

2013 Moose Habitat Survey

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Introduction

Fire and timber harvest are generally believed to be beneficial to moose (*Alces alces*) through the creation of early successional forest. A study of moose response to the 1971 Little Indian Sioux Wildfire in Minnesota by Peek (1974), and other authors (Lenarz et al. 2011 and Peek et al. 1976), support this view. Public and media interest following recent large fires in northeastern Minnesota often has included questions regarding benefits to moose. Along with other reasons, local timber harvest is frequently justified as creating better moose habitat (Superior National Forest [SNF] 2011).

Constitutionally dedicated funding for Minnesota wildlife habitat has increased interest and support for moose habitat enhancement and led to discussions among managers about where and how to fund habitat projects using timber management and prescribed fire for moose (M. Johnson, Minnesota Deer Hunters Association, personal communication). As a result, tribal, state and federal moose managers have expressed interest in better understanding whether or not moose have responded positively to recent large wild and prescribed fires, and similarly, whether moose will respond positively to proposed timber management projects. Although moose habitat quality is not necessarily seen as responsible for the continuing decline in moose numbers, the Minnesota Moose Research and Management Plan recognizes that habitat management may have an important role to play in mitigating this decline (Minnesota Department of Natural Resources [MNDNR] 2011).

Prior to 2012 the stratified random sampling design for the annual moose population survey precluded regular observations of large habitat changes. Survey plots were selected randomly from high, medium or low moose density areas, and it might be several years before the same survey plot was flown again. In addition, moose habitat studies currently underway in Minnesota are conducted in areas where large wild or prescribed fires are absent, and are not designed to detect how moose response to habitat modification changes over time. Therefore, this survey was initiated in January, 2012. The primary objectives of this survey are to detect moose response due to wildfire, prescribed fire, and timber management activities and determine how that response changes over time. This information is intended to assist decision-making regarding where and how to prioritize funding and effort for moose habitat management, and provide more accurate and local information to constituents about benefits to moose.

Methods

In order to minimize costs and time requirements and maximize comparison with other moose demographic data, the habitat survey is flown concurrent with and using the same methods as the annual moose population survey (DeGiudice, 2013). The population survey uses a stratified random sampling technique with 3 strata based on expected moose density. The demographic data from the habitat survey are incorporated into the population survey results through the use of a permanent 4th stratum.

Habitat survey plots were located across moose range in northeastern Minnesota (Figure 1.) All survey plots were rectangular (5 x 2.67 mi.) and 8,544 acres in size. The survey was flown using 2 MNDNR Bell Jet Ranger (OH-58) helicopters. The program DNRSurvey, on Toughbook® tablet style computers, was used to record survey data. Visibility bias was considered by using a sightability model to account for visual obstruction (Giudice et al. 2012). Visual obstruction was defined as the proportion of vegetation within a circle (30-ft radius or roughly 4 moose lengths) that would prevent an observer from seeing a moose when circling that spot from an oblique angle. If more than 1 moose was observed at a location, visual obstruction was

based on the first moose sighted. Accounting for visibility bias provided a corrected estimate of moose numbers for each plot.

After consultation with local tribal, MNDNR and SNF staff in late 2011, 3 plots in each of 3 treatments types were selected to be flown as part of this survey. Treatment types were defined as wildfire, prescribed fire (Rx), and broadly as timber management. Plots were selected for a variety of reasons, including coverage across northeastern Minnesota moose range, availability of previous years' survey data, percentage of a plot impacted by a treatment, and time since treatment or until a planned treatment. Descriptions of vegetative type and ages, ownership patterns, and harvest history for timber management plots were obtained from local MNDNR and SNF wildlife staff. Information on fire history, acres burned, and 1999 blowdown patterns was obtained from SNF geographic information system (GIS) layers. The intention is to fly each of the 9 habitat plots on an annual basis for an estimated 20 years in order to help minimize the influence of annual variation of observed moose and to determine how moose response to a disturbance or treatment changes over time.

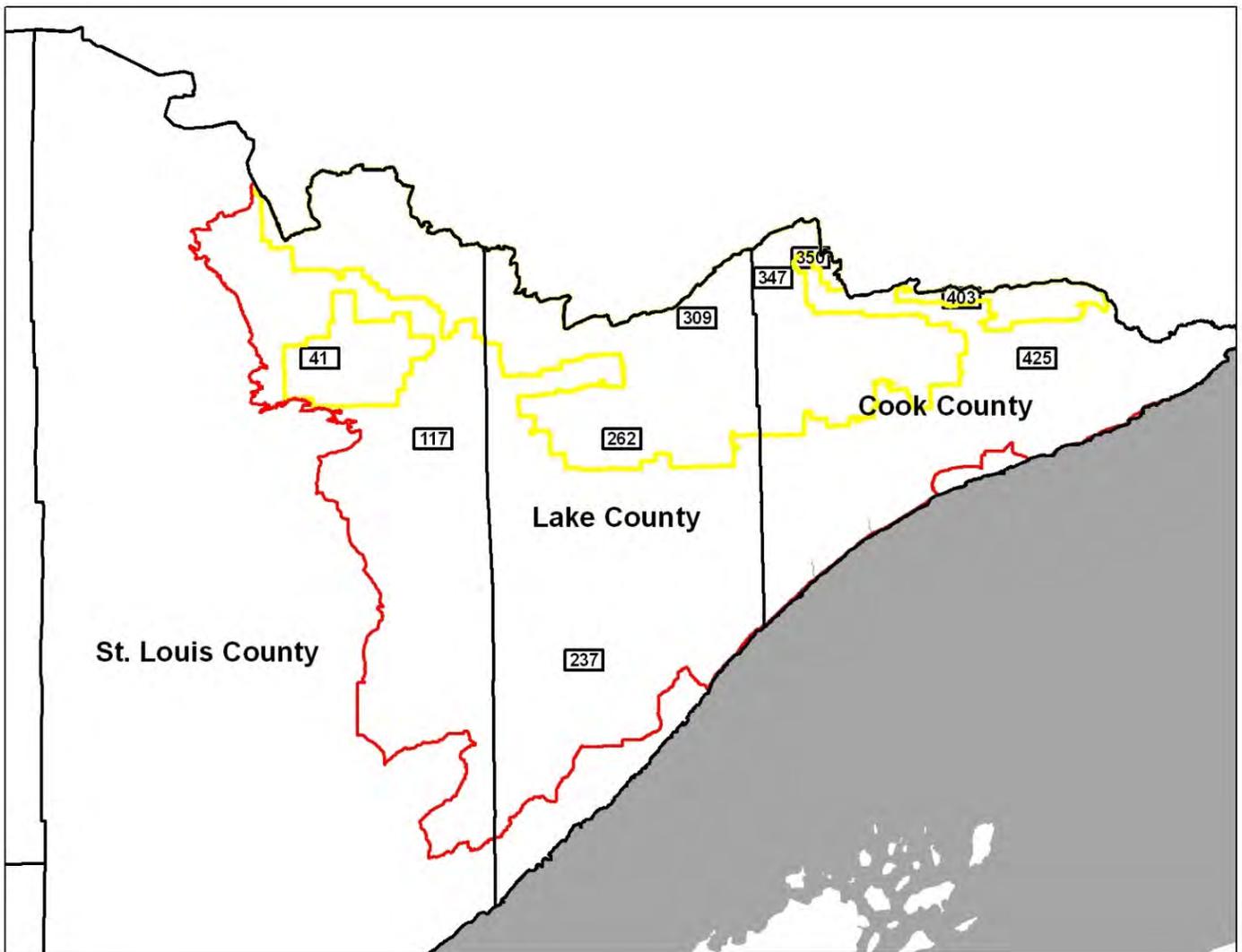


Figure 1. Locations of the 9 moose habitat survey plots. The red line delineates primary moose range and the yellow line the boundary of the Boundary Waters Canoe Area Wilderness.

Results and Discussion

Survey conditions in 2013 were described by DelGiudice (2013). The survey was initiated on 3 January and completed on 15 January with 9 actual survey days. When available for a plot, data from previous years' surveys back to 2005 are included in this report. The number of moose observed and the corrected estimate of moose numbers based on visibility bias are reported for each plot. Results prior to 2005 are not directly comparable to results in this report due to changes in plot design and survey techniques. Results for this habitat survey should be considered in the context of the entire northeastern Minnesota moose population. Since 2005, the estimated moose population has declined from 8,160 to 2,760 animals (Figure 2).

