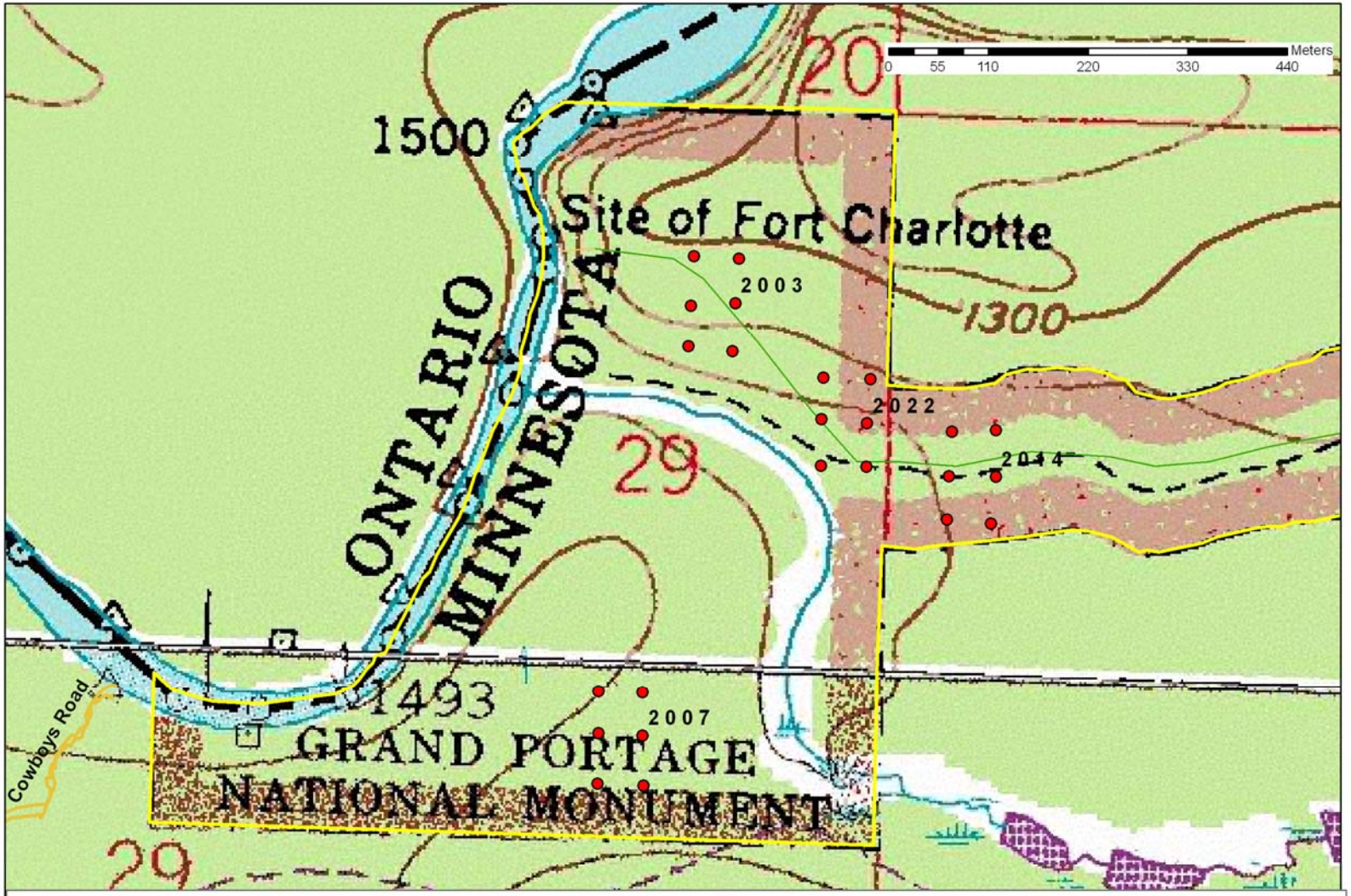

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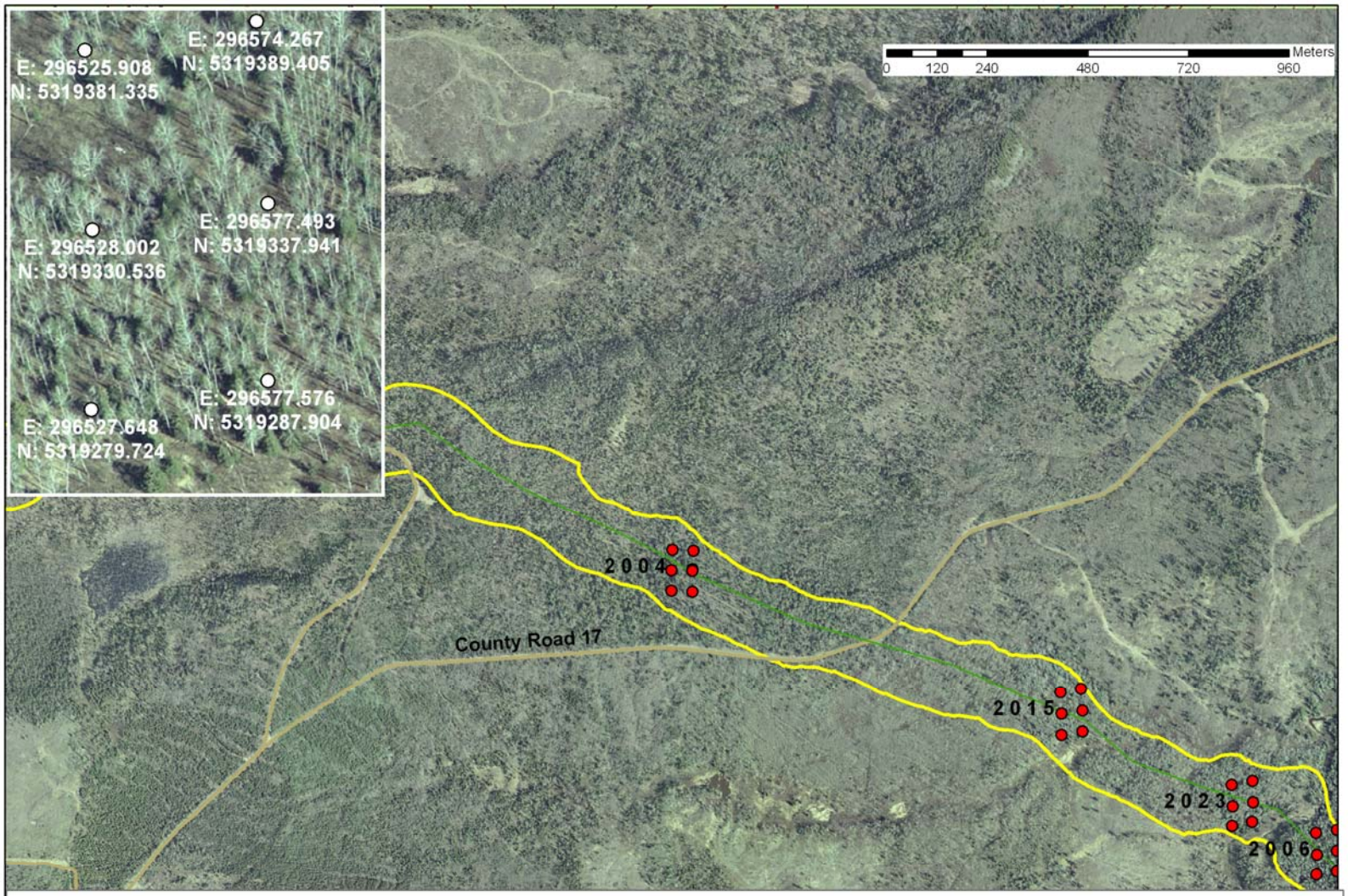
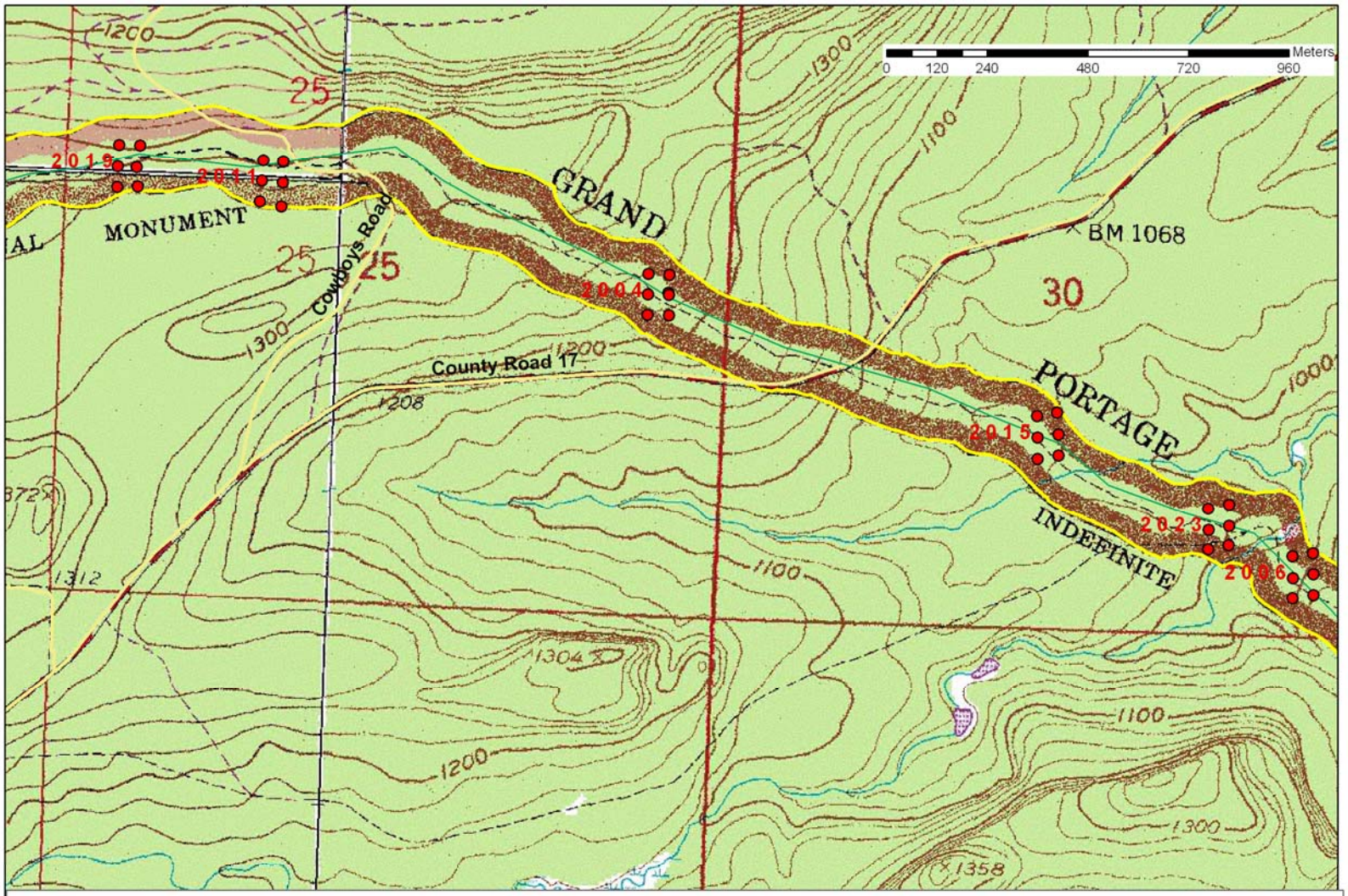
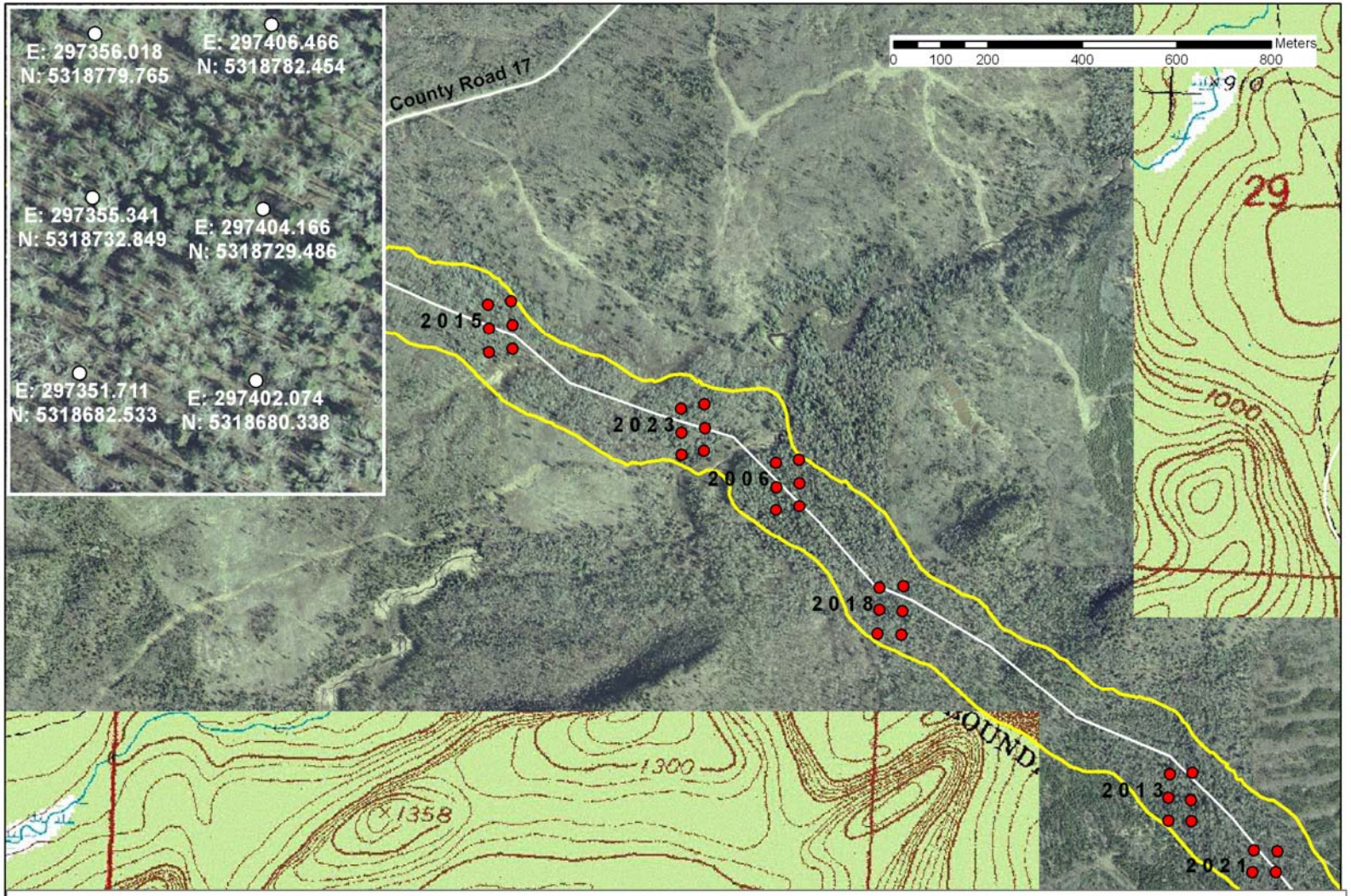


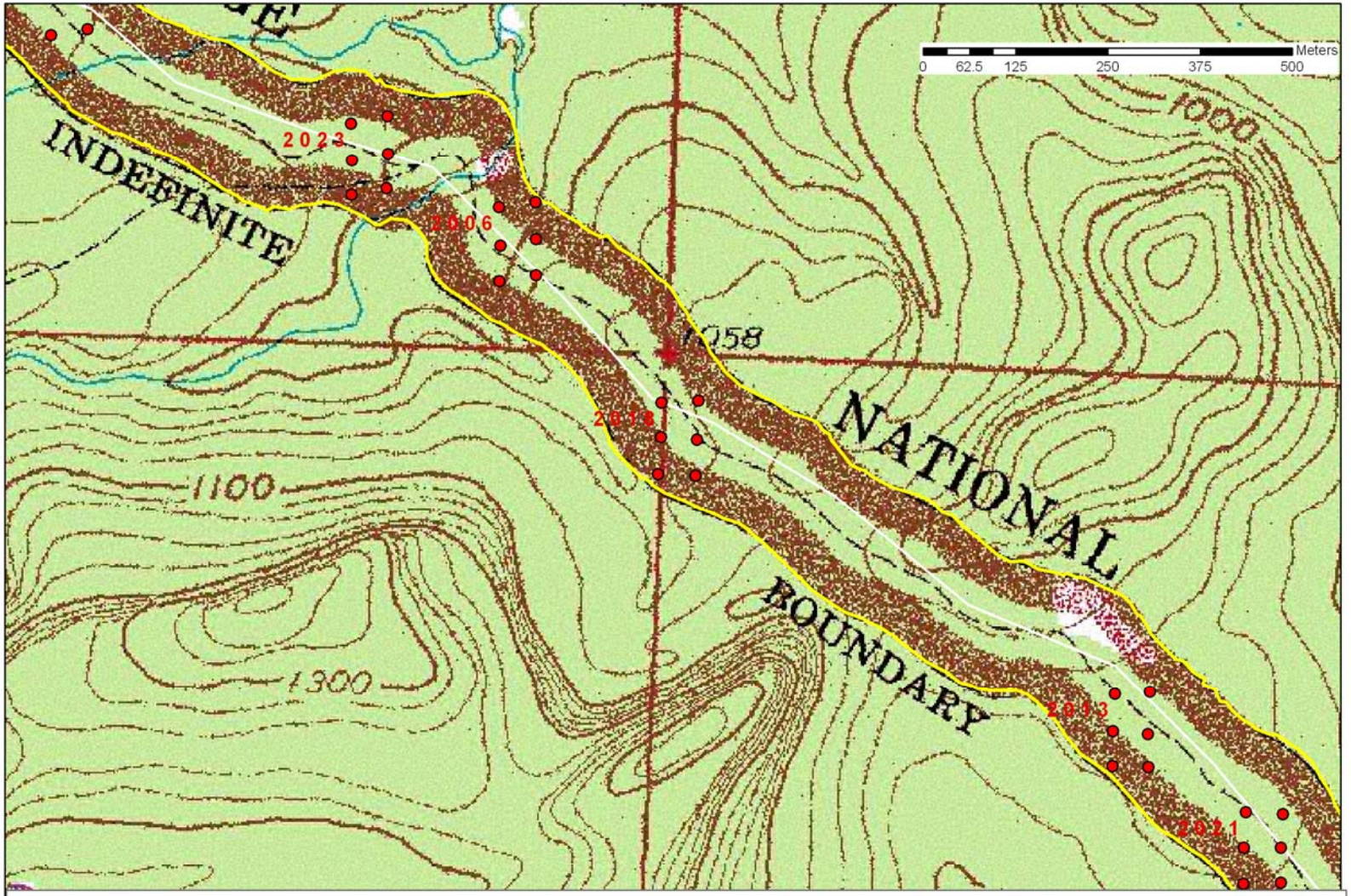
Plot 2015 Kotar Forest Type: AbPiAa (Abies-Picea-Betula/Aralia nudicaulis) Balsam fir-White spruce-Paper birch/Wild sarsaparilla



