



**National Park Service
Northeast Region
Mountains-to-the-Sea
Fire Ecology Annual Report
2009**

Summary

The Northeast Region underwent a National Fire Management Program review in May with positive feedback for the Fire Ecology and Monitoring Program. The Northeast Region Fire Effects Monitoring Crew measured over 150 monitoring plots (63 FMH, 14 CBI, 79 other) during the summer at eight National Parks units throughout the Northeast. Fire Ecology, working in conjunction with Shenandoah Natural Resources, has begun laying the groundwork to define desired future conditions for vegetation within Shenandoah National Park. Meetings began in late 2009 with a facilitator contracted from Pennsylvania State University to expedite this process. To improve the working relationship between Fire Management and Natural Resources, the two divisions collaboratively developed a draft Fire Resource Advisor plan.



March 2009 Assateague Island NS.

In recent months, Shenandoah Fire was awarded a \$30,500 research request grant to develop a fuels map for Shenandoah National Park. This will provide much needed spatial fuels data to numerous recently introduced fire software programs. Other major accomplishments include filling the Fire Ecologist position, teaching S-190 to 70+ Americorps students and conducting the first prescribed burn at two parks, Assateague Island National Seashore and Appomattox Courthouse NHP.

Table 1. Fire Effects Plot Workload 2009.

Park	Monitoring Unit	Type of Plot (FMH, photo point, other)	Pre-burn	Imm. Post	Post-burn	Total Plots
Appomattox Courthouse NBP	Mixed Grassland	FMH Brush plots	0	0	8	8
Assateague Island NS	<i>Phragmites</i>	Other	0	0	*20	*20
Cape Cod NS	Lombard Paradise Hollow Research Area	Other	0	0	15	15
Delaware Water Gap NRA	Mixed Grassland	FMH Brush plots	*10	0	0	*10
Fredericksburg and Spotsylvania NMP	Mixed Grassland	FMH Brush plots	0	0	14	14
Richmond NBP	Cold Harbor	photo points	0	0	4	4
		FMH Forest plots	0	0	2	2
	Malvern Hill Mixed Grassland	FMH Brush plots	0	0	10	10
Saratoga NHP	Mixed Grassland	FMH Brush plots	0	0	17	17
Shenandoah NP	Big Meadows (assist)	Other	0	0	28	28
	Ltems (assist)	Other	0	0	12	12
	Blackrock	CBI	0	0	14	14
	Table Mtn. Pine	FMH Forest plots	0	0	2	2
Total			10	0	146	156

* indicates new installations

Table 2. Fire Ecology Staffing 2009.

	Starting Date	Ending Date	# of Pay Periods	Training and Development
Missy Forder	1/1/2009	12/31/2010	26	First Responder, CPR/first aid, NEPA/106, Wilderness minimum requirements, Section 7, Fire refresher, CBI workshop.
Matthew Mueller	05/11/2009	10/09/2009	11	Fire Refresher, CBI workshop complete FEMO taskbook.
Sheah Mucci	05/11/2009	10/09/2009	11	Fire Refresher, CBI workshop, complete FEMO taskbook.
Tyler Schmitt	10/11/2009	09/18/2009	10	Fire Refresher, CPR/first aid, Leave No Trace, SAR training.

Table 3. Management Objectives and Monitoring Results 2009.

Results are shown using 80% Confidence Intervals of the mean. Mean are shown in the brackets.
Figures and pictures can be found in Appendix 1.

Park	Monitoring Unit	Management Objective (80% C.I.) α .2	Monitoring Results	Objectives Achieved
Richmond National Battlefield Park	Malvern Hill Planted Native and Non Native Grasslands	Figure 1. Maintain percent cover of woody species <20%.	Fescue Fields Preburn % shrub cover 15.67 ($\pm$ 11.6). 2009 % shrub cover 11.43 ($\pm$ 13.7). n=3 Preburn % tree cover 11.33 ($\pm$ 17.09). 2009 % tree cover 14.57 ($\pm$ 30.41). n=7	Yes
		Figure 2.	Planted Native Grass Fields Preburn % shrub cover 0. 2009 % shrub cover .67 ($\pm$.85). n=3 Preburn % tree cover 1 ($\pm$.57). 2009 % tree cover 1.67 ($\pm$.57). n=3	Yes n=3
		Figure 3. Reduce relative percent cover of non-native grasses by 30% after four burns	Fescue Fields Preburn - % non native cover 91.66 ($\pm$ 47.9) n=3 2-4 Treatments 71.7 % ($\pm$ 19.41) n=7	No
		Figure 3. Increase relative percent cover of native grasses by 30% after four burns.	Planted Native Grass Fields Preburn - % non native cover 1.7 ($\pm$ 1.54) n=3 Post burn 1yr % non native cover 0. n=3 Fescue Fields Preburn- % native cover 9.3 ($\pm$ 6.43). n=3 2-4Treatments % native cover 65 ($\pm$ 47.89) n=7 Planted Native Grass Fields Preburn - % native cover 127.3 ($\pm$ 15.59) n=3 Post burn 1yr % native cover 153 ($\pm$ 10.69) n=3	Already met Yes Already met

	Cold Harbor Hardwood/Pine Forest	Decrease pole size trees by 50% after four burns. Figure 4.	Decrease Pole size trees from 46 to 9 after three burns. (n=2, 3 fires)	YES
		Decrease shrubs by 50% after four burns. Figure 5.	Increase Shrubs increased from 14,730 to 31,403 (stems/acre) (n=2, 3 burns). Mostly woody vines, very few shrubs.	No *Recommend modifying this objective, due to the lack of shrubs, and abundance of woody vines, influencing the numbers.
		Maintain an open forested stand as it appeared at the time of the battle. See Photo points (pg.)	The vista was visually more open after the 1 st and 2 nd treatment. In the two years post fire it re-sprouted back vigorously. In late 2008, mechanical treatments were used to remove a portion of the small saplings. The unit was again burned in the Spring of 2009 and from the photo points appears more open.	Yes See pg 33. Photo points

Park	Monitoring Unit	Management Objective (80% C.I.)	Monitoring Results	Objectives Achieved
Appomattox Court House National Historical Park	Ferguson Field Mixed Grassland	Increase relative cover of native grasses by 10%-20% within 5 years post-burn. Figure 6.	Preburn % relative cover native grasses 77(±19.23) Post % relative cover native 57.87 (±14.29) (n=8, 1 burn)	NO
		Decrease relative cover of nonnative grasses by 20%-40% within 5 years post burn. Figure 6.	Preburn % relative cover non native grasses 68.62(±16.57) Post % relative cover non native grasses 28.12 (±6.55) (n=8, 1 burn)	YES
		Reduce relative percent cover of woody vegetation by 20%-40% within 5 years post burn. Figure 7.	Preburn % relative cover woody vegetation 40.5(±10.65) Post % relative cover woody vegetation 49.5 (±14.34) (n=8, 1 burn)	NO

Park	Monitoring Unit	Management Objective (80% C.I.)	Monitoring Results	Objectives Achieved
Fredericksburg and Spotsylvania National Historical Park	Spotsylvania Mixed Grassland	Decrease percent cover of woody vegetation by >20% after four burns. Figure 8. Figure 9-16. Analyzed Woody vegetation by field	Decrease Preburn % Cover 52.25(±16.38) n=4. 3-5 burns % cover 75.23(±11.0) n=13. See figures for results.	No
		Maintain 75% cover in native grasses with less than 25% non native grass cover. Figure 17. Figure 18-25. Analyzed native and non native grasses by field.	Yes Preburn % Cover 52.25(±16.38) with an n=4. After 3-5 burns % cover of 75.23(±11.0) with an n=13. See figures for results.	Yes
Saratoga National Historical Park	Mixed Grassland	Figure 26 -27. Increase relative cover of native grasses and herbs by 20% and decrease woody shrub cover 20%.	Preburn % relative cover grasses 56.0(±16.0) and forbs 35(±0) Current 73 (±8.0) and forbs 36.5 (±3.5) (n=2, 2 burns) Preburn % cover shrubs 48.0(±9.0). Current % cover shrubs 36.5 (±8.0). (n=2, 2 burns)	Yes No
		Decrease cover of non native forbs by 20% and increase cover of native grasses by 20%. Figure 28-29.	Preburn % cover non-native forbs 79 and native grass 34. Current non native forbs 182 (±24.0) and native grass 101 (±6.0). n=1-2, 3 burns	No

Park	Monitoring Unit	Management Objective (80% C.I.)	Monitoring Results	Objectives Achieved
Delaware Water Gap National Recreation Area	Mixed Grassland Darrones/Silver Spray Burn Units	Increase relative cover of native grasses by at least 25% within 5 years post-burn.	N/A	Pre burn data only.
		Decrease relative cover of nonnative species at least 25% within 5 years post burn.	N/A	Pre burn data only.
		Reduce relative percent cover of woody vegetation by 25% within 5 years post burn.	N/A	Pre burn data only.

Delaware Water Gap National Recreation Area	Monitoring Unit	Management Objective (Restoration)	Monitoring Results	Objective Achieved?
	Darrones 2009 RX	Reduce 1-hr fuels $\geq 75\%$ Reduce 10-hr fuels $\geq 75\%$ if present Maintain native grass cover (1-year post burn) Maintain native herbaceous cover (1-year post burn) Reduce shrub and brush cover $\geq 10\%$ (1-year post burn) Overstory mortality $> 10\%$ (all species, 1-year post burn) Overstory mortality $> 10\%$ (pine/cedar species, 1-year post burn)	100% $\geq 75\%$ TBD TBD TBD TBD TBD	YES YES Pg. 60-63
	Loch Lomond 2008 RX	Maintain native grass cover (1-year post burn) Maintain native herbaceous cover (1-year post burn) $> 10\%$ overstory mortality for all fuels > 1 -hour (1-year post burn)	Maintained Maintained $> 10\%$	YES YES YES Pg. 60-63
	Snyder 2009 RX	Reduce 1-hr fuels $\geq 75\%$ Reduce 10-hr fuels $\geq 75\%$ if present Maintain native grass cover (1-year post burn) Maintain native herbaceous cover (1-year post burn) Reduce shrub and brush cover $\geq 10\%$ (1-year post burn) Overstory mortality $> 10\%$ (all species, 1-year post burn) Overstory mortality $> 10\%$ (pine/cedar species, 1-year post burn)	100% None present TBD TBD TBD TBD TBD	YES Pg. 60-63

	Monitoring Unit	Management Objective (Restoration)	Monitoring Results	Objective Achieved?
	Snyder 2008 RX	Maintain native grass cover (1-year post burn) Maintain native herbaceous cover (1-year post burn) > 10% overstory mortality for all fuels >1-hour (1-year post burn) if present	Maintained Maintained >10%	YES YES YES Pg. 60-63

Park	Monitoring Unit	Management Objective	Monitoring Results	Objectives Achieved
Assateague Island National Seashore	Phragmites	Remove dead biomass, particularly dead stems of <i>Phragmites australis</i>	See report pg. 33-52	Yes
		Maintain species diversity of native species post burn	See report pg. 33-52	Yes

	Monitoring Unit	Management Objective	Monitoring Results	Objective Achieved?
Cape Cod National Seashore	Marconi WUI Broom Crowberry monitoring	Determine extent and time for colonization of burn pile footprints by <i>Corema</i>	Distance and direction to nearest <i>Corema</i> population, burn pile foot print area, and burn pile center data was recorded.	Yes Pages 53-56.
	Fire Cache <i>Corema</i> transplanting	Measure long term cover and health of 40 <i>Corema</i> plants prior to transplanting	Area (size) and relative health (poor, fair, good) were recorded	Yes Pages 53-56.
	Lombard Paradise Hollow	Research, vegetation	Collected data included: live and dead pre- and post-treatment fuel loading by size class and % cover and height class estimations of under- and over-story vegetation.	YES Pages 53-56.

	Monitoring Unit	Management Objective	Monitoring Results	Objective Achieved?
		Research, burning	Day of burn information collected: RH, foliar moisture content, 1- 100 hr downed woody fuel moisture, wind speed and direction (each minute) and fire ROS	YES Pages 53-56.
	Heathland Monitoring / Marconi Site Heathland restoration	Establish pre-treatment baseline data for 35 area heathland restoration in the Marconi area	Photo points, point intercept and <i>releve'</i> data were recorded	Yes Pages 53-56.
	Broom Crowberry burn experiments	Determine if spring, summer or fall burning favors <i>Corema conradii</i> , three each 03 acres plots were burned (2.7 acres)	Post-burn monitoring to begin 2010	Pending Pages 53-56.
	Heathland /Hunting summer burning plots	Determine the impact summer cut/burn units have on shrub fuels in Marconi area heathlands.	Post-burn monitoring to begin 2010	Pending Pages 53-56.

Table 4. Fire Ecologist Accomplishments and Area of Focus.

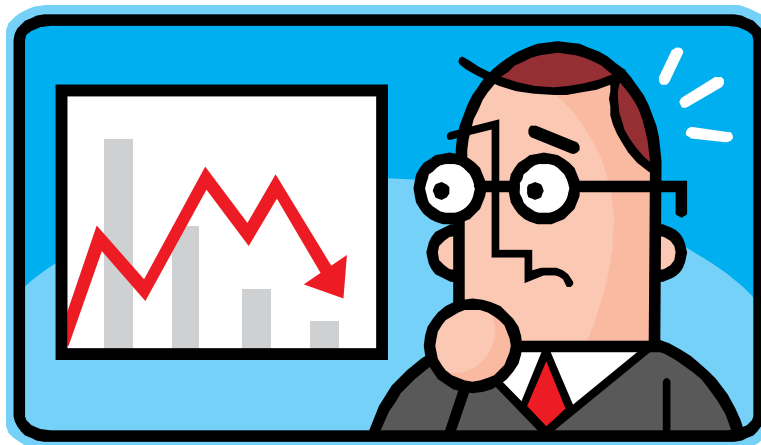
Category	% Time	Accomplishments/Focus Areas
Planning	4%	PEPC, treatment plans
Presentations	6%	Park staff, teach classes.
NPS meetings task groups	4%	FESC meeting and conference calls, NE conference calls, AFE meeting
Interagency Work	2%	Fire Learning Network, Central Appalachian Fire Network
Fire Assignments	2%	0% wildfire, 2% prescribed fire
Research	7%	General fire ecology work, such as: monitoring plans, treatment recommendations to managers
Data collection	35%	Includes installs and postburn measurements Ecologist served as crew leader because the position was not filled until mid-June.
Data entry	5%	
Data Analysis	6%	
Supervision & Administration	15%	Hiring, supervision, travel, payroll, etc.
Training	9%	First Responder, CPR/first aid, NEPA/106, Wilderness minimum requirements, Section 7, Fire refresher, CBI workshop.
Miscellaneous	3%	SAR etc.

Table 6. Fire Effects Crew Accomplishments and Area of Focus.

Category	% Time	Notes
FMH plots	50%	Includes installs and postburn measurements
WUI plots	0%	
CBI plots	10%	CBI Blackrock, CBI workshop at GRSM and BISO.
Other plot work	7%	LTEM plots in the Blackrock burn unit, fuel samples
Fire Assignments	1%	One summer prescribed burn at CACO, no wildfire assignments.
Fuels work	0%	
Data Entry	23%	All data entered into FFI.
Supervision/ Administration	5%	Travel, timesheets, etc
Training	10%	Heartsaver First Aid, Search and Rescue, mandatory gov't training, plant ID, fire refresher, etc.
Miscellaneous	4%	SAR etc.

Appendix 1.

Data Analysis Graphs and Discussion



Malvern Hill is composed of a complex of six fields. For data analysis this year, fields that were sprayed, stumped, tilled and planted with native grasses were separated from fields historically planted in Fescue and burned. Not all fields are burned every year, therefore the number of treatments are presented as a range.

Figure 1. Richmond National Battlefield Park- Malvern Hill.

Fescue Fields

Management Objective: Maintain percent cover of woody species <20%.

Current Results: Decrease in percent cover of woody shrubs. Preburn % cover 15.67 (±11.6), 2009 % cover 11.43 (±13.7). Increase in percent cover of trees 11.33 (±17.09) preburn, 14.57(±30.41).

Discussion: Large increase in winged sumac (*Rhus copallinum*) in one plot after treatments may have led to an increase in mean percent cover of trees. Plot 3 (field 12 acre South), 31 trees 2005 now -83 trees 2009. Analyzed four fields together, 12 acres South, 29 acre North, Parsonage NE and Parsonage South. Number of burn treatment 2-4. Bars represent SE of the mean.

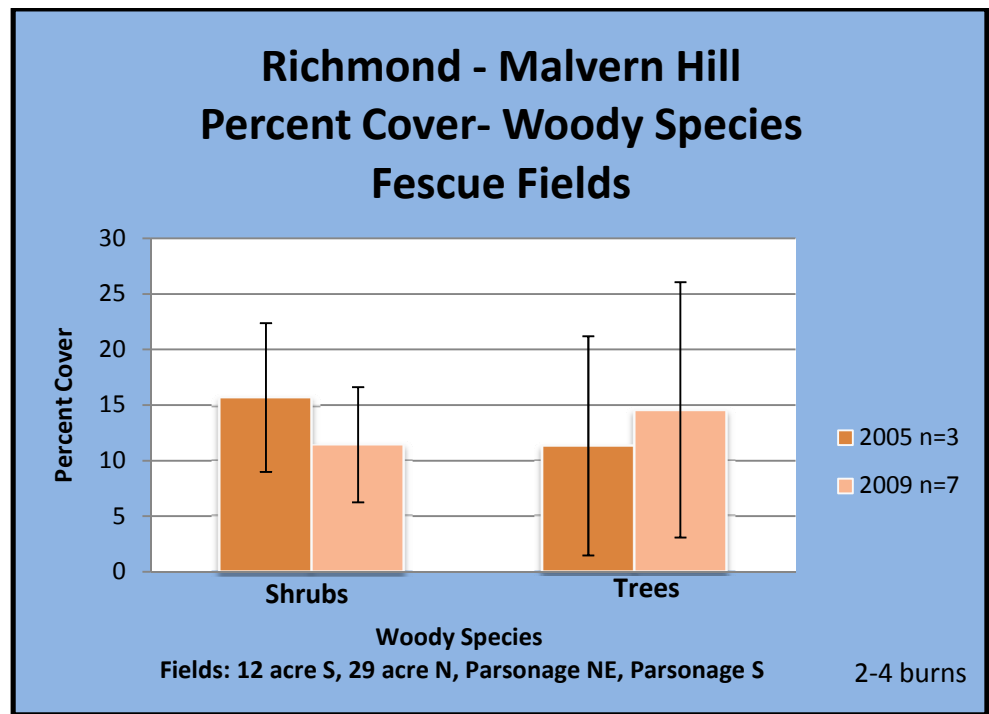


Figure 2. Richmond National Battlefield Park- Malvern Hill.

Planted Native Grass Fields

Management Objective: Maintain percent cover of woody species <20%.

Current Results: Slight increase in percent cover of woody shrubs. Preburn shrub % cover 0, 2009 shrub % cover .67 ($\pm$.85). Slight increase in percent cover of trees 1 ($\pm$.57) preburn, 1.67($\pm$.57).

Discussion: Percent cover of woody species in fields cut, stumped and planted with native grass is very low. Bars represent SE of the mean.

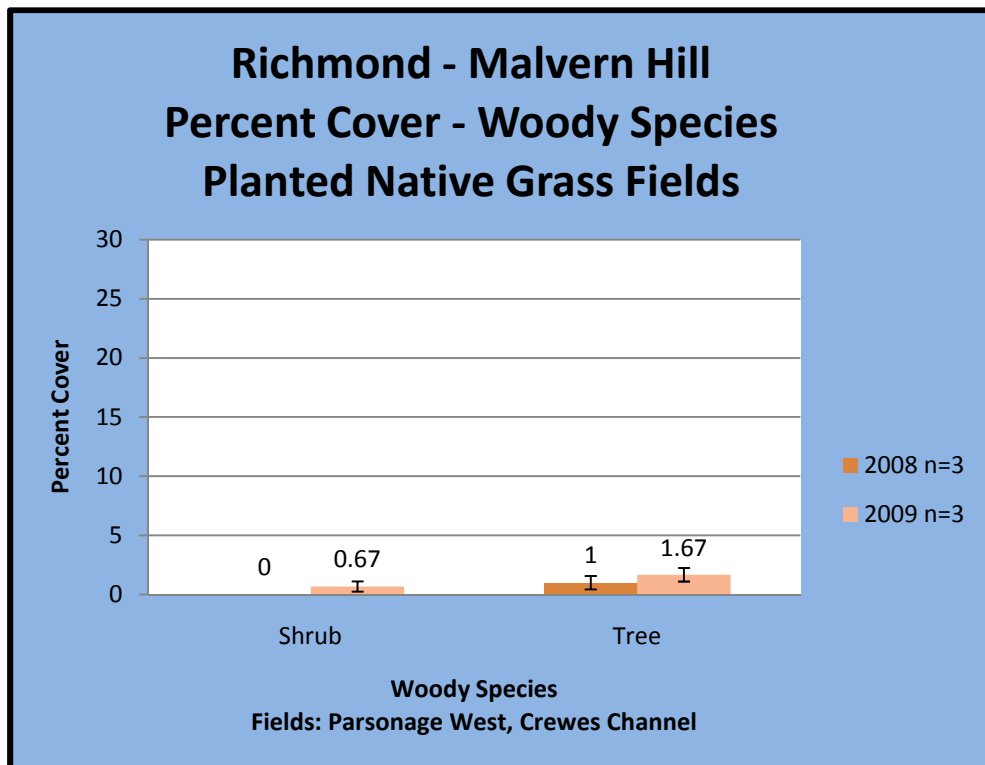


Figure 3. Richmond Malvern Hill.

Fescue Fields

Management Objective: Reduce relative percent cover of non-native grasses by 30% after four burns. Increase relative percent cover of native grasses by 30% after 4 burns.

Current Results: Decrease in relative percent cover of non-native grasses.
Increase in relative percent cover of native grasses.
Preburn - % non native grass cover 91.66 (± 47.9) After 2-4 burns 71.7 % (± 19.41) non native grass.
Preburn - % native grass cover 9.3 (± 6.43). After 2-4 burns 65 (± 47.89).