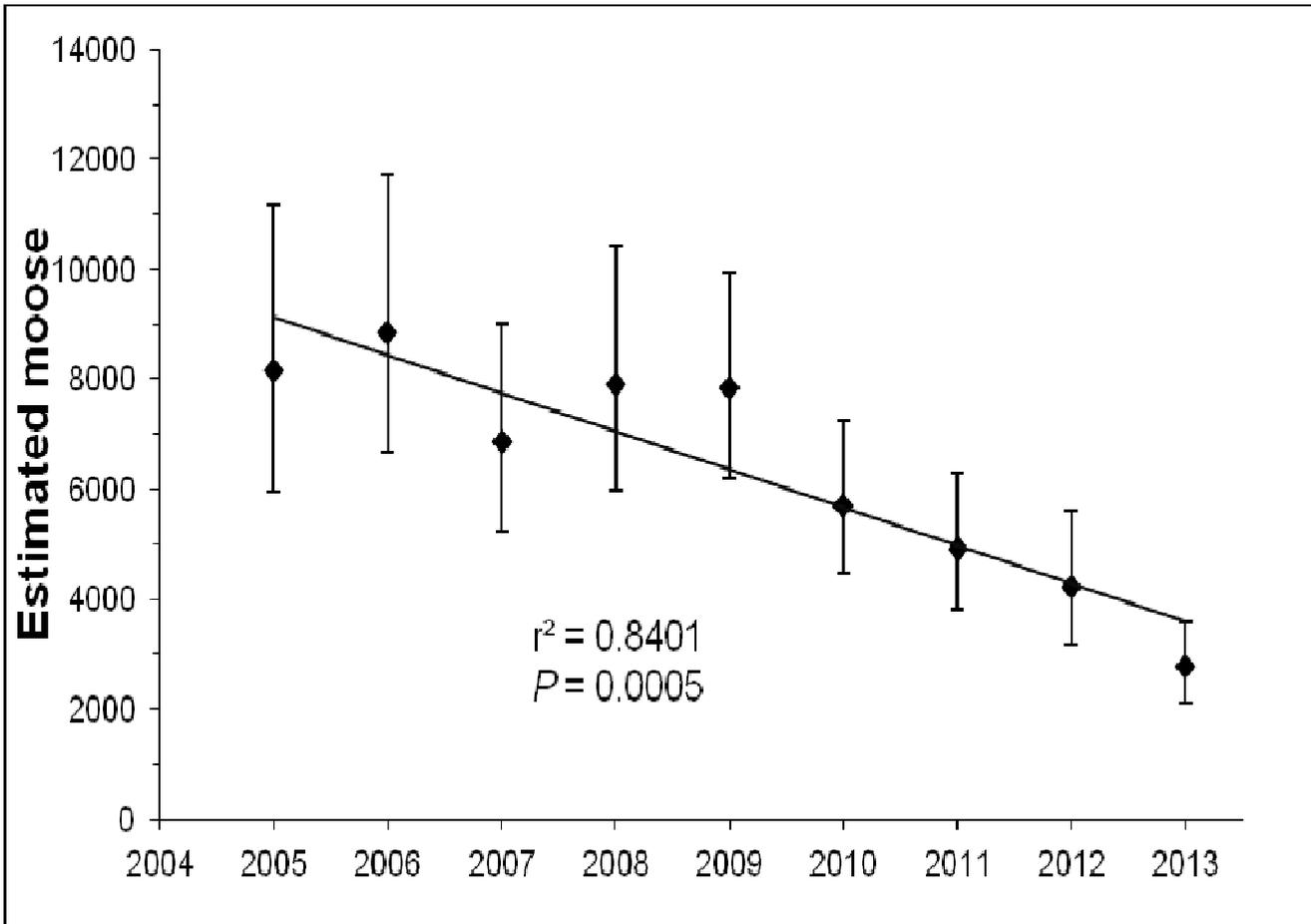


Figure 2. Point estimates, 90% confidence intervals, and trend line of estimated moose numbers in northeastern Minnesota, 2005-2013 (DelGiudice, 2013).

Timber Management Plots

Plot 117 Twin-Mitchell Project Area

Plot 117 is located 7 miles southwest of Ely (Figure 3). Land ownership within the plot is a mixture of approximately 31% St. Louis County, 29% SNF, 19% State of Minnesota, 16% private, and 5% public waters of Minnesota. There is one MDNR administered Scientific Natural Area located partially within the plot boundary. It accounts for <1% of the State ownership. The plot is a mix of upland forest with intermixed lowlands of black spruce, mixed swamp conifer, alder and lowland brush and grass. The upland vegetation is a mix of aspen/spruce-fir, red pine, white pine and jack pine cover types. The upland forest is a mix of ages ranging from 0-9 age classes to some red and white pine stands that are near 100 years old. The majority of private lands are mature and older forest.

The State land ownership is comprised of 65% conifers, 27% hardwoods, and the remaining 8% is a mix of lowland brush, muskeg, permanent and non-permanent water habitats. Approximately 56% of the State conifer stands are 0-20 years old, 9% are 20-40 years, and 13% are between the ages of 40-85. The remaining 22% includes stands of white pine, red pine, and black spruce that are 100+ years old. Nearly a third of the State hardwood stands are 0-10 years in age, 35% are 10-30 years, and 16% are between the ages of 30-85. The remaining 17% is mainly ash stands that are over 100 years old. On SNF lands approximately 41% is aspen and aspen/conifer mix, 33% lowland conifer, 16% spruce fir, and 11% pine.

The State timber management plan for Fiscal Year 2013 does not include any harvest within this plot. Past harvest of State lands within this plot has occurred primarily in white pine, red pine, black spruce, and aspen stands. About 20% of the SNF land was harvested approximately 20-30 years ago. The remainder is in a mature and older condition. Within the next 1-5 years approximately 400 acres of final harvest of aspen will occur on SNF lands. Between the years of 1995-2009 St. Louis County harvested approximately 583 acres in aspen and conifer forest types. The County plans an additional 550 acres of harvest before 2014 primarily in the same forest types.

In 2013, 7 moose (corrected estimate = 10) were observed on plot 117, part of the Twin-Mitchell Project Area (Figure 4).

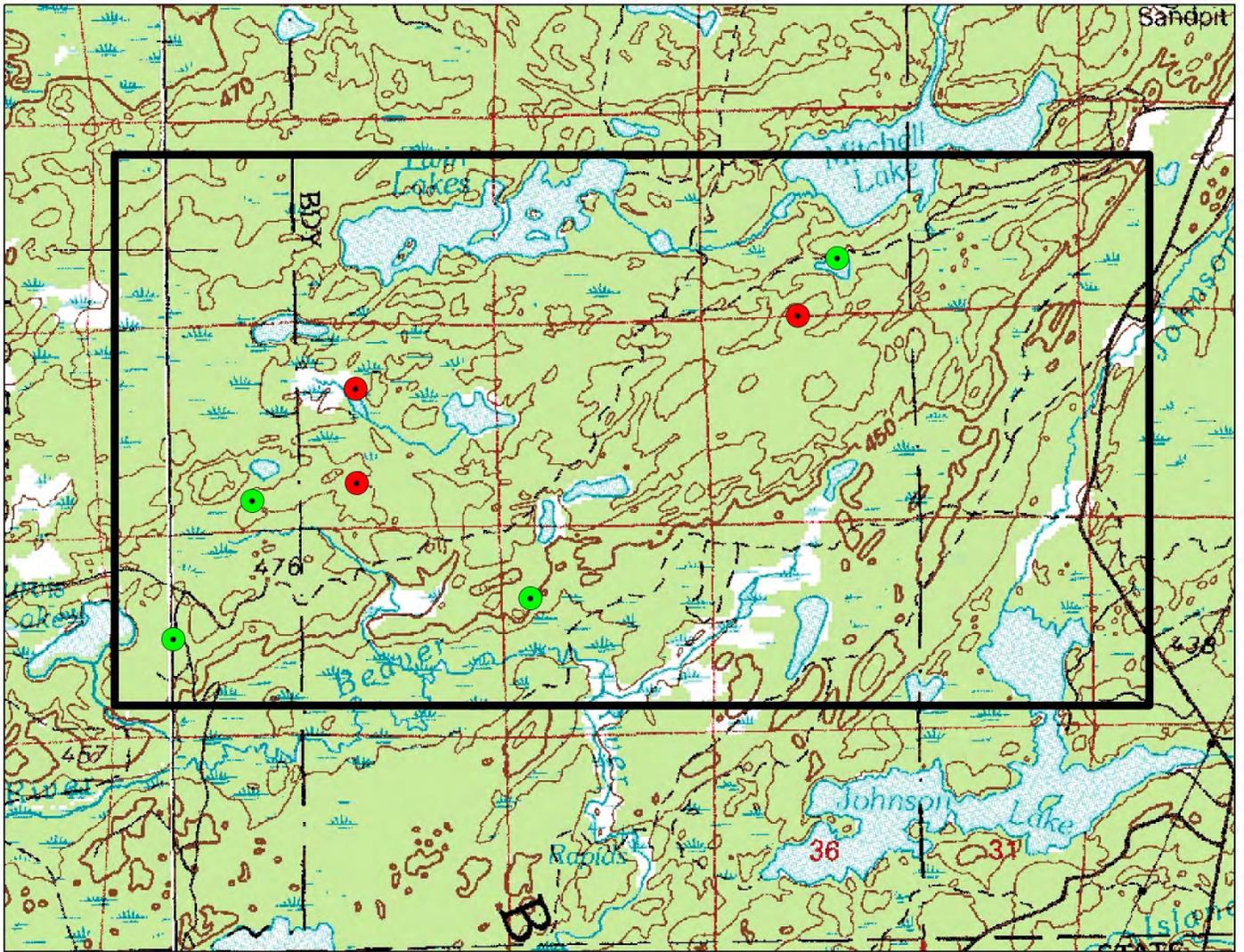


Figure 3. Plot 117 with locations of observed moose groups from 2013 shown as red dots and 2012 as green dots.