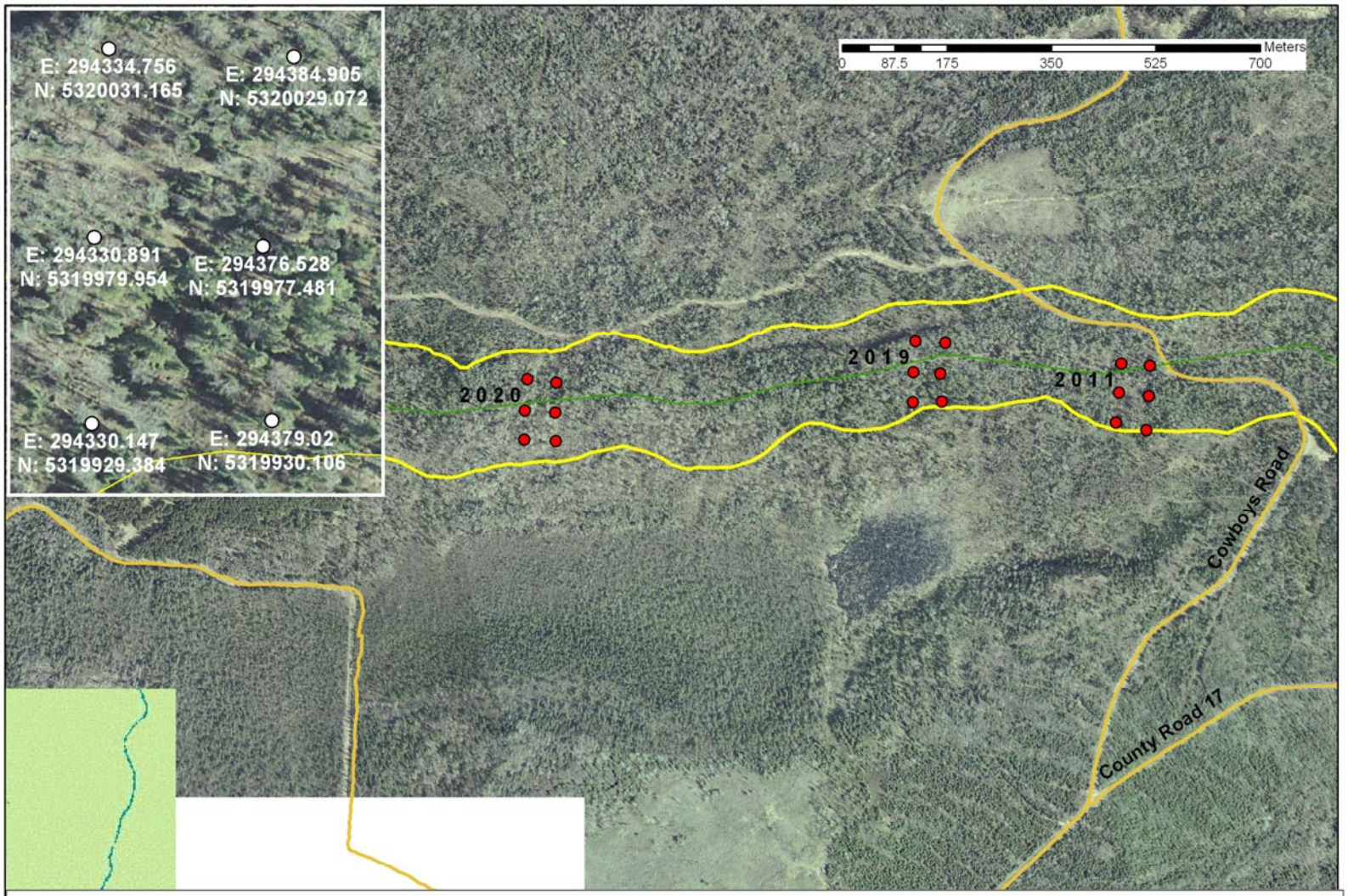
Plot 2015 Kotar Forest Type: AbPiAa (Abies-Picea-Betula/Aralia nudicaulis) Balsam fir-White spruce-Paper birch/Wild sarsaparilla



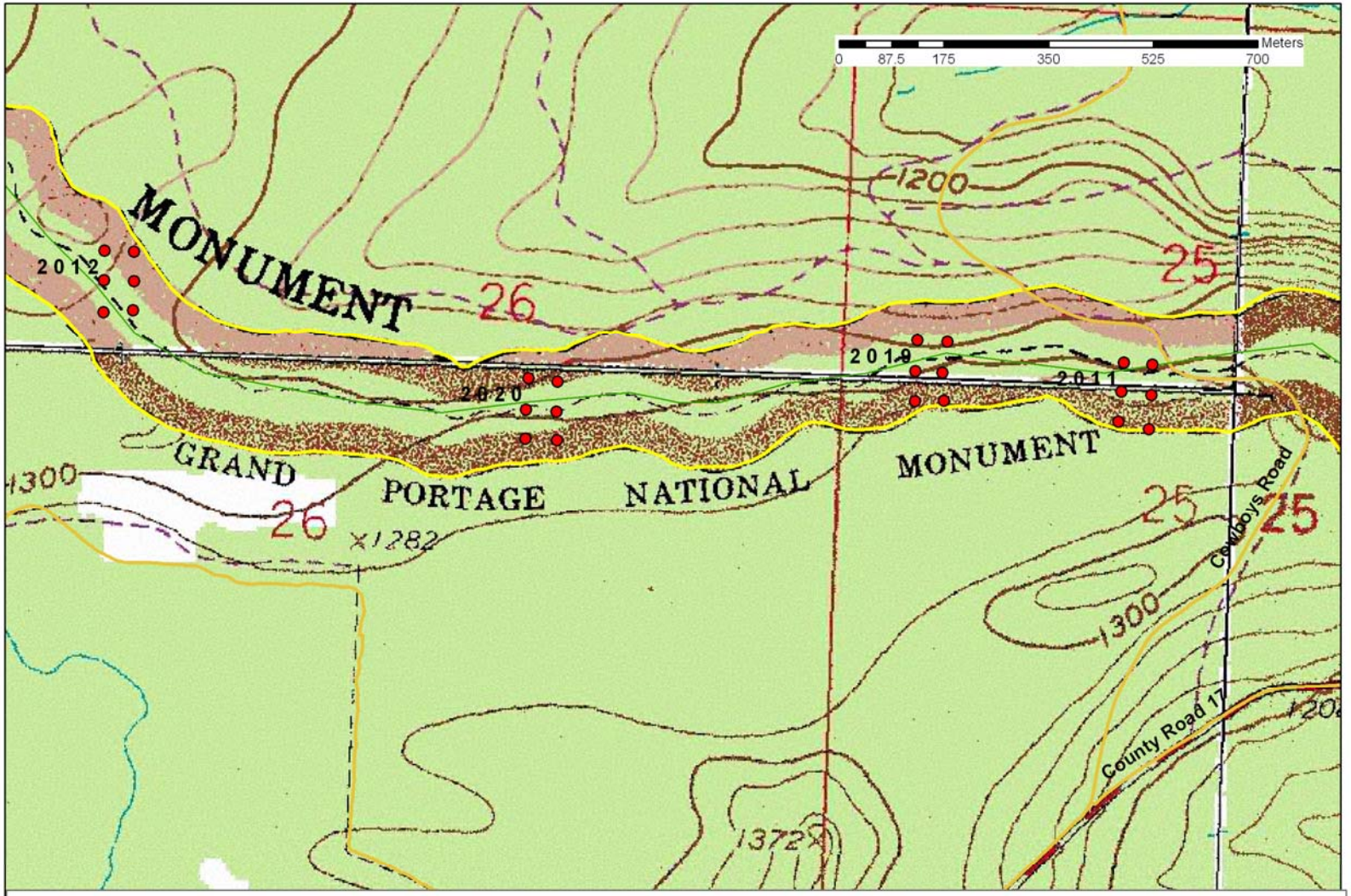
Plot 2018 Kotar Forest Type: AbPiAa (Abies-Picea-Betula/Aralia nudicaulis) Balsam fir-White spruce-Paper birch/Wild sarsaparilla



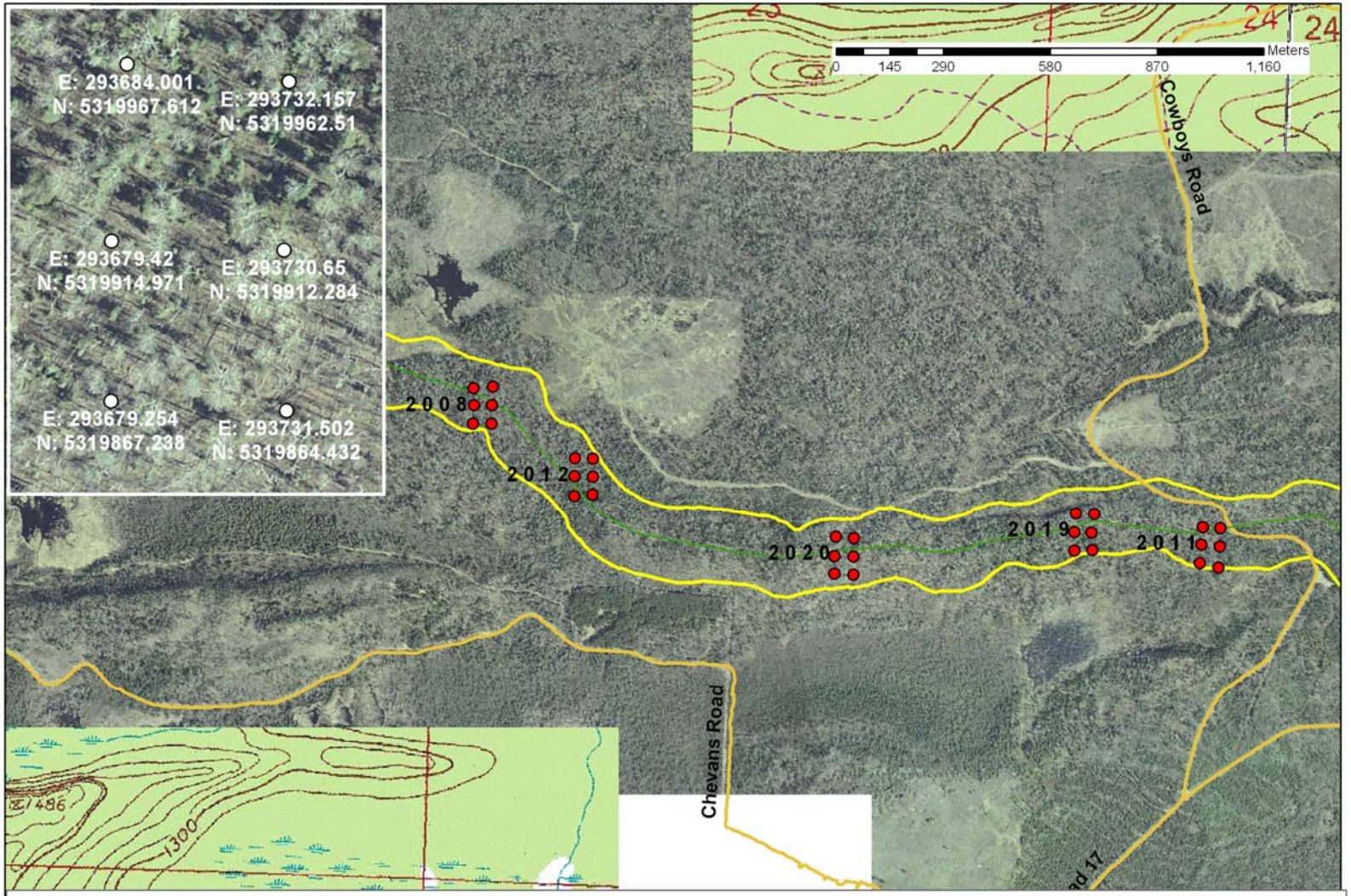
Plot 2018 Kotar Forest Type: AbPiAa (Abies-Picea-Betula/Aralia nudicaulis) Balsam fir-White spruce-Paper birch/Wild sarsaparilla



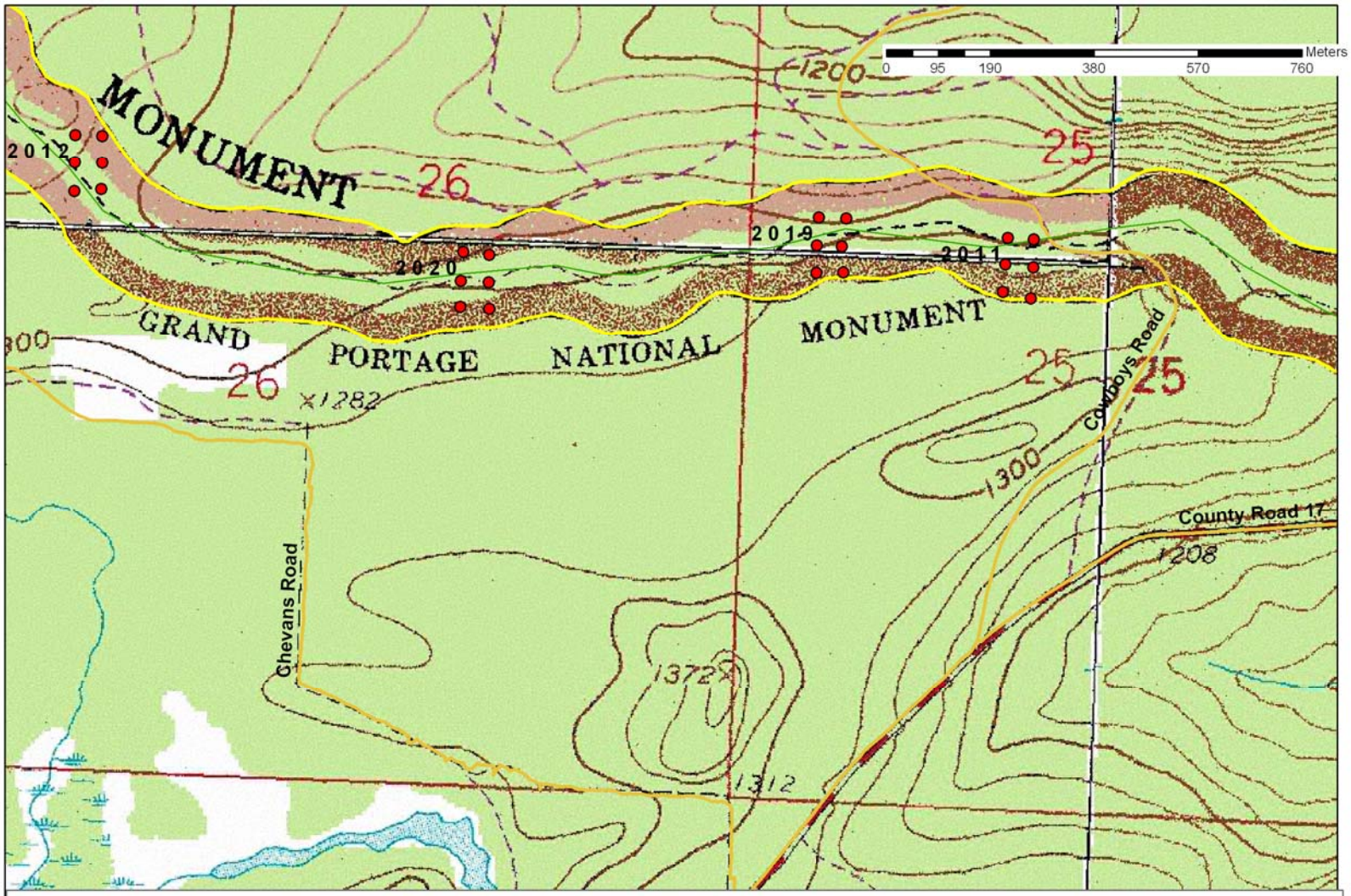
Plot 2019 Kotar Forest Type: AbPiAa (Abies-Picea-Betula/Aralia nudicaulis) Balsam fir-White spruce-Paper birch/Wild sarsaparilla



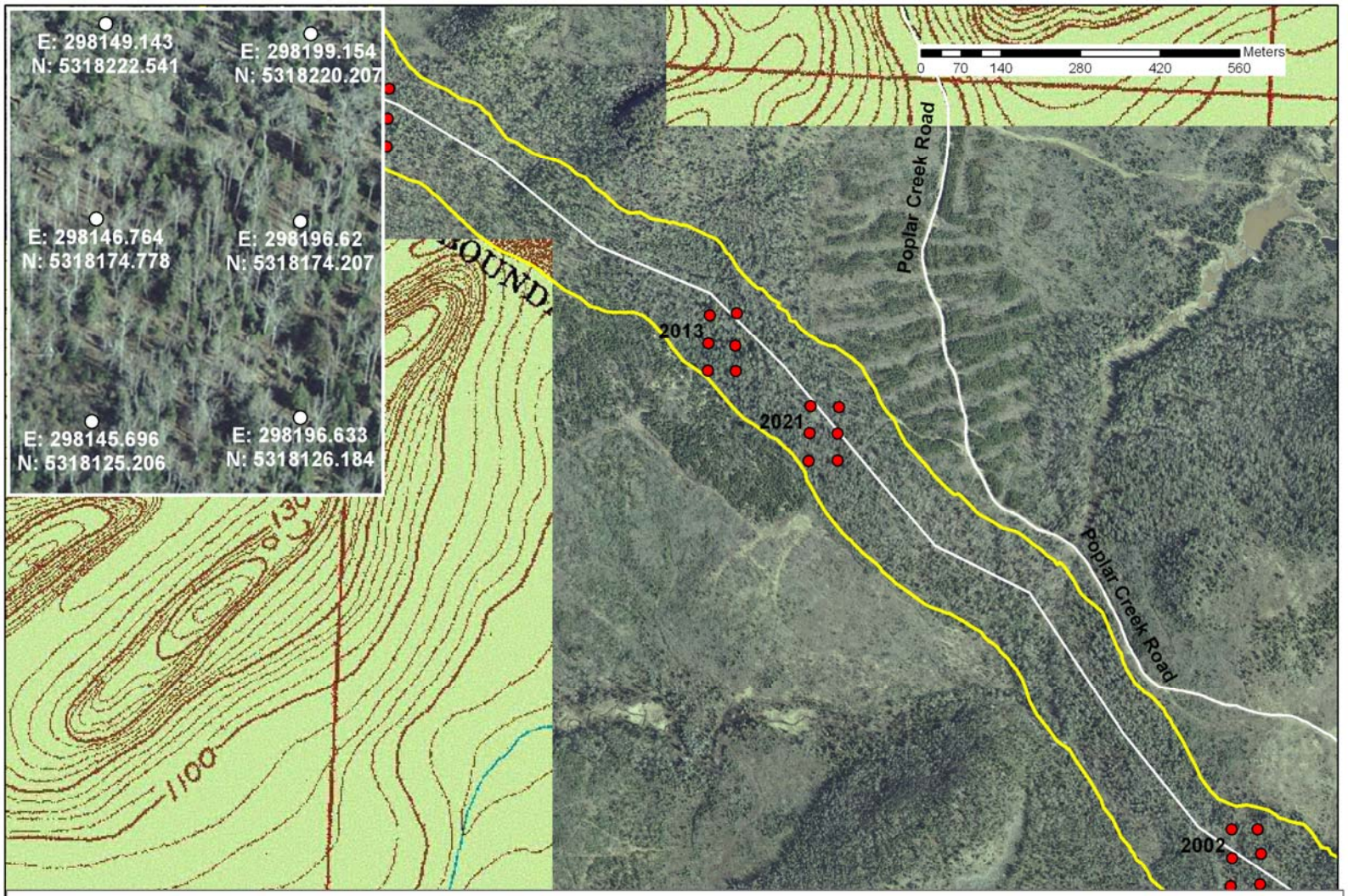
Plot 2019 Kotar Forest Type: AbPiAa (Abies-Picea-Betula/Aralia nudicaulis) Balsam fir-White spruce-Paper birch/Wild sarsaparilla



Plot 2020 Kotar Forest Type: AbPiAa (Abies-Picea-Betula/Aralia nudicaulis) Balsam fir-White spruce-Paper birch/Wild sarsaparilla