Discussion: There may have been a slight decrease in non native grasses after 2-4 burn treatments. There is a substantial increase in native species after 2-4 burn treatments. The 12 acre South field (plots 3 and 6) had the largest increase in native species, exceeding the other three fields. This field has been burned four times, the highest frequency. Bars represent SE of the mean.

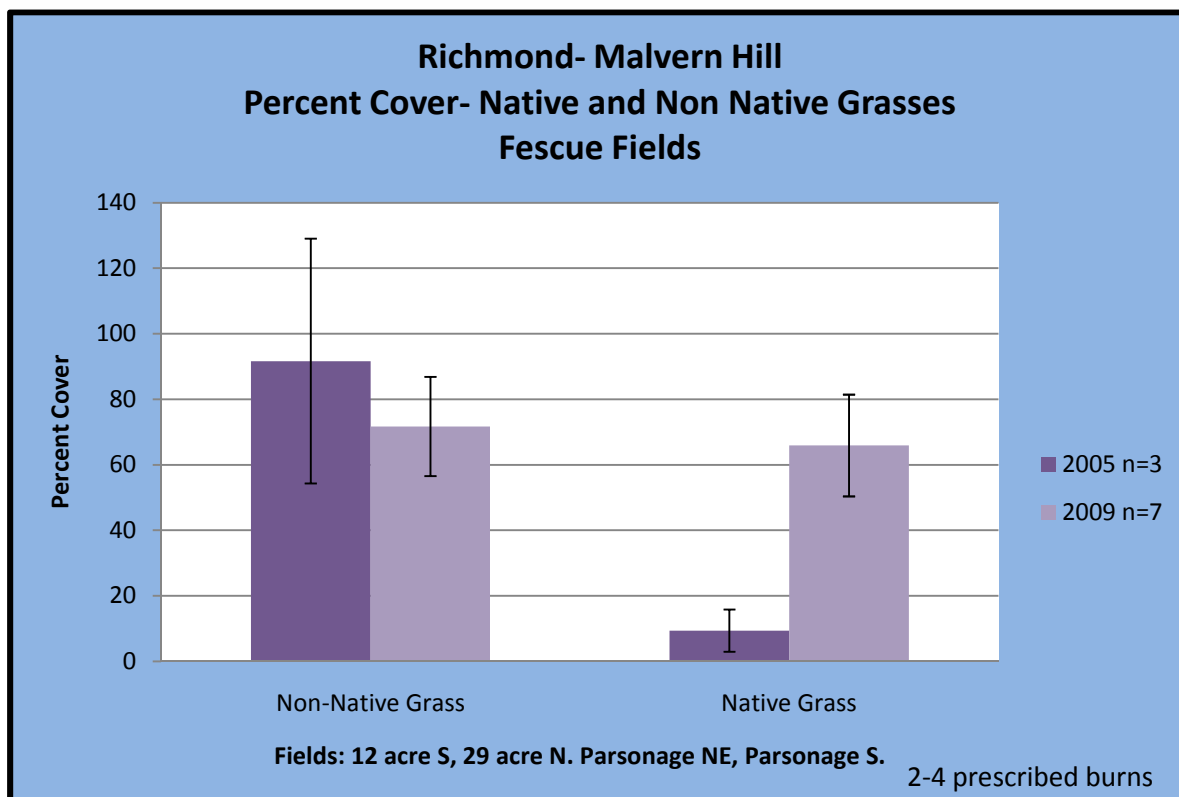


Figure 4. Richmond Malvern Hill.

Planted Native Grass Fields

Management Objective: Reduce relative percent cover of non-native grasses by 30% after four burns. Increase relative percent cover of native grasses by 30% after 4 burns.

Current Results: Decrease in relative percent cover of grasses.

Increase in relative percent cover native grasses.

Preburn - % non native grass cover 1.6 (± 1.54) After 1 burn 0 non native grasses.

Preburn - % native grass cover 127.3(± 15.59). After 1 burn 153(± 10.69).

Discussion: There were very few non-native grasses found preburn. 2Post burn non were found.

Native grasses may have increased slightly one year post burn. Bars represent SE of the mean.

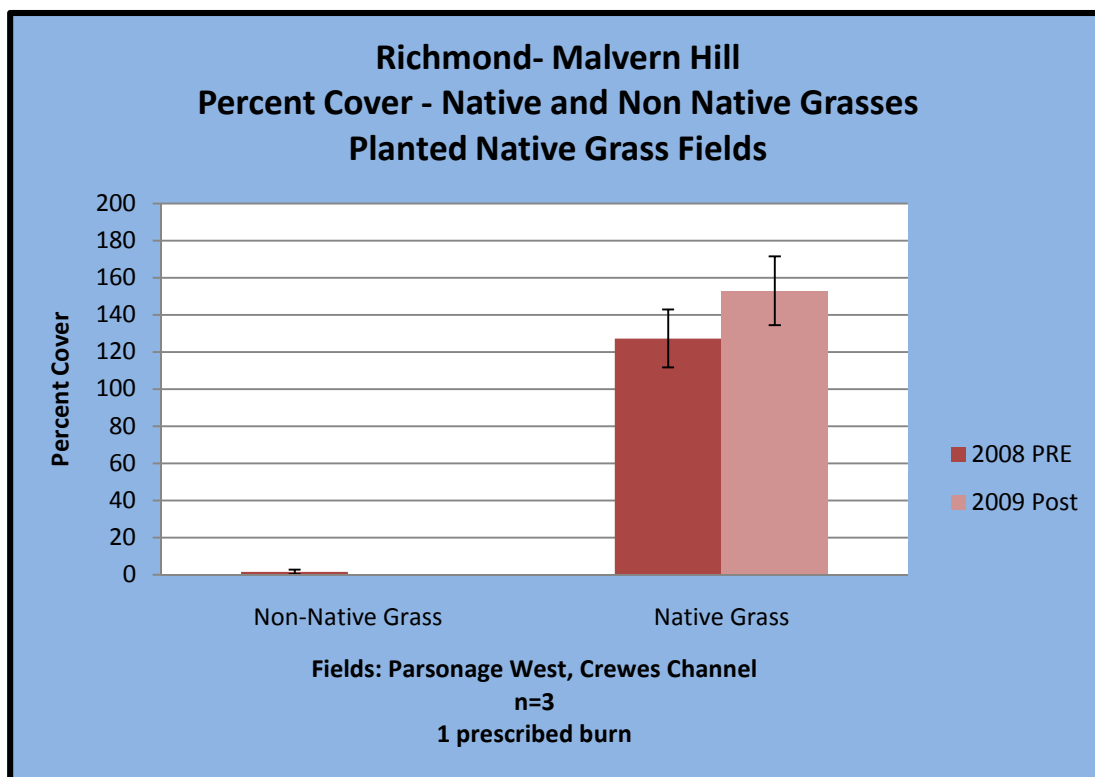


Figure 4. Richmond Cold Harbor.

Management Objective: Decrease pole size trees by 50% after four burns.

Current Results: Decrease in the number of pole size trees from 46 trees to 9 trees after three burn treatments and one mechanical treatment.

Discussion: Burning and mechanical treatment has reduced the number of pole trees, particularly in Plot 1. Bars represent SE of the mean.

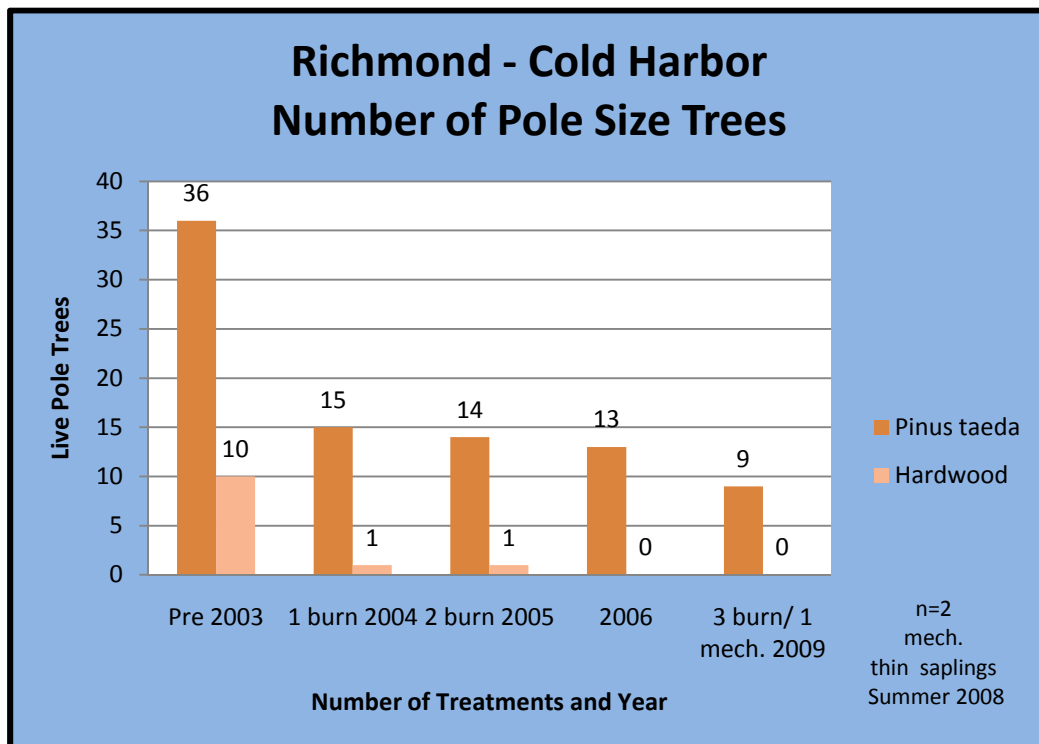


Figure 5. Richmond Cold Harbor

Management Objective: Decrease shrubs by 50% after four burns.

Current Results: Large increase in vine density after two burns, very few true shrubs found.

Discussion: The shrub layer is mainly composed of the woody vines *Vitis* species, *Rubus* spp, *Smilax* spp. Winged sumac (*Rhus copalinum*) is the only woody shrub found in any significant numbers. Recommend dropping this protocol due to the lack of shrubs and the error found in counting stems of woody vines. Bars represent SE of the mean.

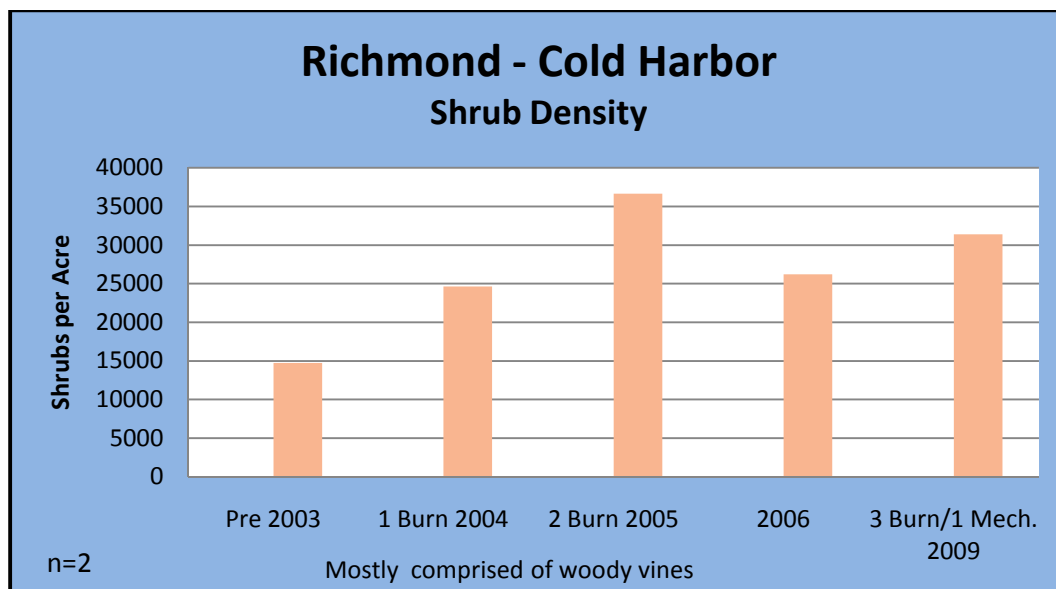


Figure 6. Appomattox Court House

Management Objective: Increase relative cover of native grasses by 10% - 20% within 5 years post-burn.

Decrease relative cover of nonnative grasses by 20% - 40% within 5 years post burn.

Current Results: Preburn % relative cover native grasses 77(± 19.23) Post % relative cover native 57.87 (± 14.29)
Preburn % relative cover non-native grasses 68.62(± 16.57) Post % relative cover non-native grasses 28.12 (± 6.55) (n=8, 1 burn)

Discussion: After one burn treatment native grasses decreased slightly, however monitoring took place one month earlier than the year before. Non native grasses showed a significant decrease. The mid Atlantic EPMT crew sprayed new Fescue growth immediately post burn. We believe this had an impact in the dramatic decrease of non-native grasses. Bars represent SE of the mean. n=8.

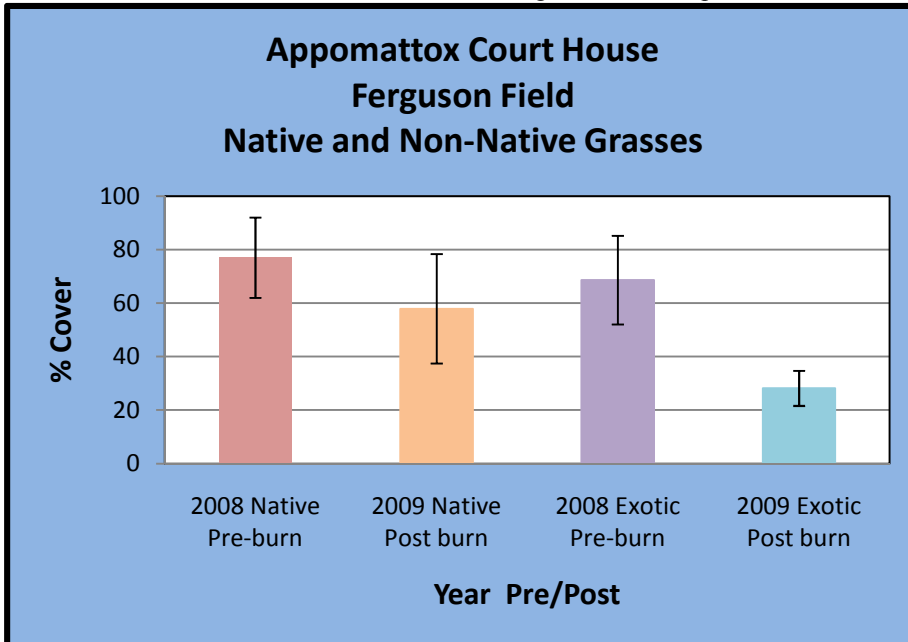


Figure 7. Appomattox Court House

Management Objective: Reduce relative percent cover of woody vegetation by 20%-40% within 5 years post burn.

Current Results: Preburn % relative cover woody vegetation 40.5(± 10.65). Post % relative cover woody vegetation 49.5 (± 14.34) (n=8, 1 burn)

Discussion: Woody species increased after one treatment. The increase was primarily attributed to an increase in Rubus species post burn. Bars represent SE of the mean. (n=8, 1 burn).

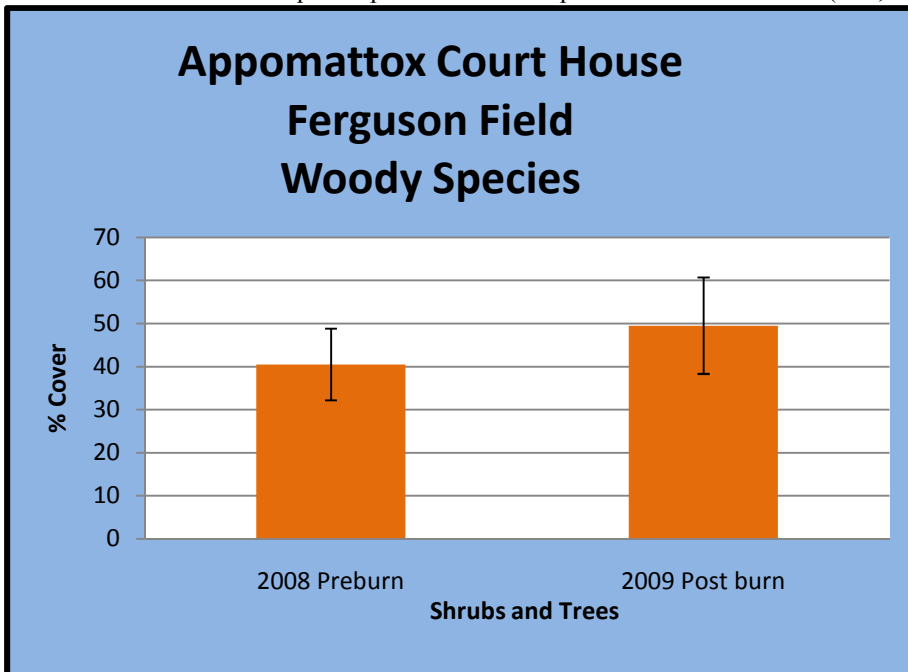


Figure 8. Fredericksburg and Spotsylvania NMP.

All Fields combined- Woody Vegetation

Management Objective: Decrease percent cover of woody vegetation by >20% after four burns.

Current Results: Preburn % Cover 52.25(± 16.38) with an n=4. After 3-5 burns % cover of 75.23(± 11.0) with an n=13.

Discussion: The greatest success came after a combination summer burn, mow in 2004 and spring burn in 2005. Recent studies have found it effective to conduct a burn and mow treatment during the growing season when plant carbohydrate reserves are low. Burning does not seem to decrease the percent cover of woody stems. Bars represent SE of the mean.

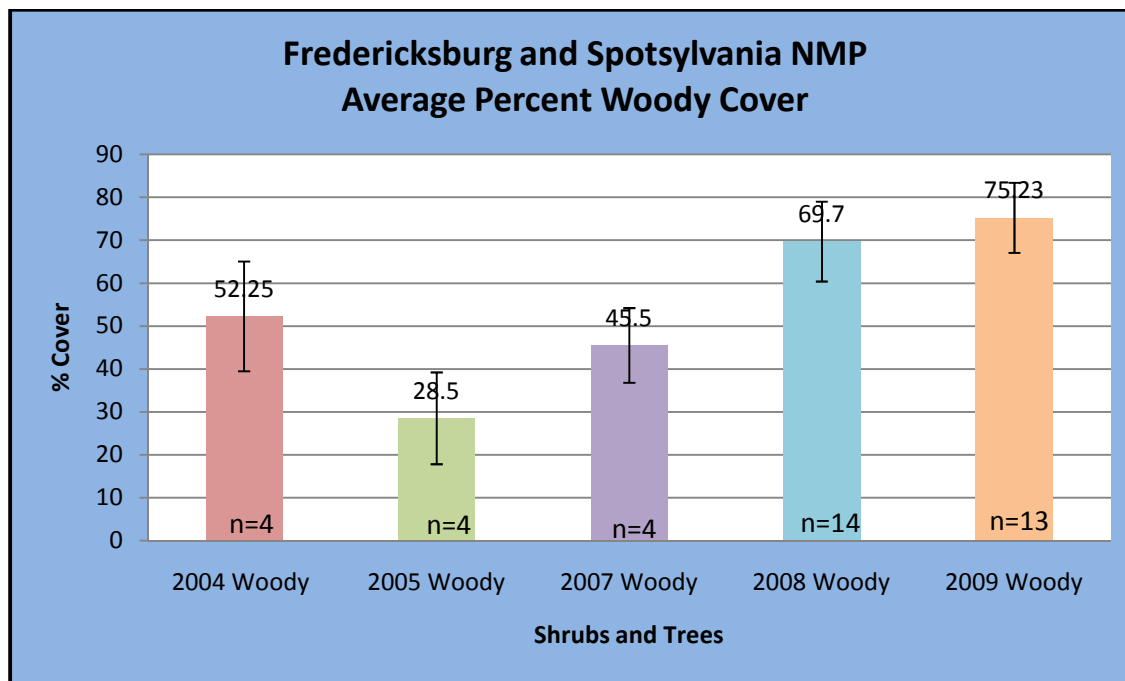
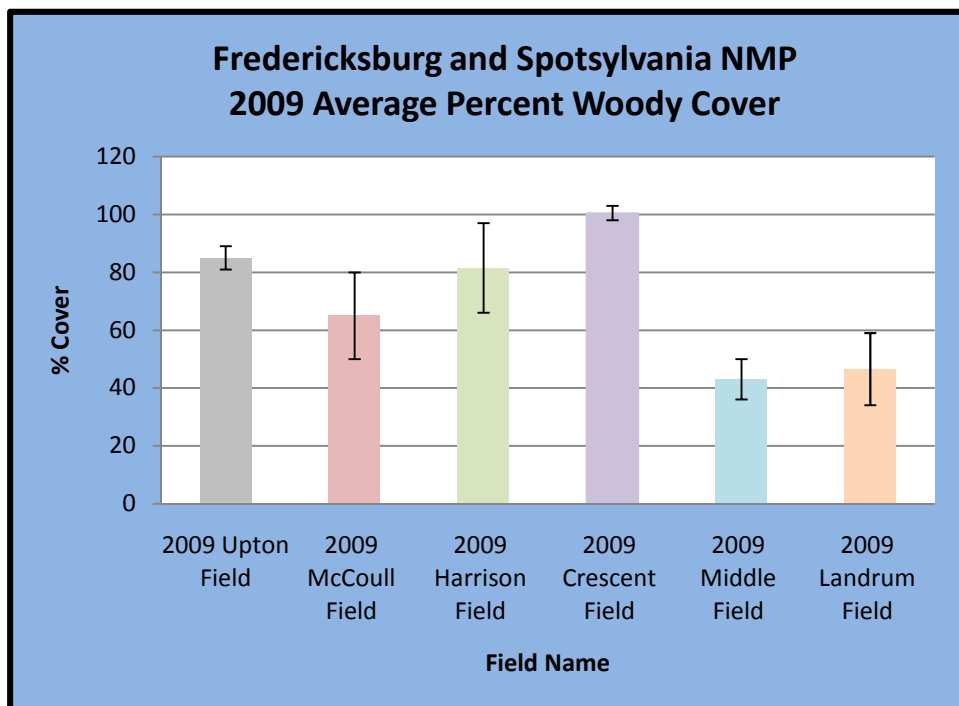


Figure 9. Fredericksburg and Spotsylvania NMP.

