



**National Park Service
Voyageurs National Park and Great Lakes Eco-region
Fire Ecology Annual Report
Calendar Year 2004**

Summary

The new fire ecologist for the eco-region (Scott Weyenberg) started in early August and is stationed at Voyageurs N. P. All burning and FMH sampling at VOYA took place prior to my arrival.

Fifty-one acres of red/white pine forest were burned through prescribed fire in late May. July through early August personnel were busy with the park's first large scale Fire Use fire. The fire burned approximately 1400 acres of predominately boreal mixedwood forest. It was an ideal fire in many ways and was a great success for the fire program and the park. Though no FMH plots were burned, broad scale post fire sampling was done to obtain burn severity, pre-burn vegetation estimates, and post-burn baseline data. The only burning done this fall were piles left from the 2003 mechanical thinning project.

Voyageurs N. P. hosted the Fire Learning Network annual meeting for the Border Lakes Group in early December. The meeting was well attended by the MN DNR, USFS, TNC and Ontario MNR.

In anticipation of burning in the spring of '05 at St. Croix Scenic Riverway, I met with Robin Maerklein and tested sampling methods for prairies and savannas. Sampling methods still need some refinement, so nothing was implemented.

I made a trip to Indiana Dunes to get a feel for the park and the program. Additional details are contained in the INDU annual report.

Table 1. Fire Effects Plot Workload 2004

Park	Monitoring Unit	Type of Plot (FMH, photo point, other)	Pre-burn	Immed. Post	Postburn (1-20 yrs)	Total Plots
Voyageurs	Red Pine	FMH Forest plot	3	0	1	4
Voyageurs	White Pine	FMH Forest plot	2	0	5	7
Voyageurs	Jack Pine	FMH Forest plot	0	1	1	2
Voyageurs	Aspen-Birch/Boreal Conifer	FMH Forest plot	1	0	0	1
Voyageurs	White Spruce-Fir-Aspen	FMH Forest plot	0	0	0	0
Voyageurs	Red Pine (Sec 33 Fire)	Non-FMH (Modified CBI, vegetation)	0	8	0	8
Voyageurs	Aspen-Birch/Boreal Conifer (Sec 33 Fire)	Nom-FMH (Modified CBI, vegetation)	0	20	0	20
Total			6	29	7	42

Table 2. Fire Ecology Staffing 2004

The monitoring staff at Voyageurs is the fire crew. The pay periods given for them below only include time spent on monitoring. Not counting the fire ecologist, 14 pay periods were dedicated to monitoring.

Monitor	Starting Date	Ending Date	# of Pay Periods	Training and Development
Scott Weyenberg	8/8/04	NA	9	S-290, FRCC
Kurt Fogelberg	4/90	NA	1	
Troy Anderson	5/9/04	10/9/04	4	S-290
Jason Anderson	5/9/04	10/9/04	4	S-290
Greg Carlson	4/18/04	9/30/04	2.5	
Owen Johnson	5/9/04	9/04/04	2.5	

Table 3. Management Objectives and Monitoring Results 2003

Monitoring data has not been statistically analyzed at this time, however a report containing some preliminary analyses is attached.

Ecologist Accomplishments.

- Reviewed the Indiana Dune National Lakeshore FEMP. Depending on what the park thinks of it, it will likely be completed in 2005.
- Involved in planning the Border Lakes Fire Learning Network annual meeting.
- Collaborating with VOYA resource management staff to secure funding for a deer exclosure, and assessments of current stand age and composition and pre-settlement forest composition throughout the park.
- Performed initial post-burn assessment of Sec. 33 fire.

Optional.

As is the case at INDU we will also institute burn level monitoring at VOYA in 2005. This will help us assess whether objectives were met. To find additional time for this sampling, we may postpone the 5 year re-reads to 10years if the 5 year change is deemed insignificant.

We will likely monitor fire effects on wetlands in 2005. After consultation with local experts it seems clear that the state of knowledge in fire in northern wetlands is very limited. Fire frequency for various wetland types is unknown for the most part. Fortunately, the Sec. 33 fire burned some wetlands and fire effects can be monitored there.