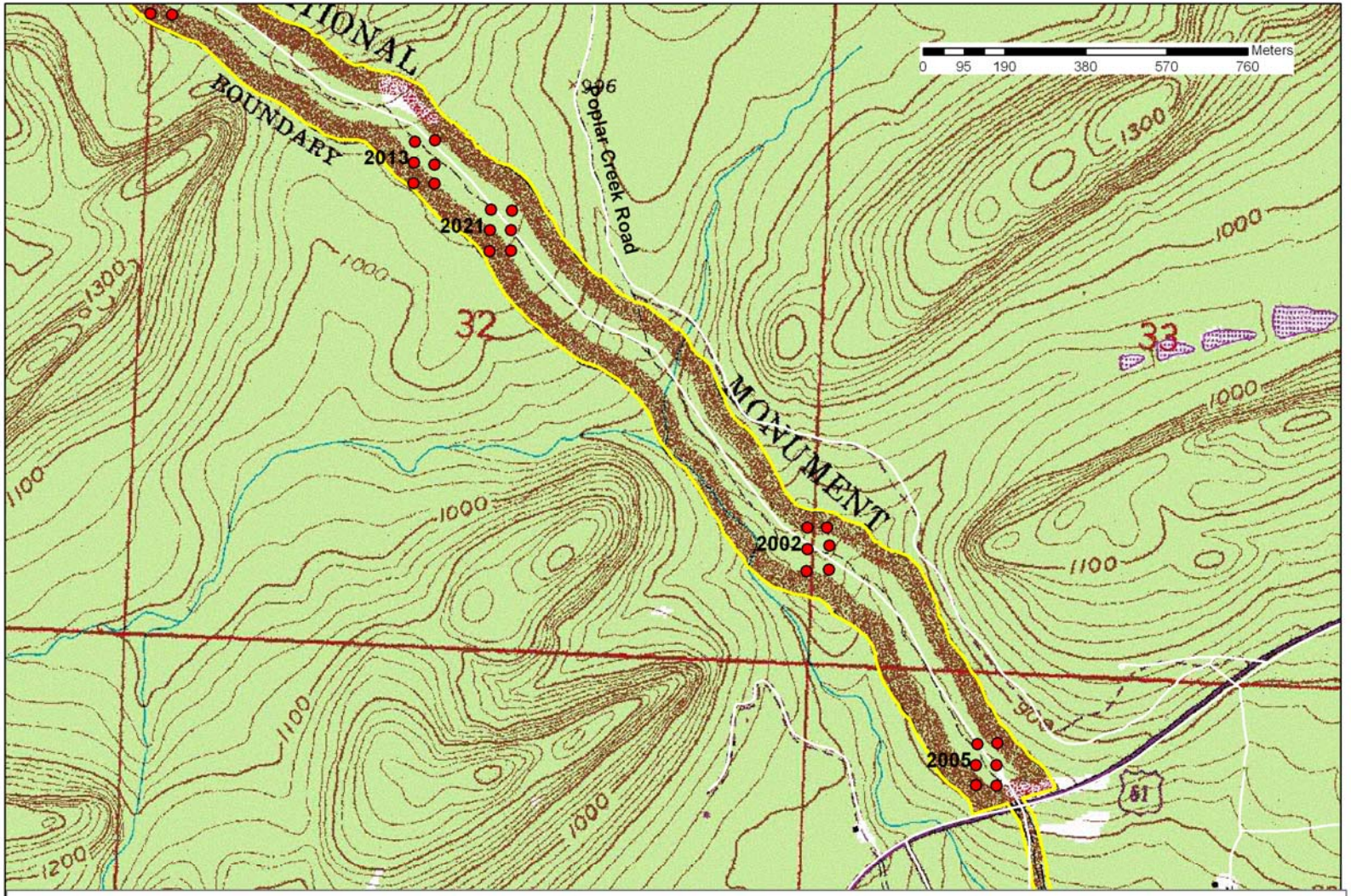


Plot 2020 Kotar Forest Type: AbPiAa (Abies-Picea-Betula/Aralia nudicaulis) Balsam fir-White spruce-Paper birch/Wild sarsaparilla



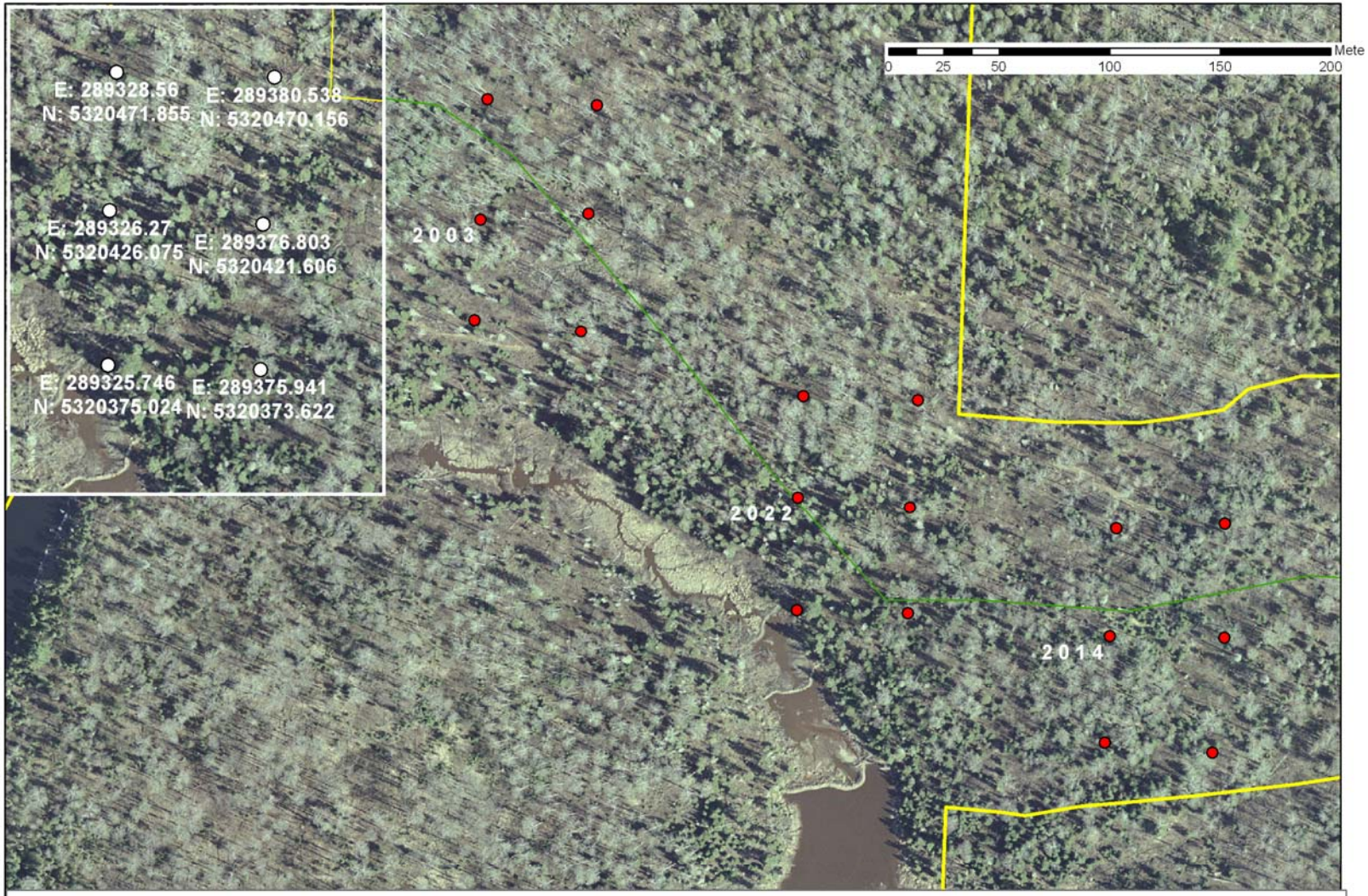
Plot 2021 Kotar Forest Type: AbPiAa (Abies-Picea-Betula/Aralia nudicaulis) Balsam fir-White spruce-Paper birch/Wild sarsaparilla

Navigate to this plot via Poplar Creek Rd.

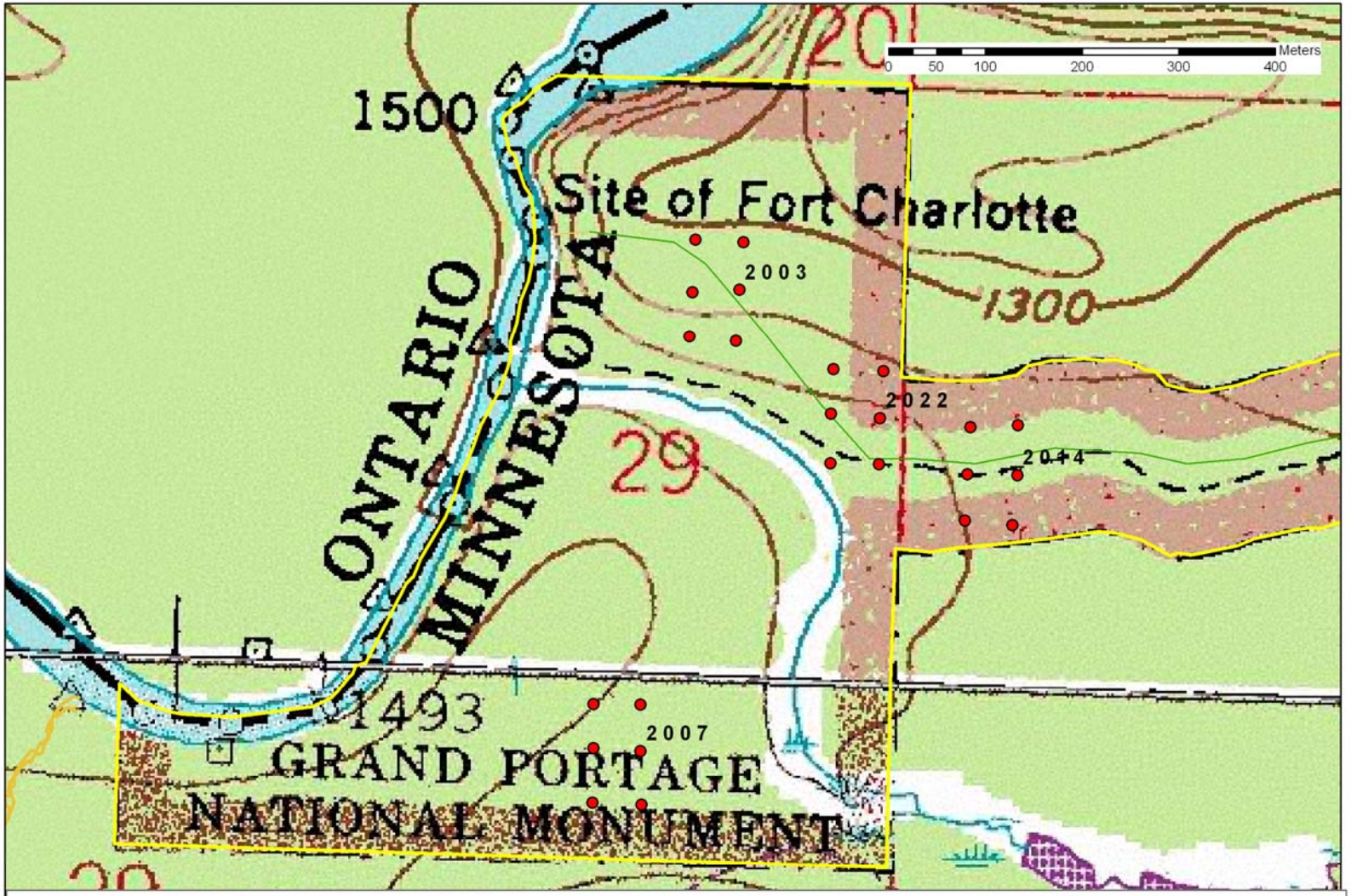


Plot 2021 Kotar Forest Type: AbPiAa (Abies-Picea-Betula/Aralia nudicaulis) Balsam fir-White spruce-Paper birch/Wild sarsaparilla

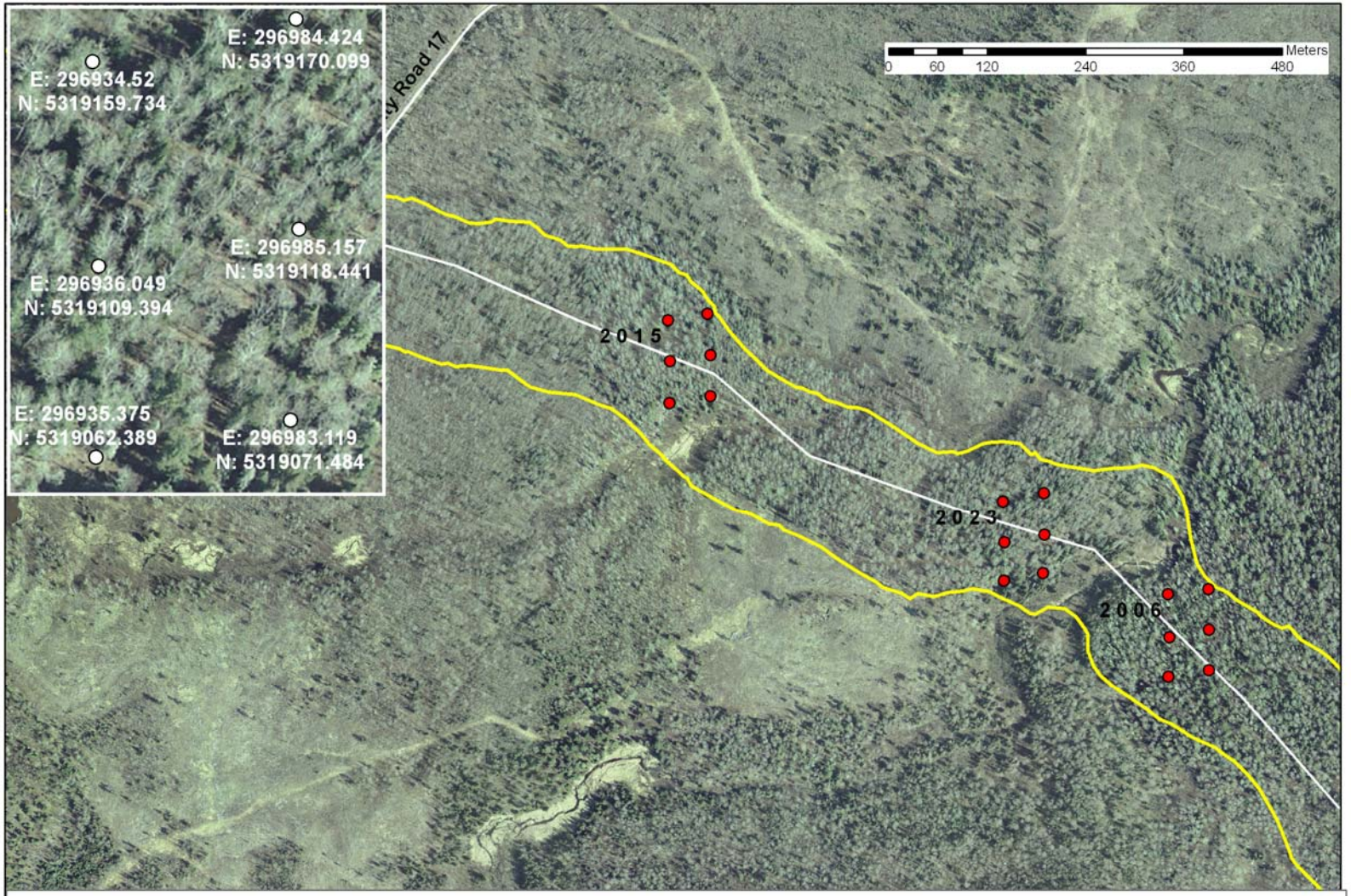
Navigate to this plot via Poplar Creek Rd.



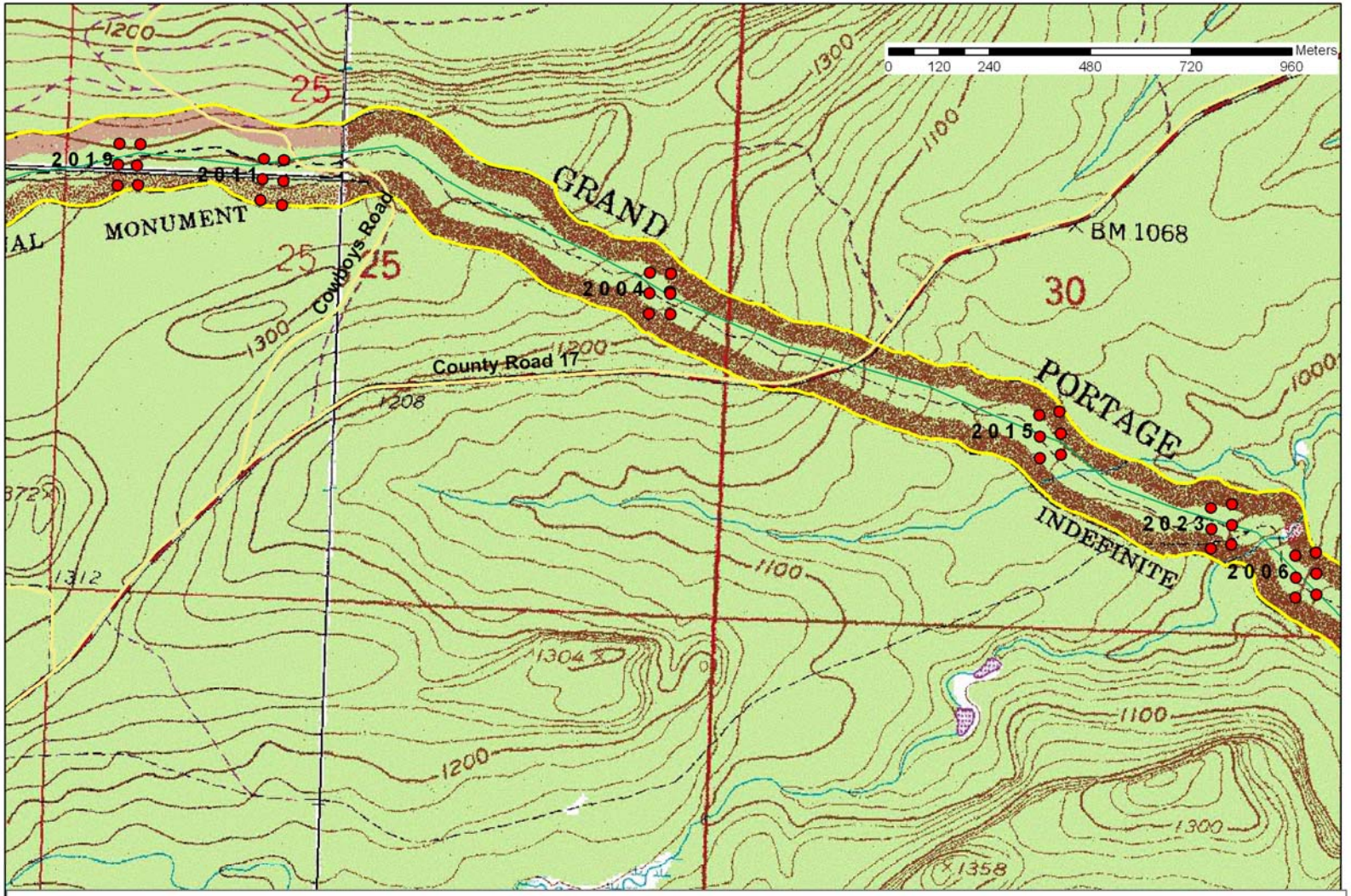
Plot 2022 Kotar Forest Type: AbPiAa (Abies-Picea-Betula/Aralia nudicaulis) Balsam fir-White spruce-Paper birch/Wild sarsaparilla