2009 Woody Vegetation by Field

Woody vegetation by field at FRSP in 2009. Middle field had the lowest percent cover of woody vegetation with 43%. Half of this field (one transect) has been mowed multiple times. The highest percent cover of woody species by field was found in the Crescent field with 100.5% cover of woody vegetation. This field has had the least number of treatments, burned in 2004, 2006 and 2009 and has not been mowed recently. n=2 in each field. Bars represent SE of the mean.

Upton Field 85% (± 4.0)	Crescent Field 100.5% (± 2.5)
McCoull Field 65% (± 15.0)	Middle Field 43% (± 7.0)
Harrison Field 81.5% (± 15.5)	Landrum Field 46.5% (± 12.5)



Average Percent Woody Vegetation by Field

There are six fields with 2 brush plots in each field. Each field was analyzed by year.

McCoull Field

Figure 10. Fredericksburg and Spotsylvania NMP.

McCoull House Field, burned summer 2004, spring 2005, 2006, 2008, 2009.

2004 /40% (± 9.0) 2008/ 35.5% (± 2.5)

2005 /13% (± 8.0) 2009/ 65% (± 15.0)

2007 32.5% (± 2.5)

n=2 in each field. Bars represent SE of the mean.

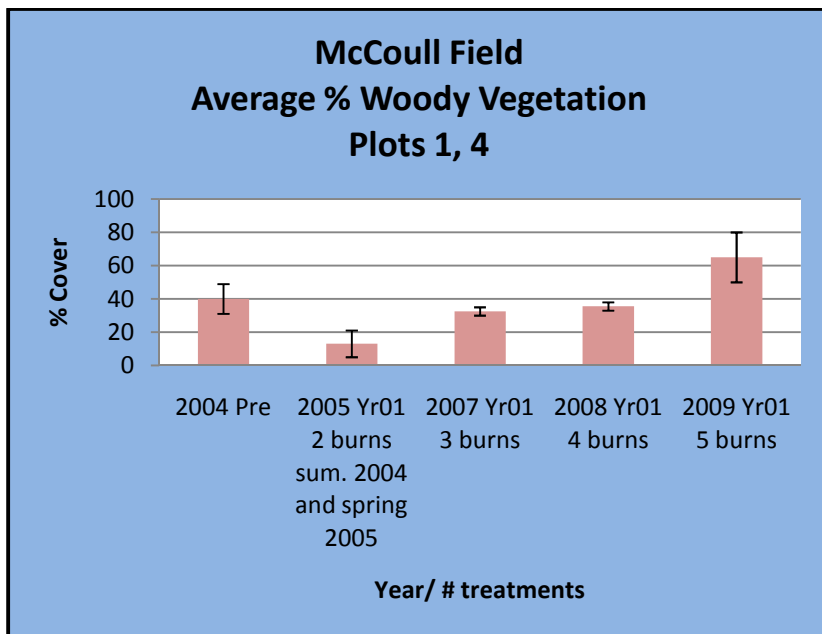


Figure 11. Fredericksburg and Spotsylvania NMP.

Harrison Field

Harrison House Field, burned spring 2004*, 2005*, 2007, 2008 and 2009.

*Plots did not burn.

2004 /64.5 %(± 24.5)

2008/ 64% (± 14.0)

2005 /44 %(± 12.0)

2009/ 81.5 %(± 15.5)

2007 58.5% (± 10.5)

n=2 in each field. Bars represent SE of the mean.

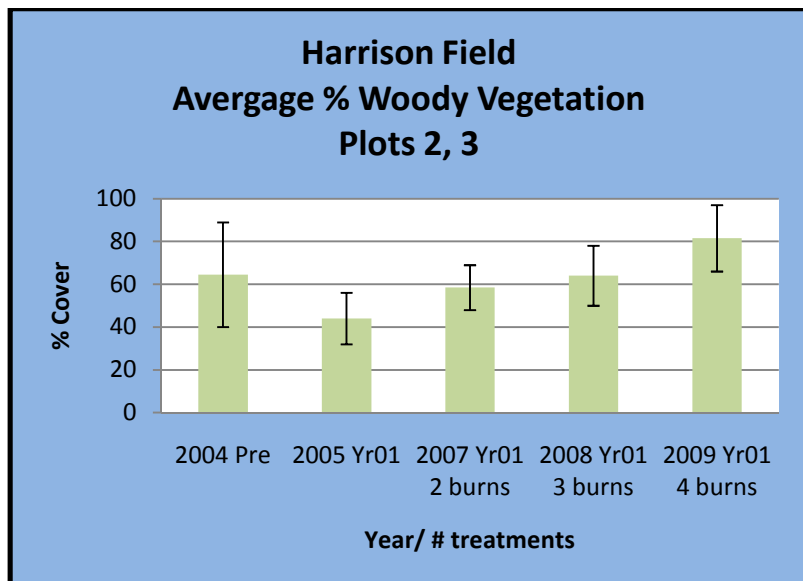


Figure 12. Fredericksburg and Spotsylvania NMP.

Upton Field

Upton Field, burned spring 2004*, 2005*, 2006*, 2008*, 2009.

*Plots did not burn.

2008/ 82.5% (± 6.5)

2009/ 85 %(± 4)

n=2 in each field. Bars represent SE of the mean.

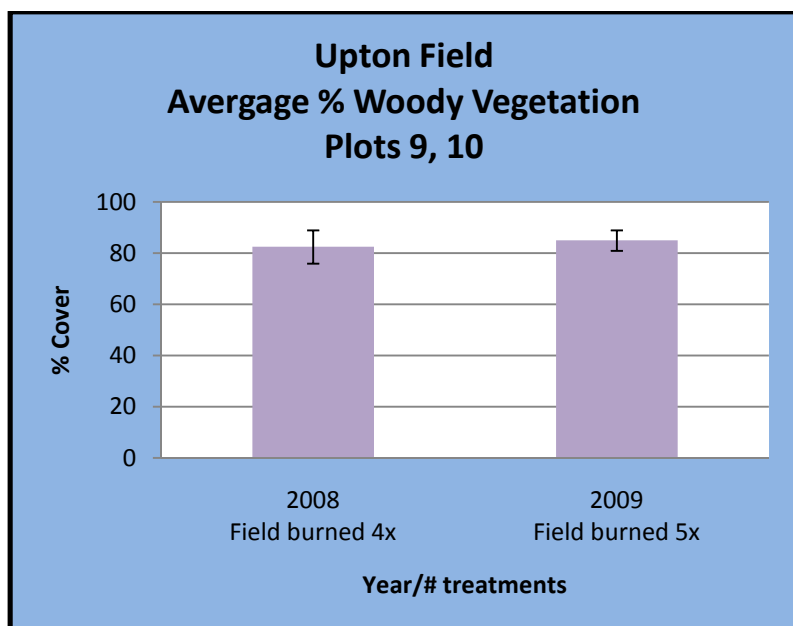


Figure 13. Fredericksburg and Spotsylvania NMP.

Crescent Field

Crescent Field, burned spring 2004*, 2005*, 2009.

*Plots did not burn.

2008/ 117 %(± 2.0)

2009/ 100.5 %(± 2.5)

n=2 in each field. Bars represent SE of the mean.

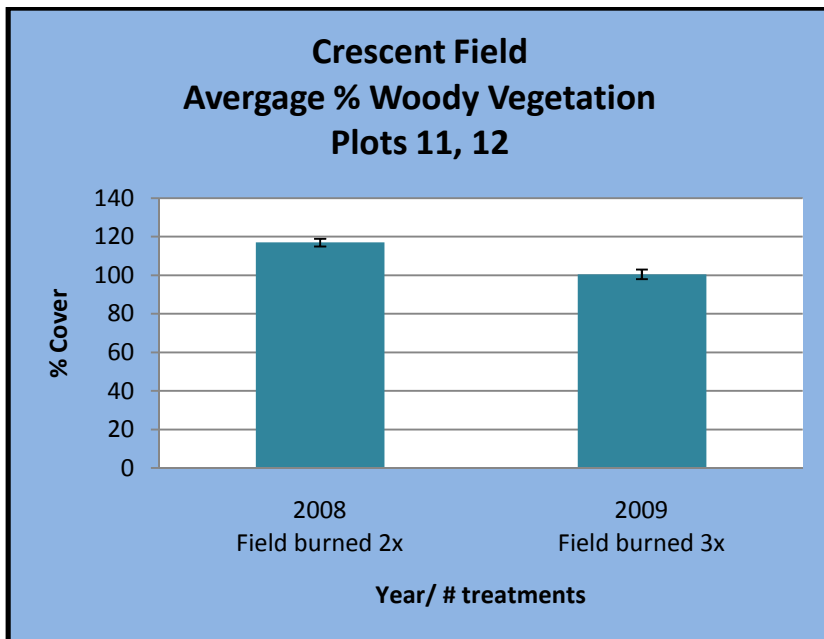


Figure 14. Fredericksburg and Spotsylvania NMP.

Middle Field

Middle Field, burned spring 2004*, 2005*, 2007*, 2008* and 2009.

*Plots did not burn.

2008/ 41 %(± 11.0)

2009/ 43 %(± 7.0)

n=2 in each field. Bars represent SE of the mean.

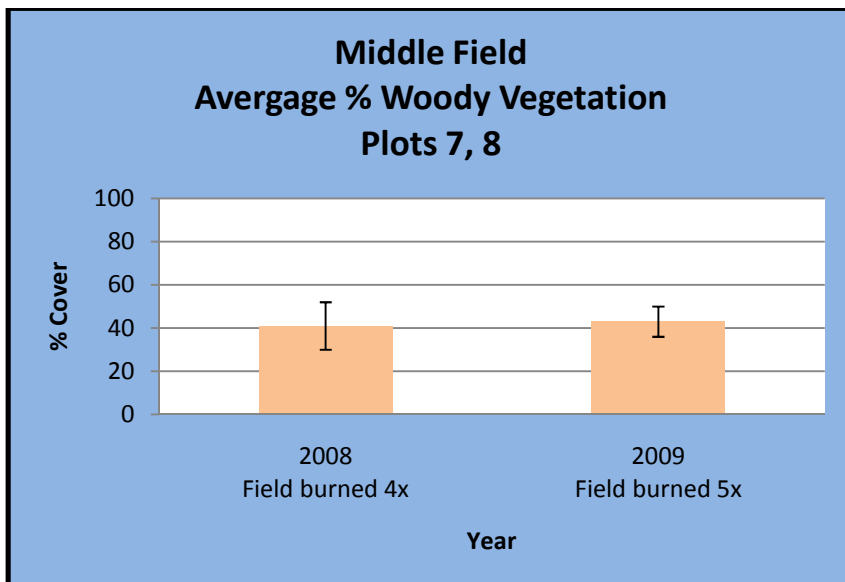


Figure 15. Fredericksburg and Spotsylvania NMP.

Landrum Field

Landrum Field, burned 2004*, 2005*, 2007*, 2008*, 2009*.

*Plots not burned, plots mowed 2x in 2009.

2008/ 50.5 %(± 8.5)

2009/ 46.5 %(± 12.5)

n=2 in each field. Bars represent SE of the mean.

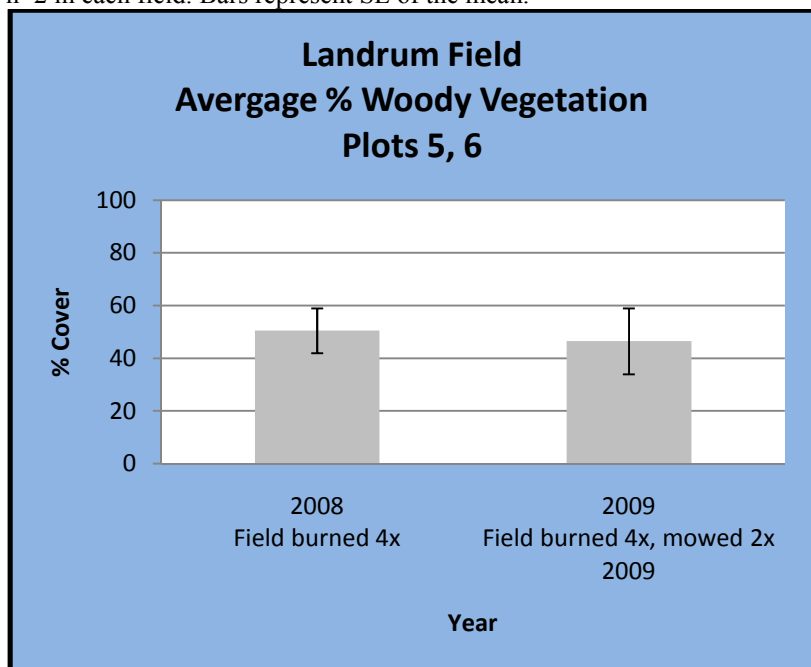


Figure 16. Fredericksburg and Spotsylvania NMP.

Earthwork Plots

Two plots were installed on the Earthworks at the request of the NRM. One plot was treated with fire, the other plot was left untreated.

Earthwork Plots in Landrum Field

2008/ Plot 13 Pre 125%, after one treatment Yr01 108%

2009/Plot 14 Pre 135%, un-treated plot, Yr02 132%

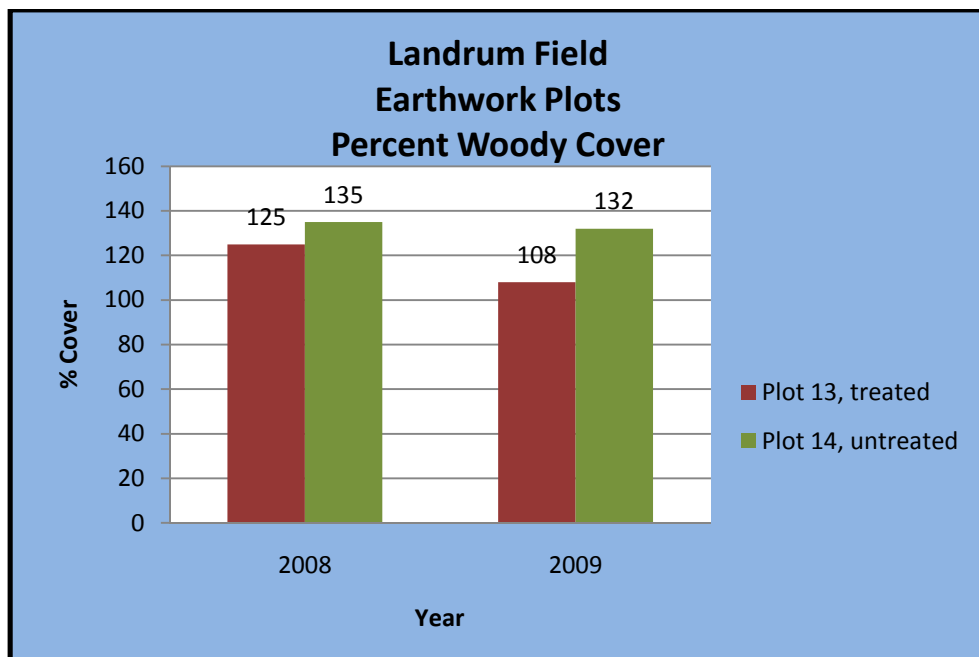


Figure 17. Fredericksburg and Spotsylvania NMP.

All Fields combined Native and Non Native Grass Cover

Management Objective: Maintain 75% cover in native grasses with less than 25% non native grass cover.

Current Results: Preburn % relative cover 122.5 (± 14.54) n=4, 3-5 Burns 106.5(± 10.64) n=12

Discussion: Native grass cover in most fields is high with exotic non native grass cover relatively low.

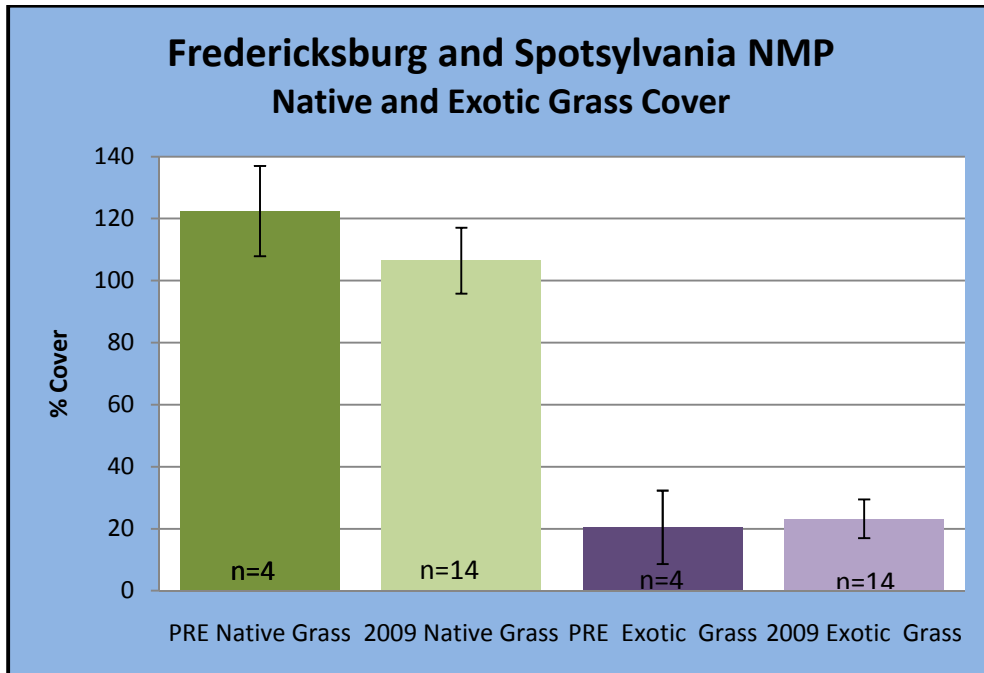


Figure 18. Fredericksburg and Spotsylvania NMP.

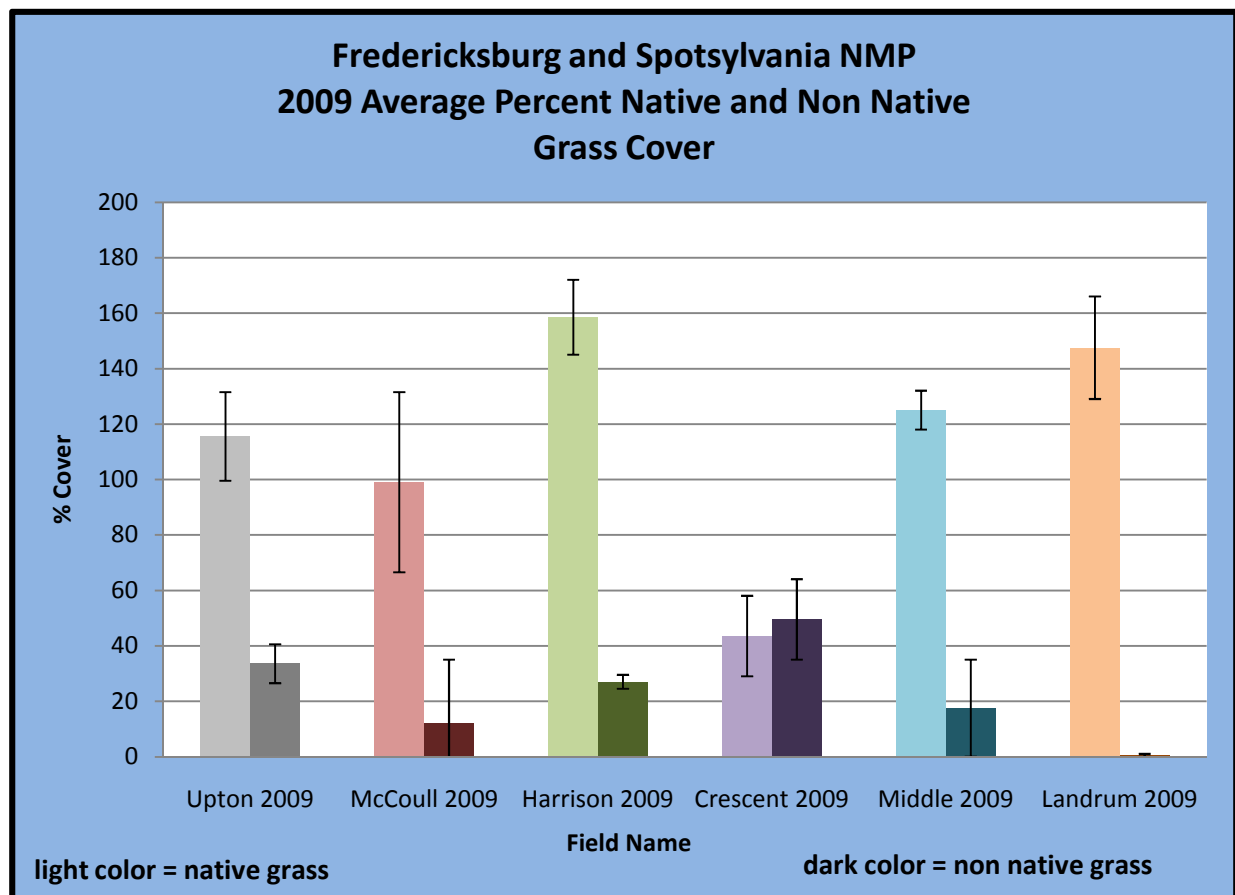
2009 Native and Non Native Grass Cover by Field

Crescent field had the highest percent cover of non native grass with 49.5% and by far the lowest native grass cover with 43.5%. Crescent field also had the highest percent cover of woody species. Upton field has the second highest percentage of non native grasses and a high percent cover of woody vegetation. Middle and Landrum fields have a high cover of native species and a low cover of woody vegetation.

n=2 in each field. Bars represent SE of the mean.