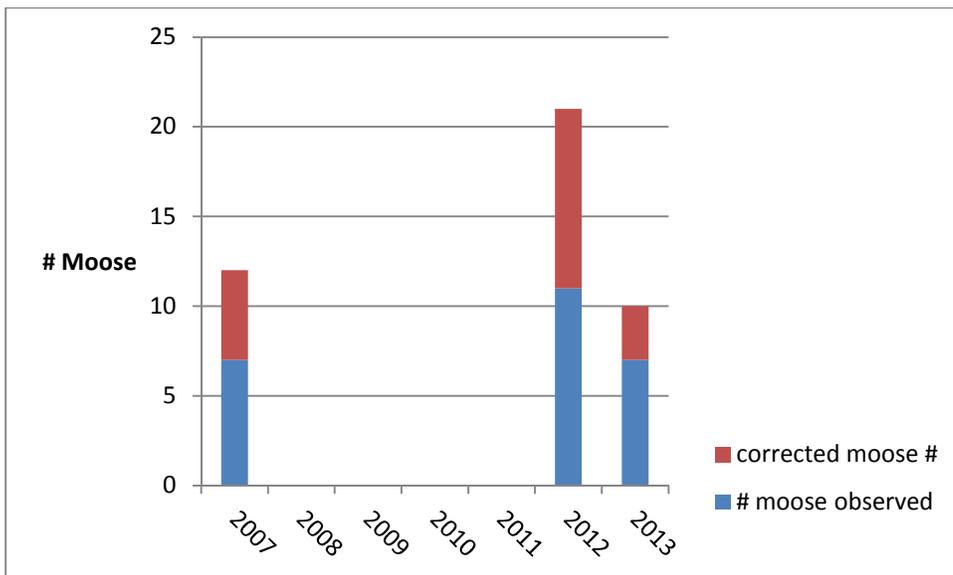


Figure 4. Plot 117 survey results.

Plot 237, Lillian Creek Project Area

Plot 237 is located immediately southwest of Cloquet Lake in Lake County (Figure 5). The plot has mixed ownership; 65% SNF, 15% State, 15% Lake County, and the remaining 5% in private ownership. The plot is about half wetland and half upland habitat. The upland vegetation is dominated by the aspen/spruce-fir cover type. In addition, there are a few acres in stands typed as upland black spruce, jack pine and red pine. Many stands across all ownerships are typed as upland brush. Lowlands are dominated by black spruce, mixed swamp conifer, and lowland brush. The majority of timber on SNF land and about half the timber on State land is in age classes above 70 years of age. On Lake County land 35% of the timber is >70 years of age and 41% is between 20 and 30 years of age.

There has been little recent timber harvest on the plot. Less than 5% of SNF land has been harvested in the last 20 years and an additional 25% of the SNF timber was cut 20-30 years ago. On State land, 8% of the forest has been harvested in the last 20 years, with an additional 19% cut or planted during the 1980s. Lake County has harvested 9% of their land in the last 20 years. The SNF has 1 current timber sale (Whyte Creek), which is due to be completed in early 2013. This sale is even-aged management of upland aspen/spruce-fir (67 acres) and lowland black spruce (76 acres). The planned Lillian Lake Sale has 250 acres of partial harvest thinning of aspen, red pine and white spruce to be offered for sale in 2013 and cut before 2015. The State has 1 current sale consisting of 63 acres of lowland black spruce being cut under even-aged management. Another 180 State acres of upland and lowland spruce on the western end of the plot will be evaluated for treatment in 2012, and most of that will be offered for sale within the next 3 years. Lake County plans to offer 20 acres for sale in the next 5 years.

In 2013, 1 moose (corrected estimate = 2) was observed on plot 237, part of the Lillian Creek Project Area (Figure 6).

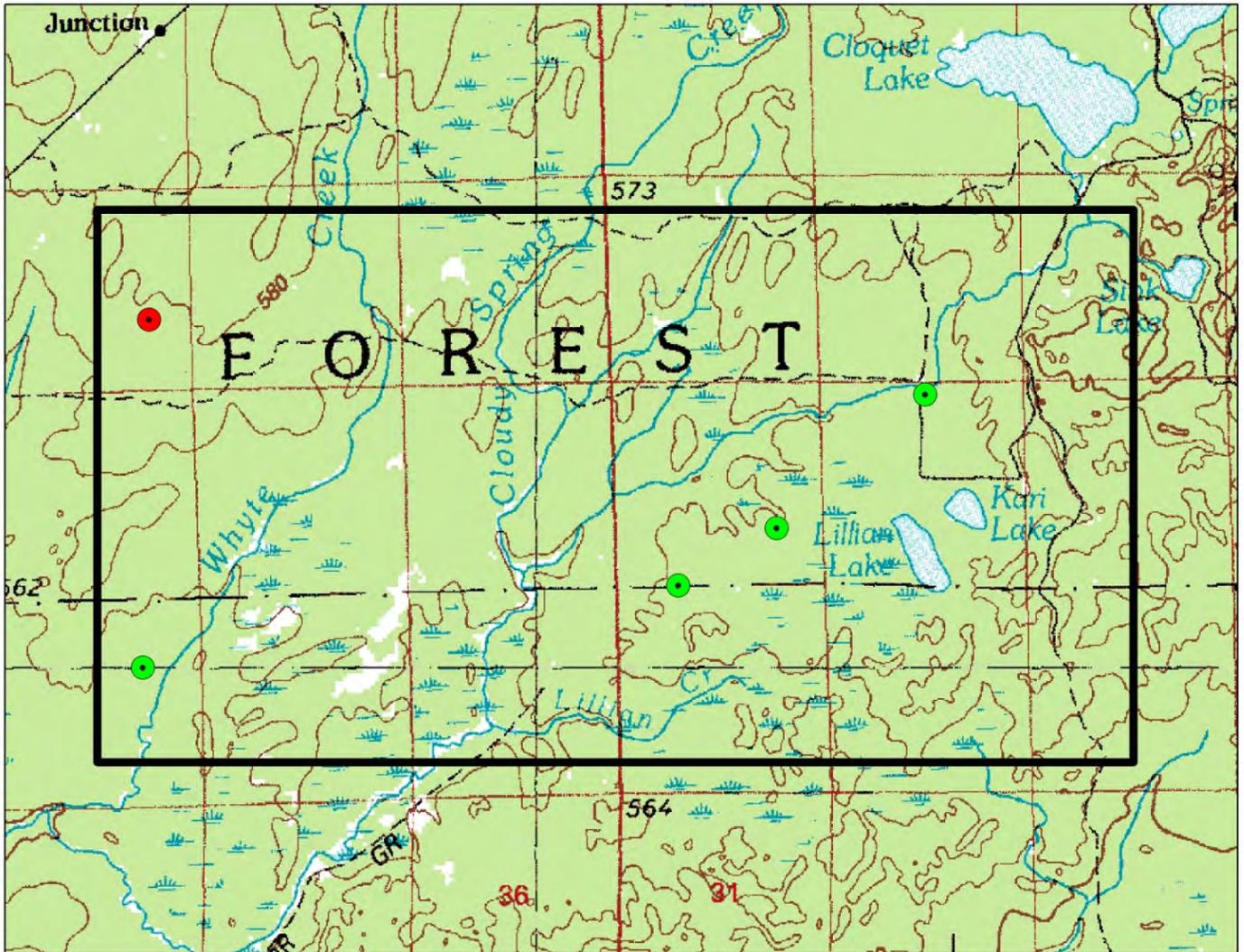


Figure 5. Plot 237 with locations of observed moose groups from 2013 shown as red dots and 2012 as green dots.

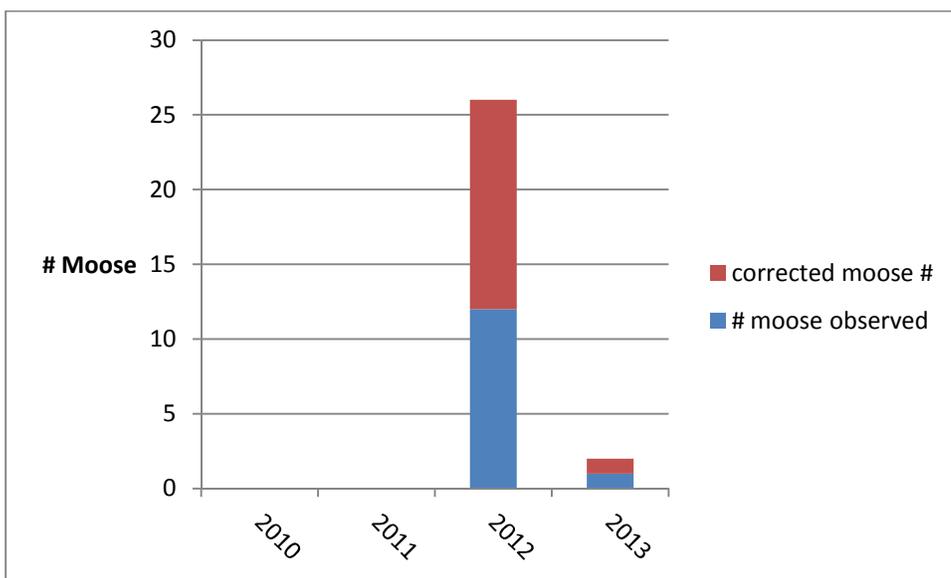


Figure 6. Plot 237 survey results.

Plot 425 Lima Green Project Area

Plot 425 is located immediately southwest of Greenwood Lake in Cook County (Figure 7). Ownership is approximately 84% SNF and 16% State. Project area wide, mesic birch-aspen-spruce-fir forests comprise approximately 49% of SNF lands and mesic red and white pine approximately 31%. Lowland conifer comprises approximately 11% of local SNF land, with cedar, jack pine-black spruce, lowland non-forest and "other" making up the remainder. By 2014, < 1% of the upland conifer or aspen and birch on SNF land will be < 10 years of age. Approximately half of the SNF acres will be in the 10-49-year age class, with remaining birch-aspen-spruce-fir in age classes to 100+ and red and white pine to 120+ years.

State land within Plot 425 is 66% in upland forest with aspen-birch and jack pine stands dominating. Black spruce lowland forest is 22% of remaining State land with the rest in non-forest grass, brush or water. About 14% of upland forests on State land are < 10 years old, 22% 11-20 years, and 64% in the 21-160-year age class.