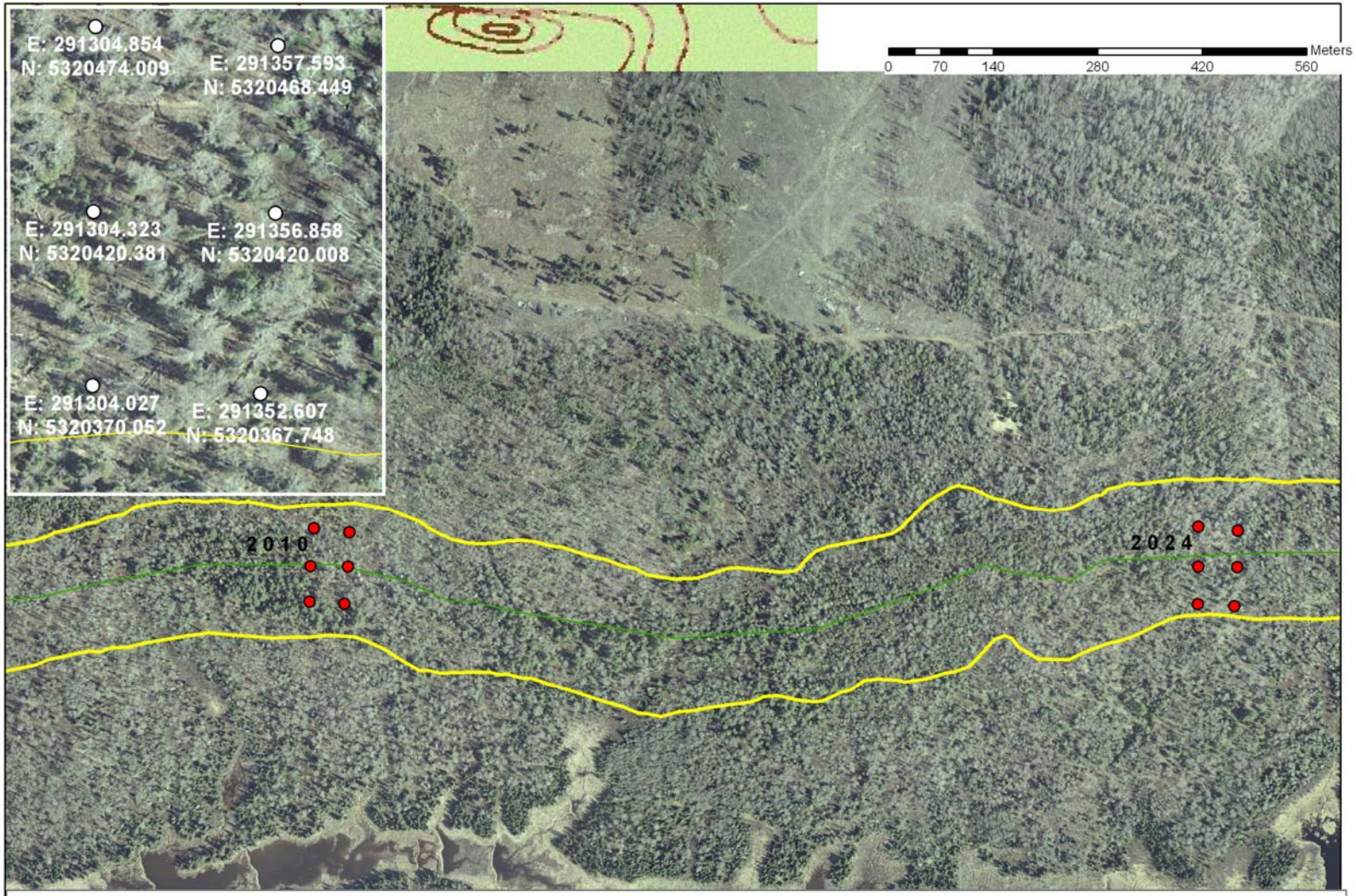
Plot 2022 Kotar Forest Type: AbPiAa (Abies-Picea-Betula/Aralia nudicaulis) Balsam fir-White spruce-Paper birch/Wild sarsaparilla



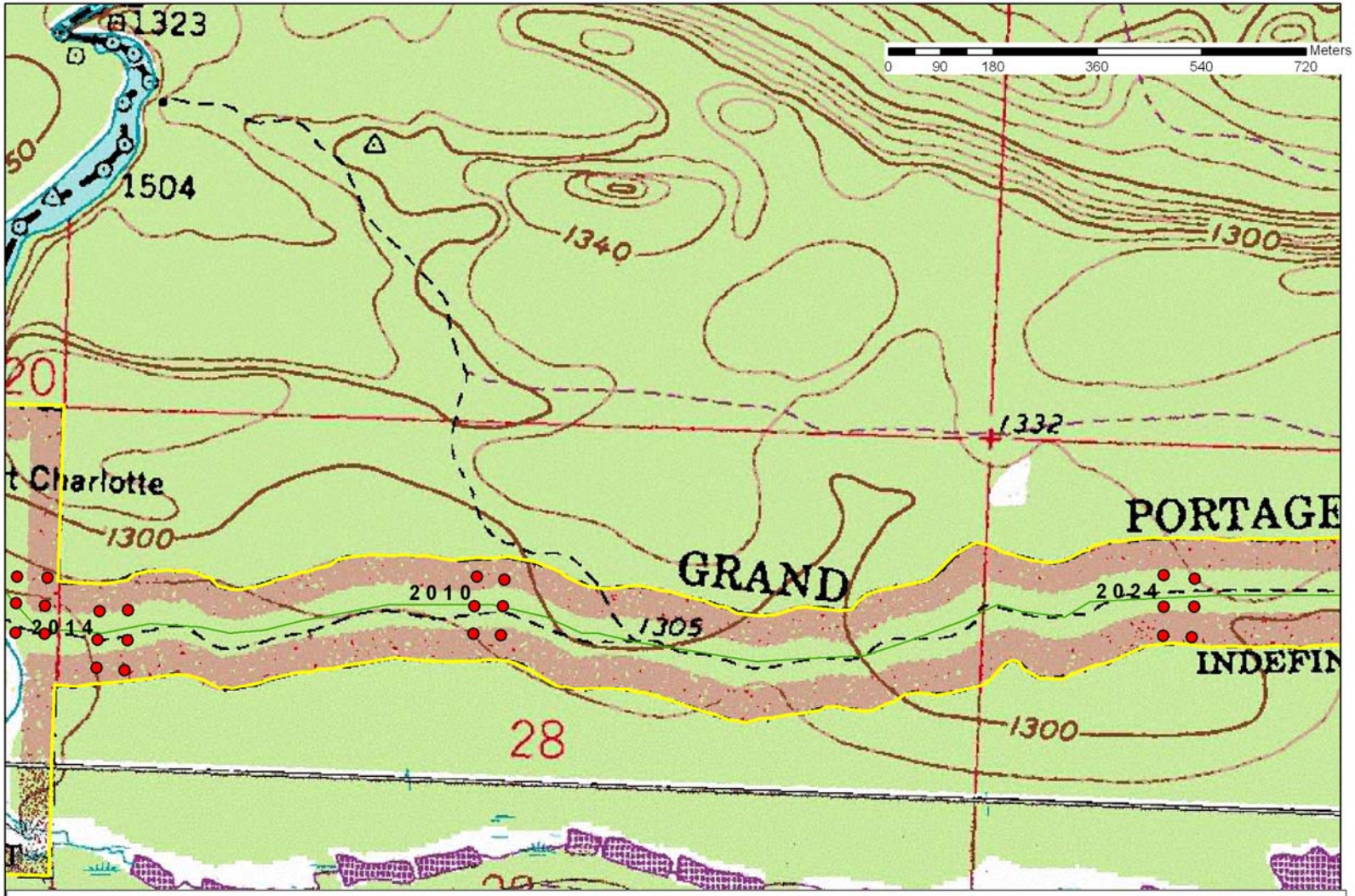
Plot 2023 Kotar Forest Type: AbPiAa (Abies-Picea-Betula/Aralia nudicaulis) Balsam fir-White spruce-Paper birch/Wild sarsaparilla



Plot 2023 Kotar Forest Type: AbPiAa (Abies-Picea-Betula/Aralia nudicaulis) Balsam fir-White spruce-Paper birch/Wild sarsaparilla



Plot 2024 Kotar Forest Type: AbPiAa (Abies-Picea-Betula/Aralia nudicaulis) Balsam fir-White spruce-Paper birch/Wild sarsaparilla



Plot 2024 Kotar Forest Type: AbPiAa (Abies-Picea-Betula/Aralia nudicaulis) Balsam fir-White spruce-Paper birch/Wild sarsaparilla

Appendix B

Complete Species List of Plants Sampled

Species Encountered during Site Visits - by Park

Park: GRPO Year: 2007

Species

HERB

Alismataceae
- Sagittaria latifolia

Apiaceae
- Cicuta bulbifera
- Heracleum maximum
- Osmorhiza longistylis
- Osmorhiza sp.
- Sanicula marilandica

Apocynaceae
- Apocynum androsaemifolium

Araliaceae
- Aralia nudicaulis

Aristolochiaceae
- Asarum canadense

Asteraceae
- Achillea millefolium
- Anaphalis margaritacea
- Cirsium sp.
- Eupatorium maculatum
- Eupatorium sp.
- Eurybia macrophylla
- Hieracium scabrum
- Hieracium sp.
- Lactuca sp.
- Leucanthemum vulgare
- Petasites frigidus var. palmatus
- Prenanthes alba
- Solidago simplex
- Solidago sp.
- Symphyotrichum puniceum var. puniceum
- Taraxacum officinale

Balsaminaceae
- Impatiens capensis

Boraginaceae
- Mertensia virginica

Brassicaceae
- Cardamine sp.

Caprifoliaceae
- Linnaea borealis ssp. americana

Cornaceae
- Cornus canadensis

Cyperaceae
- Carex crinita var. crinita
- Carex gracillima
- Carex intumescens
- Carex lacustris
- Carex norvegica
- Carex retrorsa
- Carex sp.
- Carex stipata
- Scirpus sp.

HERB

Dennstaedtiaceae
- Pteridium aquilinum var. latiusculum

Dryopteridaceae
- Athyrium filix-femina ssp. angustum
- Dryopteris carthusiana
- Dryopteris sp.
- Gymnocarpium dryopteris
- Onoclea sensibilis

Equisetaceae
- Equisetum pratense
- Equisetum sp.

Fabaceae
- Trifolium pratense
- Trifolium repens

Gentianaceae
- Halenia deflexa

Iridaceae
- Iris versicolor
- Sisyrinchium montanum

Lamiaceae
- Lycopus americanus
- Mentha arvensis
- Prunella vulgaris

Lemnaceae
- Lemna minor

Liliaceae
- Clintonia borealis
- Lilium philadelphicum
- Maianthemum canadense
- Polygonatum pubescens
- Streptopus amplexifolius
- Streptopus lanceolatus var. roseus
- Trillium cernuum

Lycopodiaceae
- Huperzia sp.
- Lycopodium annotinum
- Lycopodium clavatum
- Lycopodium complanatum
- Lycopodium sp.

Onagraceae
- Chamerion angustifolium
- Circaea alpina ssp. alpina

Orchidaceae
- Corallorhiza maculata

Osmundaceae
- Osmunda claytoniana

Papaveraceae
- Sanguinaria canadensis

Plantaginaceae
- Plantago major

Poaceae
- Oryzopsis asperifolia
- Phleum pratense

Species Encountered during Site Visits - by Park

HERB

Poaceae
- Poa compressa
- Poaceae sp.

Primulaceae
- Trientalis borealis

Pyrolaceae
- Moneses uniflora
- Orthilia secunda
- Pyrola asarifolia
- Pyrola minor

Ranunculaceae
- Actaea sp.
- Anemone canadensis
- Anemone quinquefolia var. quinquefolia
- Aquilegia canadensis
- Caltha palustris
- Coptis trifolia
- Ranunculus acris
- Ranunculus hispidus
- Ranunculus pensylvanicus
- Thalictrum dasycarpum

Rosaceae
- Agrimonia striata
- Fragaria virginiana
- Geum sp.
- Potentilla norvegica
- Potentilla sp.
- Rubus pensilvanicus

Rubiaceae
- Galium aparine
- Galium sp.
- Galium triflorum

Saxifragaceae
- Mitella nuda

Thelypteridaceae
- Phegopteris connectilis
- Thelypteris palustris

Violaceae
- Viola sp.

HERBACEOUS VINE

Fabaceae
- Lathyrus venosus
- Vicia americana
- Vicia villosa

SHRUB

Betulaceae
- Alnus incana ssp. rugosa
- Alnus viridis ssp. crispa
- Corylus cornuta var. cornuta

Caprifoliaceae
- Diervilla lonicera
- Lonicera canadensis
- Lonicera hirsuta

SHRUB

Caprifoliaceae
- Lonicera oblongifolia
- Sambucus racemosa
- Viburnum rafinesquianum

Cornaceae
- Cornus sericea

Cupressaceae
- Juniperus communis var. depressa

Ericaceae
- Vaccinium angustifolium
- Vaccinium myrtilloides

Grossulariaceae
- Ribes glandulosum
- Ribes hirtellum
- Ribes lacustre
- Ribes oxyacanthoides
- Ribes sp.
- Ribes triste

Rhamnaceae
- Rhamnus alnifolia

Rosaceae
- Amelanchier sp.
- Rosa acicularis
- Rosa blanda
- Rubus idaeus ssp. strigosus
- Rubus parviflorus
- Rubus pubescens

Salicaceae
- Salix sp.

Taxaceae
- Taxus canadensis

TREE

Aceraceae
- Acer rubrum
- Acer saccharum
- Acer spicatum

Betulaceae
- Betula papyrifera

Cupressaceae
- Thuja occidentalis

Oleaceae
- Fraxinus nigra

Pinaceae
- Abies balsamea
- Picea glauca
- Picea mariana
- Pinus strobus

Rosaceae
- Crataegus douglasii
- Prunus virginiana
- Sorbus decora

Species Encountered during Site Visits - by Park

TREE

Salicaceae

Populus balsamifera
Populus tremuloides
Salix bebbiana
Salix sp.

Ulmaceae

Ulmus americana

Appendix C

Individual Plot Data

Density and Basal Area of Tree Species (Live trees)

Plot: 2002

Species	Density (individuals / ha)	Basal Area (m²/ ha)
hardwood		
Acer spicatum	122.2	0.1
Betula papyrifera	166.7	2.0
Populus tremuloides	288.9	14.0
Prunus virginiana	11.1	0.0
softwood		
Abies balsamea	1700.0	11.5
Picea glauca	22.2	0.5
TOTAL	**2,311.1**	**28.2**

Plot: 2003

Species	Density (individuals / ha)	Basal Area (m²/ ha)
hardwood		
Acer spicatum	77.8	0.1
Betula papyrifera	88.9	1.7
Fraxinus nigra	122.2	1.4
Populus tremuloides	733.3	3.5
Prunus virginiana	11.1	0.0
Salix sp.	11.1	0.0
Sorbus decora	11.1	0.0
softwood		
Abies balsamea	377.8	2.0
Picea glauca	11.1	0.0
TOTAL	**1,444.4**	**8.8**

Plot: 2004

Species	Density (individuals / ha)	Basal Area (m²/ ha)
hardwood		
Acer spicatum	588.9	0.6
Betula papyrifera	100.0	0.8
Fraxinus nigra	11.1	0.0
Populus balsamifera	11.1	0.2
Populus tremuloides	211.1	15.5
softwood		
Abies balsamea	588.9	4.0
Picea glauca	44.4	1.7
Pinus strobus	55.6	7.6
Thuja occidentalis	11.1	1.5
TOTAL	**1,622.2**	**31.8**

Plot: 2005

Species	Density (individuals / ha)	Basal Area (m²/ ha)
hardwood		
Acer saccharum	11.1	0.0
Acer spicatum	122.2	0.2
Betula papyrifera	155.6	1.9
Populus tremuloides	266.7	12.6
Prunus virginiana	44.4	0.0
softwood		
Abies balsamea	1022.2	11.2
Picea glauca	211.1	4.4
Pinus strobus	33.3	1.7
TOTAL	**1,866.7**	**32.1**

Plot: 2006

Species	Density (individuals / ha)	Basal Area (m²/ ha)
hardwood		
Acer spicatum	300.0	0.4
Betula papyrifera	144.4	4.6
Populus tremuloides	100.0	11.4
Sorbus decora	11.1	0.0
softwood		
Abies balsamea	1500.0	7.7
Picea glauca	188.9	1.7
TOTAL	**2,244.4**	**25.9**

Plot: 2007

Species	Density (individuals / ha)	Basal Area (m²/ ha)
hardwood		
Acer rubrum	66.7	0.1
Acer spicatum	166.7	0.2
Betula papyrifera	100.0	2.7
Populus tremuloides	66.7	10.1
softwood		
Abies balsamea	344.4	1.2
Picea mariana	22.2	0.5
Thuja occidentalis	77.8	4.8
TOTAL	**844.4**	**19.5**

Plot: 2008

Species	Density (individuals / ha)	Basal Area (m²/ ha)
hardwood		
Acer spicatum	355.6	0.5
Betula papyrifera	111.1	2.4
Fraxinus nigra	44.4	0.1
Populus tremuloides	155.6	17.5
Ulmus americana	11.1	0.0
softwood		
Abies balsamea	833.3	3.8
Picea glauca	22.2	1.3
TOTAL	**1,533.3**	**25.7**

Plot: 2010

Species	Density (individuals / ha)	Basal Area (m²/ ha)
hardwood		
Acer spicatum	11.1	0.0
Betula papyrifera	100.0	2.4
Fraxinus nigra	77.8	0.3
Populus tremuloides	233.3	14.1
softwood		
Abies balsamea	266.7	0.8
Picea glauca	55.6	0.7
Pinus strobus	22.2	4.9
Thuja occidentalis	88.9	2.7
TOTAL	**855.6**	**26.0**

Plot: 2011

Species	Density (individuals / ha)	Basal Area (m²/ ha)
hardwood		
Acer spicatum	566.7	0.6
Betula papyrifera	66.7	2.8
Fraxinus nigra	111.1	1.3
Populus tremuloides	166.7	6.2
Prunus virginiana	11.1	0.0
softwood		
Abies balsamea	611.1	2.8
Picea glauca	88.9	5.1
Pinus strobus	11.1	2.3
TOTAL	**1,633.3**	**21.1**

Plot: 2012

Species	Density (individuals / ha)	Basal Area (m²/ ha)
hardwood		
Acer spicatum	211.1	0.2
Betula papyrifera	77.8	2.8
Populus tremuloides	422.2	5.0
softwood		
Abies balsamea	977.8	7.4
Picea glauca	33.3	0.1
TOTAL	**1,722.2**	**15.5**

Plot: 2013

Species	Density (individuals / ha)	Basal Area (m²/ ha)
hardwood		
Acer spicatum	377.8	0.5
Betula papyrifera	22.2	0.6
Populus tremuloides	66.7	5.4
softwood		
Abies balsamea	1000.0	4.3
Picea glauca	77.8	4.8
Pinus strobus	66.7	9.7
Thuja occidentalis	55.6	3.3
TOTAL	**1,666.7**	**28.5**

Plot: 2014

Species	Density (individuals / ha)	Basal Area (m²/ ha)
hardwood		
Acer spicatum	44.4	0.0
Betula papyrifera	22.2	0.1
Populus tremuloides	100.0	11.7
softwood		
Abies balsamea	1277.8	10.1
Picea glauca	11.1	0.4
TOTAL	**1,455.6**	**22.4**

Plot: 2015

Species	Density (individuals / ha)	Basal Area (m²/ ha)
hardwood		
Acer spicatum	222.2	0.2
Betula papyrifera	188.9	3.4
Fraxinus nigra	22.2	0.0
Populus tremuloides	144.4	14.4
softwood		
Abies balsamea	233.3	10.5
Picea glauca	22.2	0.5
TOTAL	**833.3**	**29.1**

Plot: 2018

Species	Density (individuals / ha)	Basal Area (m²/ ha)
hardwood		
Acer spicatum	422.2	0.5
Betula papyrifera	200.0	8.2
Populus tremuloides	77.8	11.9
softwood		
Abies balsamea	511.1	7.8
Picea glauca	55.6	2.2
TOTAL	**1,266.7**	**30.5**

Plot: 2019

Species	Density (individuals / ha)	Basal Area (m²/ ha)
hardwood		
Acer spicatum	411.1	0.5
Betula papyrifera	122.2	2.0
Populus tremuloides	233.3	3.1
Prunus virginiana	11.1	0.0
Sorbus decora	22.2	0.0
softwood		
Abies balsamea	800.0	3.8
Picea glauca	33.3	2.9
Pinus strobus	33.3	2.9
TOTAL	**1,666.7**	**15.3**

Plot: 2020

Species	Density (individuals / ha)	Basal Area (m²/ ha)
hardwood		
Acer spicatum	466.7	0.5
Betula papyrifera	100.0	1.7
Populus tremuloides	322.2	4.7
Prunus virginiana	22.2	0.2
softwood		
Abies balsamea	366.7	2.2
Picea glauca	122.2	1.7
TOTAL	**1,400.0**	**11.0**

