



**National Park Service
Northeast Region
Mountains-to-the-Sea
Fire Ecology Annual Report
2010**

Summary

The fire ecology program continued to integrate with the Natural and Cultural Resources Division through collaboration on several projects. They worked jointly to define management and strategic objectives to



facilitate the recently implemented Wildland Fire Decision Support System (WFDSS). WFDSS is the newest generation electronic software tool used to assist decision making in managing wildland fires.

A Resource Advisor (READ) training class is planned in the park April 26-28th 2011 of this year. This is a great opportunity to bring a traditionally taught Western course to the Northeast.

Significant progress was made in efforts to define desired future conditions for fire dependent ecosystems within the park. Meetings were held in 2010, with a facilitator contracted from Pennsylvania State University, with the

project to be completed in April of 2011. The resulting product will serve as the foundation for the parks prescribed fire program and ensure that fire management activities are informed and supported by the best available scientific information. This will promote future projects being planned and implemented in areas of the park that will benefit the most. Working in conjunction with area Fire Learning Networks (FLNs) and the Consortium of Appalachian Fire Managers (CAFMS) has greatly improved and lent credibility to this endeavor.

In the spring, Tyler Schmitt was hired into the lead fire effects monitor position. Tyler worked as a seasonal technician last year and brings to the program extensive experience in fire effects and vegetation monitoring from numerous National Park service units. Lisa Loncar was hired into the newly established assistant lead fire effects monitor position this year as well. Unfortunately, she left the position to pursue another job closer to family. Non-the less, the fire effects monitoring crew had a notably successful year, measuring over 110 monitoring plots during the field season at eight National Parks units throughout the Northeast.



Table 1. Fire Effects Plot Workload (2010) and Total Plots Installed

Park	Monitoring Unit	Type of Plot (FMH, photo point, other)	Pre-burn	Imm. Post	Post-burn	Total Plots
Acadia NP	Carriage Road Vistas	FMH Forest Plot (mod.)	0	0	0	8
Antietam NBP	Prye House Vista	non-FMH brush transect	0	0	0	1
	Snively Ford Woods	non-FMH forest transect	0	0	0	6
	West Woods	non-FMH forest transect	0	0	0	5
	Sherrick Farm Woods	FMH Forest Plot	0	0	0	1
Appomattox Courthouse NBP	Mixed Grassland	FMH Brush Plot	0	0	8	8
	NC Woodlot	FMH Forest Plot	3	0	0	3
Assateague Island NS	<i>Phragmites australis</i>	non-FMH Plot	19	0	0	39
Cape Cod NS	Lombard Paradise Hollow	Other *(Colloborative with Research Area Crary)	0	0	54	54
Delaware Water Gap NRA	Mixed Grassland	FMH Brush Plot	0		10	10
Fredericksburg and Spotsylvania NMP	Mixed Grassland	FMH Brush Plot	0	0	14	14
Richmond NBP	Cold Harbor	Photo Points	0	0	0	4
		FMH Forest Plot	0	0	2	2
	Malvern Hill	FMH Brush Plot	0	0	13	13
Saratoga NHP	Mixed Grassland	FMH Brush plots	0	0	15	24
Shenandoah NP	Pine-Oak	FMH Forest Plot	3	0	3	6
	Xeric Oak	FMH Forest Plot	3	0	0	3
	Mesic Oak	FMH Forest Plot	3	0	0	3
	Gray Birch	FMH Forest Plot	0	0	0	10
	Sawmill	Brown's lines	0	0	0	10
	Blackrock	CBI	-	-	0	14
	Fultz Run	CBI	-	-	0	20
	Lewis Mountain	CBI	-	-	0	16
	Rocky Top	CBI	-	-	0	19
	SHEN Complex	CBI	-	-	0	11
	Big Meadows	SNP prescribed fire transects	-	-	16	79
	SHEN LTEM Plots	LTEM *(Colloborative with I&M)	-	-	15	-
Total			31	0	150	383