Harvest plans for SNF lands in Plot 425 include approximately 2,216 acres of various treatments, including 1,917 acres of clear-cut with reserves. The environmental assessment for the project was signed in July, 2012 and work has begun to lay out timber sales. There are no current plans for harvest on State land.

In 2013, 12 moose (corrected estimate = 31) were seen on plot 425, part of the Lima Green Project Area (Figure 8).

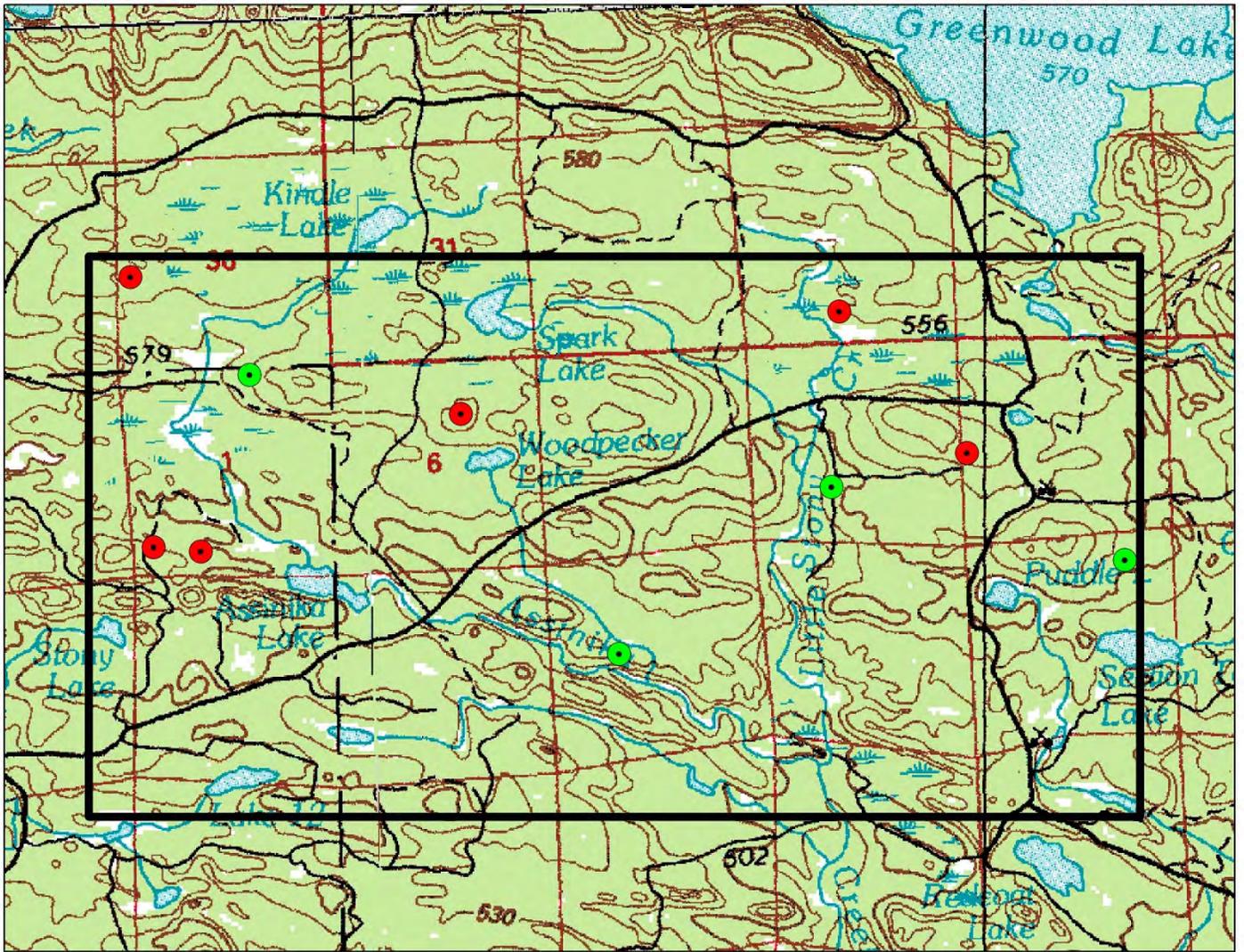


Figure 7. Plot 425 with locations of observed moose groups from 2013 shown as red dots and 2012 as green dots.

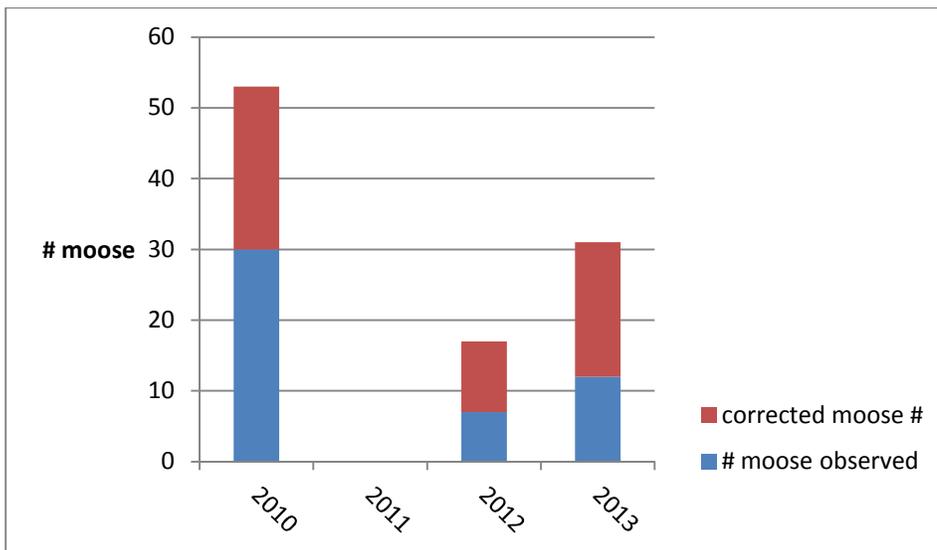


Figure 8. Plot 425 survey results.

Prescribed Fire Plots

Plot 41 Trout Lake Rx Fire

Plot 41 is located on the northeastern shore of Trout Lake in the Boundary Waters Canoe Area Wilderness (BWCAW) in St. Louis County (Figure 9). The Trout Lake Rx Fire was conducted in September, 2005 and totaled 9,867 acres of which approximately 3,860 acres are in the plot. The main purpose of the fire was to reduce fuel loads following the 4 July 1999 blowdown event. Except for 1,250 acres in the northwest corner of the plot, Plot 41 was entirely impacted by the storm with damage increasing in a generally west to east direction. On 1,540 acres, wind damage was estimated at 10-33% of the standing timber. On 4,400 acres across the central and southern portions of the plot wind damage was estimated at 34-66% of the timber. In the northeastern corner of the plot, 1,290 acres suffered damage to 67-100% of the timber.

In 2013, 7 moose (corrected estimate = 14) were seen on plot 41, part of the Trout Lake Rx Fire (Figure 10). Aerial observation suggests fire intensity across the plot was relatively light. Regeneration appears abundant and contains a strong conifer component.