Plot: 2021

Species	Density (individuals / ha)	Basal Area (m²/ ha)
hardwood		
Acer spicatum	433.3	0.6
Betula papyrifera	88.9	2.6
Populus tremuloides	300.0	19.3
softwood		
Abies balsamea	711.1	7.2
Picea glauca	44.4	1.3
Pinus strobus	11.1	0.5
Thuja occidentalis	33.3	0.2
TOTAL	**1,622.2**	**31.8**

Plot: 2022

Species	Density (individuals / ha)	Basal Area (m²/ ha)
hardwood		
Acer spicatum	55.6	0.0
Betula papyrifera	122.2	1.9
Populus tremuloides	144.4	8.8
Prunus virginiana	11.1	0.0
Salix sp.	11.1	0.0
Sorbus decora	11.1	0.0
softwood		
Abies balsamea	722.2	4.4
Picea mariana	111.1	3.9
TOTAL	**1,188.9**	**19.1**

Plot: 2023

Species	Density (individuals / ha)	Basal Area (m²/ ha)
hardwood		
Acer spicatum	77.8	0.1
Betula papyrifera	44.4	0.4
Populus tremuloides	188.9	18.3
Prunus virginiana	11.1	0.0
Sorbus decora	11.1	0.0
softwood		
Abies balsamea	366.7	6.7
Picea glauca	177.8	3.0
Pinus strobus	33.3	4.0
TOTAL	**911.1**	**32.6**

Plot: 2024

Species	Density (individuals / ha)	Basal Area (m²/ ha)
hardwood		
Acer spicatum	288.9	0.4
Betula papyrifera	133.3	4.4
Fraxinus nigra	200.0	2.0
Populus tremuloides	411.1	12.4
Prunus virginiana	22.2	0.0
softwood		
Abies balsamea	322.2	4.9
Picea mariana	55.6	3.7
Thuja occidentalis	33.3	1.3
TOTAL	**1,466.7**	**29.1**

Density and Basal Area of Tree Species (Dead trees)

Plot: 2002

Species	Density (individuals / ha)	Basal Area (m²/ ha)
hardwood		
Acer spicatum	22.2	0.0
Betula papyrifera	111.1	2.1
Populus tremuloides	133.3	5.5
softwood		
Abies balsamea	44.4	0.0
softwood / hardwood		
unknown dead tree	133.3	0.4
TOTAL	**444.4**	**8.1**

Plot: 2003

Species	Density (individuals / ha)	Basal Area (m²/ ha)
hardwood		
Acer spicatum	133.3	0.3
Populus tremuloides	11.1	1.3
softwood / hardwood		
unknown dead tree	88.9	2.5
TOTAL	**233.3**	**4.1**

Plot: 2004

Species	Density (individuals / ha)	Basal Area (m²/ ha)
hardwood		
Acer spicatum	88.9	0.1
Betula papyrifera	166.7	4.0
Populus tremuloides	133.3	12.1
softwood		
Abies balsamea	11.1	0.4
softwood / hardwood		
unknown dead tree	33.3	0.5
TOTAL	**433.3**	**17.1**

Plot: 2005

Species	Density (individuals / ha)	Basal Area (m²/ ha)
hardwood		
Acer spicatum	33.3	0.0
Betula papyrifera	22.2	0.2
Populus tremuloides	44.4	0.5
softwood		
Abies balsamea	55.6	1.2
Picea glauca	66.7	3.0
softwood / hardwood		
unknown dead tree	66.7	1.3
TOTAL	**288.9**	**6.3**

Plot: 2006

Species	Density (individuals / ha)	Basal Area (m²/ ha)
hardwood		
Acer spicatum	11.1	0.0
Betula papyrifera	77.8	3.9
Populus tremuloides	11.1	1.4
softwood		
Abies balsamea	55.6	1.7
Picea glauca	22.2	1.2
Pinus strobus	22.2	2.7
softwood / hardwood		
unknown dead tree	77.8	3.0
TOTAL	**277.8**	**13.8**

Plot: 2007

Species	Density (individuals / ha)	Basal Area (m²/ ha)
hardwood		
Acer rubrum	33.3	0.0
Acer spicatum	33.3	0.1
Betula papyrifera	11.1	0.2
Populus tremuloides	22.2	3.5
softwood / hardwood		
unknown dead tree	188.9	6.1
TOTAL	**288.9**	**9.8**

Plot: 2008

Species	Density (individuals / ha)	Basal Area (m²/ ha)
hardwood		
Acer spicatum	66.7	0.2
Populus tremuloides	44.4	3.7
softwood		
Abies balsamea	11.1	0.0
TOTAL	**122.2**	**3.9**

Plot: 2010

Species	Density (individuals / ha)	Basal Area (m²/ ha)
hardwood		
Betula papyrifera	11.1	0.0
Populus tremuloides	22.2	0.8
softwood		
Abies balsamea	77.8	2.4
Pinus strobus	11.1	1.3
softwood / hardwood		
unknown dead tree	22.2	0.3
TOTAL	**144.4**	**4.9**

Plot: 2011

Species	Density (individuals / ha)	Basal Area (m²/ ha)
hardwood		
Acer spicatum	211.1	0.3
Populus tremuloides	22.2	3.1
softwood		
Picea glauca	11.1	0.1
softwood / hardwood		
unknown dead tree	188.9	2.3
TOTAL	**433.3**	**5.7**

Plot: 2012

Species	Density (individuals / ha)	Basal Area (m²/ ha)
hardwood		
Acer spicatum	155.6	0.1
Betula papyrifera	22.2	3.6
Populus tremuloides	100.0	11.4
softwood		
Abies balsamea	11.1	0.2
Picea glauca	11.1	1.3
softwood / hardwood		
unknown dead tree	22.2	1.2
TOTAL	**322.2**	**17.7**

Plot: 2013

Species	Density (individuals / ha)	Basal Area (m²/ ha)
hardwood		
Acer spicatum	88.9	0.2
Betula papyrifera	66.7	2.9
Populus tremuloides	33.3	2.7
softwood		
Picea glauca	22.2	1.3
softwood / hardwood		
unknown dead tree	44.4	1.5
TOTAL	**255.6**	**8.6**

Plot: 2014

Species	Density (individuals / ha)	Basal Area (m²/ ha)
hardwood		
Populus tremuloides	100.0	8.8
softwood		
Abies balsamea	22.2	0.0
TOTAL	**122.2**	**8.8**

Plot: 2015

Species	Density (individuals / ha)	Basal Area (m²/ ha)
hardwood		
Acer spicatum	44.4	0.1
Betula papyrifera	66.7	1.2
Populus tremuloides	133.3	11.1
softwood / hardwood		
unknown dead tree	11.1	0.4
TOTAL	**255.6**	**12.8**

Plot: 2018

Species	Density (individuals / ha)	Basal Area (m²/ ha)
hardwood		
Acer spicatum	22.2	0.0
Betula papyrifera	200.0	6.6
Populus tremuloides	11.1	1.1
softwood		
Abies balsamea	22.2	1.3
Picea glauca	11.1	0.0
Pinus strobus	11.1	0.3
TOTAL	**277.8**	**9.3**

Plot: 2019

Species	Density (individuals / ha)	Basal Area (m²/ ha)
hardwood		
Acer spicatum	77.8	0.1
Betula papyrifera	33.3	1.3
softwood		
Abies balsamea	11.1	0.4
softwood / hardwood		
unknown dead tree	288.9	4.5
TOTAL	**411.1**	**6.2**

Plot: 2020

Species	Density (individuals / ha)	Basal Area (m²/ ha)
hardwood		
Acer spicatum	522.2	0.7
Betula papyrifera	55.6	3.2
Populus tremuloides	33.3	7.4
softwood		
Abies balsamea	44.4	0.1
softwood / hardwood		
unknown dead tree	266.7	4.3
TOTAL	**922.2**	**15.5**

Plot: 2021

Species	Density (individuals / ha)	Basal Area (m²/ ha)
hardwood		
Acer spicatum	100.0	0.2
Betula papyrifera	111.1	3.1
Populus tremuloides	155.6	8.5
softwood / hardwood		
unknown dead tree	22.2	0.0
TOTAL	**388.9**	**11.7**

Plot: 2022

Species	Density (individuals / ha)	Basal Area (m²/ ha)
hardwood		
Betula papyrifera	88.9	0.9
Populus tremuloides	11.1	3.8
softwood		
Abies balsamea	22.2	0.9
Picea mariana	11.1	0.8
softwood / hardwood		
unknown dead tree	77.8	1.3
TOTAL	**211.1**	**7.8**

Plot: 2023

Species	Density (individuals / ha)	Basal Area (m²/ ha)
hardwood		
Acer spicatum	11.1	0.0
Betula papyrifera	22.2	0.1
Populus tremuloides	55.6	3.4
softwood		
Abies balsamea	33.3	2.2
TOTAL	**122.2**	**5.8**

Plot: 2024

Species	Density (individuals / ha)	Basal Area (m²/ ha)
hardwood		
Betula papyrifera	66.7	2.4
Fraxinus nigra	22.2	0.4
Populus tremuloides	33.3	3.3
softwood		
Abies balsamea	33.3	2.5
Picea mariana	22.2	0.7
softwood / hardwood		
unknown dead tree	11.1	0.3
TOTAL	**188.9**	**9.6**

Frequency of Species in Groundlayer Quadrats

Plot: 2002

Species	Quadrat Frequency Transect 1	2	3	Mean Quadrat Frequency
Abies balsamea	0.3	0.2	0.2	0.23
Agrimonia striata	0.0	0.2	0.0	0.07
Alnus incana ssp. rugosa	0.0	0.2	0.0	0.07
Alnus viridis ssp. crispa	0.0	0.1	0.0	0.03
Aralia nudicaulis	0.6	0.5	0.8	0.63
Carex gracillima	0.0	0.1	0.1	0.07
Carex sp.	0.2	0.1	0.1	0.13
Clintonia borealis	0.2	0.4	0.0	0.20
Cornus canadensis	0.1	0.0	0.0	0.03
Cornus sericea	0.3	0.2	0.0	0.17
Corylus cornuta var. cornuta	0.1	0.3	0.0	0.13
Diervilla lonicera	0.6	0.3	0.1	0.33
Equisetum pratense	0.0	0.4	0.0	0.13
Equisetum sp.	0.1	0.0	0.0	0.03
Eurybia macrophylla	0.9	0.8	0.9	0.87
Fragaria virginiana	0.1	0.4	0.3	0.27
Galium aparine	0.0	0.1	0.0	0.03
Galium triflorum	0.1	0.0	0.0	0.03
Heracleum maximum	0.0	0.1	0.0	0.03
Impatiens capensis	0.0	0.1	0.0	0.03
Maianthemum canadense	0.3	0.4	0.1	0.27
Mertensia virginica	0.2	0.1	0.2	0.17
Mitella nuda	0.1	0.2	0.1	0.13
Moneses uniflora	0.0	0.5	0.0	0.17
Poaceae sp.	0.0	0.0	0.3	0.10
Populus tremuloides	0.0	0.0	0.1	0.03
Prenanthes alba	0.0	0.1	0.0	0.03
Prunus virginiana	0.0	0.0	0.3	0.10
Pteridium aquilinum var. latiusculum	0.1	0.1	0.1	0.10
Pyrola asarifolia	0.2	0.2	0.6	0.33
Ranunculus acris	0.0	0.2	0.0	0.07
Ribes triste	0.2	0.1	0.0	0.10
Rosa acicularis	0.0	0.2	0.4	0.20
Rubus parviflorus	0.4	0.4	0.1	0.30
Rubus pubescens	0.2	0.3	0.3	0.27
Solidago sp.	0.0	0.1	0.0	0.03
Streptopus lanceolatus var. roseus	0.5	0.2	0.0	0.23
Thalictrum dasycarpum	0.0	0.1	0.0	0.03

Plot: 2003

Species	Quadrat Frequency Transect 1	2	3	Mean Quadrat Frequency
Abies balsamea	0.3	0.0	0.0	0.10
Acer spicatum	0.0	0.0	0.1	0.03
Alnus incana ssp. rugosa	0.1	0.8	0.0	0.30
Amelanchier sp.	0.0	0.0	0.1	0.03
Anemone quinquefolia var. quinquefolia	0.1	0.0	0.4	0.17
Apocynum androsaemifolium	0.1	0.0	0.0	0.03
Aralia nudicaulis	0.6	0.0	0.6	0.40
Athyrium filix-femina ssp. angustum	0.0	0.4	0.0	0.13
Caltha palustris	0.0	0.3	0.0	0.10
Carex sp.	0.0	0.5	0.0	0.17
Chamerion angustifolium	0.1	0.0	0.0	0.03
Clintonia borealis	0.3	0.0	0.5	0.27
Cornus canadensis	0.1	0.0	0.2	0.10
Cornus sericea	0.2	0.4	0.1	0.23
Corylus cornuta var. cornuta	0.1	0.0	0.0	0.03
Diervilla lonicera	0.4	0.0	0.2	0.20
Dryopteris carthusiana	0.0	0.5	0.0	0.17
Equisetum pratense	0.0	0.5	0.0	0.17
Eurybia macrophylla	0.6	0.0	0.3	0.30
Galium triflorum	0.5	0.5	0.3	0.43
Impatiens capensis	0.1	1.0	0.5	0.53
Lonicera canadensis	0.0	0.0	0.1	0.03
Maianthemum canadense	0.2	0.0	0.3	0.17
Mentha arvensis	0.0	0.7	0.0	0.23
Mitella nuda	0.1	0.2	0.4	0.23
Oryzopsis asperifolia	0.0	0.0	0.1	0.03
Poaceae sp.	0.3	0.4	0.3	0.33
Populus tremuloides	0.1	0.0	0.0	0.03
Prunus virginiana	0.1	0.0	0.0	0.03
Pteridium aquilinum var. latiusculum	0.4	0.0	0.1	0.17
Ribes lacustre	0.1	0.2	0.0	0.10
Ribes triste	0.0	0.4	0.0	0.13
Rosa acicularis	0.2	0.0	0.1	0.10
Rubus idaeus ssp. strigosus	0.7	0.7	0.4	0.60
Rubus parviflorus	0.2	0.0	0.6	0.27
Rubus pubescens	0.2	0.3	0.2	0.23
Streptopus lanceolatus var. roseus	0.4	0.0	0.3	0.23
Symphyotrichum puniceum var. puniceum	0.0	0.1	0.0	0.03
Thalictrum dasycarpum	0.0	0.1	0.0	0.03
Trientalis borealis	0.0	0.0	0.3	0.10

Plot: 2004

Species	Quadrat Frequency Transect 1	2	3	Mean Quadrat Frequency
Abies balsamea	0.2	0.2	0.2	0.20
Acer spicatum	0.3	0.2	0.0	0.17
Alnus incana ssp. rugosa	0.0	0.1	0.2	0.10
Alnus viridis ssp. crispa	0.0	0.0	0.1	0.03
Amelanchier sp.	0.1	0.1	0.1	0.10
Anemone quinquefolia var. quinquefolia	0.1	0.4	0.0	0.17
Apocynum androsaemifolium	0.2	0.2	0.0	0.13
Aralia nudicaulis	0.9	0.4	0.9	0.73
Athyrium filix-femina ssp. angustum	0.0	0.1	0.1	0.07
Carex sp.	0.4	0.2	0.0	0.20
Clintonia borealis	0.0	0.0	0.1	0.03
Cornus canadensis	0.1	0.0	0.1	0.07
Cornus sericea	0.1	0.0	0.1	0.07
Corylus cornuta var. cornuta	0.1	0.1	0.0	0.07
Diervilla lonicera	0.0	0.5	0.3	0.27
Dryopteris carthusiana	0.0	0.1	0.0	0.03
Equisetum pratense	0.0	0.2	0.0	0.07
Eurybia macrophylla	0.7	0.8	1.0	0.83
Fragaria virginiana	0.1	0.3	0.2	0.20
Fraxinus nigra	0.1	0.0	0.0	0.03
Galium triflorum	0.2	0.0	0.1	0.10
Lathyrus venosus	0.1	0.0	0.0	0.03
Lonicera canadensis	0.2	0.2	0.2	0.20
Maianthemum canadense	0.4	0.2	0.1	0.23
Mertensia virginica	0.0	0.0	0.1	0.03
Mitella nuda	0.0	0.1	0.4	0.17
Moneses uniflora	0.0	0.1	0.4	0.17
Oryzopsis asperifolia	0.0	0.0	0.2	0.07
Petasites frigidus var. palmatus	0.1	0.0	0.3	0.13
Pinus strobus	0.0	0.1	0.0	0.03
Populus tremuloides	0.2	0.4	0.2	0.27
Prunus virginiana	0.2	0.1	0.0	0.10
Pteridium aquilinum var. latiusculum	0.0	0.0	0.1	0.03
Pyrola asarifolia	0.2	0.2	0.5	0.30
Rosa acicularis	0.0	0.3	0.1	0.13
Rubus idaeus ssp. strigosus	0.0	0.2	0.0	0.07
Rubus parviflorus	0.8	0.2	0.7	0.57
Rubus pubescens	0.6	0.5	0.7	0.60
Sanicula marilandica	0.2	0.1	0.2	0.17
Streptopus lanceolatus var. roseus	0.1	0.1	0.1	0.10
Trillium cernuum	0.0	0.0	0.1	0.03

Plot: 2005

Species	Quadrat Frequency Transect 1	2	3	Mean Quadrat Frequency
Abies balsamea	0.1	0.2	0.3	0.20
Achillea millefolium	0.0	0.1	0.0	0.03
Amelanchier sp.	0.0	0.2	0.0	0.07
Anemone quinquefolia var. quinquefolia	0.0	0.0	0.3	0.10
Aralia nudicaulis	0.8	0.5	0.4	0.57
Carex sp.	0.1	0.0	0.2	0.10
Clintonia borealis	0.0	0.2	0.2	0.13
Cornus canadensis	0.0	0.2	0.5	0.23
Cornus sericea	0.0	0.0	0.1	0.03
Diervilla lonicera	0.4	0.5	0.7	0.53
Eurybia macrophylla	1.0	0.9	0.9	0.93
Fragaria virginiana	0.0	0.2	0.2	0.13
Galium triflorum	0.0	0.1	0.2	0.10
Lathyrus venosus	0.0	0.0	0.1	0.03
Linnaea borealis ssp. americana	0.0	0.1	0.2	0.10
Maianthemum canadense	0.0	0.4	0.4	0.27
Mertensia virginica	0.0	0.0	0.2	0.07
Phleum pratense	0.0	0.2	0.0	0.07
Poa compressa	0.0	0.2	0.0	0.07
Poaceae sp.	0.0	0.4	0.0	0.13
Populus tremuloides	0.1	0.0	0.0	0.03
Pteridium aquilinum var. latiusculum	0.1	0.0	0.0	0.03
Pyrola asarifolia	0.2	0.0	0.0	0.07
Pyrola minor	0.0	0.0	0.2	0.07
Rosa acicularis	0.0	0.3	0.4	0.23
Rubus parviflorus	0.7	0.2	0.7	0.53
Rubus pubescens	0.0	0.0	0.1	0.03
Sanicula marilandica	0.0	0.1	0.0	0.03
Solidago simplex	0.0	0.2	0.0	0.07
Streptopus lanceolatus var. roseus	0.0	0.1	0.2	0.10
Trifolium pratense	0.0	0.1	0.0	0.03
Viola sp.	0.0	0.1	0.0	0.03