Table 2. Fire Ecology Staffing 2010

	Starting Date	Ending Date	# of Pay Periods	READ Qualified (Yes or No)	Training and Development
Missy Forder Ecologist	12/31/2010	1/1/2011	26	Yes	Data Analysis II: Ecological Modeling Using R, GIS Project Design for Natural Resources, S-230 (Crew Boss), S-234 (Ignition Operations), L-280 (Followership to Leadership), I-200 (ICS for Single Resources and IA Incidents), EVOC, Operational Leadership, Fire Refresher.
Tyler Schmitt Lead Monitor	3/28/2010	12/18/2010	19	No	GIS Project Design for Natural Resources, Operational Leadership, EVOC, GRSM CBI workshop, Fire Refresher.
Lisa Loncar Former Assistant Lead	4/25/2010	10/23/2010 (left position)	13	No	Leave-no-trace, Search and Rescue, First Aid/CPR, Operational Leadership, GRSM CBI workshop, Fire Refresher.
Jill Templeton Crewmember	5/23/2010	10/9/2010	10	No	Leave-no-trace, Search and Rescue, First Aid/CPR, Fire Refresher.
Matt Smith Detailed crewmember from EVER Fire Effects	5/23/2010	9/25/2010	9	No	RX-310 (Intro. Fire Effects), Operational Leadership.

Table 3. Management Objectives and Monitoring Results

Park	Monitoring Unit	Management Objective (80% C.I.) α .2	Monitoring Results	Objectives Achieved?	YR Last Analysis Complete
Richmond National Battlefield Park	Malvern Hill	Maintain percent cover of woody species <25%.	Cool Season Grass Fields Shrub Cover = 4% ($\pm$.2) Tree Cover = 16% ($\pm$ 11) Warm Season Grass Fields Shrub Cover = 0 Tree Cover = 2 ($\pm$.1)	YES YES	2010
		Percent cover of non-natives grasses and forbs < 25%.	Cool Season Grass Fields Non-Native Grass Cover = 47 ($\pm$ 12) Non-Native Forb Cover = 12($\pm$ 5) Warm Season Grass Fields Non-Native Grass Cover = .3 ($\pm$.3) Non-Native Forb Cover = *10($\pm$ 10) *Plot 10 LESCUN	NO YES	2010
		Percent cover of "meadow specialists" native grasses and forbs >75%.	Cool Season Grass Fields Native Grass Cover = 71($\pm$ 12) Native Forb Cover = 43($\pm$ 10) Warm Season Grass Fields Native Grass Cover = 150($\pm$ 4) Native Forb Cover = 13($\pm$ 3)	YES YES	2010
	Cold Harbor	Decrease pole size trees by 50% after four burns.	Pre: 46 pole trees 03YR02: 22 pole trees	Yes	2010
		Maintain an open forested stand as it appeared at the time of the battle.	Photopoints on going.	Yes	2010
		Increase relative percent cover of herbaceous species by 75%	Pre: 1.2% 03YR02: 7%	Yes	2010
Appomattox Court House National	Ferguson Field Mixed Grassland	Maintain percent cover of woody species <25%	Woody species= 9 ($\pm$ 3)	Yes	2010
		Percent cover of non-natives grasses and forbs < 25%.	Non-native grass = 38 ($\pm$ 7) Non-native forbs = 10($\pm$ 4)	Yes	2010
		Percent cover of native grasses and forbs >75%.	Native grasses = 83 ($\pm$ 7) Native forbs = 13 ($\pm$ 4)	Yes	2010

	NC Woodlot	Short Term: Reduce Fuels: <1/4 inch diameter size class (litter) by 65 - 75%, 1/4 to 1 inch diameter size class by 25% to 50%, 1in to 3 in diameter size class by 10%-25%	Preburn plots installed 2010	N/A	N/A
		Short Term: Reduce Density of pole-sized trees by at least 25% as measured within 1 year post burn.	Preburn plots installed 2010	N/A	N/A
		Short Term: Limit overstory mortality to <25% as measured 1 year post burn	Preburn plots installed 2010	N/A	N/A
Fredericksburg and Spotsylvania National Historical Park	Spotsylvania Mixed Grassland	Maintain woody species < 25%.	Low Shrub Cover Fields Shrubs=19 (±4) Trees=19 (±2) High Shrub Cover Fields Shrubs=54(±7) Trees=22 (±4)	No	2010
		Percent Cover on non-native grasses and forbs <25%.	Low Shrub Cover Fields Non-native grass = 2 (±1) Non-native forbs = .3(±.3) High Shrub Cover Fields Non-native grass = 21(±5) Non-native forbs = .3(±.3)	Yes	2010
		Percent cover of native grasses and forbs >75%.	Low Shrub Cover Fields Native grass = 80 (±4) Native forbs = 41 (±3) High Shrub Cover Fields Native grass = 67(±12) Native grass = 67(±10)	Yes	2010
Delaware Water Gap National Recreation Area	Mixed Grassland / Darrones and Silver Spray Units	Percent cover of native grasses and herbs >75%.	PRE Native Grass = 11% (±2) 01YR01 Native Grass = 15% (±4) PRE Native Herb = 113% (±13) 01YR01 Native Herb = 95% (±12)	NO YES	2010
		Reduce shrub and brush cover by ≥10% as determined one year post burn. *Recommend changing to Percent cover of woody species < 25%.	PRE Shrub = 17% (±2) 01YR01 Shrub = 17% (±2) (Probably lower, some shrubs should be grouped with herbs).	YES	2010