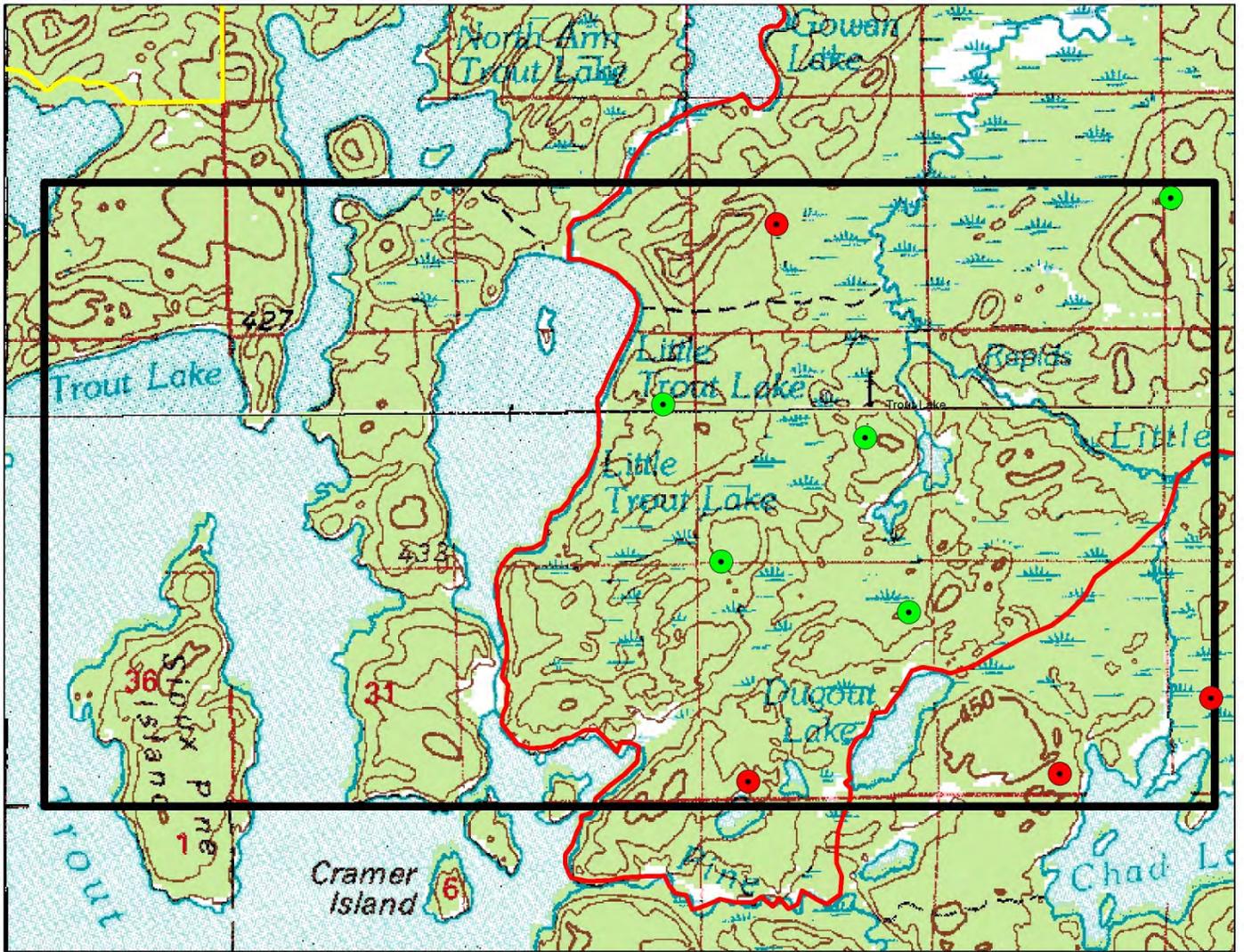


Figure 9. Plot 41 with the border of the BWCaw delineated by the yellow line and the perimeter of the Trout Lake Rx Fire by red. Locations of observed moose groups from 2013 are shown as red dots and 2012 as green dots.

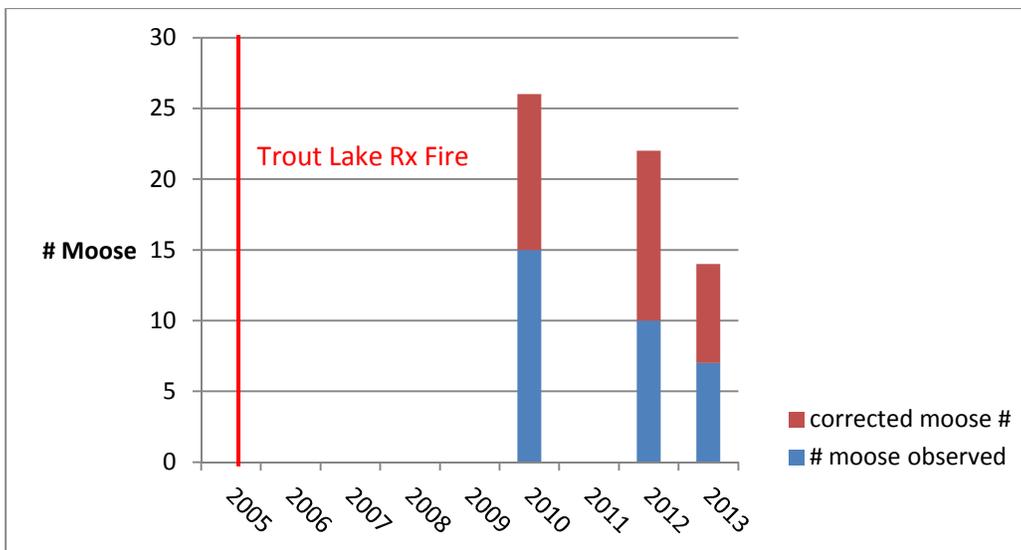


Figure 10. Plot 41 survey results.

Plot 309 Kekspider Rx Fire

Plot 309 is located around Kekekabic Lake in the BWCAW in Lake County (Figure 11). The Kekspider Rx Fire was conducted in October, 2010 and totaled 4,961 acres of which approximately 4,270 acres are in the plot. The main purpose of the fire was to reduce fuel loads following the July 1999 blowdown event. Plot 309 was completely affected by the storm with damage to timber classified as 67-100% across the entire plot.

In 2013, 1 moose (corrected estimate = 2) were observed on plot 309, part of the Kekspider Rx Fire (Figure 12). In 2012, the observed number of moose equaled the corrected number of moose. Aerial observation suggests the fire burned with various intensities across the plot. Regeneration following the blowdown and the fire, is generally well in evidence from the air and contains a strong conifer component.

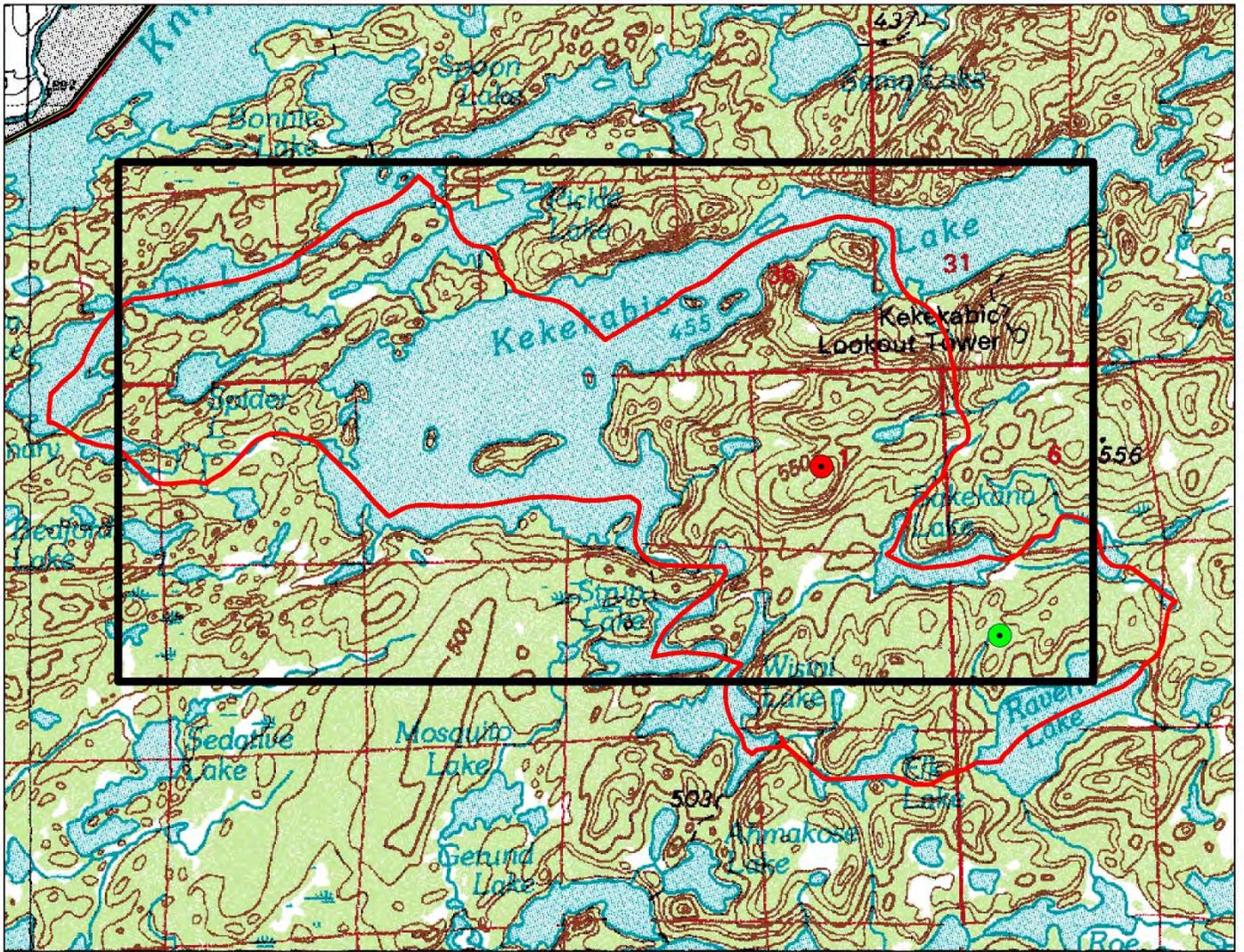


Figure 11. Plot 309 with the perimeter of the Kekspider Rx Fire delineated in red and the 2013 moose location as a red dot and the 2012 location as a green dot.

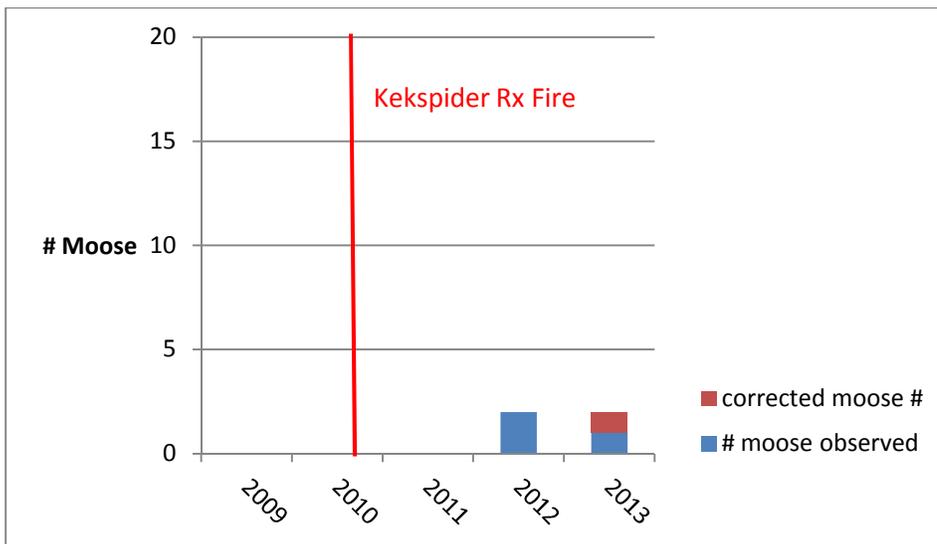


Figure 12. Plot 309 survey results.