Plot: 2006

Species	Quadrat Frequency Transect 1	2	3	Mean Quadrat Frequency
Abies balsamea	0.2	0.4	0.2	0.27
Acer spicatum	0.1	0.2	0.0	0.10
Alnus viridis ssp. crispa	0.0	0.2	0.0	0.07
Amelanchier sp.	0.1	0.0	0.0	0.03
Anemone quinquefolia var. quinquefolia	0.2	0.1	0.2	0.17
Aralia nudicaulis	0.8	0.1	0.9	0.60
Carex sp.	0.1	0.2	0.2	0.17
Clintonia borealis	0.1	0.0	0.0	0.03
Cornus canadensis	0.6	0.1	0.8	0.50
Cornus sericea	0.0	0.1	0.1	0.07
Corylus cornuta var. cornuta	0.1	0.1	0.0	0.07
Diervilla lonicera	0.1	0.0	0.3	0.13
Equisetum pratense	0.0	0.1	0.0	0.03
Eurybia macrophylla	0.8	0.4	0.6	0.60
Fragaria virginiana	0.0	0.0	0.1	0.03
Gymnocarpium dryopteris	0.2	0.0	0.0	0.07
Linnaea borealis ssp. americana	0.0	0.1	0.1	0.07
Lonicera canadensis	0.0	0.0	0.1	0.03
Maianthemum canadense	0.2	0.1	0.4	0.23
Mertensia virginica	0.1	0.0	0.2	0.10
Mitella nuda	0.5	0.2	0.0	0.23
Moneses uniflora	0.1	0.0	0.0	0.03
Picea mariana	0.0	0.0	0.1	0.03
Plantago major	0.0	0.0	0.1	0.03
Poaceae sp.	0.0	0.1	0.0	0.03
Populus tremuloides	0.0	0.1	0.1	0.07
Prenanthes alba	0.0	0.0	0.1	0.03
Pyrola asarifolia	0.3	0.0	0.3	0.20
Ranunculus acris	0.0	0.0	0.1	0.03
Ribes glandulosum	0.0	0.0	0.1	0.03
Ribes triste	0.1	0.0	0.0	0.03
Rosa acicularis	0.1	0.1	0.3	0.17
Rubus idaeus ssp. strigosus	0.0	0.1	0.0	0.03
Rubus parviflorus	0.4	0.4	0.5	0.43
Rubus pubescens	0.6	0.2	0.6	0.47
Sorbus decora	0.1	0.0	0.0	0.03
Streptopus lanceolatus var. roseus	0.4	0.1	0.2	0.23
Trientalis borealis	0.1	0.0	0.2	0.10

Plot: 2007

Species	Quadrat Frequency Transect 1	2	3	Mean Quadrat Frequency
Abies balsamea	0.0	0.2	0.1	0.10
Acer spicatum	0.5	0.3	0.1	0.30
Amelanchier sp.	0.0	0.2	0.0	0.07
Anemone quinquefolia var. quinquefolia	0.2	0.3	0.2	0.23
Aralia nudicaulis	0.6	1.0	0.3	0.63
Athyrium filix-femina ssp. angustum	0.1	0.3	0.0	0.13
Cardamine sp.	0.0	0.0	0.1	0.03
Carex sp.	0.1	0.3	0.5	0.30
Clintonia borealis	0.9	1.0	0.3	0.73
Coptis trifolia	0.1	0.1	0.0	0.07
Cornus canadensis	0.9	0.5	0.3	0.57
Cornus sericea	0.3	0.2	0.0	0.17
Corylus cornuta var. cornuta	0.2	0.5	0.0	0.23
Diervilla lonicera	0.3	0.0	0.2	0.17
Dryopteris carthusiana	0.2	0.0	0.0	0.07
Equisetum pratense	0.0	0.0	0.1	0.03
Eurybia macrophylla	0.6	0.7	0.4	0.57
Fragaria virginiana	0.4	0.1	0.0	0.17
Galium triflorum	0.7	0.8	0.1	0.53
Impatiens capensis	0.0	0.6	0.5	0.37
Lathyrus venosus	0.0	0.0	0.2	0.07
Lonicera canadensis	0.4	0.2	0.0	0.20
Lonicera oblongifolia	0.1	0.0	0.0	0.03
Lycopodium clavatum	0.2	0.3	0.0	0.17
Lycopodium complanatum	0.6	0.1	0.0	0.23
Maianthemum canadense	0.2	0.6	0.2	0.33
Mentha arvensis	0.0	0.0	0.1	0.03
Mertensia virginica	0.0	0.2	0.1	0.10
Mitella nuda	0.6	0.4	0.3	0.43
Moneses uniflora	0.0	0.0	0.1	0.03
Osmunda claytoniana	0.1	0.0	0.0	0.03
Petasites frigidus var. palmatus	0.4	0.1	0.1	0.20
Poaceae sp.	0.7	0.7	0.3	0.57
Polygonatum pubescens	0.0	0.0	0.1	0.03
Populus tremuloides	0.0	0.1	0.2	0.10
Pyrola asarifolia	0.0	0.0	0.1	0.03
Ribes triste	0.6	0.5	0.2	0.43
Rosa acicularis	0.2	0.1	0.0	0.10
Rubus idaeus ssp. strigosus	0.8	0.7	0.3	0.60
Rubus pubescens	0.9	0.8	0.3	0.67
Streptopus lanceolatus var. roseus	0.7	0.5	0.2	0.47
Trientalis borealis	0.3	0.0	0.1	0.13
Viola sp.	0.4	0.2	0.0	0.20

Plot: 2008

Species	Quadrat Frequency Transect 1	2	3	Mean Quadrat Frequency
Abies balsamea	0.2	0.1	0.2	0.17
Acer spicatum	0.0	0.0	0.2	0.07
Alnus incana ssp. rugosa	0.0	0.1	0.0	0.03
Anemone quinquefolia var. quinquefolia	0.3	0.0	0.2	0.17
Apocynum androsaemifolium	0.1	0.0	0.1	0.07
Aralia nudicaulis	0.9	0.2	0.6	0.57
Carex sp.	0.4	0.4	0.3	0.37
Clintonia borealis	0.8	0.0	0.3	0.37
Cornus canadensis	0.1	0.0	0.1	0.07
Cornus sericea	0.2	0.3	0.0	0.17
Corylus cornuta var. cornuta	0.4	0.0	0.1	0.17
Diervilla lonicera	0.1	0.1	0.2	0.13
Dryopteris carthusiana	0.0	0.2	0.0	0.07
Eurybia macrophylla	1.0	0.8	0.7	0.83
Fraxinus nigra	0.0	0.1	0.0	0.03
Galium triflorum	0.4	0.3	0.2	0.30
Heracleum maximum	0.0	0.4	0.0	0.13
Impatiens capensis	0.0	0.6	0.0	0.20
Lathyrus venosus	0.0	0.0	0.1	0.03
Linnaea borealis ssp. americana	0.2	0.0	0.0	0.07
Lonicera canadensis	0.0	0.0	0.3	0.10
Lycopodium sp.	0.2	0.0	0.0	0.07
Maianthemum canadense	0.6	0.1	0.3	0.33
Mentha arvensis	0.0	0.5	0.0	0.17
Mertensia virginica	0.0	0.1	0.0	0.03
Mitella nuda	0.2	0.4	0.3	0.30
Petasites frigidus var. palmatus	0.1	0.0	0.0	0.03
Poaceae sp.	0.2	0.2	0.2	0.20
Populus tremuloides	0.0	0.3	0.2	0.17
Pteridium aquilinum var. latiusculum	0.0	0.0	0.1	0.03
Pyrola asarifolia	0.0	0.0	0.2	0.07
Ribes lacustre	0.0	0.1	0.0	0.03
Ribes triste	0.0	0.3	0.0	0.10
Rosa acicularis	0.3	0.3	0.0	0.20
Rubus idaeus ssp. strigosus	0.0	0.3	0.0	0.10
Rubus parviflorus	0.3	0.0	0.7	0.33
Rubus pubescens	0.2	0.6	0.4	0.40
Sanicula marilandica	0.1	0.3	0.0	0.13
Streptopus lanceolatus var. roseus	0.1	0.0	0.6	0.23
Trientalis borealis	0.0	0.1	0.1	0.07
Trillium cernuum	0.0	0.1	0.0	0.03

Plot: 2010

Species	Quadrat Frequency Transect 1	2	3	Mean Quadrat Frequency
Abies balsamea	0.3	0.4	0.1	0.27
Acer spicatum	0.2	0.0	0.0	0.07
Alnus incana ssp. rugosa	0.2	0.1	0.0	0.10
Anemone quinquefolia var. quinquefolia	0.1	0.5	0.5	0.37
Apocynum androsaemifolium	0.0	0.2	0.0	0.07
Aralia nudicaulis	0.1	0.5	0.5	0.37
Carex sp.	0.0	0.5	0.1	0.20
Chamerion angustifolium	0.0	0.0	0.1	0.03
Clintonia borealis	0.3	0.6	0.8	0.57
Cornus canadensis	0.2	0.7	0.1	0.33
Cornus sericea	0.4	0.0	0.0	0.13
Corylus cornuta var. cornuta	0.0	0.3	0.5	0.27
Diervilla lonicera	0.0	0.4	0.4	0.27
Equisetum pratense	0.4	0.0	0.0	0.13
Eurybia macrophylla	0.5	0.7	0.7	0.63
Fragaria virginiana	0.0	0.1	0.0	0.03
Galium triflorum	0.3	0.2	0.2	0.23
Impatiens capensis	0.5	0.0	0.1	0.20
Lathyrus venosus	0.0	0.0	0.1	0.03
Linnaea borealis ssp. americana	0.1	0.1	0.0	0.07
Lonicera canadensis	0.0	0.0	0.5	0.17
Maianthemum canadense	0.1	0.4	0.1	0.20
Mertensia virginica	0.1	0.0	0.3	0.13
Mitella nuda	0.0	0.3	0.1	0.13
Moneses uniflora	0.0	0.2	0.0	0.07
Petasites frigidus var. palmatus	0.4	0.0	0.0	0.13
Picea glauca	0.0	0.0	0.1	0.03
Poaceae sp.	0.5	0.1	0.2	0.27
Populus tremuloides	0.0	0.1	0.0	0.03
Prenanthes alba	0.0	0.1	0.0	0.03
Prunus virginiana	0.0	0.0	0.1	0.03
Pteridium aquilinum var. latiusculum	0.0	0.3	0.4	0.23
Ranunculus acris	0.0	0.1	0.0	0.03
Ranunculus hispidus	0.1	0.0	0.0	0.03
Ribes lacustre	0.1	0.0	0.0	0.03
Rosa acicularis	0.1	0.5	0.4	0.33
Rubus idaeus ssp. strigosus	0.6	0.1	0.3	0.33
Rubus parviflorus	0.1	0.2	0.3	0.20
Rubus pubescens	0.4	0.5	0.1	0.33
Sanicula marilandica	0.0	0.1	0.0	0.03
Scirpus sp.	0.0	0.1	0.0	0.03
Streptopus lanceolatus var. roseus	0.0	0.4	0.1	0.17
Trifolium pratense	0.0	0.2	0.0	0.07
Viburnum rafinesquianum	0.1	0.0	0.0	0.03

Plot: 2011

Species	Quadrat Frequency Transect 1	2	3	Mean Quadrat Frequency
Abies balsamea	0.4	0.0	0.4	0.27
Acer spicatum	0.2	0.0	0.3	0.17
Actaea sp.	0.1	0.0	0.0	0.03
Alnus incana ssp. rugosa	0.0	0.1	0.0	0.03
Anemone quinquefolia var. quinquefolia	0.4	0.6	0.5	0.50
Apocynum androsaemifolium	0.0	0.1	0.0	0.03
Aralia nudicaulis	0.8	0.1	0.6	0.50
Athyrium filix-femina ssp. angustum	0.0	0.0	0.3	0.10
Carex sp.	0.2	0.3	0.5	0.33
Chamerion angustifolium	0.0	0.3	0.0	0.10
Clintonia borealis	0.3	0.1	0.5	0.30
Cornus canadensis	0.6	0.0	0.0	0.20
Cornus sericea	0.1	0.1	0.4	0.20
Corylus cornuta var. cornuta	0.1	0.0	0.0	0.03
Diervilla lonicera	0.0	0.2	0.1	0.10
Dryopteris carthusiana	0.0	0.0	0.2	0.07
Equisetum pratense	0.0	0.0	0.1	0.03
Eurybia macrophylla	1.0	1.0	0.7	0.90
Fragaria virginiana	0.4	0.0	0.2	0.20
Fraxinus nigra	0.0	0.0	0.1	0.03
Galium triflorum	0.0	0.2	0.2	0.13
Gymnocarpium dryopteris	0.0	0.0	0.1	0.03
Impatiens capensis	0.0	0.1	0.0	0.03
Linnaea borealis ssp. americana	0.1	0.0	0.0	0.03
Lonicera canadensis	0.1	0.0	0.2	0.10
Maianthemum canadense	0.2	0.1	0.2	0.17
Mertensia virginica	0.0	0.2	0.2	0.13
Mitella nuda	0.7	0.3	0.8	0.60
Moneses uniflora	0.0	0.3	0.1	0.13
Oryzopsis asperifolia	0.1	0.0	0.2	0.10
Petasites frigidus var. palmatus	0.3	0.0	0.2	0.17
Poaceae sp.	0.1	0.3	0.0	0.13
Populus balsamifera	0.0	0.1	0.0	0.03
Populus tremuloides	0.2	0.1	0.0	0.10
Prunus virginiana	0.1	0.1	0.1	0.10
Pteridium aquilinum var. latiusculum	0.1	0.3	0.0	0.13
Pyrola asarifolia	0.2	0.1	0.1	0.13
Ribes lacustre	0.1	0.0	0.1	0.07
Ribes oxyacanthoides	0.0	0.0	0.1	0.03
Ribes sp.	0.0	0.1	0.0	0.03
Ribes triste	0.1	0.1	0.0	0.07
Rosa acicularis	0.4	0.1	0.3	0.27
Rubus idaeus ssp. strigosus	0.0	0.4	0.0	0.13
Rubus parviflorus	0.4	0.5	0.0	0.30
Rubus pubescens	0.5	0.3	0.7	0.50
Sanicula marilandica	0.0	0.1	0.0	0.03
Sorbus decora	0.1	0.1	0.0	0.07
Streptopus lanceolatus var. roseus	0.1	0.2	0.1	0.13
Taxus canadensis	0.1	0.0	0.2	0.10
Trientalis borealis	0.2	0.0	0.1	0.10
Trillium cernuum	0.0	0.1	0.3	0.13
Viola sp.	0.0	0.0	0.1	0.03

Plot: 2012

Species	Quadrat Frequency Transect 1	2	3	Mean Quadrat Frequency
Abies balsamea	0.3	0.4	0.4	0.37
Acer spicatum	0.4	0.7	0.3	0.47
Actaea sp.	0.0	0.1	0.0	0.03
Agrimonia striata	0.0	0.0	0.1	0.03
Amelanchier sp.	0.1	0.0	0.0	0.03
Anemone quinquefolia var. quinquefolia	0.2	0.2	0.1	0.17
Aralia nudicaulis	0.8	0.5	0.7	0.67
Betula papyrifera	0.0	0.2	0.1	0.10
Carex sp.	0.1	0.5	0.4	0.33
Clintonia borealis	0.9	0.8	0.9	0.87
Cornus canadensis	0.6	0.6	0.9	0.70
Corylus cornuta var. cornuta	0.7	0.3	0.0	0.33
Dryopteris carthusiana	0.0	0.2	0.3	0.17
Equisetum pratense	0.0	0.0	0.6	0.20
Eurybia macrophylla	1.0	0.8	0.9	0.90
Fragaria virginiana	0.1	0.0	0.1	0.07
Fraxinus nigra	0.0	0.0	0.1	0.03
Galium triflorum	0.2	0.4	0.4	0.33
Gymnocarpium dryopteris	0.0	0.2	0.1	0.10
Lathyrus venosus	0.0	0.0	0.1	0.03
Linnaea borealis ssp. americana	0.3	0.1	0.2	0.20
Lonicera canadensis	0.4	0.2	0.5	0.37
Lycopodium clavatum	0.1	0.1	0.0	0.07
Maianthemum canadense	0.4	0.2	0.3	0.30
Mertensia virginica	0.0	0.0	0.1	0.03
Mitella nuda	0.7	0.4	0.8	0.63
Petasites frigidus var. palmatus	0.0	0.0	0.7	0.23
Phegopteris connectilis	0.0	0.0	0.3	0.10
Pinus strobus	0.0	0.0	0.1	0.03
Poaceae sp.	0.0	0.0	0.1	0.03
Populus tremuloides	0.3	0.0	0.0	0.10
Pyrola asarifolia	0.1	0.2	0.2	0.17
Ranunculus acris	0.0	0.0	0.1	0.03
Ribes triste	0.0	0.0	0.6	0.20
Rosa acicularis	0.1	0.0	0.3	0.13
Rubus idaeus ssp. strigosus	0.1	0.0	0.0	0.03
Rubus parviflorus	0.5	0.3	0.0	0.27
Rubus pubescens	0.3	0.3	1.0	0.53
Sanicula marilandica	0.0	0.0	0.1	0.03
Sorbus decora	0.1	0.0	0.0	0.03
Streptopus amplexifolius	0.0	0.1	0.1	0.07
Streptopus lanceolatus var. roseus	0.4	0.5	0.3	0.40
Trientalis borealis	0.1	0.1	0.3	0.17
Viola sp.	0.1	0.1	0.0	0.07

Plot: 2013

Species	Quadrat Frequency Transect 1	2	3	Mean Quadrat Frequency
Abies balsamea	0.2	0.4	0.2	0.27
Acer spicatum	0.4	0.2	0.8	0.47
Alnus incana ssp. rugosa	0.1	0.0	0.0	0.03
Alnus viridis ssp. crispa	0.0	0.0	0.1	0.03
Anemone quinquefolia var. quinquefolia	0.0	0.1	0.1	0.07
Aralia nudicaulis	0.7	0.2	0.6	0.50
Athyrium filix-femina ssp. angustum	0.0	0.1	0.0	0.03
Carex sp.	0.2	0.2	0.3	0.23
Clintonia borealis	0.1	0.4	0.4	0.30
Cornus canadensis	0.4	0.3	0.5	0.40
Cornus sericea	0.1	0.0	0.0	0.03
Corylus cornuta var. cornuta	0.0	0.2	0.0	0.07
Diervilla lonicera	0.0	0.2	0.0	0.07
Dryopteris carthusiana	0.1	0.0	0.0	0.03
Equisetum pratense	0.2	0.3	0.0	0.17
Eurybia macrophylla	0.7	0.6	0.6	0.63
Galium triflorum	0.1	0.1	0.4	0.20
Linnaea borealis ssp. americana	0.1	0.0	0.4	0.17
Lonicera canadensis	0.0	0.1	0.1	0.07
Lycopodium annotinum	0.0	0.1	0.0	0.03
Maianthemum canadense	0.0	0.4	0.6	0.33
Mertensia virginica	0.0	0.1	0.1	0.07
Mitella nuda	0.4	0.7	0.2	0.43
Petasites frigidus var. palmatus	0.1	0.0	0.4	0.17
Poaceae sp.	0.1	0.1	0.0	0.07
Populus tremuloides	0.0	0.2	0.2	0.13
Pyrola asarifolia	0.1	0.2	0.3	0.20
Rosa acicularis	0.5	0.2	0.3	0.33
Rubus parviflorus	0.0	0.1	0.1	0.07
Rubus pubescens	0.9	0.6	0.9	0.80
Sorbus decora	0.0	0.0	0.1	0.03
Streptopus lanceolatus var. roseus	0.0	0.2	0.1	0.10