Concern has been raised at INDU and VOYA regarding the transfer of live pre-burn fuels to dead post-burn fuels thus increasing the fuel loading. To help us assess overall progress, I will track changes in total above ground biomass, and fire hazard as a function of fuel type flammability. A new program, Fuel Characteristic Classification System (unreleased), has recently been developed to do this, and I will be testing its effectiveness for our needs. Given the above stated fuels changes, it appears that in certain cases a more frequent fire frequency may be needed in the early stages of restoration.

A serious problem at VOYA is white-tailed deer browsing. Prescribed fire is successful in regenerating white pine, however the trees never make it out of the seedling stage. Resource management would like to install deer exclosures to assess the extent of browsing on white pine and other species; however funds are not available currently.

2004 Preliminary Analyses for Voyageurs National Park

Prepared by Scott Weyenberg

No statistical analyses were done for the following report. I think the trends are reasonably accurate for the data we have, however the actual numbers are not accurate for various reasons. Trends were analyzed by monitoring type, *Pinus resinosa* (n=5), *P. strobus* (n=9), *P. banksiana* (n=4) and Mixedwood (n=2). Data does not exist for all sites out to ten years, therefore to keep the year 10 average from spiking missing data were projected.

Fuels

With the exception of the jack pine monitoring type, fuel loads in all classes were decreased with burning (Fig. 1). After five years, total fuel load began increasing to the point at which they were equal to or higher than pre-burn levels in all types. One must keep in mind that one 9" log falling across the line increases the loading by 1.7 T/ac, therefore not much is required to increase the loading substantially.

Fuel area index (FAI) is also plotted with total woody loading (Fig. 1). Fuel area index is defined as the total fuel surface area per unit ground area (ft²/ft²). This is similar to surface to volume ratio and is used here as a surrogate for fire hazard. Each class is weighted differently based on its surface area, as such, smaller fuels are given more weight than larger ones. The index was determined for each fuel class by multiplying its loading by the FAI constant. A slight increase in FAI was seen in the white pine type from year 1 to year 10, but all other types saw constant or large decreases after burning.

Contrary to the increases seen in total woody loading ten years post burn fuel hazard has decreased in down and dead woody fuels.

Seedlings and Saplings

Seedling counts of select species are plotted for four monitoring types (Fig.2). Seedlings were defined as those trees less than dbh (4.5'). Those greater than dbh and less than 1" dbh were considered saplings. Saplings were only plotted for the white pine monitoring type as they did not occur in significant enough numbers to warrant plotting them for the other types.

White pine regeneration is rather significant in the red and white pine types, peaking at 2 years post and tapering off after tens years (Fig. 2). Red pine regeneration is nearly non-existent. Red maple is ubiquitous in all types. It increases significantly after burning and is the only species recruiting to the sapling stage in any significant amount. White pine, though quite abundant, never progresses much past the 0.30 m height class (data not shown).

Pole Sized Trees

Basal areas (BA) of the most abundant pole sized trees were plotted for each monitoring type. As expected, large decreases in BA were seen after burning (Fig. 3). Increases in BA of white and jack pine in the jack pine type, result from the growth of the 3 trees measured. Red maple is increasing in the mixedwood type, but remains relatively constant in all other types BA.

Overstory Trees

Average basal areas for dominate overstory species and all species combined were plotted for each type (Fig. 4). Decreases in BA were seen post burning in types. Basal area continued to decrease in the jack pine type ten years post, while all others remained constant. Total basal area in the jack pine type seems quite low even in the pre condition, possibly due to the substrate. Conversely, the BA in the white pine type is quite high.

Conclusion

Although ten year total fuel loading has increased or remained constant as compared to pre-burn levels, the fire hazard (FAI) still remains at a lower point. Additionally, live pole sized balsam fir were significantly reduced, but were merely converted to dead trees. Dead trees were not analyzed due to inconsistencies in the data; however it appears that by year ten most of these trees fall to the ground. Though a substantial amount of live fuel is converted to dead and down fuel, it still appears that the fire hazard was reduced through burning.

Recruitment of white pine is still a problem. White pine is regenerating well, however it is not making it past the seedling stage. This is I believe is due in large part to deer browsing. Additionally, judging from the high overstory BA in the white pine type, $\sim 200\text{ft}^2/\text{ac}$, light levels are likely below optimum for white pine growth.