Upton Field N-115% (± 13.5) / NN-33.5% (± 2.5)
McCoull Field 99% (± 16.0) / NN-12% (± 7.0)
Harrison Field 158.5% (± 32.5) / NN-27% (± 23.0)

Crescent Field 43.5% (± 14.5) / NN-49.5% (± 14.5)
Middle Field 125% (± 7.0) / NN-17.5% (± 17.5)
Landrum Field 147.5% (± 18.5) / NN-.5% ($\pm .5$)



Average Percent Native and Non-Native Grass Cover by Field

Figure 19. Fredericksburg and Spotsylvania NMP.

McCoull House Field, burned summer 2004, spring 2005, 2006, 2008, 2009.

2004 - N 130% (± 30.0) / NN 24% (± 23.0)

2008- N 77.5% (± 2.5) / NN 5.5% (± 1.5)

2005- N 81.5% (± 7.5) / NN 27.5% (± 25.5)

2009- N 99% (± 16.0) / NN 12.0% (± 7.0)

2007- N 93% (± 6.0) / NN 18.5% (± 4.5)

n=2 in each field. Bars represent SE of the mean.

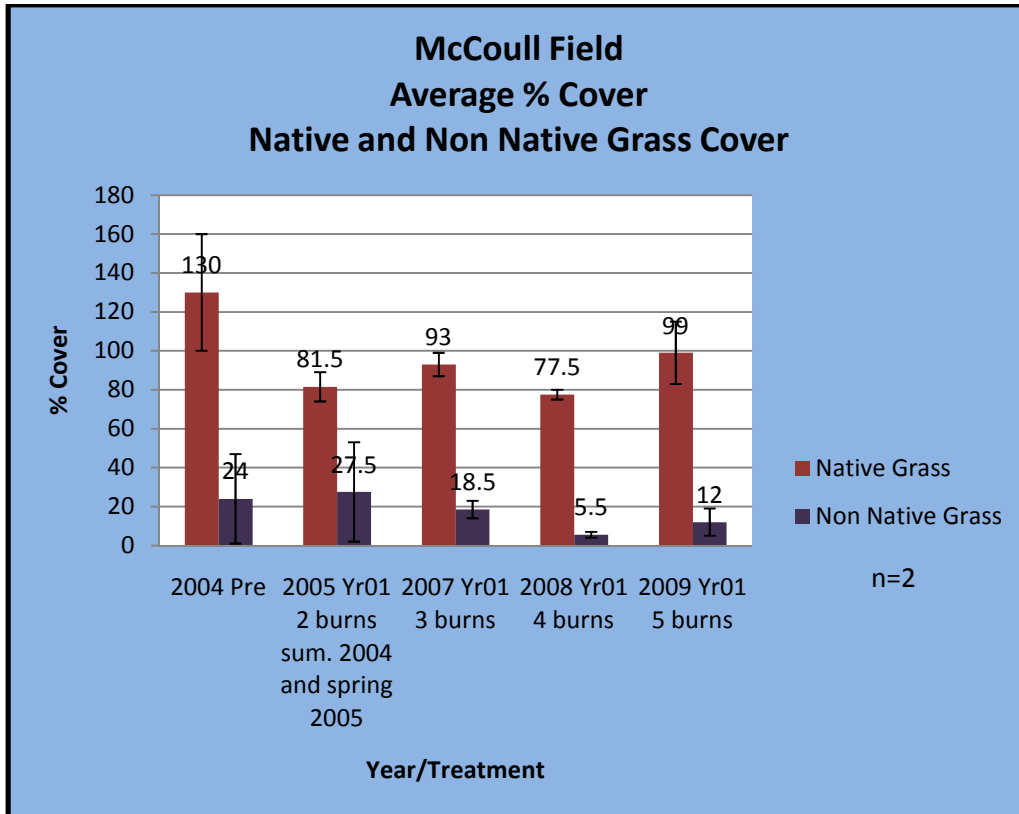


Figure 20. Fredericksburg and Spotsylvania NMP.

Harrison Field

Harrison House Field, burned spring 2004*, 2005*, 2007, 2008 and 2009.

*Plots did not burn.

2004 –N 145.5 % (± 14.5) / NN 17% (± 17.0)

2008-N 121.5% (± 11.5) / NN 26.5% (± 4.5)

2005 –N 91 % (± 26.0) / NN 29% (± 6.0)

2009-N 158.5 % (± 32.5) / NN 27% (± 23)

2007- N 132% (± 20) / NN 36.5% (± 4.5)

n=2 in each field. Bars represent SE of the mean.

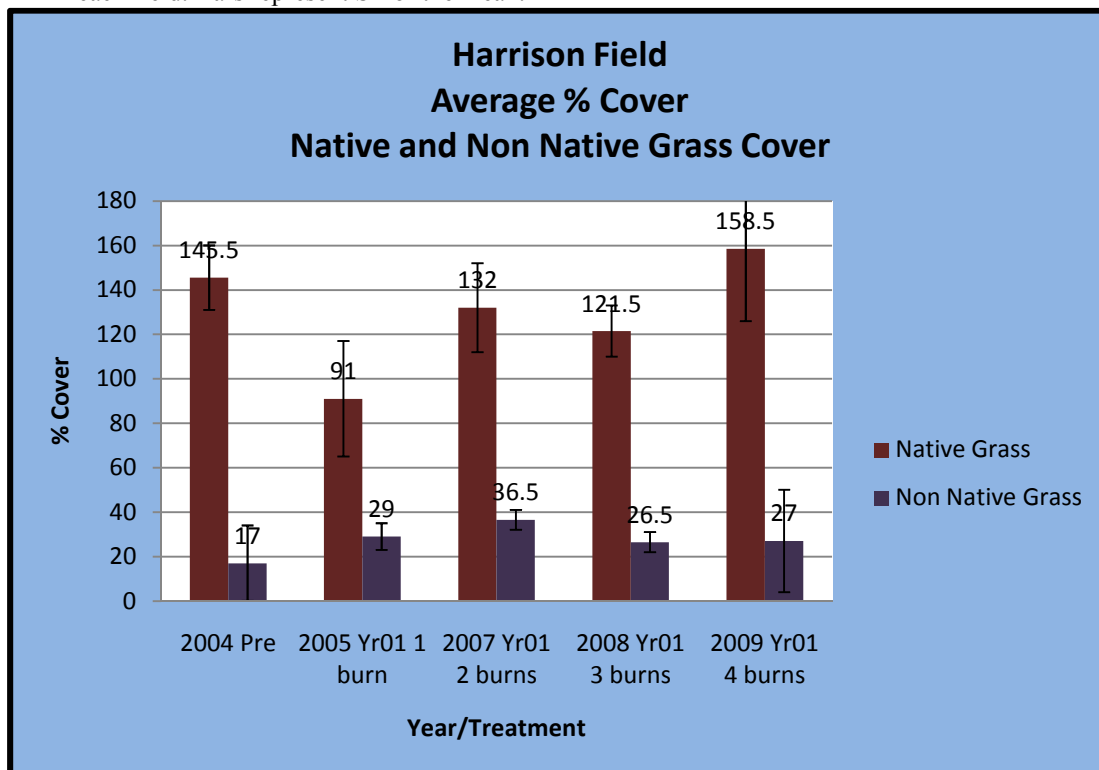


Figure 21. Fredericksburg and Spotsylvania NMP.

Upton Field

Upton Field, burned spring 2004*, 2005*, 2006*, 2008*, 2009.

*Plots did not burn.

2008-N 129.5% (± 17.5) / NN 9% (± 5.0)

2009-N 115.5% (± 13.5) / NN 33.5% (± 2.5)

n=2 in each field. Bars represent SE of the mean.

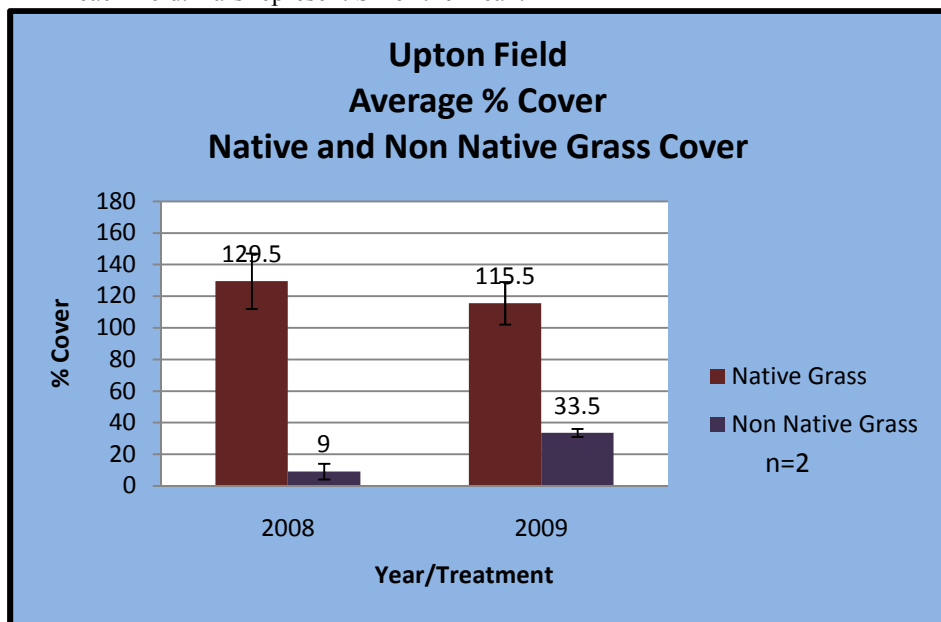


Figure 22. Fredericksburg and Spotsylvania NMP.

Crescent Field

Crescent Field, burned spring 2004*, 2005*, 2009.

*Plots did not burn.

2008-N 74% (± 1.0) / NN 47% (± 7.0)

2009- N 43.5% (± 14.5) / NN 49.5% (± 14.5)

n=2 in each field. Bars represent SE of the mean.

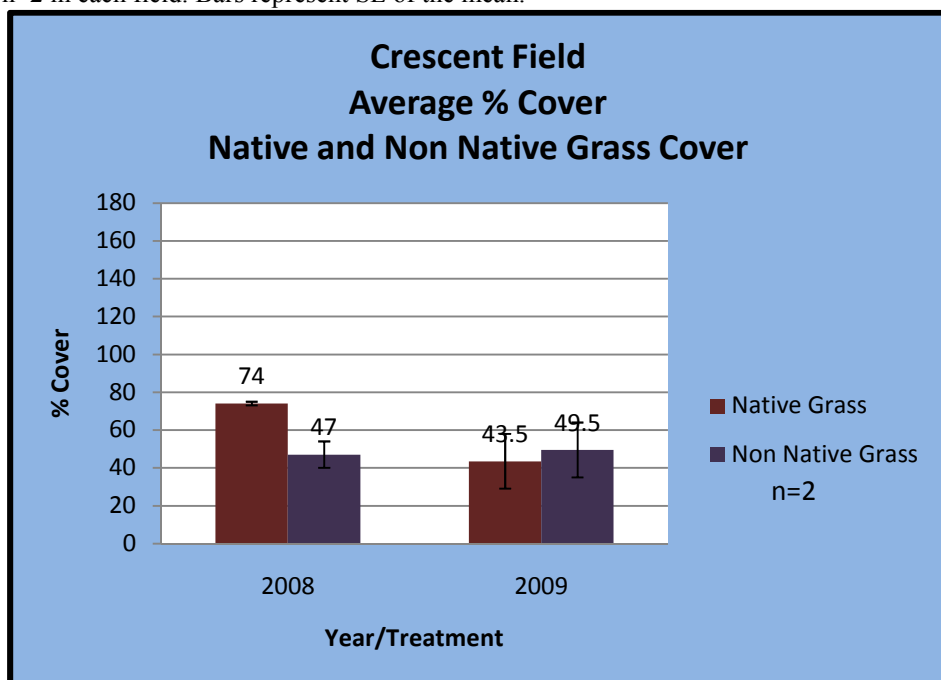


Figure 23. Fredericksburg and Spotsylvania NMP.

Middle Field

Middle Field, burned spring 2004*, 2005*, 2007*, 2008* and 2009.

*Plots did not burn.

2008 N- 112.5% (± 15.5) / NN 0% (± 0.0)

2009 N- 125 % (± 7.0) / NN 17.5% (± 17.5)

n=2 in each field. Bars represent SE of the mean.

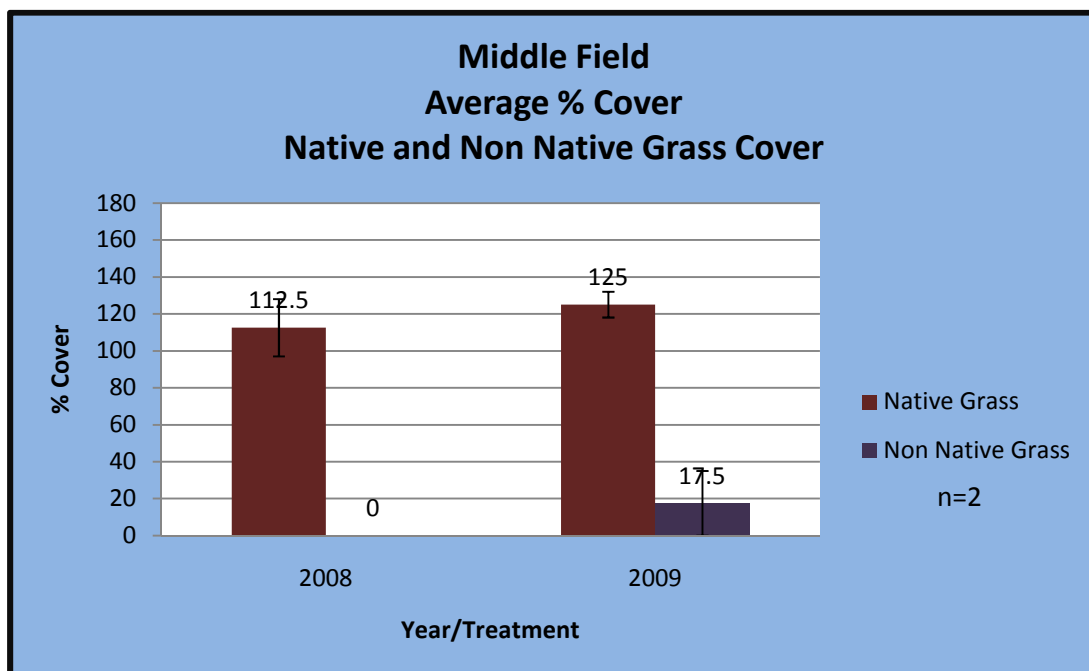


Figure 24. Fredericksburg and Spotsylvania NMP.

Landrum Field

Landrum Field, burned 2004*, 2005*, 2007*, 2008*, 2009*.

*Plots not burned, plots mowed 2x in 2009.

2008- N 110 % (± 2.0) / NN 2.5% (± 0.5)

2009- N 147.5 % (± 18.5) / NN .5% (± 0.5)

n=2 in each field. Bars represent SE of the mean.

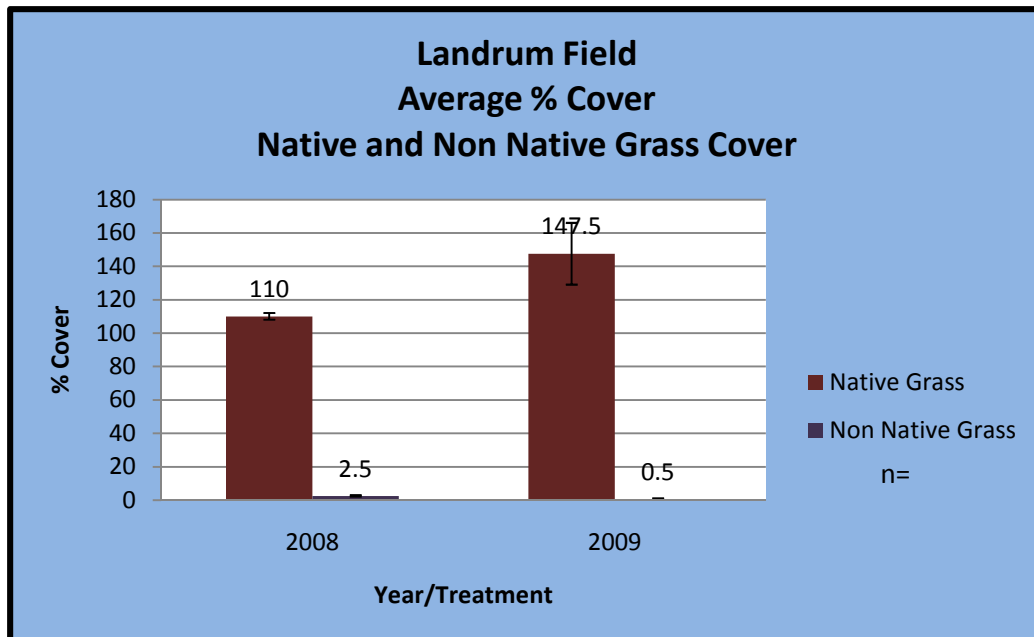


Figure 25. Fredericksburg and Spotsylvania NMP.

Earthwork Plots in Landrum Field

Two plots were installed on the Earthworks at the request of the NRM. One plot was treated with fire the other plot was left untreated.

Treated Plot 2008- Plot 13- N Pre 114%, NN 37% / One treatment N 91%, NN 16%

Un -Treated Plot 2009- Plot 14- N 14 Pre 91%, NN 20% / Un-treated N 73%, NN 12%

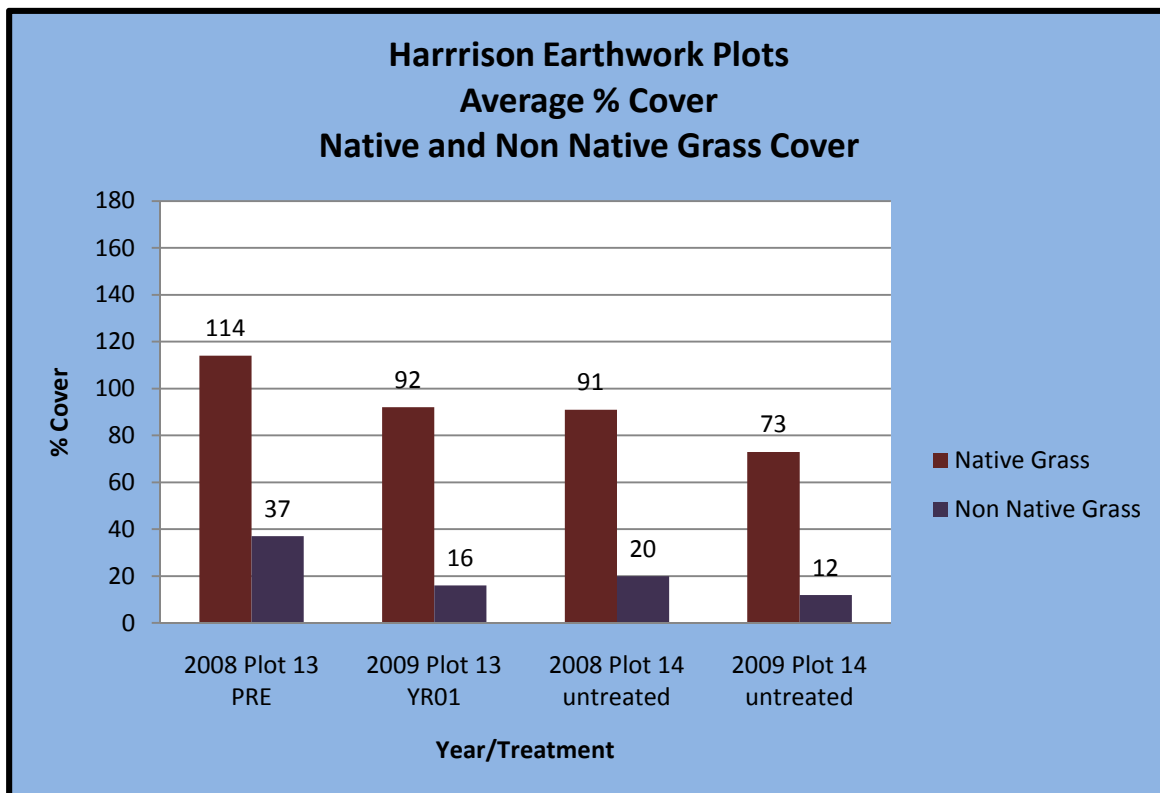


Figure 26. Saratoga National Historical Park
Bemis Heights Slope

Management Objective: Increase relative cover of native grasses and herbs by 20% and decrease woody shrub cover 20%.

Current status: Preburn % relative cover grasses 56.0($\pm$ 16.0) and forbs 35($\pm$ 0)

Current 73 ($\pm$ 8.0) and forbs 36.5 ($\pm$ 3.5) (n=2, 2 burns)

Preburn % cover shrubs 48.0($\pm$ 9.0).

Current % cover shrubs 36.5 ($\pm$ 8.0). (n=2, 2 burns)

Discussion: Native Grass and native forb cover increased. Woody vegetation decreased.