Plot: 2014

Species	Quadrat Frequency Transect 1	2	3	Mean Quadrat Frequency
Abies balsamea	0.1	0.2	0.0	0.10
Acer spicatum	0.1	0.0	0.0	0.03
Actaea sp.	0.0	0.1	0.1	0.07
Alnus incana ssp. rugosa	0.1	0.1	0.0	0.07
Amelanchier sp.	0.2	0.0	0.2	0.13
Anemone quinquefolia var. quinquefolia	0.2	0.1	0.3	0.20
Aralia nudicaulis	0.3	0.4	0.7	0.47
Asarum canadense	0.0	0.0	0.3	0.10
Athyrium filix-femina ssp. angustum	0.1	0.1	0.0	0.07
Carex norvegica	0.1	0.0	0.0	0.03
Carex sp.	0.3	0.0	0.3	0.20
Clintonia borealis	0.5	0.6	0.6	0.57
Cornus canadensis	0.3	0.4	0.1	0.27
Cornus sericea	0.0	0.0	0.1	0.03
Corylus cornuta var. cornuta	0.3	0.1	0.0	0.13
Diervilla lonicera	0.8	0.3	0.4	0.50
Dryopteris carthusiana	0.1	0.0	0.0	0.03
Equisetum pratense	0.3	0.2	0.0	0.17
Eurybia macrophylla	0.6	0.3	0.4	0.43
Galium triflorum	0.2	0.6	0.4	0.40
Geum sp.	0.1	0.1	0.0	0.07
Huperzia sp.	0.0	0.1	0.0	0.03
Impatiens capensis	0.3	0.4	0.1	0.27
Lathyrus venosus	0.1	0.0	0.0	0.03
Lonicera canadensis	0.1	0.0	0.0	0.03
Lycopodium sp.	0.0	0.1	0.0	0.03
Maianthemum canadense	0.1	0.2	0.2	0.17
Mertensia virginica	0.3	0.0	0.4	0.23
Mitella nuda	0.3	0.5	0.3	0.37
Phleum pratense	0.1	0.0	0.0	0.03
Plantago major	0.1	0.0	0.0	0.03
Poaceae sp.	0.2	0.4	0.2	0.27
Prunus virginiana	0.1	0.0	0.1	0.07
Pyrola asarifolia	0.0	0.2	0.0	0.07
Ranunculus acris	0.1	0.0	0.0	0.03
Ribes lacustre	0.0	0.0	0.1	0.03
Ribes triste	0.0	0.2	0.2	0.13
Rosa acicularis	0.0	0.4	0.1	0.17
Rubus idaeus ssp. strigosus	0.2	0.6	0.5	0.43
Rubus parviflorus	0.1	0.0	0.4	0.17
Rubus pubescens	0.6	0.3	0.1	0.33
Sanicula marilandica	0.1	0.0	0.0	0.03
Streptopus lanceolatus var. roseus	0.3	0.0	0.1	0.13
Trientalis borealis	0.0	0.1	0.0	0.03
Trifolium pratense	0.1	0.0	0.0	0.03
Trillium cernuum	0.1	0.0	0.1	0.07
Vicia americana	0.0	0.2	0.0	0.07
Viola sp.	0.2	0.2	0.0	0.13

Plot: 2015

Species	Quadrat Frequency Transect 1	2	3	Mean Quadrat Frequency
Abies balsamea	0.1	0.0	0.0	0.03
Actaea sp.	0.0	0.1	0.1	0.07
Agrimonia striata	0.0	0.1	0.0	0.03
Alnus incana ssp. rugosa	0.0	0.2	0.3	0.17
Amelanchier sp.	0.1	0.1	0.2	0.13
Anemone quinquefolia var. quinquefolia	0.1	0.0	0.0	0.03
Aralia nudicaulis	0.7	0.9	0.8	0.80
Asarum canadense	0.0	0.4	0.0	0.13
Carex sp.	0.2	0.1	0.0	0.10
Clintonia borealis	0.1	0.3	0.0	0.13
Cornus sericea	0.2	0.1	0.2	0.17
Corylus cornuta var. cornuta	0.0	0.1	0.0	0.03
Diervilla lonicera	0.0	0.1	0.3	0.13
Dryopteris carthusiana	0.0	0.2	0.0	0.07
Eurybia macrophylla	0.9	0.8	0.9	0.87
Fragaria virginiana	0.0	0.0	0.2	0.07
Fraxinus nigra	0.3	0.0	0.0	0.10
Galium triflorum	0.0	0.0	0.2	0.07
Heracleum maximum	0.4	0.3	0.0	0.23
Impatiens capensis	0.4	0.1	0.0	0.17
Lactuca sp.	0.0	0.1	0.0	0.03
Lonicera hirsuta	0.3	0.1	0.0	0.13
Maianthemum canadense	0.2	0.4	0.0	0.20
Mentha arvensis	0.4	0.1	0.0	0.17
Mitella nuda	0.0	0.8	0.0	0.27
Oryzopsis asperifolia	0.0	0.0	0.1	0.03
Osmorhiza longistylis	0.0	0.0	0.2	0.07
Osmunda claytoniana	0.1	0.0	0.0	0.03
Poaceae sp.	0.3	0.3	0.7	0.43
Populus tremuloides	0.3	0.0	0.1	0.13
Prenanthes alba	0.1	0.0	0.0	0.03
Prunus virginiana	0.4	0.1	0.1	0.20
Pteridium aquilinum var. latiusculum	0.2	0.0	0.1	0.10
Pyrola asarifolia	0.1	0.7	0.1	0.30
Ribes hirtellum	0.0	0.0	0.1	0.03
Ribes triste	0.2	0.2	0.1	0.17
Rosa acicularis	0.0	0.1	0.1	0.07
Rubus idaeus ssp. strigosus	0.8	0.7	0.2	0.57
Rubus parviflorus	0.0	0.3	0.1	0.13
Rubus pubescens	0.5	0.0	0.2	0.23
Sanguinaria canadensis	0.0	0.0	0.1	0.03
Sanicula marilandica	0.3	0.3	0.0	0.20
Streptopus lanceolatus var. roseus	0.0	0.2	0.0	0.07
Thalictrum dasycarpum	0.1	0.2	0.0	0.10
Trillium cernuum	0.2	0.1	0.0	0.10
Viola sp.	0.3	0.1	0.2	0.20

Plot: 2018

Species	Quadrat Frequency Transect 1	2	3	Mean Quadrat Frequency
Abies balsamea	0.2	0.1	0.3	0.20
Acer spicatum	0.3	0.4	0.1	0.27
Agrimonia striata	0.0	0.1	0.0	0.03
Alnus incana ssp. rugosa	0.1	0.0	0.0	0.03
Alnus viridis ssp. crispa	0.0	0.0	0.1	0.03
Amelanchier sp.	0.3	0.3	0.1	0.23
Anemone quinquefolia var. quinquefolia	0.0	0.1	0.4	0.17
Aralia nudicaulis	0.8	0.4	0.9	0.70
Athyrium filix-femina ssp. angustum	0.0	0.1	0.0	0.03
Carex gracillima	0.0	0.1	0.0	0.03
Carex sp.	0.2	0.4	0.3	0.30
Chamerion angustifolium	0.1	0.0	0.0	0.03
Clintonia borealis	0.2	0.3	0.2	0.23
Cornus canadensis	0.0	0.5	0.7	0.40
Cornus sericea	0.2	0.0	0.0	0.07
Corylus cornuta var. cornuta	0.1	0.1	0.1	0.10
Diervilla lonicera	0.3	0.0	0.7	0.33
Eurybia macrophylla	0.5	0.4	1.0	0.63
Fragaria virginiana	0.4	0.2	0.3	0.30
Galium triflorum	0.1	0.1	0.0	0.07
Lathyrus venosus	0.1	0.0	0.0	0.03
Lonicera canadensis	0.0	0.0	0.1	0.03
Lonicera hirsuta	0.0	0.0	0.1	0.03
Maianthemum canadense	0.4	0.6	0.4	0.47
Mertensia virginica	0.0	0.1	0.0	0.03
Mitella nuda	0.3	0.5	0.1	0.30
Moneses uniflora	0.0	0.0	0.1	0.03
Picea glauca	0.0	0.0	0.1	0.03
Plantago major	0.0	0.1	0.0	0.03
Poaceae sp.	0.5	0.0	0.0	0.17
Populus tremuloides	0.1	0.1	0.1	0.10
Prenanthes alba	0.0	0.1	0.0	0.03
Prunella vulgaris	0.0	0.1	0.0	0.03
Pteridium aquilinum var. latiusculum	0.1	0.0	0.0	0.03
Pyrola asarifolia	0.2	0.5	0.3	0.33
Ranunculus acris	0.0	0.1	0.0	0.03
Ribes triste	0.1	0.1	0.2	0.13
Rosa acicularis	0.2	0.1	0.2	0.17
Rubus idaeus ssp. strigosus	0.2	0.0	0.1	0.10
Rubus parviflorus	0.5	0.6	0.6	0.57
Rubus pubescens	0.8	0.7	0.5	0.67
Sanicula marilandica	0.2	0.1	0.0	0.10
Streptopus lanceolatus var. roseus	0.0	0.1	0.3	0.13
Trifolium pratense	0.1	0.0	0.0	0.03

Plot: 2019

Species	Quadrat Frequency Transect 1	2	3	Mean Quadrat Frequency
Abies balsamea	0.2	0.0	0.0	0.07
Acer spicatum	0.2	0.1	0.2	0.17
Actaea sp.	0.1	0.0	0.0	0.03
Alnus incana ssp. rugosa	0.0	0.0	0.2	0.07
Amelanchier sp.	0.0	0.0	0.1	0.03
Anemone quinquefolia var. quinquefolia	0.7	0.8	0.7	0.73
Apocynum androsaemifolium	0.2	0.3	0.0	0.17
Aralia nudicaulis	0.9	0.8	0.3	0.67
Betula papyrifera	0.1	0.0	0.0	0.03
Carex sp.	0.0	0.6	0.3	0.30
Chamerion angustifolium	0.0	0.2	0.0	0.07
Clintonia borealis	0.8	0.4	0.4	0.53
Cornus canadensis	0.7	0.5	0.3	0.50
Cornus sericea	0.0	0.2	0.0	0.07
Corylus cornuta var. cornuta	0.5	0.1	0.6	0.40
Diervilla lonicera	0.1	0.0	0.1	0.07
Dryopteris sp.	0.0	0.0	0.2	0.07
Equisetum pratense	0.0	0.0	0.2	0.07
Eurybia macrophylla	1.0	1.0	0.7	0.90
Fragaria virginiana	0.0	0.4	0.0	0.13
Galium triflorum	0.2	0.2	0.2	0.20
Impatiens capensis	0.0	0.0	0.1	0.03
Lathyrus venosus	0.3	0.1	0.0	0.13
Linnaea borealis ssp. americana	0.5	0.5	0.0	0.33
Lonicera canadensis	0.3	0.1	0.1	0.17
Maianthemum canadense	0.9	0.6	0.3	0.60
Mertensia virginica	0.0	0.1	0.0	0.03
Mitella nuda	0.4	0.3	0.6	0.43
Moneses uniflora	0.3	0.0	0.0	0.10
Oryzopsis asperifolia	0.5	0.0	0.2	0.23
Poaceae sp.	0.0	0.4	0.1	0.17
Populus tremuloides	0.1	0.2	0.0	0.10
Prunus virginiana	0.0	0.0	0.1	0.03
Pteridium aquilinum var. latiusculum	0.0	0.2	0.0	0.07
Pyrola asarifolia	0.3	0.1	0.2	0.20
Ribes triste	0.0	0.1	0.2	0.10
Rosa acicularis	0.2	0.2	0.0	0.13
Rubus idaeus ssp. strigosus	0.0	0.0	0.3	0.10
Rubus parviflorus	0.2	0.3	0.3	0.27
Rubus pubescens	0.2	0.4	0.6	0.40
Solidago sp.	0.0	0.1	0.0	0.03
Sorbus decora	0.0	0.1	0.0	0.03
Streptopus lanceolatus var. roseus	0.2	0.0	0.2	0.13
Trientalis borealis	0.1	0.0	0.2	0.10

Plot: 2020

Species	Quadrat Frequency Transect 1	2	3	Mean Quadrat Frequency
Abies balsamea	0.1	0.2	0.4	0.23
Acer spicatum	0.2	0.2	0.5	0.30
Actaea sp.	0.0	0.0	0.1	0.03
Amelanchier sp.	0.0	0.2	0.1	0.10
Anemone quinquefolia var. quinquefolia	0.3	0.0	0.3	0.20
Apocynum androsaemifolium	0.0	0.0	0.1	0.03
Aralia nudicaulis	0.8	0.9	1.0	0.90
Betula papyrifera	0.0	0.0	0.1	0.03
Carex sp.	0.3	0.3	0.4	0.33
Chamerion angustifolium	0.0	0.0	0.1	0.03
Clintonia borealis	0.9	0.7	0.9	0.83
Cornus canadensis	0.8	0.7	0.9	0.80
Cornus sericea	0.0	0.1	0.1	0.07
Corylus cornuta var. cornuta	0.3	0.3	0.2	0.27
Diervilla lonicera	0.2	0.0	0.0	0.07
Eurybia macrophylla	0.8	0.9	1.0	0.90
Fragaria virginiana	0.0	0.6	0.5	0.37
Galium triflorum	0.9	0.6	1.0	0.83
Gymnocarpium dryopteris	0.1	0.0	0.0	0.03
Linnaea borealis ssp. americana	0.1	0.2	0.3	0.20
Lonicera canadensis	0.2	0.2	0.2	0.20
Lonicera hirsuta	0.1	0.1	0.3	0.17
Maianthemum canadense	0.7	0.6	0.7	0.67
Mertensia virginica	0.0	0.1	0.2	0.10
Mitella nuda	1.0	0.7	0.7	0.80
Moneses uniflora	0.2	0.0	0.1	0.10
Oryzopsis asperifolia	0.1	0.1	0.3	0.17
Petasites frigidus var. palmatus	0.0	0.3	0.0	0.10
Poaceae sp.	0.0	0.1	0.2	0.10
Populus tremuloides	0.1	0.3	0.4	0.27
Prunus virginiana	0.1	0.1	0.1	0.10
Pyrola asarifolia	0.2	0.0	0.1	0.10
Ribes lacustre	0.0	0.0	0.1	0.03
Ribes triste	0.3	0.2	0.3	0.27
Rosa acicularis	0.0	0.3	0.2	0.17
Rubus idaeus ssp. strigosus	0.0	0.0	0.2	0.07
Rubus parviflorus	0.3	0.2	0.3	0.27
Rubus pubescens	0.8	0.6	0.5	0.63
Sanicula marilandica	0.0	0.1	0.0	0.03
Sorbus decora	0.1	0.0	0.1	0.07
Streptopus lanceolatus var. roseus	0.2	0.4	0.0	0.20
Taxus canadensis	0.1	0.3	0.0	0.13
Trientalis borealis	0.1	0.5	0.2	0.27
Vicia americana	0.0	0.1	0.0	0.03
Viola sp.	0.1	0.0	0.1	0.07

Plot: 2021

Species	Quadrat Frequency Transect 1	2	3	Mean Quadrat Frequency
Abies balsamea	0.2	0.2	0.0	0.13
Acer spicatum	0.1	0.2	0.1	0.13
Alnus incana ssp. rugosa	0.2	0.0	0.4	0.20
Anemone quinquefolia var. quinquefolia	0.2	0.2	0.4	0.27
Apocynum androsaemifolium	0.1	0.0	0.0	0.03
Aralia nudicaulis	0.7	1.0	0.8	0.83
Carex sp.	0.1	0.2	0.0	0.10
Clintonia borealis	0.3	0.6	0.2	0.37
Cornus canadensis	0.3	0.3	0.6	0.40
Cornus sericea	0.0	0.0	0.2	0.07
Corylus cornuta var. cornuta	0.1	0.2	0.1	0.13
Diervilla lonicera	0.5	0.0	0.1	0.20
Dryopteris carthusiana	0.0	0.0	0.1	0.03
Equisetum pratense	0.0	0.0	0.1	0.03
Eurybia macrophylla	1.0	1.0	1.0	1.00
Fragaria virginiana	0.5	0.4	0.1	0.33
Galium triflorum	0.0	0.1	0.1	0.07
Hieracium sp.	0.0	0.1	0.0	0.03
Lathyrus venosus	0.0	0.0	0.1	0.03
Linnaea borealis ssp. americana	0.0	0.2	0.0	0.07
Lonicera canadensis	0.0	0.1	0.0	0.03
Maianthemum canadense	0.5	0.4	0.4	0.43
Mertensia virginica	0.0	0.2	0.1	0.10
Moneses uniflora	0.1	0.3	0.0	0.13
Poaceae sp.	1.0	0.3	0.4	0.57
Populus tremuloides	0.2	0.0	0.2	0.13
Pteridium aquilinum var. latiusculum	0.1	0.6	0.0	0.23
Pyrola asarifolia	0.5	0.5	0.1	0.37
Ranunculus acris	0.0	0.1	0.0	0.03
Ribes triste	0.1	0.0	0.0	0.03
Rosa acicularis	0.0	0.0	0.3	0.10
Rubus idaeus ssp. strigosus	0.0	0.0	0.1	0.03
Rubus parviflorus	0.2	0.2	0.2	0.20
Rubus pubescens	0.0	0.7	0.6	0.43
Sanicula marilandica	0.0	0.1	0.0	0.03
Streptopus lanceolatus var. roseus	0.2	0.3	0.0	0.17
Trientalis borealis	0.0	0.1	0.3	0.13

Plot: 2022

Species	Quadrat Frequency Transect 1	2	3	Mean Quadrat Frequency
Abies balsamea	0.4	0.1	0.0	0.17
Acer spicatum	0.0	0.1	0.0	0.03
Alnus incana ssp. rugosa	0.1	0.1	0.0	0.07
Amelanchier sp.	0.1	0.2	0.3	0.20
Anemone quinquefolia var. quinquefolia	0.3	0.4	0.5	0.40
Aralia nudicaulis	0.5	0.9	0.5	0.63
Carex sp.	0.4	0.3	0.4	0.37
Circaea alpina ssp. alpina	0.0	0.0	0.1	0.03
Clintonia borealis	0.9	0.8	0.4	0.70
Coptis trifolia	0.2	0.1	0.0	0.10
Cornus canadensis	0.3	0.7	0.1	0.37
Cornus sericea	0.1	0.2	0.2	0.17
Corylus cornuta var. cornuta	0.5	0.0	0.3	0.27
Diervilla lonicera	0.3	0.0	0.4	0.23
Dryopteris carthusiana	0.2	0.0	0.4	0.20
Equisetum pratense	0.1	0.0	0.0	0.03
Eurybia macrophylla	0.7	0.8	0.3	0.60
Fragaria virginiana	0.1	0.1	0.0	0.07
Galium triflorum	0.4	0.1	0.4	0.30
Gymnocarpium dryopteris	0.0	0.0	0.1	0.03
Impatiens capensis	0.0	0.0	0.4	0.13
Linnaea borealis ssp. americana	0.1	0.3	0.0	0.13
Maianthemum canadense	0.6	0.5	0.3	0.47
Mertensia virginica	0.0	0.0	0.2	0.07
Mitella nuda	0.3	0.4	0.6	0.43
Moneses uniflora	0.0	0.1	0.0	0.03
Petasites frigidus var. palmatus	0.1	0.0	0.0	0.03
Picea mariana	0.0	0.1	0.0	0.03
Poaceae sp.	0.1	0.1	0.1	0.10
Populus tremuloides	0.2	0.0	0.0	0.07
Prenanthes alba	0.0	0.0	0.1	0.03
Pteridium aquilinum var. latiusculum	0.0	0.3	0.1	0.13
Pyrola asarifolia	0.2	0.0	0.0	0.07
Ribes lacustre	0.0	0.1	0.0	0.03
Ribes triste	0.1	0.3	0.4	0.27
Rosa acicularis	0.2	0.4	0.1	0.23
Rubus idaeus ssp. strigosus	0.6	0.3	0.9	0.60
Rubus parviflorus	0.0	0.0	0.2	0.07
Rubus pubescens	0.6	0.8	0.5	0.63
Sambucus racemosa	0.0	0.0	0.1	0.03
Sorbus decora	0.1	0.0	0.0	0.03
Streptopus lanceolatus var. roseus	0.4	0.3	0.3	0.33
Trientalis borealis	0.1	0.6	0.3	0.33
Viola sp.	0.0	0.0	0.3	0.10