		Reduce exotic invasive cover by $\geq 25\%$ as determined one year post burn. <i>*Recommend changing to Percent cover of non-natives grasses and forbs < 25%.</i>	PRE Non-native Herbs = 43% (± 8) 01YR01 Non-native Herbs = 42% (± 8) PRE Non-native Grass = 127% (± 12) 01YR01 Non-native Grass = 94% (± 12)	NO	2010
Assateague Island National Seashore	Phragmites	Treat and restore native coastal communities to areas currently infested with <i>P. australis</i> .	a. (ANOVA: $F_{2,35} = 3.41$, $P < 0.0456$).; b. ($t = 2.44$, $P < 0.020$).; c. (no statistical analyses performed on indices); d. ($t = 2.71$, $P < 0.011$).; e. ($t = 3.40$, $P < 0.002$).; f. ($t = 2.54$, $P < 0.016$).; g. ($t = 2.34$, $P < 0.026$) and h. ($t = 2.08$, $P < 0.045$). Figure 16.	YES	YES
Cape Cod National Seashore	Marconi WUI Broom Crowberry monitoring	Determine extent and time for colonization of burn pile footprints by <i>Corema</i>	In progress, ~ 5 yr study	on-going	expected 2014
	Fire Cache <i>Corema</i> transplanting	Measure long term cover and health of 40 <i>Corema</i> plants prior to transplanting	ocular estimate only, 50% mortality	yes	expected 2014
	Lombard Paradise Hollow	Research, vegetation	in prep year 24 (Patterson et. al.)	yes	~2012
		Research, burning	in prep year 24 (Patterson et. al.)	yes	~2012
	Heathland Monitoring / Marconi Site Heathland restoration	Establish pre-treatment baseline data for 35 area heathland restoration in the Marconi area	on-going, Univ FLA (Von Holle, principle investigator)	on-going	expected 2014
	Broom Crowberry burn	Determine if spring, summer or fall burning favors <i>Corema conradii</i> , three each 03 acres plots were burned (2.7 acres)	in prep year 2 (Patterson et. al.)	on-going	expected 2014
	Heathland /Hunting summerx plots	Determine the impact summer cut/burn units have on shrub fuels in Marconi area heathlands.	on-going, Univ FLA (Von Holle, principle investigator)	on-going	expected 2014

Shenandoah National Park	Big Meadows	Maintain the cultural open landscape.	Data analysis completed by SHEN NCR. 16 of the 79 plots monitored in 2010.	YES	2010
		Examine changes in vegetation over time in response to management.	Data analysis completed by SHEN NCR. 16 of the 79 plots monitored in 2010.	YES	2010
		Monitor Northern Blue ridge Mafic fen plant community which contains a significant amount of the parks rare plant species.	Data analysis completed by SHEN NCR. 16 of the 79 plots monitored in 2010.	YES	2010
	Pine-Oak	> 50% reduction in fuel loading.	Preburn plots installed in 2010.	N/A	N/A
		>70% reduction of mesic pole size trees (2.5 - 15 cm dbh) (i.e. red maple (<i>Acer rubrum</i>), blackgum (<i>Nyssa sylvatica</i>), sassafras (<i>Sassafras albidum</i>) and hickory (<i>Carya</i> spp.).	Preburn plots installed in 2010.	N/A	N/A
		25 – 50% reduction in overstory tree density.	Preburn plots installed in 2010.	N/A	N/A
		>200 tall (>60 cm in height) yellow pine seedlings (<i>Pinus pungens</i> , <i>Pinus rigida</i> , <i>Pinus virginiana</i>) per acre.	Preburn plots installed in 2010.	N/A	N/A
		>40% cover of native herbs.	Preburn plots installed in 2010.	N/A	N/A
		No net increase in invasive exotic species cover.	Preburn plots installed in 2010.	N/A	N/A