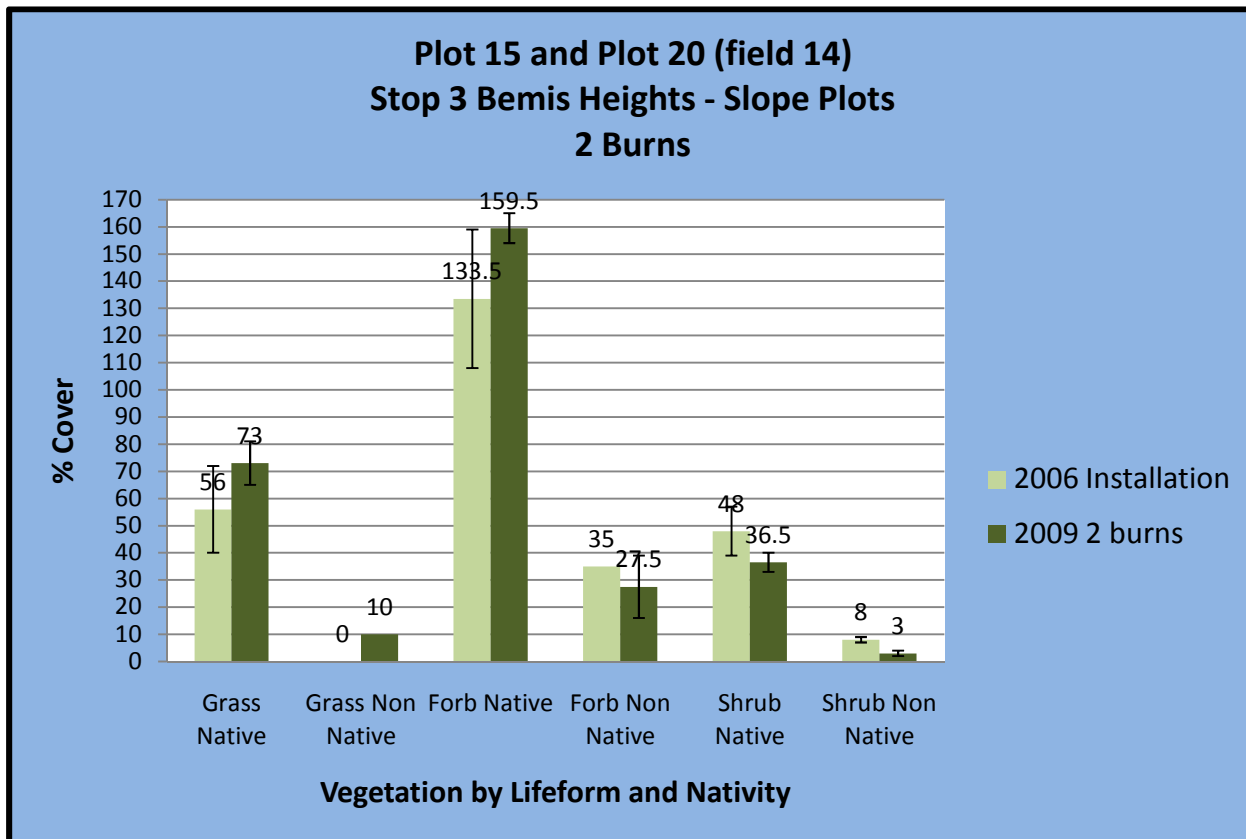


Figure 27. Saratoga National Historical Park
Great Redoubt- Slope

Management Objective: Increase relative cover of native grasses and herbs by 20% and decrease woody shrub cover 20%.

Current status: Preburn % cover grasses 20.5($\pm$ 14.5) and forbs 28.99($\pm$ 20.5)
Current 73 ($\pm$ 8.0) and forbs 36.5 ($\pm$ 3.5) (n=2-3, 3 burns)
Preburn % cover shrubs 48.0($\pm$ 9.0).

Current 53 ($\pm$ 13.22) and forbs 138 ($\pm$ 27.07) (n=2-3, 3 burns)

Discussion: Native Grass cover decreased and native forb cover increased slightly. Woody vegetation stayed the same.

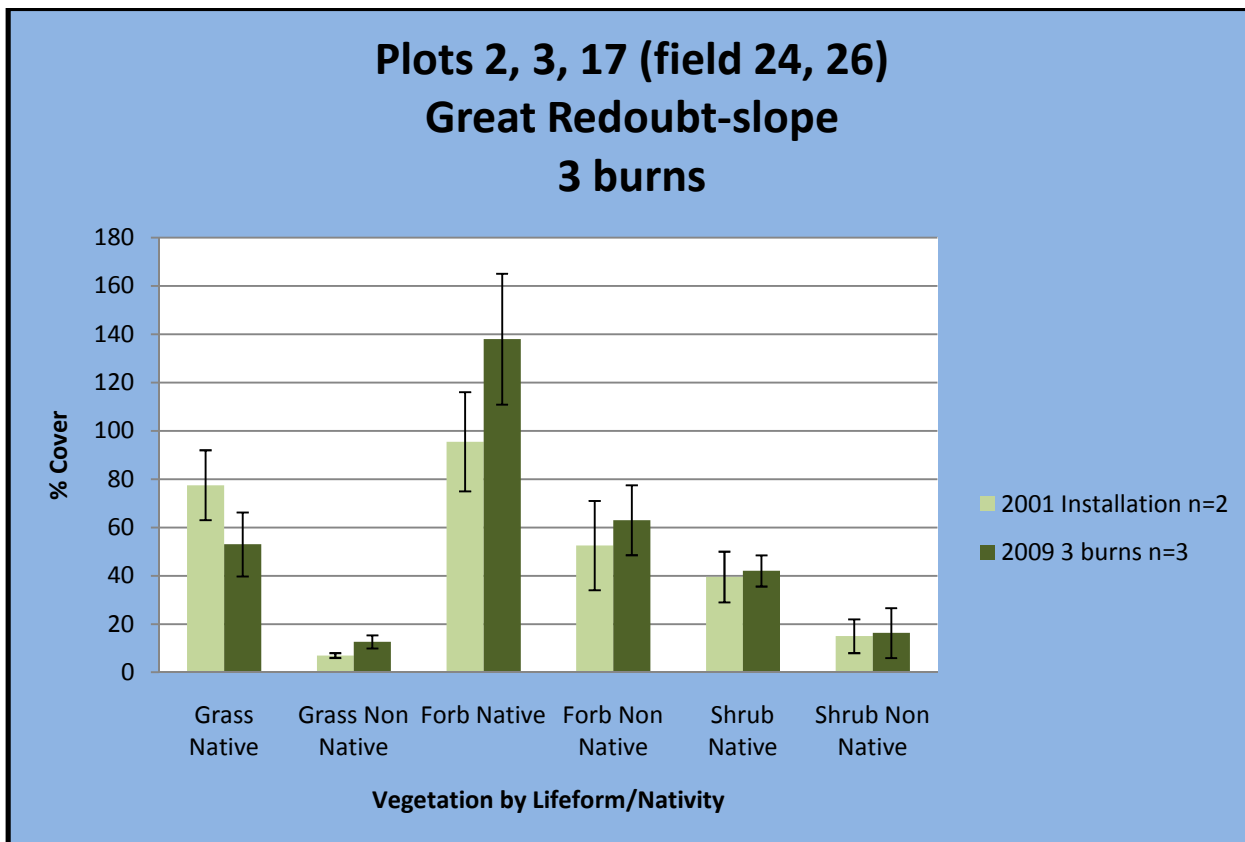


Figure 28. Saratoga National Historical Park

Nelson Farm- Circle

Management Objective: Decrease cover of non native forbs by 20% and increase cover of native grasses.

Current status: Preburn % cover non-native forbs 79 and native grass 34.
Current non native forbs 182 (± 24.0) and native grass 101 (± 6.0).
n=1-2, 3 burns

Discussion: Native Grass cover has increased, however non native forbs are also steadily increasing.

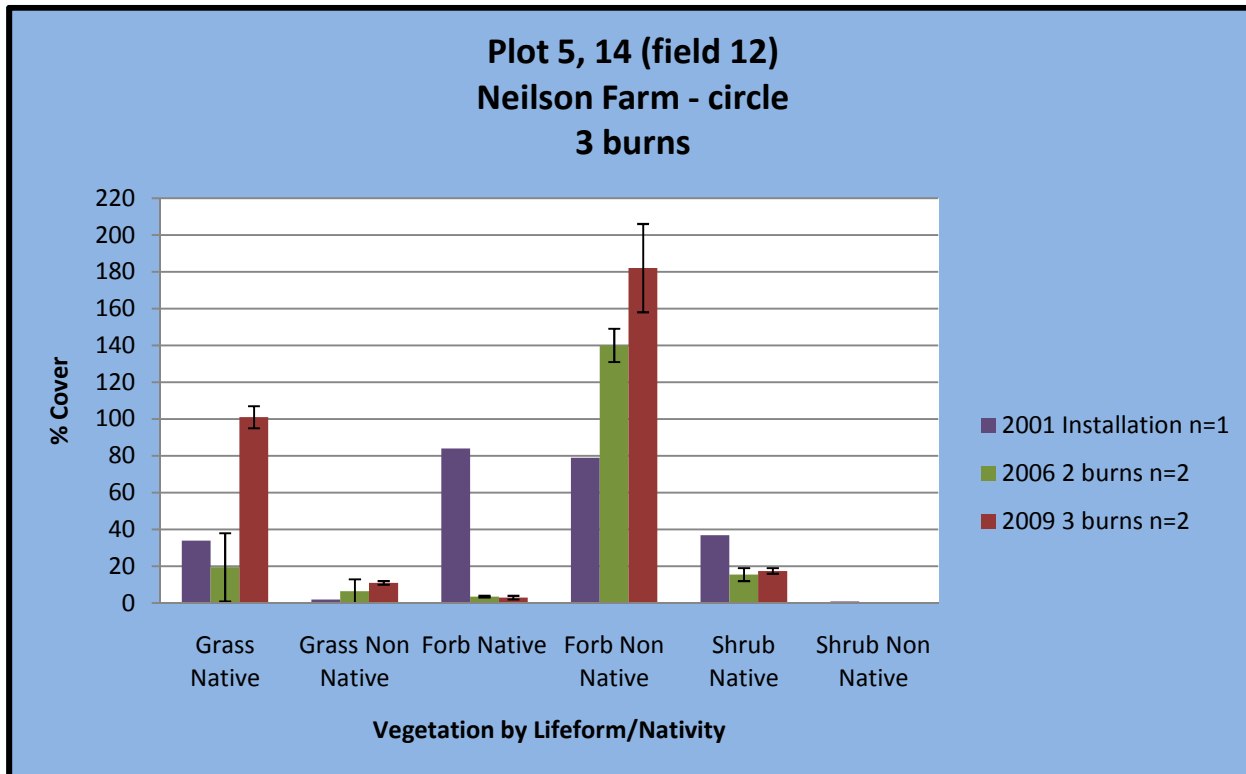


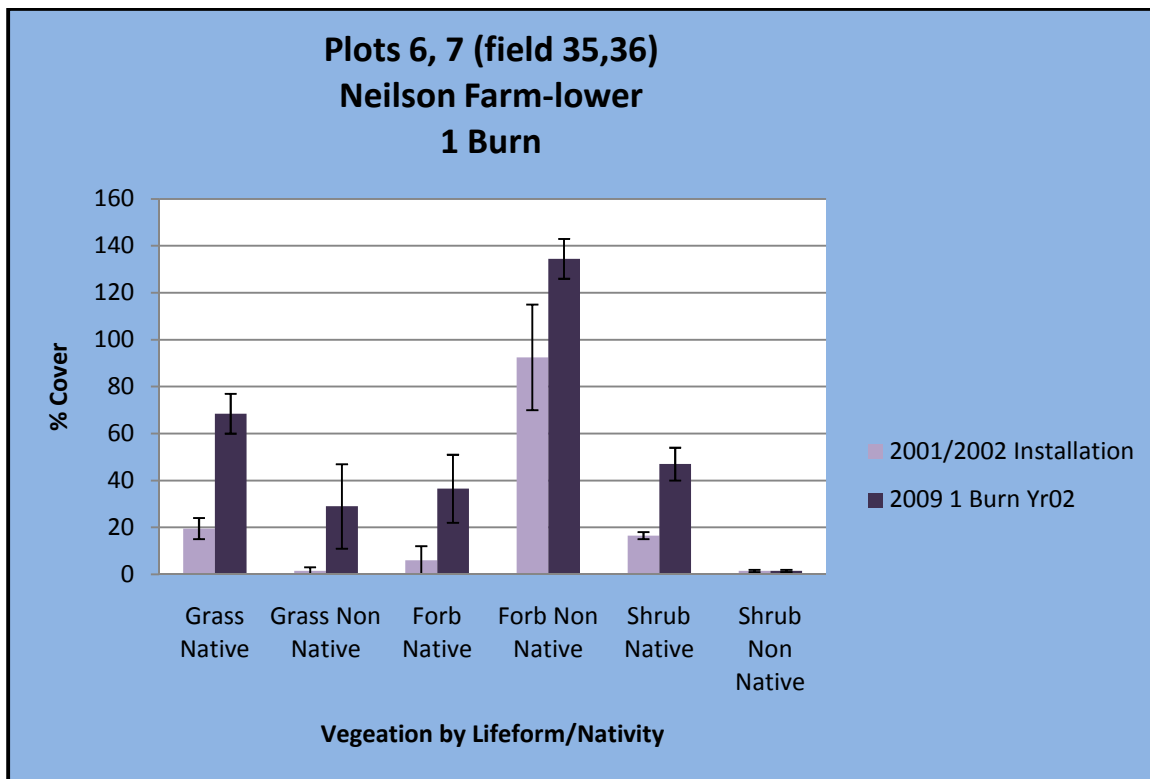
Figure 29. Saratoga National Historical Park

Nelson Farm- Lower

Management Objective: Decrease cover of non native forbs by 20% and increase cover of native grasses.

Current status: Preburn % cover non-native forbs 92.5($\pm$ 22.5) and native grass 19.5($\pm$ 4.5) .
Current non native forbs 134.5 ($\pm$ 8.5) and native grass 68.5 ($\pm$ 8.5).
n=2, 1 burns.

Discussion: Native Grass cover has increased, however non native forbs are also steadily increasing.



Richmond Cold Harbor - Photo Points

	Richmond –Cold Harbor Unit Burned- Spring 2005 Photo- Summer 2005 1 Burn
	Richmond –Cold Harbor Unit Burned- Spring 2006 Photo- Summer 2006 2 Burns
	Richmond –Cold Harbor Unit Last Burn 2 years prior Photo- Summer 2008 4 Year after initial burn *Mechanical treatment -cutting saplings and small trees occurred after photo was taken in preparation for 2009 Spring
	Richmond- Cold Harbor Unit Burned – Spring 2009 Photo- Summer 2008 3 Burns



Assateague Island National Seashore Aerial Spray and Prescribed Fire Monitoring Report



**Prepared by: Missy Forder
Fire Ecologist - Shenandoah National Park**

Introduction

Phragmites australis or common reed has been found in every U.S. state and is exponentially increasing in dominance in the coastal areas of the Eastern shore (Myers et al. 2004). *Phragmites* occurs as two subspecies, *Phragmites australis* ssp. *americanus*, which is considered native to North America (Saltonstall 2005), and the non-native invasive subspecies *Phragmites australis* ssp. *australis* which is believed to have been introduced from Europe, Asia, and/or Africa (Saltonstall 2002). *Phragmites australis* ssp. *australis* is considered one of the most invasive species in North America (Marks et al. 1993; Norris et al. 2002). The native species of *Phragmites* (*Phragmites australis* ssp. *americanus*) is uncommon and appears on the Virginia Department of Conservation rare plant watch list (Townsend 2007). A 2005 survey done on the Eastern shore found no native stands of *Phragmites* present (Myers et al. 2005).

Phragmites is a long-lived perennial that spreads rapidly by reproducing seeds and vegetatively by rhizome fragments. Rhizomes can grow several feet deep and stolons can grow horizontally 10 feet or more per year. The non-native invasive *Phragmites* reduces biological diversity in marshes by forming dense stands and crowding out native plants and wildlife that depend on these areas (Saltonstall 2005). To further inhibit biological diversity, the plant releases gallic acid into the soil which inhibits other plants from establishing (Rudrappa et al. 2007). *Phragmites* threatens the habitat of numerous plants, animals and vegetation communities, many of these species are state listed as threatened (Heffernan et al. 2009).

Dense stands of *Phragmites* can substantially increase the potential for damaging wildfires due to the vast impenetrable amounts of dead standing vegetation that is left after the fall when the plant dies back. This combined with the lowering of the water table can be detrimental to an area. The stems of *Phragmites* die every year, but persist for several years, with new stems growing. Fire in *Phragmites* stands can cause wind-born fire brands with resulting spot fires for more than 100 feet (Marks et al. 1993). This increase in fire potential threatens wildlife, structures and residential property (Heffernan et al. 2009).

Due to the devastating effects of this non-native invasive plant, through habitat loss, native species loss, decreased species diversity and increased fire hazard, numerous studies have been undertaken to find the best control method. The most efficient and economical control method for stands exceeding five acres in size is considered to be the aerial application of herbicide. This involves a helicopter mounted with a spray boom and herbicide tank that flies low and slow over the stand to allow for thorough coverage and minimize spray drift. Aerial application allows for large areas to be covered that would be difficult or impossible to cover using ground spray methods (Heffernan et al. 2009).

A successful treatment using aerial spraying will result in a stand of dead *Phragmites* stems in addition to the thick rhizome mat. Native plant species are slow to re-establish and make take multiple growing seasons with little or no bare soil exposed (Farnsworth and Myerson 1999). A recent study found that spraying in combination with cutting and raking had the greatest effect on promoting species establishment and maintaining diversity in a formally *Phragmites* dominated area (Carlson et al. 2009). Moreover, removing the dead biomass of dead stems and rhizome mat is imperative for native species re-establishment. When dealing with large expanses of *Phragmites* covering numerous acres, cutting and raking is not feasible.

The application of fire on an aerially sprayed site in the winter or early spring following the initial herbicide treatment will facilitate native plant reestablishment (Marks et al. 1993). Using fire alone will benefit the growth of *Phragmites*; therefore it is important to use it with the combination of spraying (Marks et al. 1993). Fire removes the dead stems of *Phragmites* and will increase the next aerial spray application by removing a physical spray obstruction. Moreover, burning dead stands of *Phragmites* increases the establishment of native marsh vegetation by reducing shade, exposing soil and releasing nutrients bound up in *Phragmites* stems. Following the prescribed burn it is important to re-apply herbicide to any new sprouts that return to prevent re-colonization of the species (Heffernan et al. 2009).

In late Summer of 2008, 185 acres of *Phragmites* was aerially sprayed at Assateague Island National Seashore. In late winter of 2009, 200 acres were treated with prescribed fire to remove dead biomass and promote the re-establishment of native species. The following summer, the Northeast Region Fire Effects monitoring crew assisted the natural resource staff at Assateague Island National Seashore in monitoring for species diversity and the reduction of *Phragmites*. The natural resource staff also conducted an ongoing *Phragmites* specific monitoring project underway for a few years. While our site locations differed we adapted the same protocols.

Fire Behavior

During prescribed fire operations, fire behavior tended to be influenced by fuel type changes, wind shifts, and firing patterns as relative humidities remained nearly constant throughout burning operations. Areas with small pockets of *Phragmites* and green briar and widely scattered pine tended to display slower rates of spread when ignited with a backing fire. In contrast, dense stands of *Phragmites* ignited with a flanking or head fire frequently exhibited spotting from “cotton ball” like flower embers carried easily in a light wind. Fuel consumption in the 1 and 10 hour vertical fuels tended to be greater than 90% in the continuous *Phragmites* with 60-80% top kill in the green briar and wax myrtle. Areas that were saturated with water consumed significantly less biomass.



Surface 1 and 10 hr fuels were approximately 30% consumed with 100 and 1000 hr fuels only charred. Isolated torching in the pines and brush clumps was observed in areas lit with a flanking or head fire. Isolated torching in the pines was observed with flame lengths of 20 to 30 feet. Rates of spread averaged 4 to 8 ch/hr, with an average flame length of 4 to 12 feet throughout the burn units. Smoke from the fire tended to be light and diffuse in nature, with no definite column. The smoke rarely rose above 100 to 200 feet and was pushed to the southwest for a majority of the burning duration with little or no impact on the surrounding areas.



Methods

Transect site selection was performed by the natural resource vegetation staff in the burn/spray areas using ArcGIS. Transects were all selected within the burn area, however some fell outside the sprayed infestations. Twenty-four transect start points were chosen in the six burn units. Unit 1, an island, was not monitored due to inclement weather conditions and the inability to get there by boat. Transects were 20 meters in length and orientated NE to SW. Transects were marked with rebar at 0m, 10m, and 20m. .5 meter square plot frames were placed on the SE side of the transect every 2 meters. Data collection consisted of counting live *Phragmites australis* stems and the presence of living plants by genus and species. Also recorded included overstory species, the presence of standing water and if there is an ungulate trail within the quadrat.

Unit 2

Figure 1.

Unit 2 map of the 2009 Burn/Spray Fire Effects Monitoring Transects.

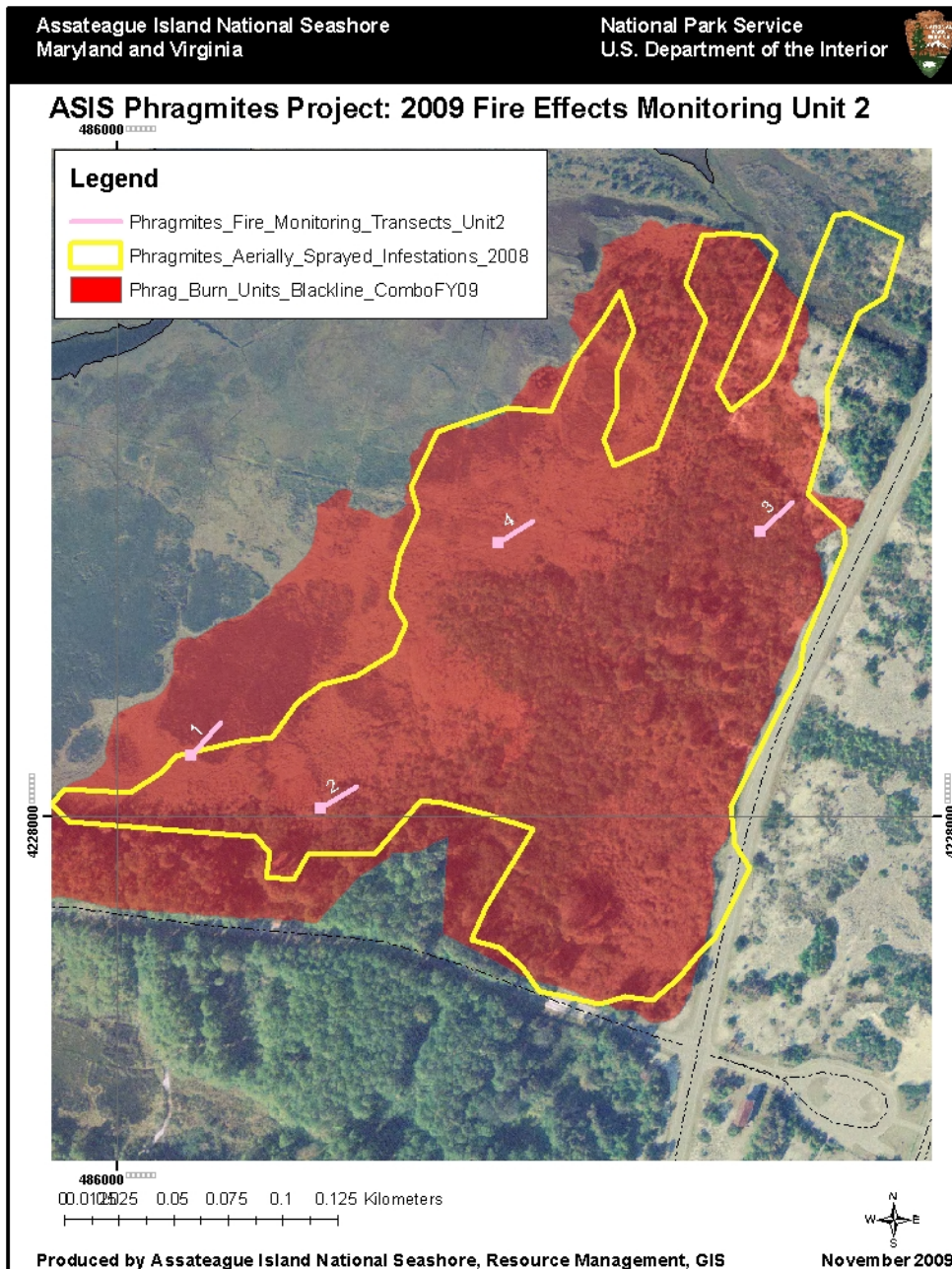


Figure 2.