Red and jack pine are not regenerating at all. The lack of red pine regeneration is likely due to lack of mineral soil exposure as well as low light conditions. Jack pine regeneration is not likely to occur without substantial heat in the canopy, which isn't an option at this point in the program.

Red maple is doing well unfortunately, and seems to be taking over in most types. It will likely shade out what pine seedlings remain.

I think significant gains could be made in red and white pine regeneration and recruitment by re-burning some areas. This could further reduce duff, woody fuels and overstory BA as well as set back the red maple. Two to three re-burns may be necessary to restore our pine types to the proper fuel loading, duff depth and species composition. Until natural stand characteristics are established the successional trajectory will continue to diverge from pine.

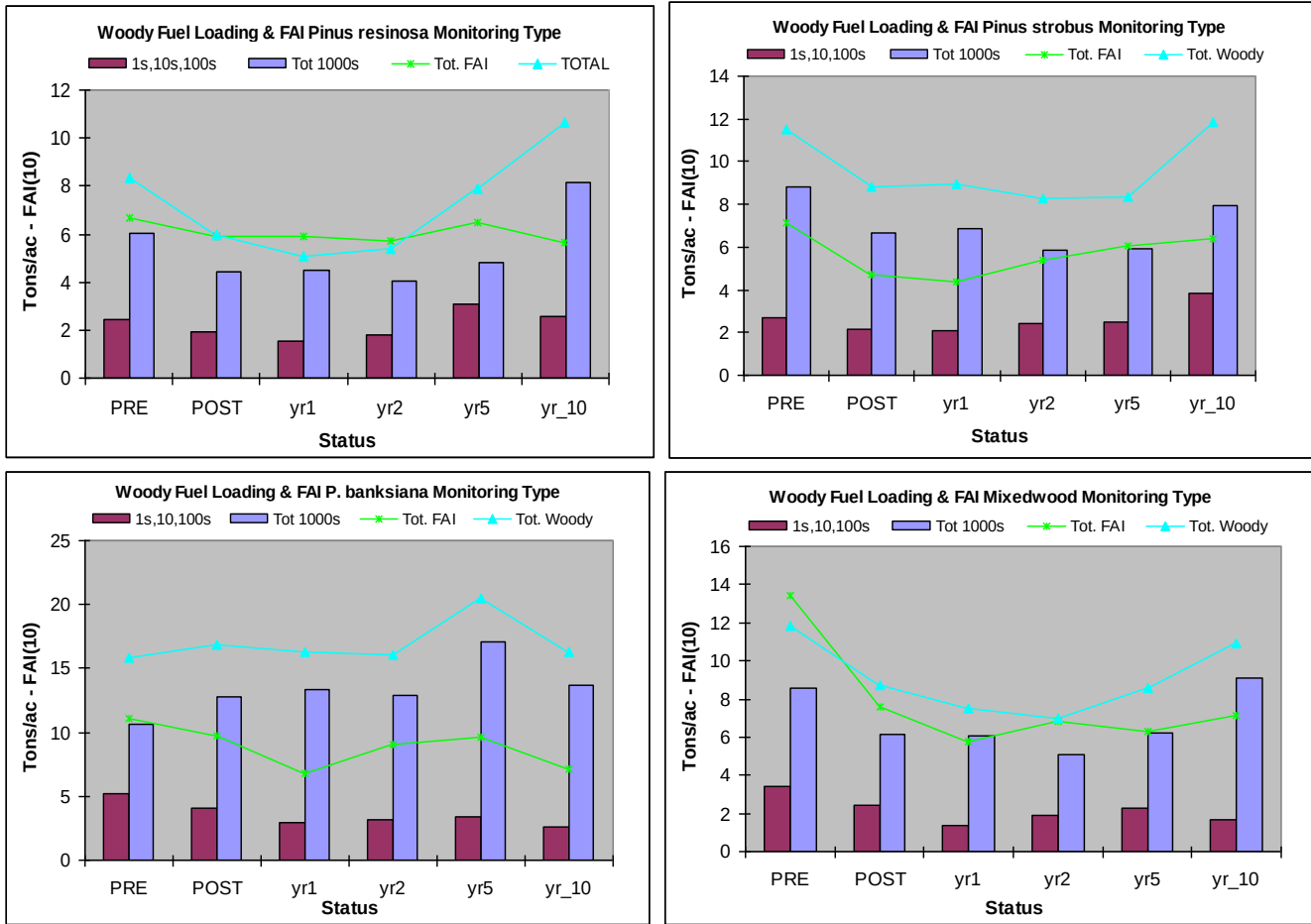


Figure 1. FAI is the sum of the averages of FAI (fuel area index) times 10 (unitless) for all woody fuels, Total Woody is the sum of the averages of all woody fuels, Total 1000s is the sum of the averages of sound and rotten 1000 hour fuels and 1s, 10s, 100s is the sum of the averages of the 1, 10 and 100 hours fuels.

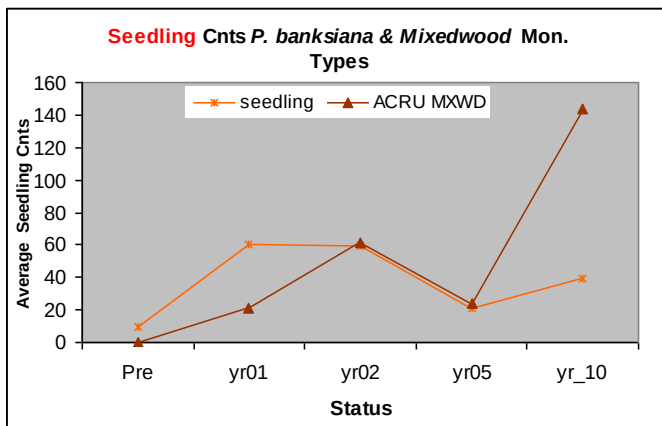
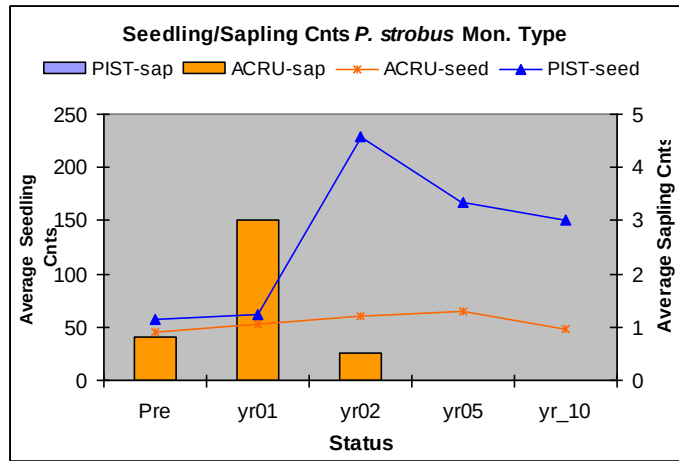
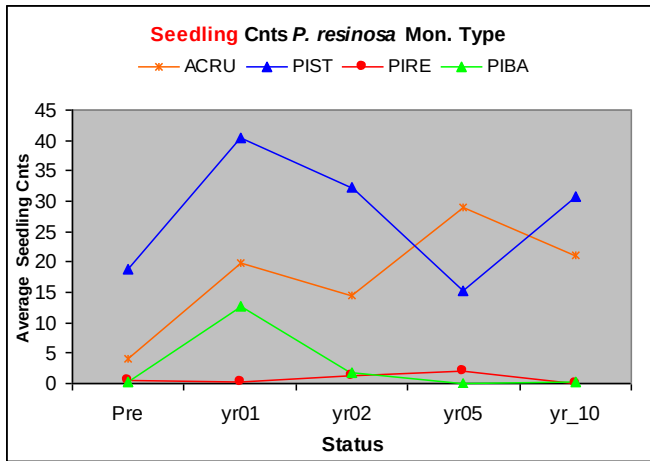


Figure 2. Seedling and sapling counts per species by monitoring type, (note: Jack pine and Mixedwood are plotted on the same graph).