Plot: 2023

Species	Quadrat Frequency Transect 1	2	3	Mean Quadrat Frequency
Abies balsamea	0.2	0.2	0.0	0.13
Actaea sp.	0.2	0.1	0.2	0.17
Alnus incana ssp. rugosa	0.3	0.0	0.0	0.10
Alnus viridis ssp. crispa	0.0	0.1	0.1	0.07
Amelanchier sp.	0.1	0.1	0.1	0.10
Anemone quinquefolia var. quinquefolia	0.0	0.4	0.1	0.17
Apocynum androsaemifolium	0.0	0.1	0.1	0.07
Aralia nudicaulis	0.4	1.0	0.9	0.77
Asarum canadense	0.1	0.0	0.2	0.10
Athyrium filix-femina ssp. angustum	0.3	0.0	0.0	0.10
Carex sp.	0.3	0.0	0.3	0.20
Clintonia borealis	0.1	0.3	0.2	0.20
Cornus canadensis	0.0	0.1	0.5	0.20
Cornus sericea	0.0	0.1	0.4	0.17
Corylus cornuta var. cornuta	0.2	0.0	0.6	0.27
Diervilla lonicera	0.0	0.0	0.3	0.10
Dryopteris carthusiana	0.2	0.0	0.1	0.10
Eurybia macrophylla	0.7	1.0	0.8	0.83
Fragaria virginiana	0.1	0.1	0.0	0.07
Galium triflorum	0.3	0.0	0.0	0.10
Heracleum maximum	0.0	0.1	0.1	0.07
Impatiens capensis	0.2	0.0	0.0	0.07
Maianthemum canadense	0.0	0.2	0.3	0.17
Mentha arvensis	0.3	0.0	0.0	0.10
Mertensia virginica	0.0	0.0	0.3	0.10
Mitella nuda	0.6	0.0	0.3	0.30
Oryzopsis asperifolia	0.0	0.1	0.0	0.03
Poaceae sp.	0.1	0.3	0.0	0.13
Populus tremuloides	0.0	0.1	0.2	0.10
Prunus virginiana	0.2	0.1	0.0	0.10
Pteridium aquilinum var. latiusculum	0.0	0.2	0.2	0.13
Pyrola asarifolia	0.5	0.4	0.0	0.30
Ranunculus acris	0.0	0.1	0.0	0.03
Ribes glandulosum	0.2	0.0	0.0	0.07
Ribes hirtellum	0.0	0.2	0.0	0.07
Ribes triste	0.0	0.0	0.1	0.03
Rosa acicularis	0.1	0.1	0.2	0.13
Rubus idaeus ssp. strigosus	0.3	0.0	0.1	0.13
Rubus parviflorus	0.0	0.1	0.5	0.20
Rubus pubescens	0.7	0.4	0.7	0.60
Sanguinaria canadensis	0.1	0.0	0.0	0.03
Sanicula marilandica	0.1	0.1	0.0	0.07
Streptopus lanceolatus var. roseus	0.2	0.2	0.0	0.13
Thalictrum dasycarpum	0.1	0.0	0.0	0.03
Trifolium pratense	0.0	0.1	0.0	0.03
Trillium cernuum	0.1	0.0	0.1	0.07
Viola sp.	0.2	0.1	0.0	0.10

Plot: 2024

Species	Quadrat Frequency Transect 1	2	3	Mean Quadrat Frequency
Abies balsamea	0.0	0.0	0.2	0.07
Acer spicatum	0.2	0.0	0.3	0.17
Alnus incana ssp. rugosa	0.2	0.1	0.4	0.23
Anemone quinquefolia var. quinquefolia	0.2	0.3	0.2	0.23
Aralia nudicaulis	0.1	0.2	0.3	0.20
Athyrium filix-femina ssp. angustum	0.4	0.0	0.1	0.17
Carex intumescens	0.2	0.0	0.0	0.07
Carex sp.	0.4	0.3	0.1	0.27
Circaea alpina ssp. alpina	0.2	0.1	0.0	0.10
Clintonia borealis	0.2	0.3	0.6	0.37
Cornus canadensis	0.0	0.0	0.2	0.07
Cornus sericea	0.0	0.1	0.2	0.10
Corylus cornuta var. cornuta	0.1	0.1	0.0	0.07
Diervilla lonicera	0.1	0.2	0.3	0.20
Dryopteris carthusiana	0.2	0.2	0.2	0.20
Eurybia macrophylla	0.6	0.5	0.7	0.60
Fragaria virginiana	0.1	0.0	0.0	0.03
Fraxinus nigra	0.5	0.1	0.0	0.20
Galium triflorum	1.0	0.6	0.4	0.67
Impatiens capensis	0.6	0.4	0.5	0.50
Lonicera canadensis	0.0	0.0	0.1	0.03
Maianthemum canadense	0.2	0.0	0.4	0.20
Mentha arvensis	0.1	0.0	0.0	0.03
Mertensia virginica	0.7	0.5	0.3	0.50
Mitella nuda	0.6	0.6	0.2	0.47
Picea mariana	0.0	0.1	0.0	0.03
Poaceae sp.	0.4	0.4	0.5	0.43
Populus tremuloides	0.1	0.0	0.1	0.07
Prenanthes alba	0.1	0.0	0.0	0.03
Pyrola asarifolia	0.0	0.0	0.1	0.03
Ribes glandulosum	0.0	0.0	0.1	0.03
Ribes hirtellum	0.2	0.1	0.0	0.10
Ribes triste	0.4	0.4	0.5	0.43
Rosa acicularis	0.3	0.3	0.1	0.23
Rubus idaeus ssp. strigosus	0.6	0.8	0.5	0.63
Rubus parviflorus	0.0	0.0	0.1	0.03
Rubus pensilvanicus	0.0	0.8	0.0	0.27
Rubus pubescens	0.9	0.0	0.4	0.43
Sanicula marilandica	0.1	0.0	0.0	0.03
Taraxacum officinale	0.1	0.0	0.0	0.03
Trientalis borealis	0.1	0.0	0.0	0.03
Trillium cernuum	0.3	0.1	0.0	0.13
Viola sp.	0.0	0.1	0.0	0.03

Percent Cover of Shrub Species

Plot: 2002

Species	Percent cover in shrub circles 1	2	3	4	5	6	mean percent cover
Alnus incana ssp. rugosa	10		25	10	15		10.00
Alnus viridis ssp. crispa	10	9					3.17
Amelanchier sp.	5	7	1				2.17
Cornus sericea				3	20		3.83
Corylus cornuta var. cornuta		10	8	7	5		5.00
Diervilla lonicera	40	18	12	8			13.00
Rosa acicularis		1		1			0.33
Rubus parviflorus	1	2	4	7			2.33
Rubus pubescens			1	1	4	2	1.33
Salix sp.		13					2.17

Number of Shrub Circles Not Sampled in Plot 2002: 0

Plot: 2003

Species	Percent cover in shrub circles 1	2	3	4	5	6	mean percent cover
Alnus incana ssp. rugosa				40	5		7.50
Amelanchier sp.	3	1			15	3	3.67
Cornus sericea	4	3	5	2		2	2.67
Corylus cornuta var. cornuta	23	30	15		20	4	15.33
Diervilla lonicera	4	2					1.00
Rhamnus alnifolia				1			0.17
Ribes lacustre				12		3	2.50
Ribes triste				2		2	0.67
Rosa acicularis	2						0.33
Rubus idaeus ssp. strigosus	16	30	19	6	25		16.00
Rubus parviflorus	6	1	3		17	9	6.00
Rubus pubescens						1	0.17

Number of Shrub Circles Not Sampled in Plot 2003: 0

Plot: 2004

Species	Percent cover in shrub circles 1	2	3	4	5	6	mean percent cover
Alnus incana ssp. rugosa					5	7	2.00
Alnus viridis ssp. crispa				6			1.00
Amelanchier sp.		7			5	4	2.67
Cornus sericea	20	4	3	4			5.17
Corylus cornuta var. cornuta		19	5	3	16	7	8.33
Diervilla lonicera						25	4.17
Lonicera canadensis	2	3				4	1.50
Ribes triste						4	0.67
Rosa acicularis	4		18	6		5	5.50
Rubus parviflorus	15	12	2	6	4		6.50
Rubus pubescens	7		2		7	5	3.50
Viburnum rafinesquianum					10		1.67

Number of Shrub Circles Not Sampled in Plot 2004: 0

Plot: 2005

Species	Percent cover in shrub circles 1	2	3	4	5	6	mean percent cover
Alnus viridis ssp. crispa			9				1.50
Amelanchier sp.				6			1.00
Corylus cornuta var. cornuta					9		1.50
Diervilla lonicera	8		20	9		3	6.67
Lonicera canadensis					3		0.50
Rosa acicularis				6		3	1.50
Rubus parviflorus	14	7	15				6.00

Number of Shrub Circles Not Sampled in Plot 2005: 0

Plot: 2006

Species	Percent cover in shrub circles 1	2	3	4	5	6	mean percent cover
Alnus incana ssp. rugosa						2	0.33
Amelanchier sp.					8		1.33
Cornus sericea	10			2			2.00
Corylus cornuta var. cornuta	8	4			5		2.83
Diervilla lonicera		35				10	7.50
Lonicera canadensis						1	0.17
Lonicera hirsuta	1						0.17
Ribes lacustre	6						1.00
Ribes triste			1				0.17
Rosa acicularis		3					0.50
Rubus parviflorus	2		5	4	17	6	5.67
Rubus pubescens	3	9	2	2	2	5	3.83

Number of Shrub Circles Not Sampled in Plot 2006: 0

Plot: 2007

Species	Percent cover in shrub circles 1	2	3	4	5	6	mean percent cover
Alnus incana ssp. rugosa		45		30			12.50
Amelanchier sp.	3				4		1.17
Corylus cornuta var. cornuta	10	39	70	44	35		33.00
Diervilla lonicera					29		4.83
Lonicera canadensis	15	16	5	6	17		9.83
Lonicera hirsuta					6		1.00
Ribes lacustre	4						0.67
Ribes triste		2	6	5	2		2.50
Rosa acicularis	4	3			4		1.83
Rubus idaeus ssp. strigosus		20	40	11	30		16.83
Rubus pubescens	34	16		17			11.17

Number of Shrub Circles Not Sampled in Plot 2007: 0

Plot: 2008

Species	Percent cover in shrub circles 1	2	3	4	5	6	mean percent cover
Alnus incana ssp. rugosa		10	50	48			18.00
Cornus sericea		2					0.33
Corylus cornuta var. cornuta	40	27			10	20	16.17
Diervilla lonicera						4	0.67
Lonicera canadensis					1	4	0.83
Ribes triste			4	1			0.83
Rosa acicularis	1	3	7	10			3.50
Rubus idaeus ssp. strigosus			10	25			5.83
Rubus parviflorus	6	4		12	8	37	11.17
Rubus pubescens		2	2	4		1	1.50

Number of Shrub Circles Not Sampled in Plot 2008: 0

Plot: 2010

Species	Percent cover in shrub circles 1	2	3	4	5	6	mean percent cover
Alnus incana ssp. rugosa		20					3.33
Amelanchier sp.	6	3	4	2	3	20	6.33
Cornus sericea			15				2.50
Corylus cornuta var. cornuta		15	10	30		5	10.00
Diervilla lonicera				28		15	7.17
Lonicera canadensis		3	5	2	8	3	3.50
Ribes lacustre	4						0.67
Rosa acicularis		10	6	1			2.83
Rubus idaeus ssp. strigosus	5	22	4	10			6.83
Rubus parviflorus			10		15	15	6.67
Rubus pubescens	10						1.67
Salix sp.		5					0.83
Viburnum rafinesquianum	25				2		4.50

Number of Shrub Circles Not Sampled in Plot 2010: 0

Plot: 2011

Species	Percent cover in shrub circles 1	2	3	4	5	6	mean percent cover
Alnus incana ssp. rugosa	6			5			1.83
Amelanchier sp.				6			1.00
Cornus sericea			30		15		7.50
Corylus cornuta var. cornuta	4		40			5	8.17
Diervilla lonicera	8						1.33
Lonicera canadensis		5	15	3	2	1	4.33
Lonicera hirsuta	2						0.33
Ribes lacustre					3		0.50
Ribes triste					4		0.67
Rosa acicularis	8	12	4		2		4.33
Rosa blanda	3		4				1.17
Rubus idaeus ssp. strigosus			10				1.67
Rubus parviflorus	12	8	20	10	7		9.50
Rubus pubescens	10	4		8	7	10	6.50
Salix sp.			3				0.50

Number of Shrub Circles Not Sampled in Plot 2011: 0

Plot: 2012

Species	Percent cover in shrub circles 1	2	3	4	5	6	mean percent cover
Alnus incana ssp. rugosa					3		0.50
Amelanchier sp.		6					1.00
Cornus sericea						2	0.33
Corylus cornuta var. cornuta	48	3		7	5	9	12.00
Lonicera canadensis		10	3		27	5	7.50
Ribes triste			8		2	3	2.17
Rosa acicularis						1	0.17
Rubus parviflorus	9	10		19		2	6.67
Rubus pubescens		6	1		8	5	3.33

Number of Shrub Circles Not Sampled in Plot 2012: 0

Plot: 2013

Species	Percent cover in shrub circles 1	2	3	4	5	6	mean percent cover
Alnus incana ssp. rugosa	8		40			3	8.50
Alnus viridis ssp. crispa	7				60		11.17
Amelanchier sp.	3	1		2		1	1.17
Cornus sericea	3				2		0.83
Corylus cornuta var. cornuta	5	7		40		4	9.33
Lonicera canadensis		1	1	1			0.50
Rosa acicularis	4	8	3	4	4	4	4.50
Rubus pubescens	5	7	5	3		20	6.67

Number of Shrub Circles Not Sampled in Plot 2013: 0

Plot: 2014	Percent cover in shrub circles						mean percent cover
Species	**1**	**2**	**3**	**4**	**5**	**6**	
Alnus incana ssp. rugosa				60		26	14.33
Amelanchier sp.	2	10	4	7	3		4.33
Cornus sericea				1	1	10	2.00
Corylus cornuta var. cornuta	35	47		3	12		16.17
Diervilla lonicera		2			50		8.67
Lonicera canadensis		4		3			1.17
Ribes lacustre					1	7	1.33
Rosa acicularis		2	17	4			3.83
Rubus idaeus ssp. strigosus	7		6	12	7	18	8.33
Rubus parviflorus	20						3.33
Rubus pubescens	3						0.50

Number of Shrub Circles Not Sampled in Plot 2014: 0

Plot: 2015	Percent cover in shrub circles						mean percent cover
Species	**1**	**2**	**3**	**4**	**5**	**6**	
Alnus incana ssp. rugosa	5	24		36		45	18.33
Alnus viridis ssp. crispa			12				2.00
Amelanchier sp.	5					8	2.17
Cornus sericea		3					0.50
Corylus cornuta var. cornuta	10				10		3.33
Diervilla lonicera	3						0.50
Lonicera canadensis						3	0.50
Lonicera hirsuta					5		0.83
Ribes hirtellum			3	4			1.17
Rosa acicularis	3						0.50
Rubus idaeus ssp. strigosus	48		17	50		39	25.67
Rubus parviflorus			8			6	2.33
Rubus pubescens	7			4			1.83

Number of Shrub Circles Not Sampled in Plot 2015: 0

Plot: 2018

Species	Percent cover in shrub circles 1	2	3	4	5	6	mean percent cover
Alnus incana ssp. rugosa		2		20	17	7	7.67
Alnus viridis ssp. crispa	12	7		5		2	4.33
Amelanchier sp.	9	8		8	3		4.67
Cornus sericea	4	4	27		2		6.17
Corylus cornuta var. cornuta			46	10		40	16.00
Diervilla lonicera	24				2	30	9.33
Lonicera canadensis			1		1	1	0.50
Lonicera hirsuta					2		0.33
Ribes triste			3			2	0.83
Rosa acicularis			1				0.17
Rubus idaeus ssp. strigosus			3				0.50
Rubus parviflorus		40		50	8	8	17.67
Rubus pubescens	5	36	6	20	7	8	13.67

Number of Shrub Circles Not Sampled in Plot 2018: 0

Plot: 2019

Species	Percent cover in shrub circles 1	2	3	4	5	6	mean percent cover
Alnus incana ssp. rugosa				6		47	8.83
Amelanchier sp.		12	8	4			4.00
Cornus sericea		2	4		1		1.17
Corylus cornuta var. cornuta	20	15	15	6	30	15	16.83
Lonicera canadensis	4	22	8	3			6.17
Rosa acicularis	2	2	1	1			1.00
Rubus idaeus ssp. strigosus						8	1.33
Rubus parviflorus	2	1	4	5	10	6	4.67
Rubus pubescens	1		3	4	1		1.50

Number of Shrub Circles Not Sampled in Plot 2019: 0

Plot: 2020

Species	Percent cover in shrub circles 1	2	3	4	5	6	mean percent cover
Amelanchier sp.			3	2	4		1.50
Corylus cornuta var. cornuta	1		12	16	48	32	18.17
Diervilla lonicera			1				0.17
Lonicera canadensis	8	12	3	3		5	5.17
Lonicera hirsuta		2					0.33
Ribes hirtellum						4	0.67
Ribes lacustre		1					0.17
Ribes triste		6			2		1.33
Rosa acicularis		7	9	2	2	6	4.33
Rubus idaeus ssp. strigosus						8	1.33
Rubus parviflorus	1	20	5	1	7	5	6.50
Rubus pubescens		8	8			8	4.00
Taxus canadensis			3				0.50

Number of Shrub Circles Not Sampled in Plot 2020: 0

Plot: 2021

Species	Percent cover in shrub circles 1	2	3	4	5	6	mean percent cover
Alnus incana ssp. rugosa	16			9	60		14.17
Alnus viridis ssp. crispa						30	5.00
Amelanchier sp.			3			6	1.50
Cornus sericea	4			1		1	1.00
Corylus cornuta var. cornuta	9	78				4	15.17
Diervilla lonicera	5			6			1.83
Lonicera canadensis	2						0.33
Rosa acicularis				1		5	1.00
Rubus parviflorus	10		1			5	2.67
Rubus pubescens		3		10		5	3.00

Number of Shrub Circles Not Sampled in Plot 2021: 0

Plot: 2022

Species	Percent cover in shrub circles 1	2	3	4	5	6	mean percent cover
Alnus incana ssp. rugosa		32	15			18	10.83
Amelanchier sp.	10		27	5			7.00
Cornus sericea	3	27			1	3	5.67
Corylus cornuta var. cornuta	40	6		10	8		10.67
Diervilla lonicera	6	8	18				5.33
Lonicera canadensis		12	5	2	3	6	4.67
Ribes hirtellum						8	1.33
Ribes lacustre					3		0.50
Ribes sp.		2				8	1.67
Ribes triste	19						3.17
Rosa acicularis	10	12	6	6	10	15	9.83
Rubus idaeus ssp. strigosus		20			5	70	15.83
Rubus parviflorus	6		26	19			8.50
Rubus pubescens	7		3	16	8	9	7.17

Number of Shrub Circles Not Sampled in Plot 2022: 0

Plot: 2023

Species	Percent cover in shrub circles 1	2	3	4	5	6	mean percent cover
Alnus incana ssp. rugosa		60	40	4	30		22.33
Amelanchier sp.	6	5	11				3.67
Cornus sericea	5		12			5	3.67
Corylus cornuta var. cornuta	37	2	4			40	13.83
Diervilla lonicera					8		1.33
Lonicera canadensis					1		0.17
Ribes hirtellum	1						0.17
Ribes triste	8						1.33
Rosa acicularis				2			0.33
Rubus idaeus ssp. strigosus	10				11	2	3.83
Rubus parviflorus					9	22	5.17
Rubus pubescens	3	2	2	4	3		2.33

Number of Shrub Circles Not Sampled in Plot 2023: 0

Plot: 2024	Percent cover in shrub circles						mean percent cover
Species	**1**	**2**	**3**	**4**	**5**	**6**	
Alnus incana ssp. rugosa	40	40	10	45	40	60	39.17
Cornus sericea			30		4	30	10.67
Corylus cornuta var. cornuta	10	5	25	38	5	3	14.33
Diervilla lonicera		20	4			1	4.17
Lonicera canadensis			3				0.50
Ribes glandulosum					50		8.33
Ribes hirtellum		4		20			4.00
Ribes triste	2		12		3		2.83
Rosa acicularis		2					0.33
Rubus idaeus ssp. strigosus	30		20	30	15	20	19.17
Rubus parviflorus					20		3.33
Rubus pubescens	17	5	2	8		8	6.67

Number of Shrub Circles Not Sampled in Plot 2024: 0

The Department of the Interior protects and manages the nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors its special responsibilities to American Indians, Alaska Natives, and affiliated Island Communities.

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