Species diversity in Unit 2 was the lowest with an average of 7 species per transect. This was the lowest species diversity of the units sampled. Transects #1 and #4 had the lowest species diversity with three species. These transects were completely saturated with standing water. All four transects were in the burn and spray area.

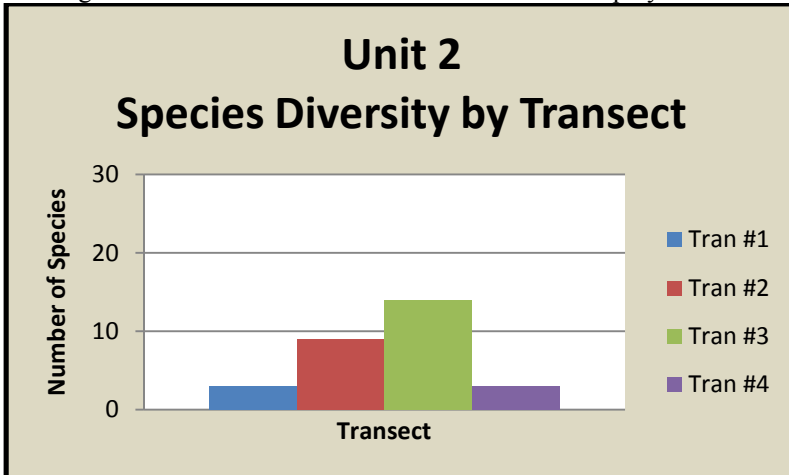
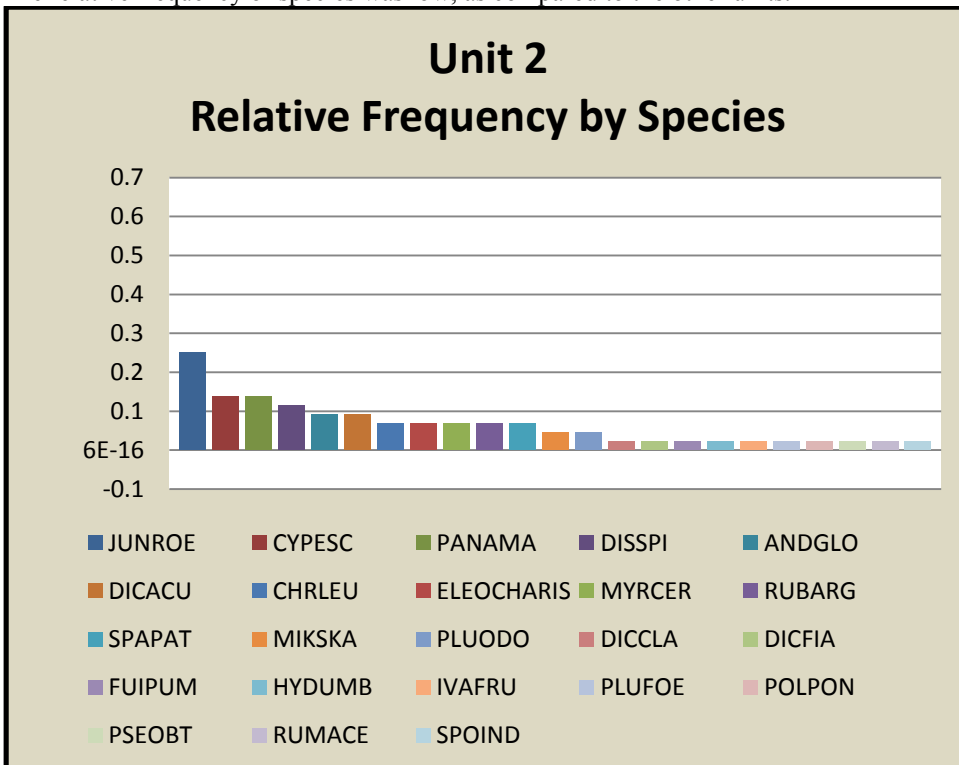


Figure 3.

The relative frequency of species was low, as compared to the other units.



*species list with Genus and Species names can be found in Appnendix A.

Unit 3

Figure 4.

Unit 3 map of the 2009 Burn/Spray Fire Effects Monitoring Transects.

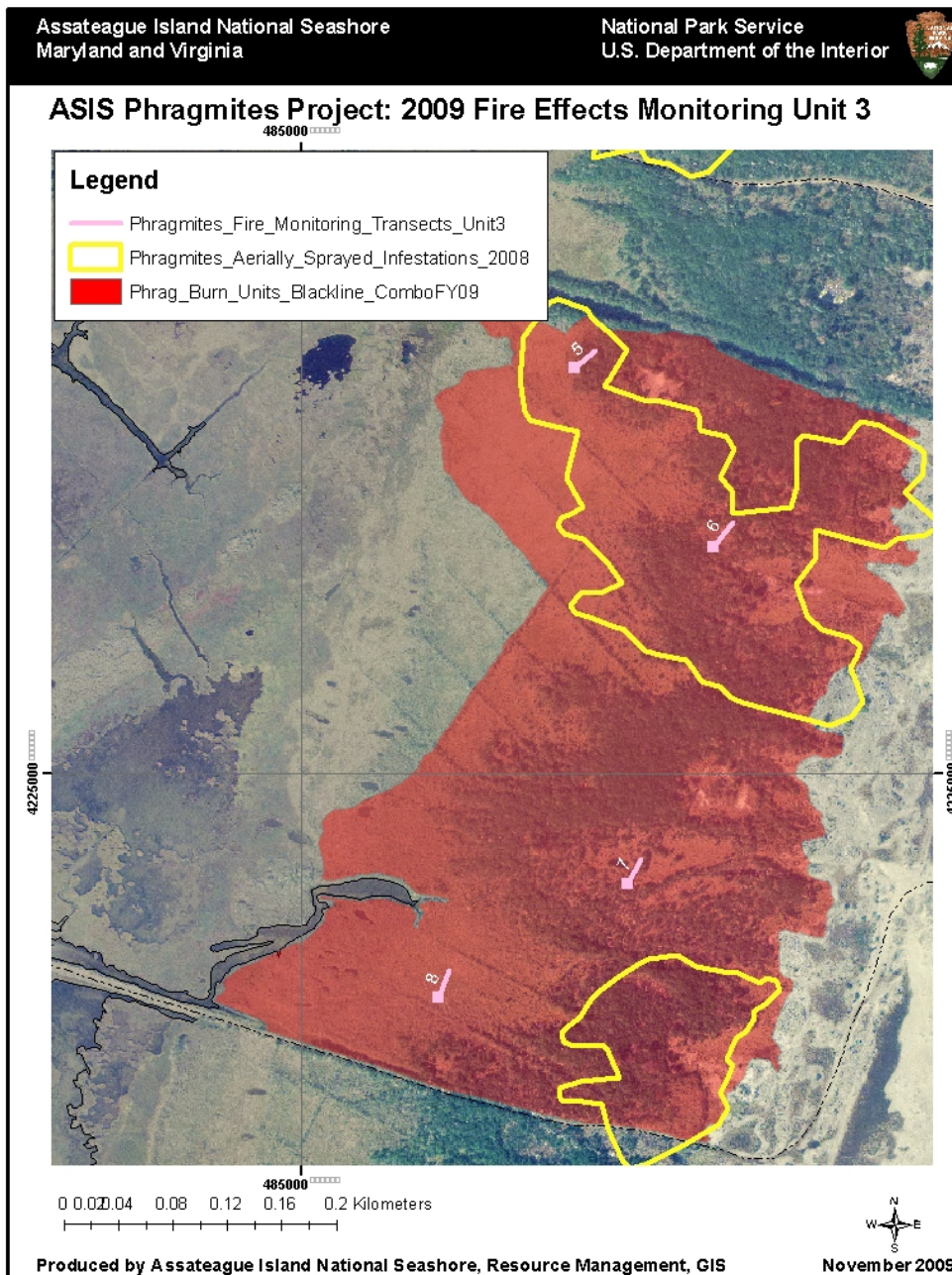


Figure 5.

Species diversity in Unit 3 was moderate with an average of 13 species per transect. Transects #5 and #6 had a species count of 13 and 15 species respectively. Transects #7 and #8 had a species count of 18 and 6. Transects #5 and #6 were in the burn/spray area. Transects #7 and #8 were only in the burn treatment area. Transect #8 had the lowest species diversity of 8 species and was completely covered by standing water.

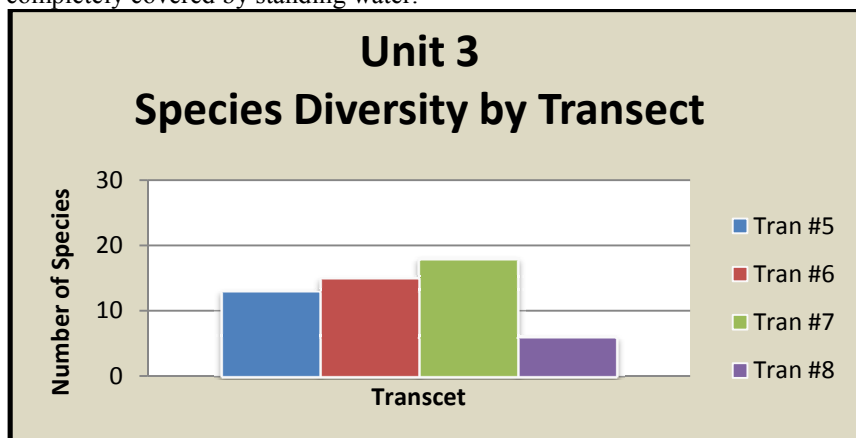
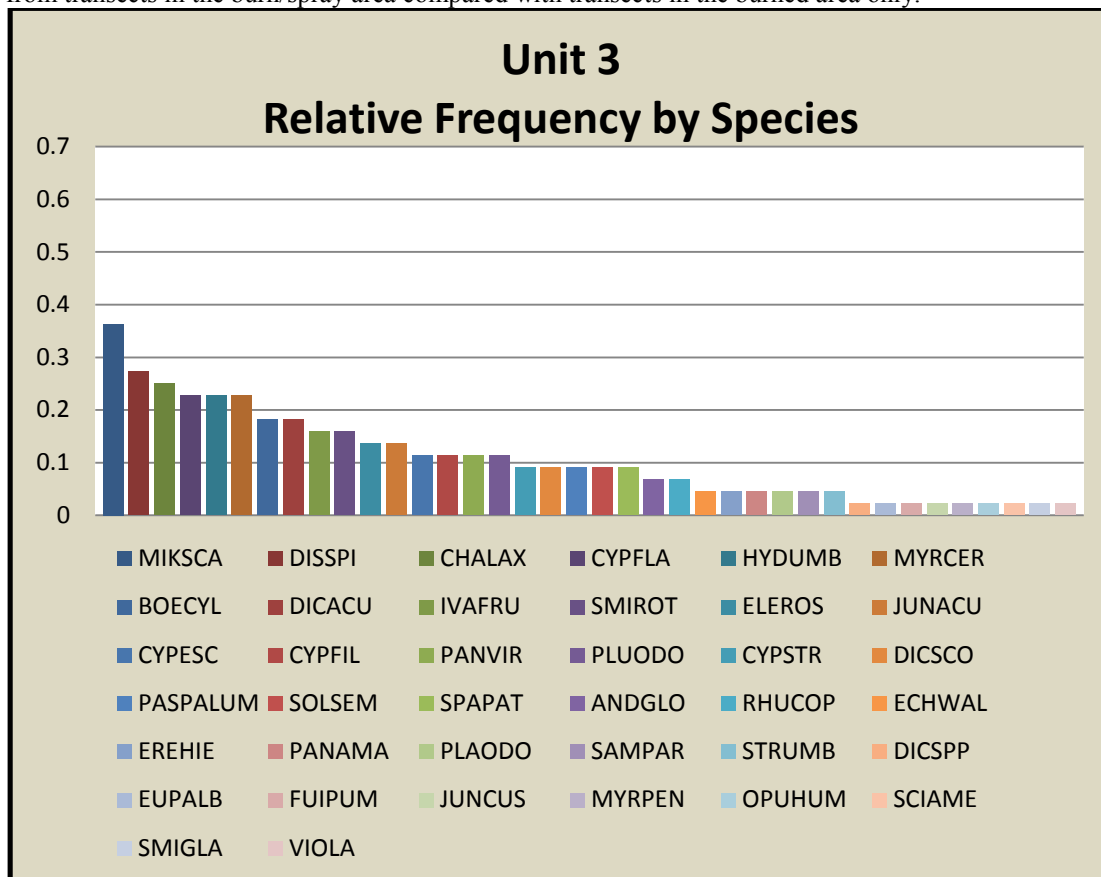


Figure 6.

The relative frequency of species was high in this unit, as compared to the other units. Species diversity was not obviously different from transects in the burn/spray area compared with transects in the burned area only.



*species list with Genus and Species names can be found in Appnendix A.

Unit 4

Figure 7.

Unit 4 map of the 2009 Burn/Spray Fire Effects Monitoring Transects.

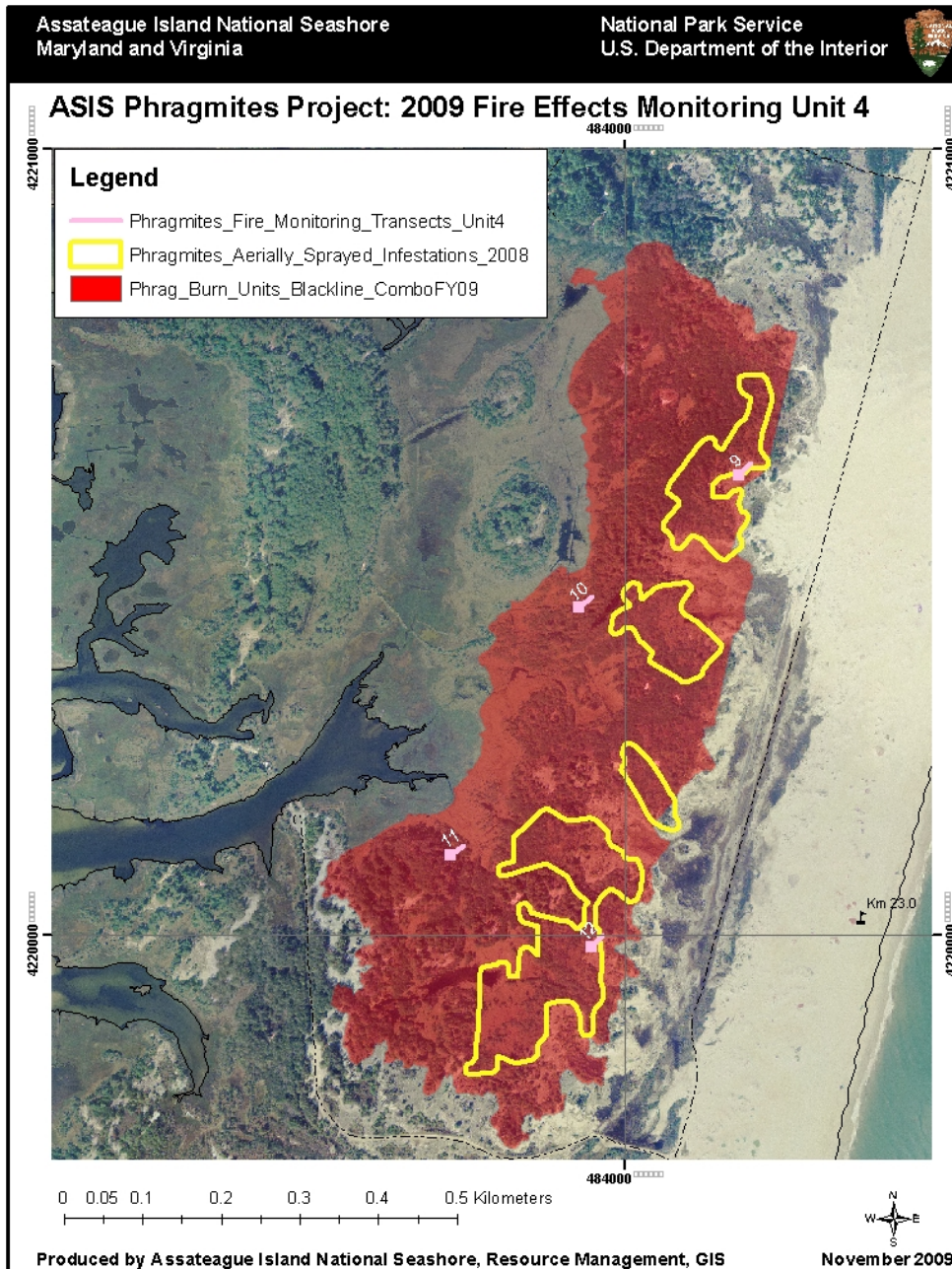


Figure 8.

Species diversity in Unit 4 was high with an average of 18 species per transect. Transects #9 and #10 had a species count of 26 and 22 species respectively. Transects #11 and #12 had a species count of 16 and 8. Transects #9 and #12 were in the burn/spray area. Transects #10 and #11 were only in the burn treatment area. Transect #12 had the lowest species diversity of 8 species.

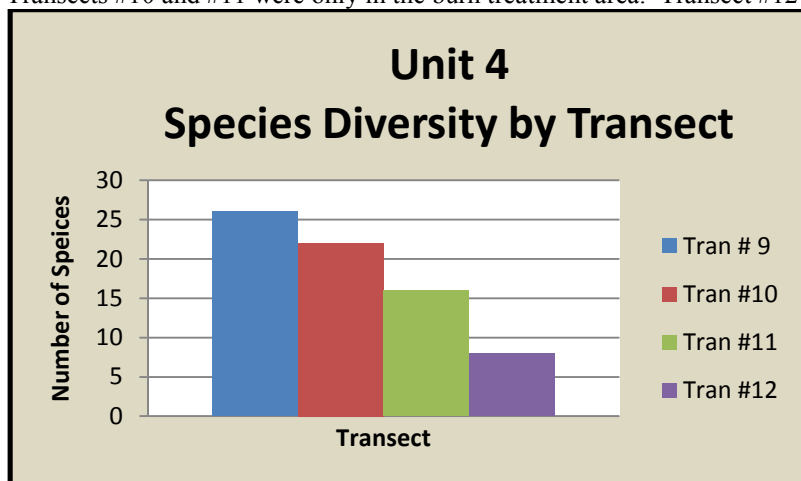
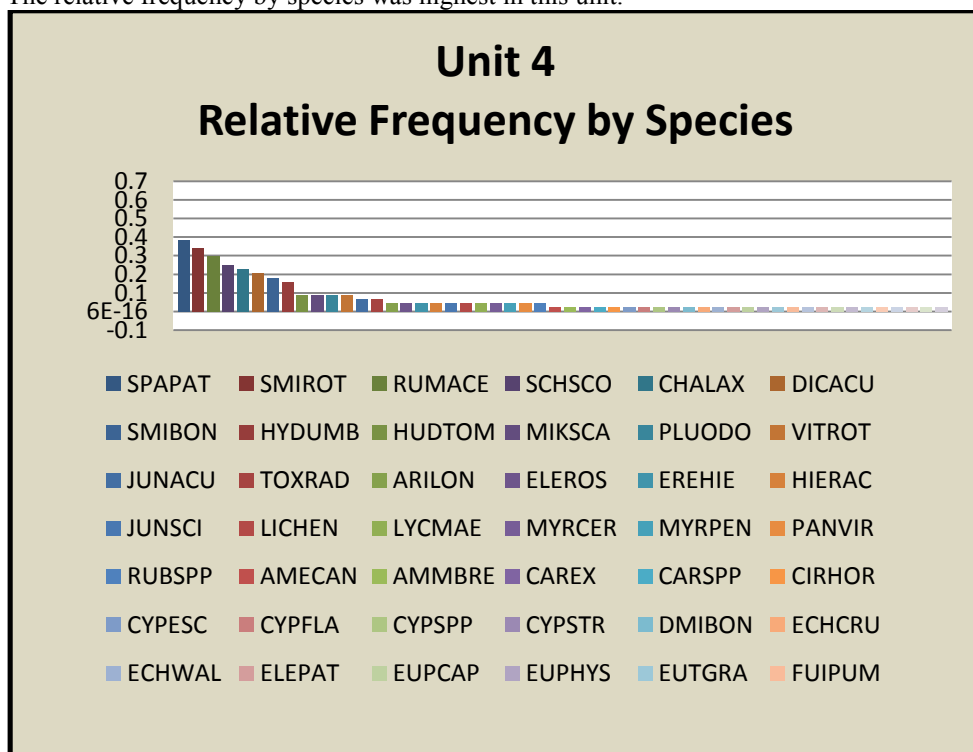


Figure 9.