Plot 403 Duncan Lake Rx Fire

Plot 403 is located around Duncan Lake in the BWCAW in Cook County and contains a few acres on the Ontario side of the border (Figure 13). The Duncan Lake Rx Fire is proposed to be 4,780 acres and is planned for completion before 2015. Approximately 4,100 acres of the fire would occur in the plot. The main purpose of the fire is to reduce fuel loads following the July 1999 blowdown event. Wind damage on approximately 4,580 acres on the southern half of the plot is classified as affecting 10-33% of the timber. Wind damage is estimated at 34-66% of the timber on approximately 1,070 acres in the northwest corner of the plot. Approximately 2,840 acres of timber on the northern third of the plot were undamaged by the storm. In addition, approximately 440 acres in the southeastern corner of the plot were burned in the May 1988, Daniel-Bearskin Wildfire.

In 2013, 10 moose (corrected estimate = 19) were observed on plot 403, part of the Duncan Lake Rx Fire (Figure 14). As indicated above, this plot was relatively lightly damaged by the 1999 blowdown event. Much of the overstory remains intact and includes a mix of hardwood and conifer. Where the blowdown was more intense, the forest floor still contains significant large woody debris.

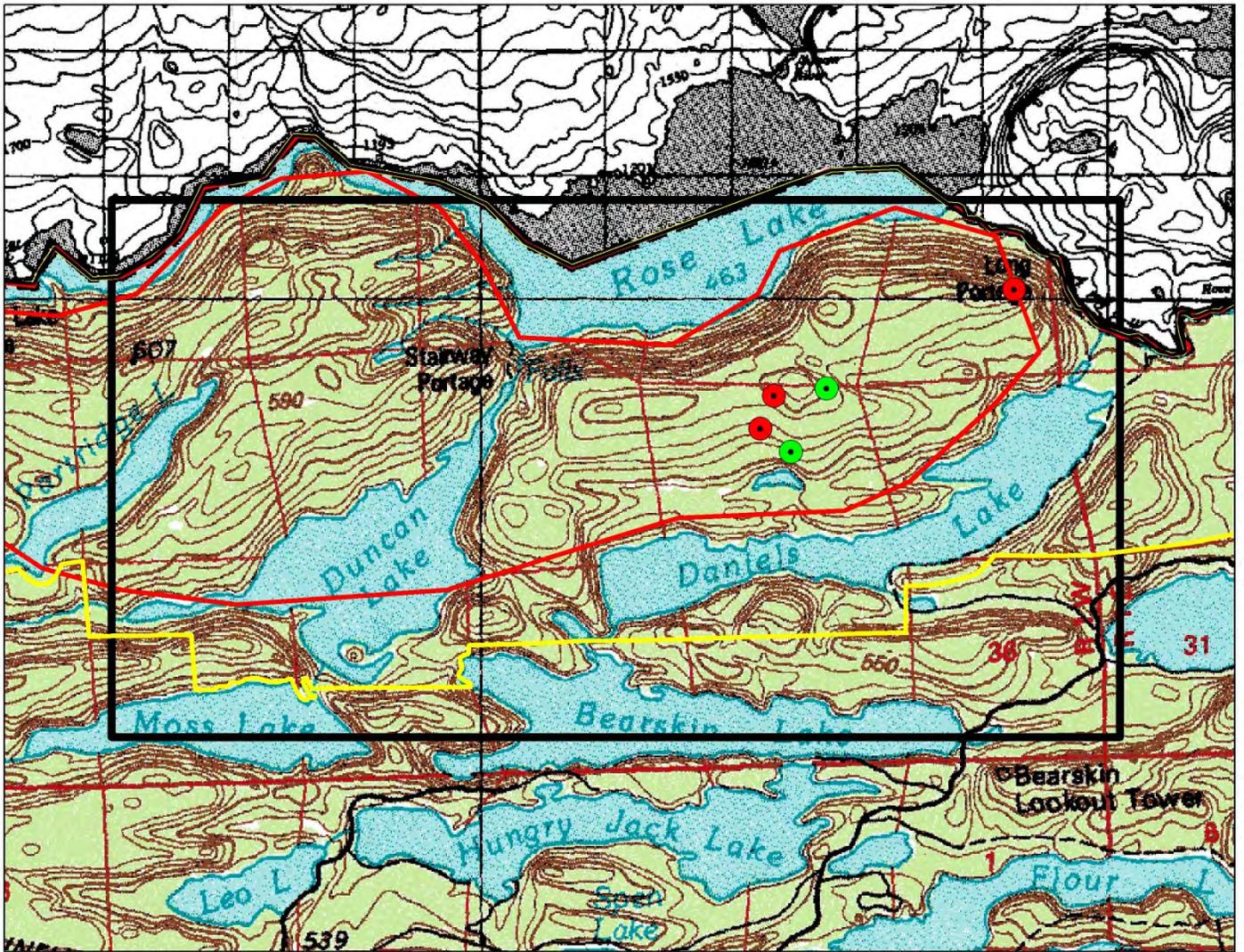


Figure 13. Plot 403 with the border of the BWCaw delineated by the yellow line and the perimeter of the planned Duncan Lake Rx Fire by red. Moose group locations from 2013 are shown as red dots and 2012 as green dots.

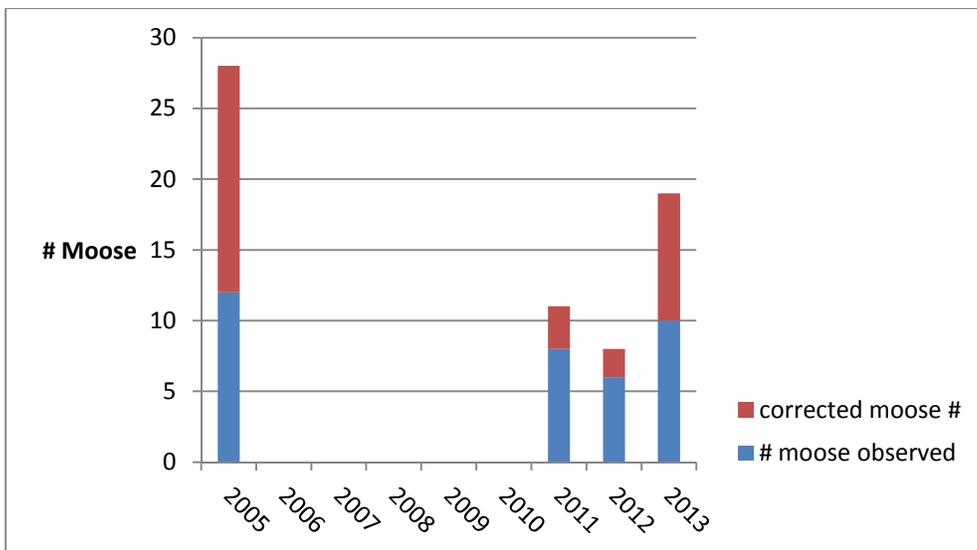


Figure 14. Plot 403 survey results.

Wildfire Plots

Plot 262 Pagami Creek Fire

Plot 262 is located around Quadga Lake in the BWCAW in Lake County (Figure 15). The Pagami Creek Fire was first detected on 18 August, 2011; however, the majority of the fire burned in a single day on 12 September when winds pushed it 16 miles to the east. Fire behavior on that day was particularly extreme. The fire eventually grew to 92,000 acres and “hotspots” remained until winter. Except for approximately 200 acres in the southwestern corner of the plot, the entire plot was affected by the fire. Most of the plot was unaffected by the July 1999 blowdown event. Damage from the blowdown to standing timber was estimated at 10-33% on approximately 250 acres in the northeastern corner of the plot.

In 2013, no moose were observed on plot 262, part of the Pagami Creek Fire (Figure 16). In 2012, the observed number of moose equaled the corrected number of moose. Aerial observation suggests the majority of the plot was severely burned. As of January, 2013, little or no brush regeneration is evident from the air across most of the plot. Almost the entire overstory, including lowland conifer stands, appears to have burned.