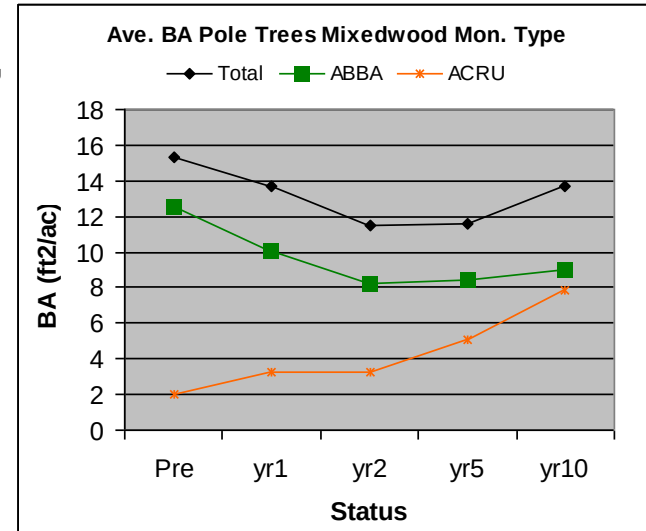
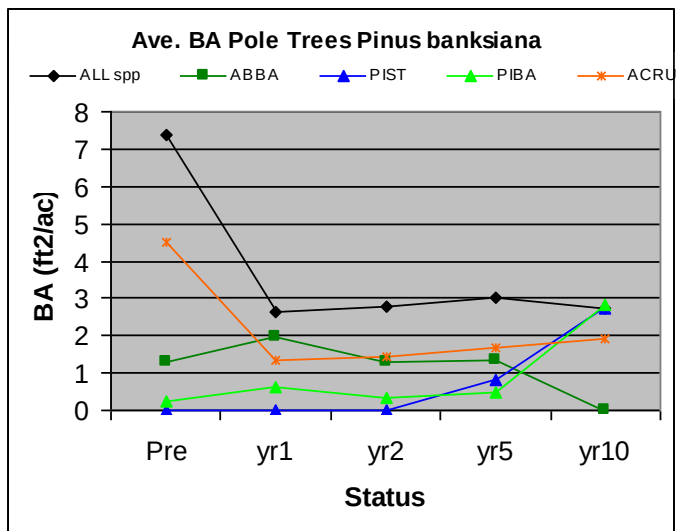
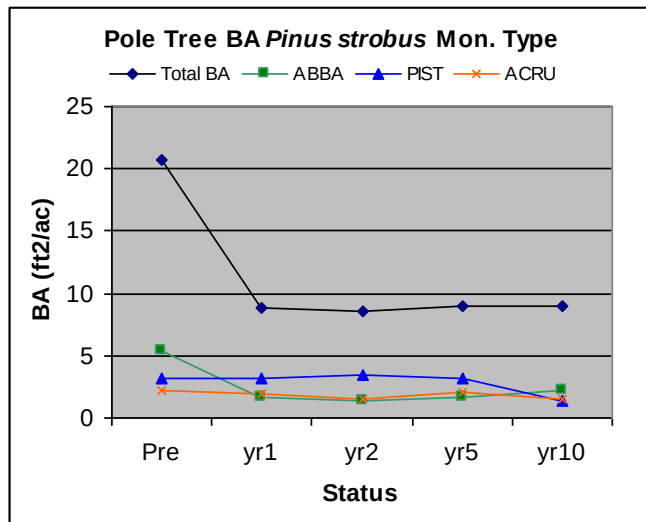
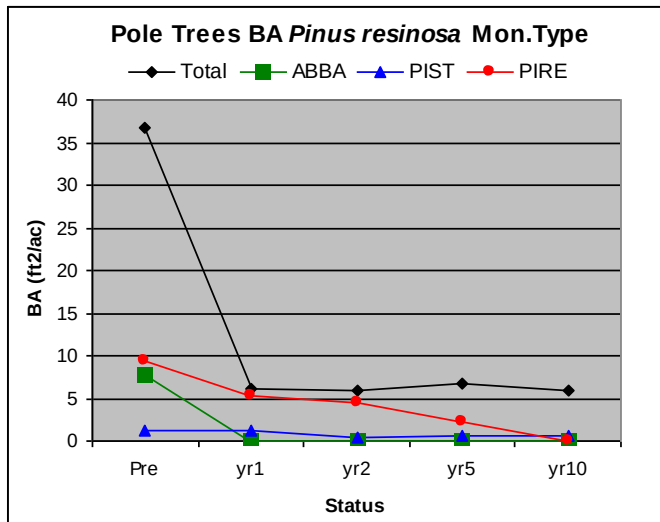


Figure3. Average basal area (BA) of pole sized trees per species by monitoring type.