The relative frequency by species was highest in this unit.



*species list with Genus and Species names can be found in Appndex A.

Unit 5

Figure 10.

Unit 5 map of the 2009 Burn/Spray Fire Effects Monitoring Transects.

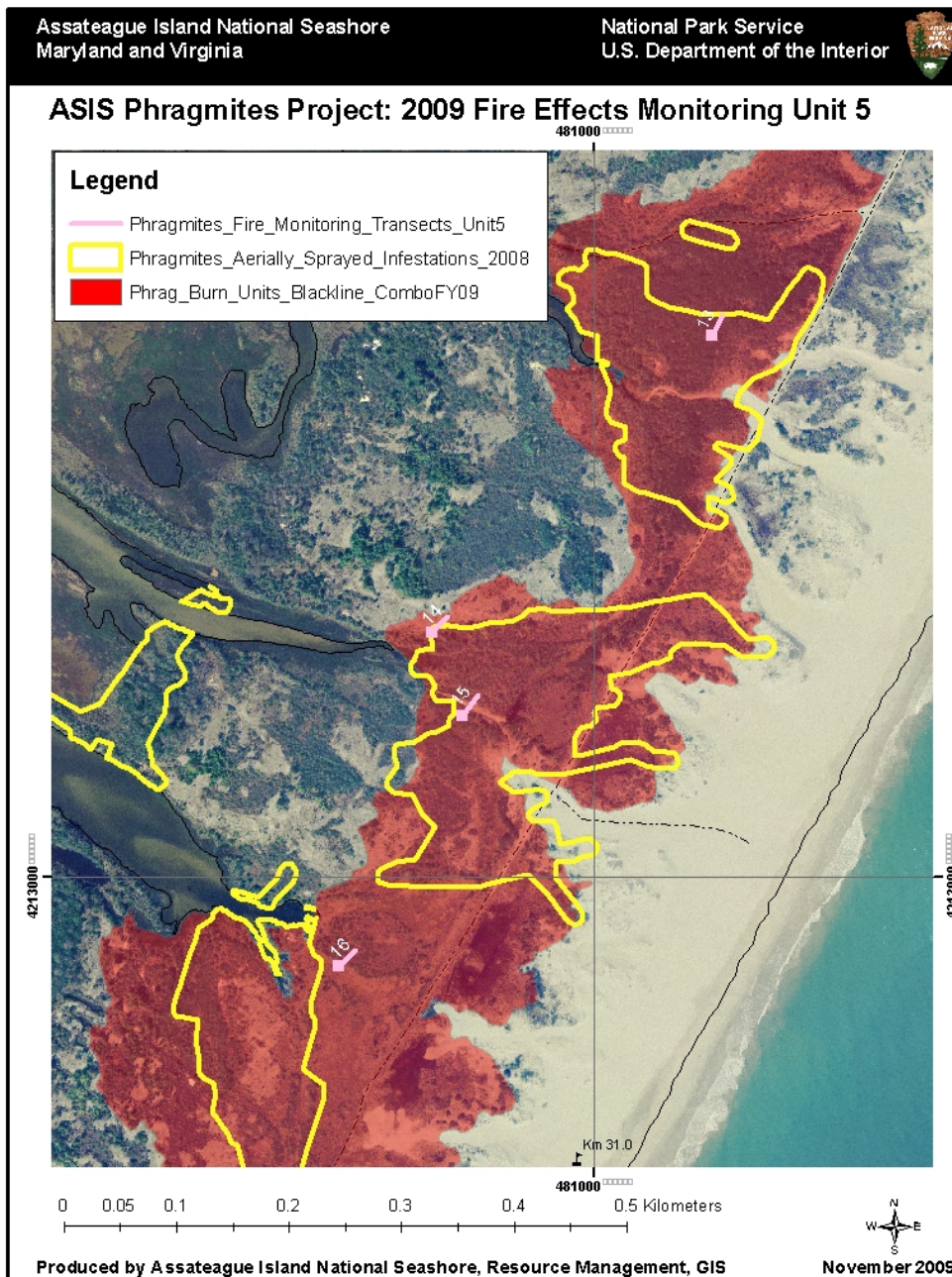


Figure 11.

Species diversity in Unit 5 was moderate with an average of 14 species per transect. Transects #13 and #14 had a species count of 16 and 17 species respectively. Transects #15 and #16 had a species count of 11. Transects #13, #14 and #15 were in the burn/spray area. Transects #16 was only in the burn treatment area.

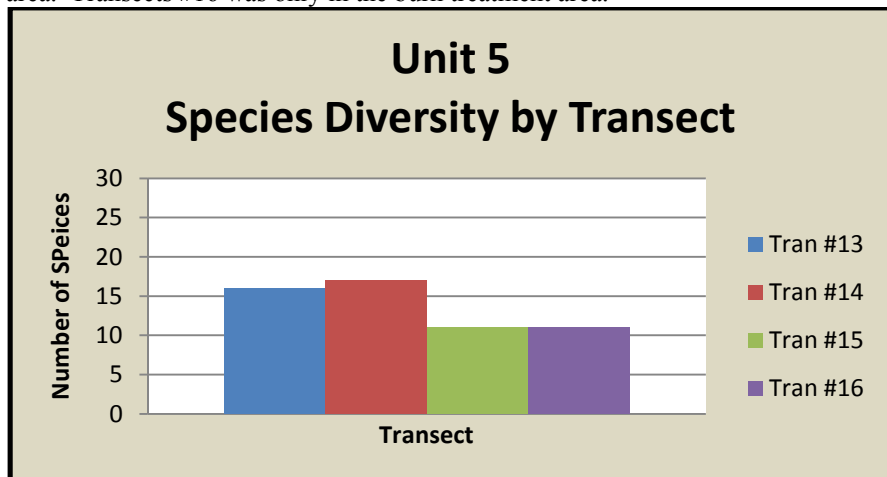
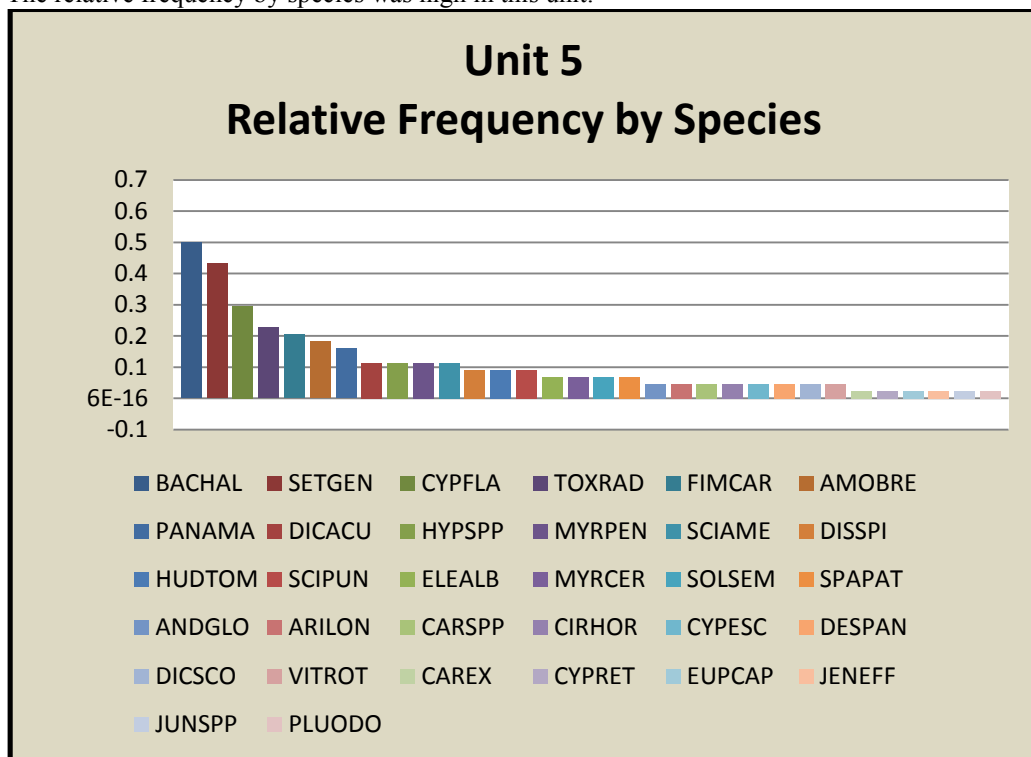


Figure 12.

The relative frequency by species was high in this unit.



*species list with Genus and Species names can be found in Appnendix A.

Unit 6

Figure 13.

Unit 6 map of the 2009 Burn/Spray Fire Effects Monitoring Transects.

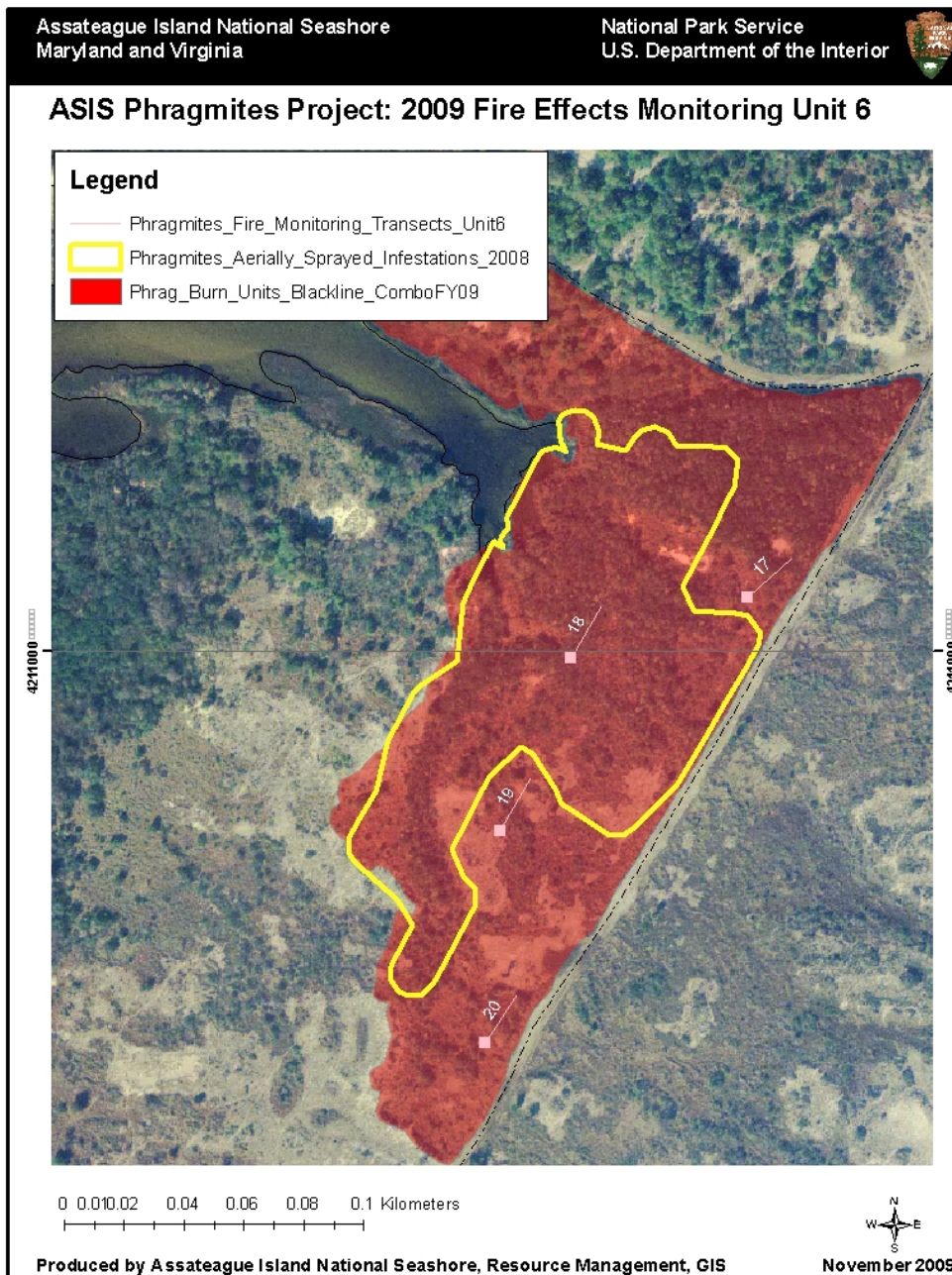


Figure 14. Species diversity in Unit 6 was moderate with an average of 13 species per transect. Transects #17 and #18 had a species count of 13 and 5 species respectively. Transects #19 and #20 had a species count of 22 and 11. Transects #18 was in the burn/spray area. Transects #17, #19 and #20 were only in the burn treatment area. Transect #18 had a low species diversity of 5 species. This transect was noted to have many dead *Phragmites* stems, and 158 tiny live shoots. The area of transect #18 did not burn well, as was apparent by the amount of dead *Phragmites* stems. Transect #18 was not completely saturated with water, but the area was very wet.

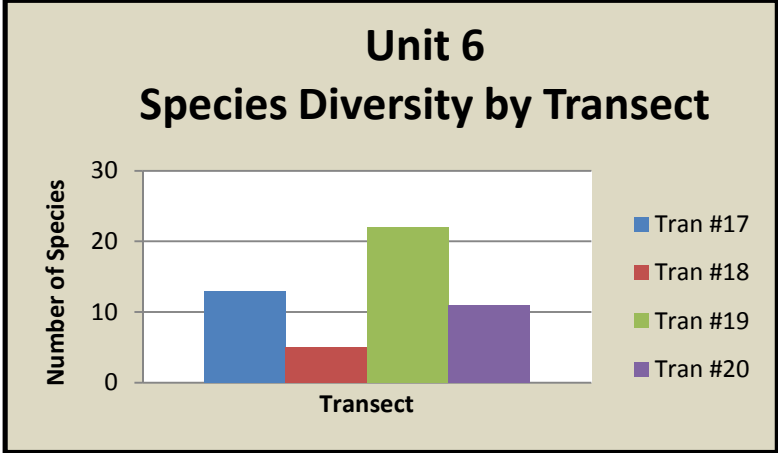
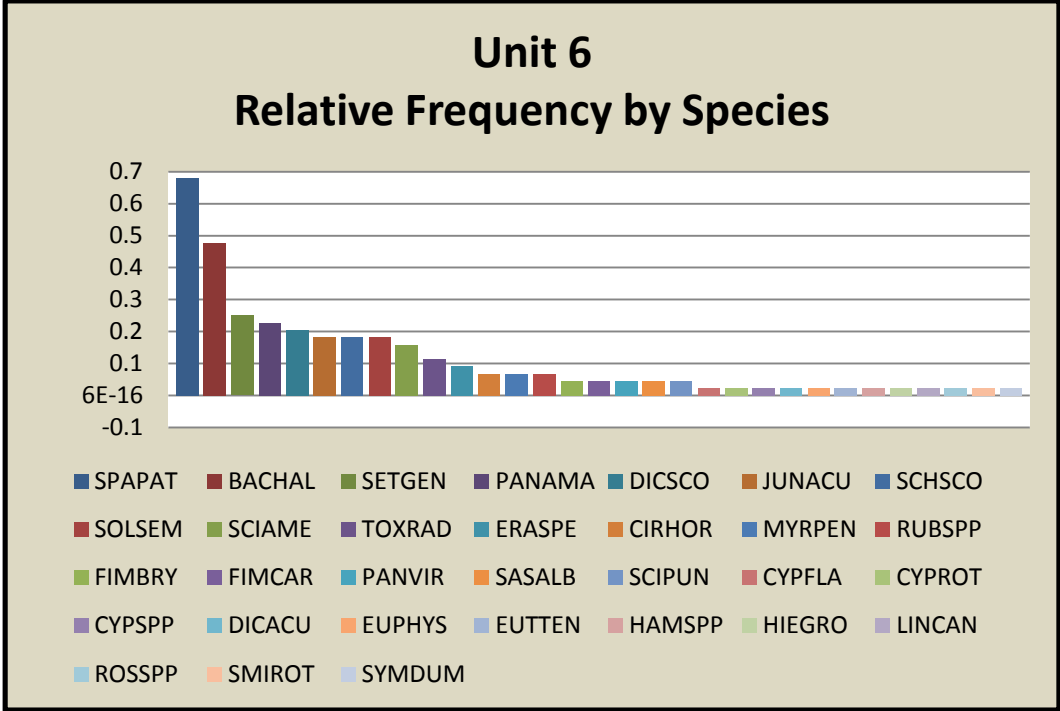


Figure 15. The relative frequency by species was high in this unit.

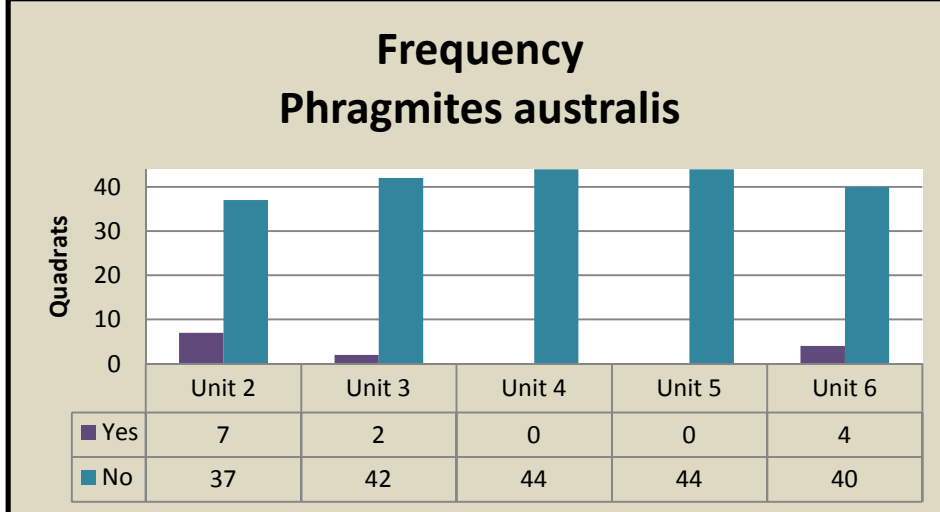


*species list with Genus and Species names can be found in Appnendix A.

Phragmites

Figure 16.

The overall frequency of *Phragmites australis* was low in all of the units. In Unit 6, Transect #18 there were 158 tiny living shoots counted. However, they were only found in 4 of the 44 quadrats. Unit 2 had the highest frequency of live shoots found in 7 of the 44 quadrats. In Unit 3 there were 2 quadrats with live stems and in Units 4 and 5 no living shoots were found.



*Yes = live *P. australis* stems No = did not contain live *P. australis* stems

Figure 17.

The relative frequency of *Phragmites australis* was .16% in Unit 2 with 7 of the 44 quadrats containing live stems. There were a total of 17 live stems found. Unit 6 had a relative frequency of .09 with live stems in 4 of the 44 quadrats. 158 tiny shoots were counted on four quadrats in Unit 6. The relative frequency of *Phragmites australis* is very low compared to the relative frequency of native species observed.

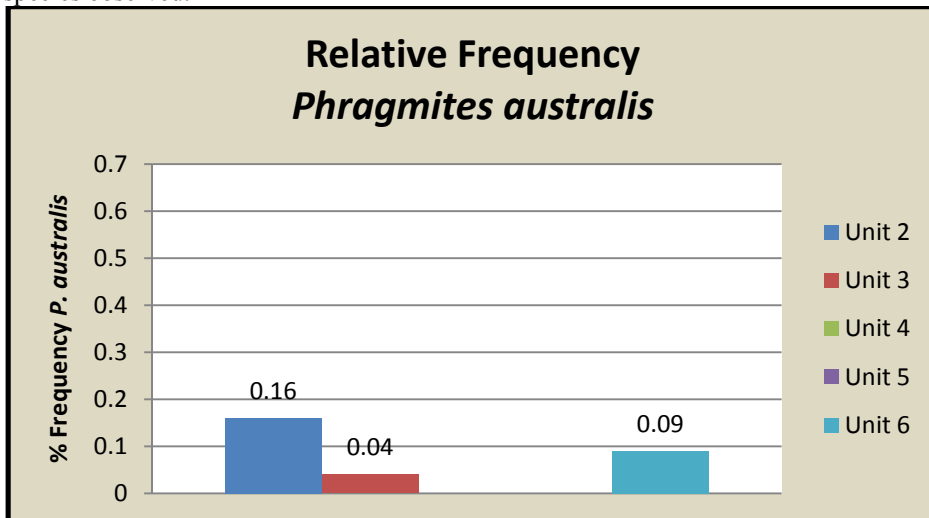


Figure 18.
Stem density levels of *Phragmites australis* by transect.