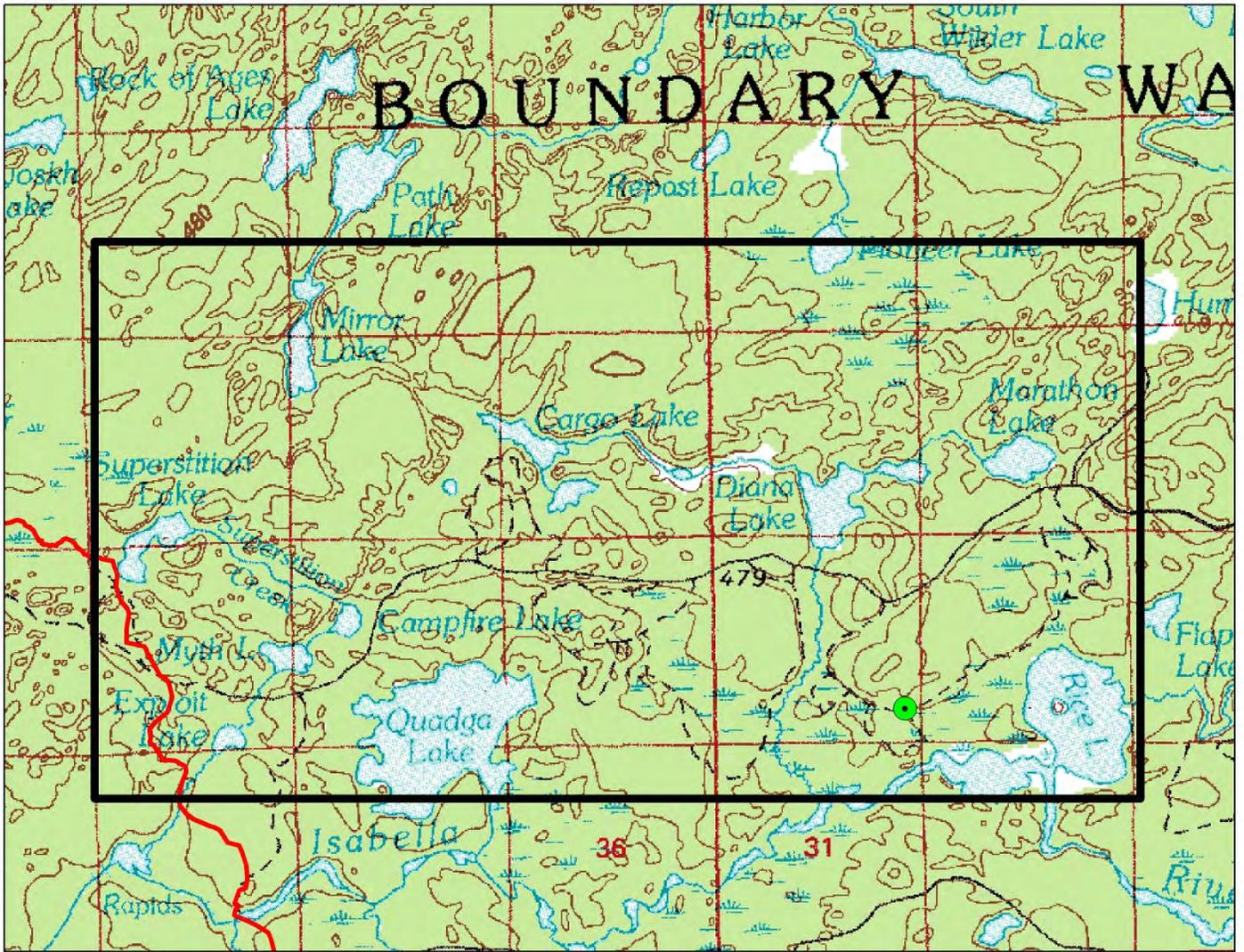


Figure 15. Plot 262 with the perimeter of the Pagami Creek Fire delineated with a red line. The 2012 moose location is shown as a green dot.

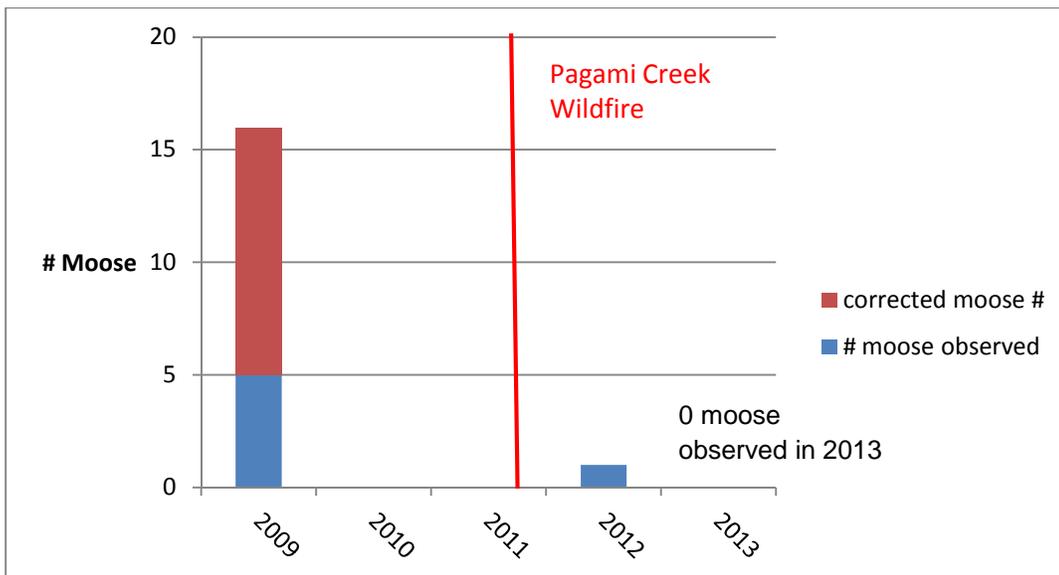


Figure 16. Plot 262 survey results.

Plot 347 Cavity Lake Fire

Plot 347 is located around Alpine Lake in the BWCAW in Cook County (Figure 17). Plot 347 was affected by 3 wildfires and a Rx fire between 2002 and 2007, as well as by the July 1999 blowdown event. The Cavity Lake Fire ignited on 13 July, 2006 and remained active until the middle of August, burning an estimated 31,830 acres total and 6,210 acres in the plot. The August, 2005 Alpine Lake Fire burned 1,070 acres in the north-central part of the plot and the Ham Lake Fire burned 110 acres in the very southeastern corner of the plot. On the southern end of Three Mile Island, 140 acres were burned in a September, 2002 Rx fire. The entire plot was impacted by the July, 1999 blowdown. Damage to timber was estimated at 67-100% on approximately 3,500 acres in western and southern portions of the plot and at 34-66% on 4,500 acres in the central and northern portions. Remaining timber in the northeast suffered damage estimated at 10-33%.

In 2013, 17 moose (corrected estimate = 23) were observed on plot 347, part of the Cavity Lake Fire (Figure 18). The southern part of plot 347 appears to have been burned more severely in the fire than the northern half of the plot. While regenerating brush is evident from the air across much of the plot, much of the upland overstory was removed in the southern half of the plot. In the northern half of the plot, the area within the Alpine Lake Fire and the northwest corner of the plot in the Cavity Lake Fire appear to have been burned less severely, and at least scattered individual and groups of overstory trees remain alive.

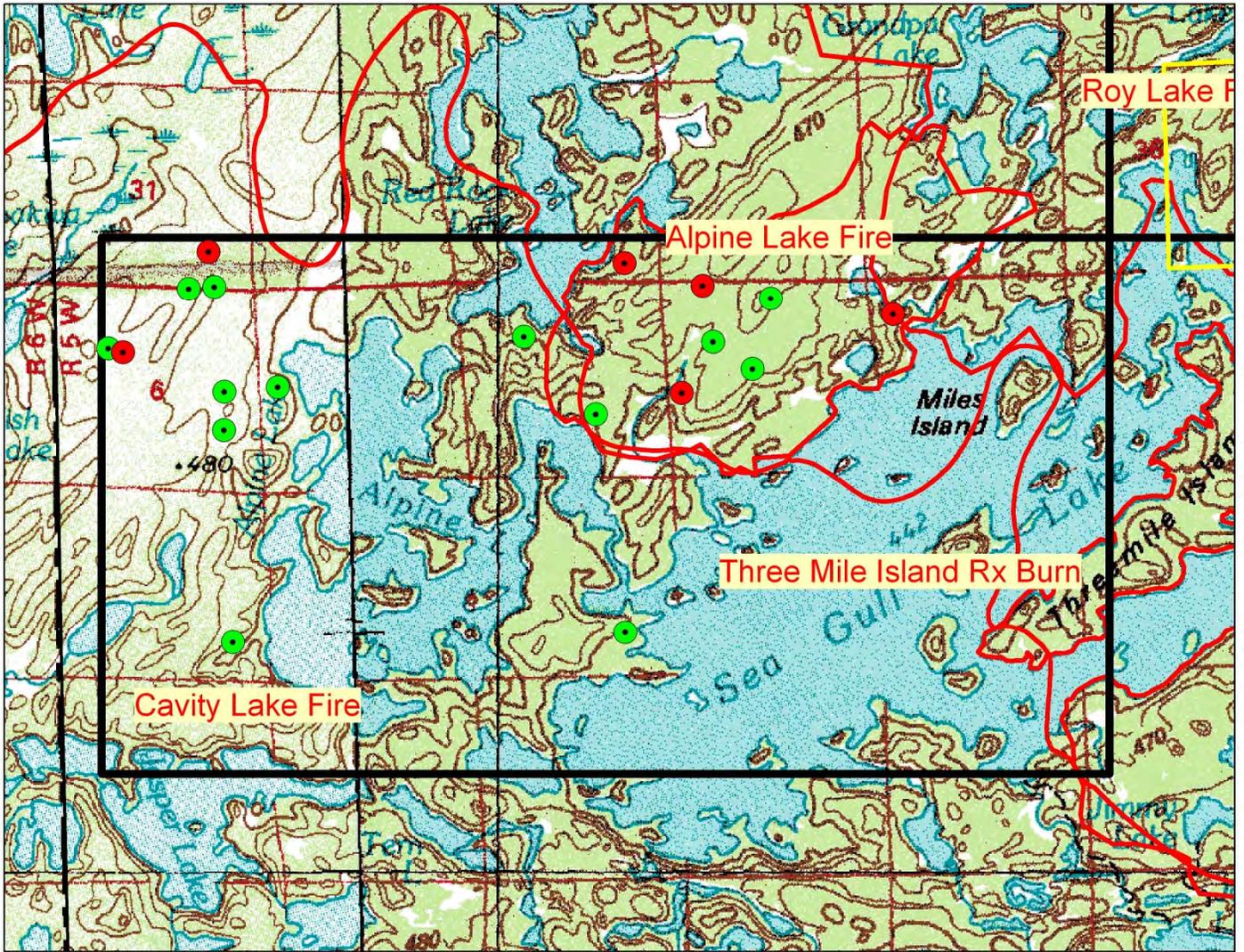


Figure 17. Plot 347 with fire perimeters delineated with red lines. Locations of observed moose groups from 2013 are shown as red dots and 2012 as green dots.