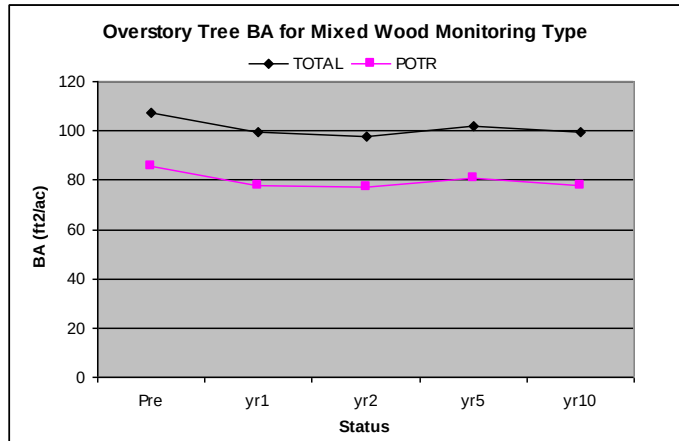
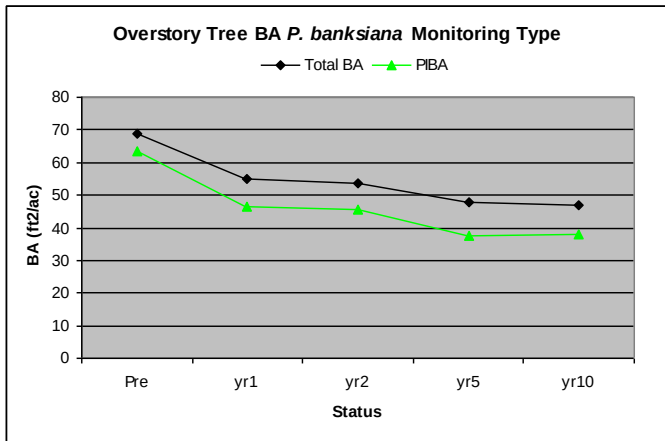
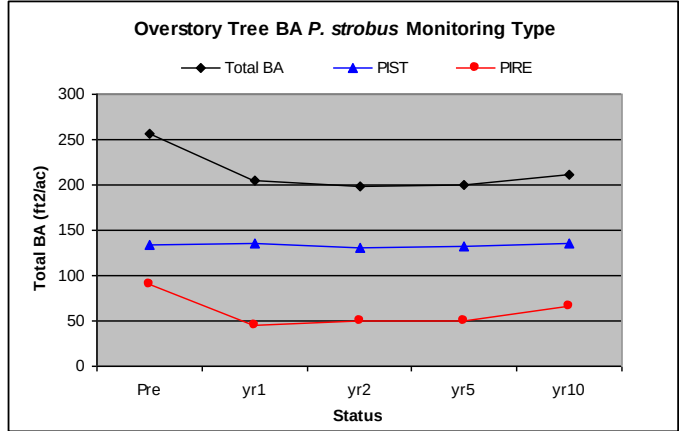
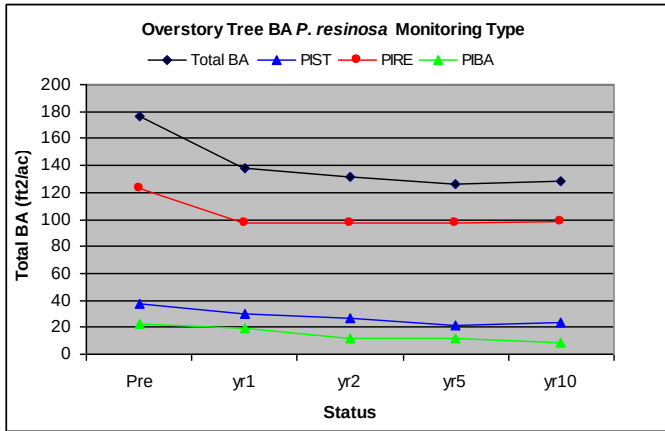


Figure 4. Basal area per dominate species by monitoring type.