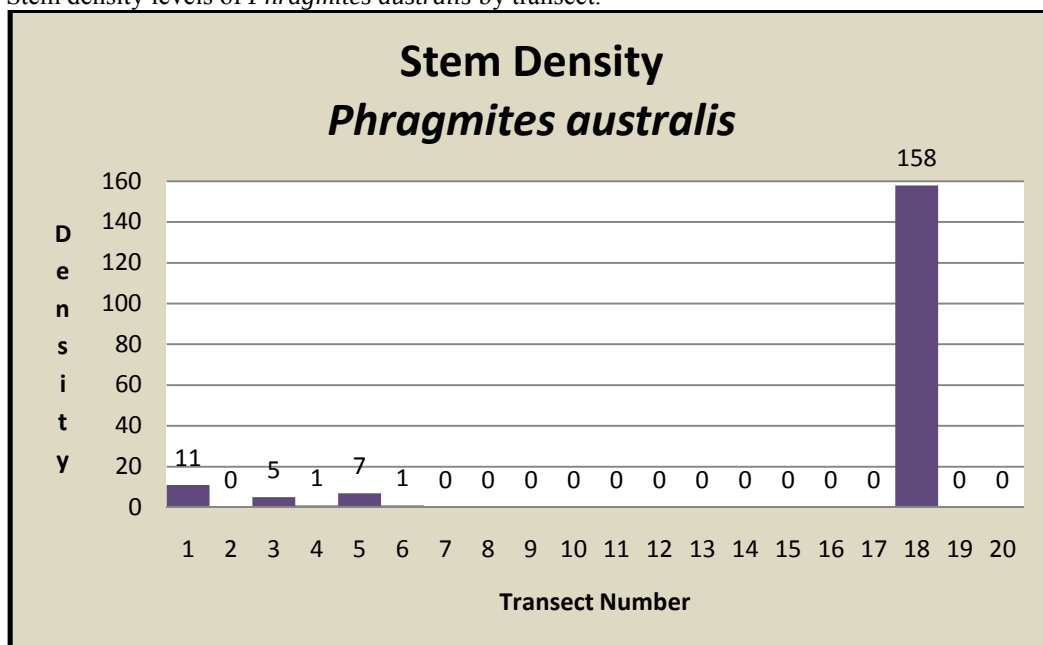
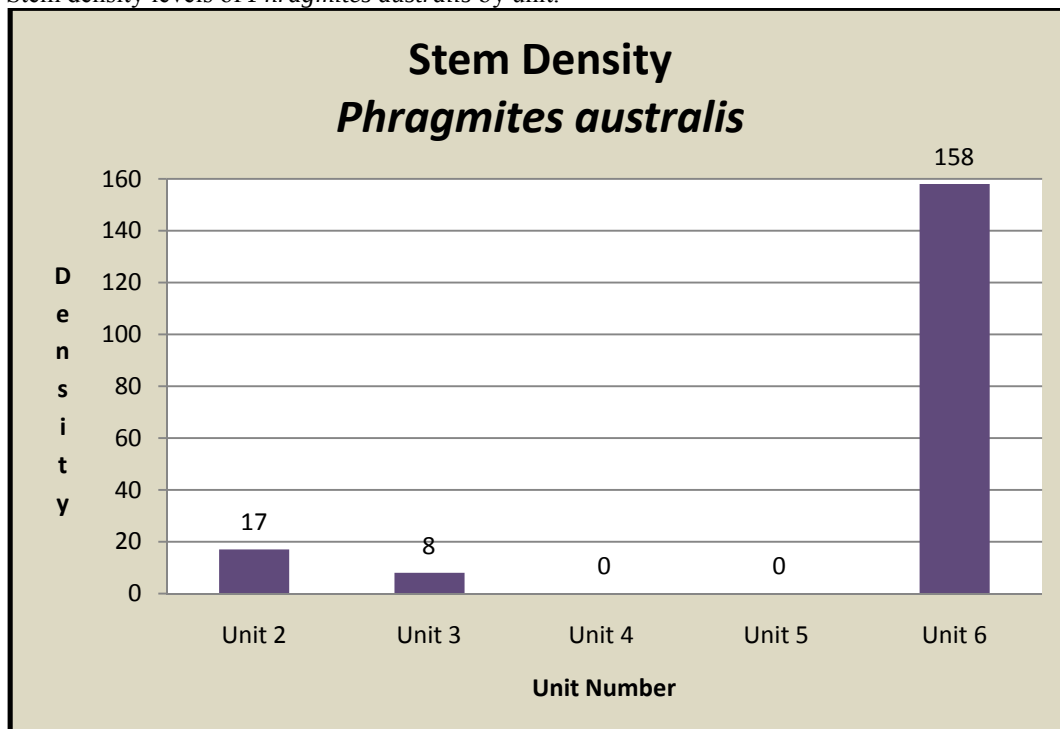


Figure 19.
Stem density levels of *Phragmites australis* by unit.



Discussion

The average species diversity for all of the units was 13 species per transect. Unit 2 had the lowest, with an average of 7 species and Unit 4 had the highest average with 18 species. Transect numbers 1,4,8 had very low species diversity, 3,3 and 6 species respectively, and were completely saturated with standing water. Transects that crossed more dry and wet gradients, had a higher species diversity, as would be expected. Transect 18 had a total of 8 species with some standing water and wet conditions. The area of unit 6, where transect 18 was located, did not consume completely during the prescribed burn, as was evidenced by the amount of dead *Phragmites* stems. The dead biomass from these stems, and the resulting shaded conditions, may be preventing native species from re-establishing. Herbaceous species frequently encountered included, *Juncus roemarianus*, *Mikania scandens*, *Distichlis spicata*, *Chasmanthium laxum*, *Spartina patens*, *Baccharis halimifolia*, *Setaria geniculata*, *Cyperus flavescens* and *Smilax* spp. All of these species are relatively common to Assateague Island.

Stem density of *Phragmites australis* was low in 19 of the 20 transects. Only 6 transects contained *Phragmites* stems, only one with substantial numbers. Transect 18 in Unit 6 had 158 live *Phragmites* stems counted in four of the 11 quadrats. As mentioned previously, this area of Unit 6 did not carry fire continuously, most likely due to the amount of standing water and wet conditions.

Conclusions

Following our monitoring, species diversity does not appear to have been negatively affected by the prescribed fire. Research suggests that target spraying of *Phragmites* at the end of the growing season has a significant impact on *Phragmites* while the least impact on other plants, leading to an increase in native wetland species the following year (Ailstock et al. 2001). It has been shown that litter and shading has a deleterious effect on species establishment, therefore thick stands require a chemical treatment and biomass reduction. While cutting and raking will achieve this objective, it is not economical or practical on a large scale. Implementing, prescribed burning the following year will remove the resulting biomass, however it may increase flowering stems. Therefore, it is important to keep treating any new growth in the infested areas. Complete *Phragmites* eradication may be an unrealistic goal, however promoting native species establishment and diversity through management is achievable (Welch et al. 2006).

Recommendations

The 2009 prescribed burn removed a significant portion of the limiting dead *Phragmites* biomass. In some areas the fire did not carry/consume completely, mostly due to water inundation. During the prescribed burning operations, wind would appear a vital factor to allow the fire to carry through the dead plant material. Our monitoring efforts utilized a previously designed monitoring study implemented at Assateague. We found it difficult to consistently use *Phragmites* stem density counts throughout the monitoring teams, due to rhizomatous vegetative growth patterns and problems differentiating new shoots. Other studies involving *Phragmites* have used ocular percent cover estimations which may be more repeatable. In addition, during our monitoring we inventoried plants to species. This could be revised to allow monitoring teams to move faster throughout the difficult terrain and increase sample size. This monitoring focused on using frequency and density measurements. In the future, if a more intensive study is undertaken, permanent plots utilizing percent cover measurements would allow for more in-depth statistical analysis.

Acknowledgements

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Appendix A.

Genus & Species Abbreviation	Genus	Species
AGRPER	Agrostis	perennans
AMECAN	Amelanchier	canadensis
AMMBRE	Ammophila	breviligulata
ANDGLO	Andropogon	glomeratus
ANDVIR	Andropogon	virginicus
ARILON	Aristada	longifolium
BACHAL	Baccharis	halimifolia
BOECYL	Boehmeria	cylindrica
CAR spp	Carex	species
CHALAX	Chasmanthium	laxum
CHRLEU	Chrysanthemum	leucanthemum
CIRHOR	Cirsium	horridulum
CYP spp	Cyperus	species
CYPESC	Cyperus	esculentus
CYPFIL	Cyperus	filicinus
CYPFLA	Cyperus	flavescens
CYPRET	Cyperus	retrorsus
CYPSTR	Cyperus	strigosus
DES spp	Desmodium	species
DESPAN	Desmodium	paniculatum
DIC spp	Dichanthelium	species
DICACU	Dichanthelium	acuminatum
DICCLA	Dichanthelium	clandestinum
DICSCO	Dichanthelium	scoparium
DIOVIR	Diodia	virginiana
DISSPI	Distichlis	spicata
ECHCRU	Echinochloa	crus-galli
ECHWAL	Echinochloa	walteri
ECLPRO	Eclipta	prostrata
ELE spp	Eleocharis	species
ELEALB	Eleocharis	albina
ELEPAR	Eleocharis	parvula
ELEROS	Eleocharis	rostellata
ERASPE	Eragrostis	spectabilis
EREHIE	Erechtites	hieracifolia
EUPALB	Eupatorium	album
EUPCAP	Eupatorium	capillifolium
EUPHYS	Eupatorium	hyssopifolium
EUTGRA	Euthamia	graminifolia
EUTTEN	Euthamia	tenuifolia
FIM spp	Fimbristylis	species
FIMCAR	Fimbristylis	caroliniana
FUIPUM	fuirena	pumila
HAM spp	Hamamelis	species
HIEGRO	Hieracium	gronovii

HIERAC	Hieracium	species
HUDTOM	Hudsonia	tomentosa
HYDUMB	Hydrocotyle	umbellata
HYP spp	Hypericum	species
IVAFRU	Iva	frutescens
JUN spp	Juniperus	species
JUNACU	Juncus	acuminatus
JUNEFF	Juncus	effusus
JUNROE	Juncus	roemerianus
JUNSCI	Juncus	scirpoides
LINCAN	Linaria	canadensis
LYCMAE	Lycopus	americanus
MIKSCA	Mikania	scandens
MYRCER	Myrica	cerifera
MYRPEN	Myrica	pensylvanica
OPUHUM	Opuntia	humifusa
PANAMA	Panicum	amarulum
PANVIR	Panicum	virgatum
PARQUI	Parthenocissus	quinquefolia
PAS spp	Paspalum	species
PHYAME	Phytolacca	americana
PINTAE	Pinus	taeda
PLUFOE	Pluchea	foetida
PLUODO	Pluchea	odorata
POAPRA	Poa	pratensis
POLPUN	Polygonum	punctatum
PSEOBT	Pseudognaphalium	obtusifolium
RHUCOP	Rhus	copallinum
ROS spp	Rosa	species
RUB spp	Rubus	species
RUBARG	Rubus	argutus
RUMACE	Rumex	acetosella
SAMPAR	Samolus	parviflorus
SASALB	sassafras	albidum
SCHSCO	Schizachyrium	scoparium
SCIAME	Scirpus	americanus
SCIPUN	Scirpus	pungens
SETGEN	Setaria	geniculata
SMIBON	Smilax	bona-nox
SMIGLA	Smilax	glauca
SMIROT	Smilax	rotundifolia
SOLSEM	Solidago	sempervirens
SPAPAT	Spartina	patens
SPOIND	Sporobolus	indicus
STRUMB	Strophostyles	umbellata
SYMDUM	Symphyotrichum	dumosum
TOXRAD	Toxicodendron	radicans
VACCOR	Vaccinium	corymbosum
VIOLAN	Viola	lanceolata
VITROT	Vitis	rotundifolia



**National Park Service
Fire Ecology Annual Report
Cape Cod National Seashore
Calendar Year 2009**

Cape Cod National Seashore had four monitoring projects/efforts in 2009:

- 1) Broom Crowberry / Marconi Site wildfire urban interface fuels reduction
- 2) Lombard/Paradise Hollow Research Area
- 3) Heathland Monitoring / Marconi Site Heathland restoration

Broom Crowberry / Marconi Site wildfire urban interface fuels reduction (13.0 Acres)

As a component of on-going fuels reduction projects around the CACO HQ and Maintenance areas there should be an expected increase in the population and cover of the state listed broom crowberry (*Corema conradii*). Colonization of burn pile footprints by crowberry is expected. Plots were established to quantify the timing and amount of crowberry recruitment in 2008. Plots were re-sampled in 2009. No significant recruitment of *Corema* was observed.

Broom Crowberry / Fire Cache Construction

Cape Cod National Seashore's began construction of a new fire cache in 2008 (the cache project was approved in 1993 however not funded). Prior to construction 40 Broom Crowberry plants required transplanting and a five year monitoring effort was started to meet Massachusetts Natural Heritage and Endangered Species Program stipulations for take. Monitoring of survival rates for *Corema* clones will occur in summer 2010.

Lombard / Paradise Hollow Research Area (monitored acres 2009 = 5.4 acres)

The Cape Cod National Seashore and the University of Massachusetts / Amherst under direction of CACO FMO David W. Crary, Jr. and Professor William A. Patterson III successfully completed the twenty-third (23rd) year of annual monitoring on research plots established in 1986 to explore the long-term effects of burning and mowing on coastal oak-pine forests.

A generalized description of the Lombard Paradise Hollow 23 year Rx burn project may be viewed at:
<http://www.umass.edu/nebarrensfuels/>

Heathland Monitoring / Marconi Site Heathland restoration (~15 Acres)

Cape Cod National Seashore is clearing 35 acres of invasive scrub oak and pitch pine forest from previously open heathland in the former Camp Wellfleet Marconi area. Live and dead forest fuels are being cut and piled for winter pile burning. Project began in 2008 and will continue through 2011. In 2009 photo monitoring was again taken (year 2 of 2). Point intersect transects were established to determine percent cover and height of scrub oak/

Table 1. Fire Effects Plot Workload Cape Cod National Seashore 2009

Park	Monitoring Unit	Type of Plot (FMH, photo point, other)	Pre-burn	Immed. Post	Postburn (1-20 yrs)	Total Plots
CACO	Marconi WUI Broom Crowberry monitoring	Photo, distance to nearest <i>Corema</i> plant	NO	Yes	Yes	40
CACO	Fire Cache <i>Corema</i> transplanting	Photo, cover, vegetation health	Yes	N/A	Annually for five years	40
CACO	Lombard Paradise Hollow (Truro, MA)	Forest mow/burn research 0.1 acre plots	Yes	Yes	Yes (1 – 20 year)	54
CACO	Marconi Heathland Monitoring	Photo, <i>releve'</i> , point intercept	Yes	No	Yes	22
CACO	Phragmites burning and <i>Spartina</i> colonization	Cut, pile and establish enclosure	Yes	n/a	n/a	2

Table 2. Fire Ecology Staffing Cape Cod National Seashore 2009

Monitor	Starting Date	Ending Date	# of Pay Periods	Training and Development
SHEN Monitoring	2009	August 09	2.0	120 hrs
Fire Techs	2009	August 09	3.5	280 hours by fire techs assisting with sampling, plot corridor maintenance and plot burning/mowing.
UMass staff Lombard/Paradise Hollow	2009	August 09	10.0 pp	800 hours of UMass support sampling
CACO Engine Supervisor	2009	n/a	1.0 pp	Supervision
CACO FMO	2009	n/a	1.0 pp	RXB2, project oversight
UMass – Broom Crowberry	2009	n/a	1.0 pp	80 hrs (Dr. Patterson)

Table 3. Management Objectives and Monitoring Results 2009

Monitoring Unit	Management Objective	Monitoring Results	Objective Achieved?
Marconi WUI Broom Crowberry monitoring	Determine extent and time for colonization of burn pile footprints by <i>Corema</i>	Distance and direction to nearest <i>Corema</i> population, burn pile footprint area, and burn pile center data was recorded.	Yes
Fire Cache <i>Corema</i> transplanting	Measure long term cover and health of 40 <i>Corema</i> plants prior to transplanting	Area (size) and relative health (poor, fair, good) were recorded	Yes

Monitoring Unit	Management Objective	Monitoring Results	Objective Achieved?
Lombard Paradise Hollow	Research, vegetation	Collected data included: live and dead pre- and post-treatment fuel loading by size class and % cover and height class estimations of under- and over- story vegetation.	YES
	Research, burning	Day of burn information collected: RH, foliar moisture content, 1- 100 hr downed woody fuel moisture, wind speed and direction (each minute) and fire ROS	YES
Heathland Monitoring / Marconi Site Heathland restoration	Establish pre-treatment baseline data for 35 area heathland restoration in the Marconi area	Photo points, point intercept and <i>releve'</i> data were recorded	Yes
Broom Crowberry burn experiments	Determine if spring, summer or fall burning favors <i>Corema conradii</i> , three each 03 acres plots were burned (2.7 acres)	Post-burn monitoring to begin 2010	Pending
Heathland /Hunting summer burning plots	Determine the impact summer cut/burn units have on shrub fuels in Marconi area heathlands.	Post-burn monitoring to begin 2010	Pending





Broom Crowberry pre-burn monitoring (point intercept) and Fire Behavior measurements. Cape Cod National Seashore 2009





**National Park Service
Delaware Water Gap National Recreation Area
Mid-Atlantic Fire Management Area
Fire Ecology Annual Report
Calendar Year 2009**

Summary

The Delaware Water Gap NRA planned to conduct three prescribed burns in 2009. The Darrones prescribed fire was conducted successfully on March 24, 2009, burning all 50 acres of the unit. The Snyder prescribed fire consisted of 2 units, 121 and 29 acres, respectively. Both units were burned on April 17, 2009, however only the larger of the two was successfully completed, burning all 121 acres. Only 5 acres of the 29 acre unit were burned as conditions exceeded prescription limits. The 176 acres burned represent a 126% increase over planned prescribed burn acres. Along with employees from DEWA, personnel from GATE, INDE, STEA, STLI, the NPS Northeast Region Exotic Plant Management Team, the US Fish and Wildlife Service, the Pennsylvania Department of Conservation and Natural Resources – Bureau of Forest Fire Protection, the New Jersey Forest Fire Service, and The Nature Conservancy assisted. All burns were conducted to maintain the native warm season grasses, perpetuate the scenic vistas, and disrupt fuel continuity. The burns also helped the park meet its open space management objectives as directed by the park's General Management Plan. DEWA continued with its hazardous fuel reduction projects clearing 5 acres around and the road leading up to the Mount Minsi repeater as well as partially thinning 2 of a planned 27 acres along the Egypt Boundary. Only two acres were cleared because the contractor defaulted on the project. DEWA also continued maintaining 40 miles of fire roads (equivalent to 68 acres – a 74%% increase above planned fire road acres), and reducing hazardous fuel around park structures for 5 acres with assistance from the Student Conservation Association.

None of the other parks within the Mid-Atlantic Fire Management Area planned to conduct any prescribed burns, monitoring, or fuels treatment.

Fire Ecology Staffing 2009

The park has no fire ecology staff. However, in August, the SHEN Fire Effects crew established monitoring plots in the Darrones and Silver Spray Burn Units that are to be treated in 2010.

Fire Ecologist Accomplishments/Focus Area

Although the SHEN Fire Effects crew performed work at DEWA, the park has no fire ecologist, and as such, all reported accomplishments were completed by the FMO and the Fire Operations/Prescribed Fire and Fuels Technician. The percent time is a percent of time associated with prescribed fire and fuels treatment projects and not of time associated with total workload. Prescribed fire and fuels treatment projects account for 50% of the total workload.

Table 1. Management Objectives and Monitoring Results 2009

Monitoring Unit	Management Objective (Restoration)	Monitoring Results	Objective Achieved?
Darrones 2009 RX	Reduce 1-hr fuels $\geq 75\%$	100%	YES
	Reduce 10-hr fuels $\geq 75\%$ if present	$\geq 75\%$	YES
	Maintain native grass cover (1-year post burn)	TBD	
	Maintain native herbaceous cover (1-year post burn)	TBD	
	Reduce shrub and brush cover $\geq 10\%$ (1-year post burn)	TBD	
	Overstory mortality $> 10\%$ (all species, 1-year post burn)	TBD	
	Overstory mortality $> 10\%$ (pine/cedar species, 1-year post burn)	TBD	
Loch Lomond 2008 RX	Maintain native grass cover (1-year post burn)	Maintained	YES
	Maintain native herbaceous cover (1-year post burn)	Maintained	YES
	$> 10\%$ overstory mortality for all fuels > 1 -hour (1-year post burn)	$> 10\%$	YES
Snyder 2009 RX	Reduce 1-hr fuels $\geq 75\%$	100%	YES
	Reduce 10-hr fuels $\geq 75\%$ if present	None present	
	Maintain native grass cover (1-year post burn)	TBD	
	Maintain native herbaceous cover (1-year post burn)	TBD	
	Reduce shrub and brush cover $\geq 10\%$ (1-year post burn)	TBD	
	Overstory mortality $> 10\%$ (all species, 1-year post burn)	TBD	
	Overstory mortality $> 10\%$ (pine/cedar species, 1-year post burn)	TBD	
Snyder 2008 RX	Maintain native grass cover (1-year post burn)	Maintained	YES
	Maintain native herbaceous cover (1-year post burn)	Maintained	YES
	$> 10\%$ overstory mortality for all fuels > 1 -hour (1-year post burn) if present	$> 10\%$	YES

Table 2. Fire Ecologist Accomplishments/Focus Areas

Category	Percent Time	Accomplishments/Focus Areas
General Planning	84%	Planning 2010 fuels projects NEPA compliance Revising Open Space Prescribed Fire Plan Completed RX Post Burn Reports for Snyder and Darrones RX fires
Monitoring Plans	0%	
Presentations	1%	Contacting park neighbors regarding Egypt Boundary Hazard Fuel Reduction Project Media interviews
NPS Meetings/ Task Groups	1%	FMO attended three PA RX Fire Council Meetings
Interagency Work	0%	
Fire Assignments and Fuels Projects	12%	COTR for Mount Minsi Repeater Hazard Fuel Reduction Project COTR for Egypt Boundary Hazard Fuel Reduction Project Snyder RX Darrones RX Fire road and structure clearing
Research	0%	
Monitoring Field Work	1%	Qualitative monitoring of 2008 and 2009 RX burn sites Qualitative monitoring of boundary work completed in previous years
Data Entry	1%	Entering information into NFPORS
Data Management and Conversion	0%	
Data Analysis	0%	
Supervision/Admin	0%	
Training & Professional Development	0%	
Miscellaneous		

Fire Effect Crew Accomplishments

DEWA had two seasonal employees in 2009 – one paid out of suppression funding and the other from hazard fuel reduction funding. The seasonal employees spent about 75% of their working on hazard fuel reduction projects involving preparing the Darrones and Snyder RX burn sites and clearing fire roads. Throughout the spring and summer, the Fire Management Office had additional support with hazard fuel projects from park volunteers, interns, and other park personnel whose primary duties were other than fire management activities.

The SHEN Fire Effects Crew established plots within the Darrones and Silver Spray Burn Units that are expected to be burned in 2010.