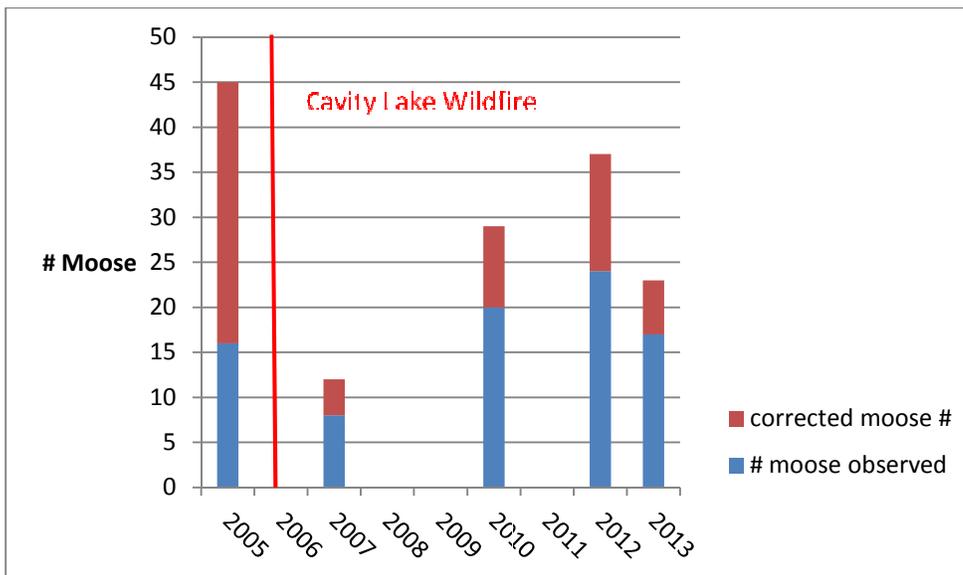


Figure 18. Plot 347 survey results.

Plot 350 Ham Lake Fire

Plot 350 is located at the end of the Gunflint Trail in Cook County, partially in and out of the BWCAW with some acres in Ontario as well (Figure 19). The Ham Lake Fire started on 5 May, 2007, and eventually burned over 75,000 acres in Minnesota and Ontario. Approximately 6,480 acres on the eastern two-thirds of the plot were affected by this fire. In addition, approximately 1,160 acres along the western edge of the plot were burned in the August, 1976 Roy Lake Fire. The July, 1999 blowdown affected much of the plot as well. Timber damage estimated at 10-33% occurred on approximately 4,000 acres in the western and southern portions of the plot. Approximately 3,470 acres in the central and eastern portions of the plot suffered damage estimated at 34-66%, and an additional 640 acres in the east central area suffered damage estimated at 67-100% of the timber.

In 2013, 16 moose (corrected estimate =23) were observed on plot 350, part of the Ham Lake Fire (Figure 20). The south central part of the plot is well developed with roads, cabins and campgrounds associated with the Gunflint Trail corridor. The western 1/3rd of the plot affected by the Roy Lake Fire is covered with dense, primarily jack pine, regeneration. Aerial observation suggests the eastern 2/3rds of the plot, which were impacted by the Ham Lake Fire, show obvious brush regeneration. Many of the conifer swamps in the fire's perimeter appear to have retained their canopy and provide an interspersion of cover with the burned areas.

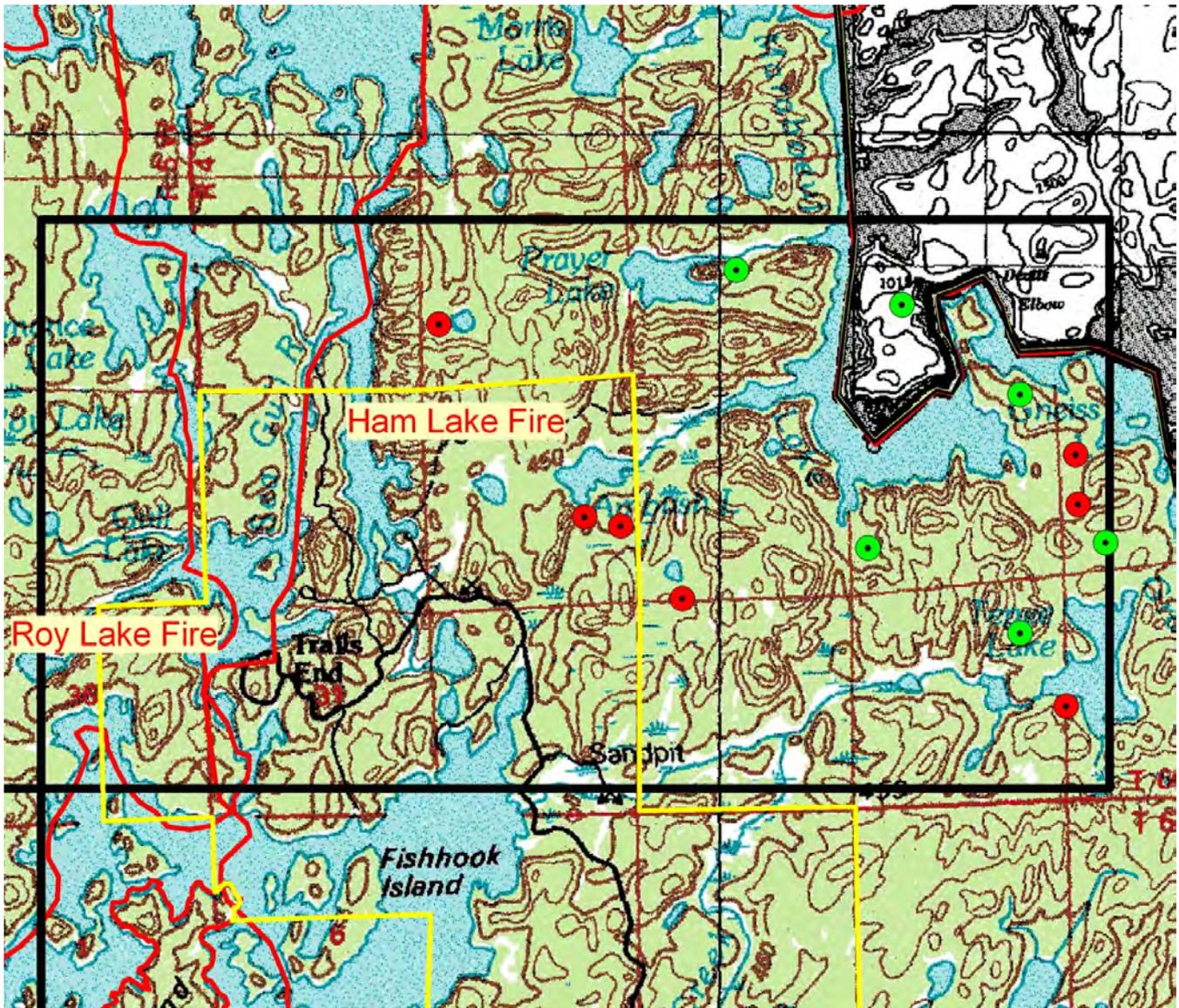


Figure 19. Plot 350 with the border of the BWCAW delineated by the yellow line and the fire perimeters by red. Locations of observed moose groups from 2013 are shown as red dots and 2012 as green dots.

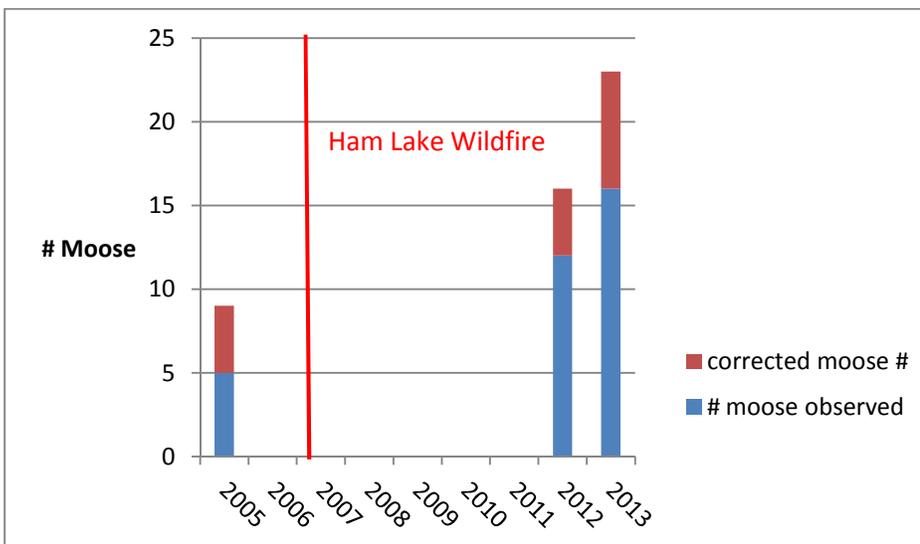


Figure 20. Plot 350 survey results.

Acknowledgments

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Figure 21. Bull moose in the Ham Lake Fire perimeter of Plot 350.

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