Shenandoah National Park	Xeric Oak	> 50% reduction in fuel loading.	Preburn plots installed in 2010.	N/A	N/A
		>70% reduction of mesic pole size trees (2.5 - 15 cm dbh) (i.e. red maple (<i>Acer rubrum</i>), blackgum (<i>Nyssa sylvatica</i>), sassafras (<i>Sassafras albidum</i>) and hickory (<i>Carya</i> spp.).	Preburn plots installed in 2010.	N/A	N/A
		15 – 30% reduction in overstory tree density.	Preburn plots installed in 2010.	N/A	N/A
		>200 tall (>60 cm in height) Oak seedlings per acre.	Preburn plots installed in 2010.	N/A	N/A
		>30% cover of native herbs.	Preburn plots installed in 2010.	N/A	N/A
		No net increase in invasive exotic species cover.	Preburn plots installed in 2010.	N/A	N/A
Saratoga National Historical Park	Mixed Grassland Hillside Plots n=5 (Plots 2,3,15,17,20)	Percent cover of native grasses and herbs >75%.	2006 Native Grass = 84% (± 11) 2010 Native Grass = 100% (± 11) 2006 Native Herb = 132% (± 19) 2010 Native Herb = 139% (± 15)	YES	2010
		Percent cover of woody species < 25%.	2006 Native Shrub = 31% (± 8) 2010 Native Shrub = 28% (± 4) 2006 Non Native Shrub = 10% (± 5) 2010 Non Native Shrub = 7% (± 4)	NO YES	2010
		Percent cover of non-natives grasses and forbs < 25%.	2006 Non-native Herbs = 41% (± 8) 2010 Non-native Herbs = 46% (± 15)	NO	2010

	Mixed Grassland Neilson Farm 2008 n=3 (Plots 5,6,7) 2010 n=6 (Plots 5,6,7,14,18,24)	Percent cover of native grasses and herbs >75%.	2008 Native Grass = 95% (± 16) 2010 Native Grass = 117% (± 12) 2008 Native Herb = 24% (± 14) 2010 Native Herb = 23% (± 6)	YES NO	 2010
		Percent cover of woody species < 25%.	2008 Native Shrub = 18% (± 5) 2010 Native Shrub = 21% (± 4) 2008 Non Native Shrub = 2% ($\pm .3$) 2010 Non Native Shrub = .5% ($\pm .2$)	YES YES	 2010
		Percent cover of non-natives grasses and forbs < 25%.	2008 Non-native Herbs = 150% (± 21) 2010 Non-native Herbs = 127% (± 22) 2008 Non-native Grass = 5% (± 3) 2010 Non-native Grass = 16% (± 5)	NO YES	 2010
	Mixed Grassland Chatfield Farm 2003 n=2 (Plots 11,12) 2010 n=3 (Plots 11,12,23)	Percent cover of native grasses and herbs >75%.	2003 Native Grass = 116% (± 26) 2010 Native Grass = 101% (± 13) 2003 Native Herb = 28% (± 2) 2010 Native Herb = 19% (± 7)	YES NO	 2010
		Percent cover of woody species < 25%.	2003 Native Shrub = 42% (± 15) 2010 Native Shrub = 33% (± 2) 2003 Non Native Shrub = 2% ($\pm .3$) 2010 Non Native Shrub = .3% ($\pm .3$)	NO YES	 2010
		Percent cover of non-natives grasses and forbs < 25%.	2003 Non-native Herbs = 74% (± 27) 2010 Non-native Herbs = 74% (± 13) 2003 Non-native Grass = 7% (± 5) 2010 Non-native Grass = 2% (± 3)	NO YES	 2010

Table 4. Fire Ecologist Accomplishments and Area of Focus

Category	Percent Time	Accomplishments and/or areas of activities
Planning	30%	• Collaborated with SHEN Natural and Cultural Resources to develop Management and Strategic Objectives for WFDSS. • Developed sound scientific objectives for the Gasline, Pass mtn and NC Woodlot prescribed fire projects and completed the NEPA process. (PEPC, section 7, 106, memo to file). • Identified six new potential projects with ecological objectives for the next three years for NFPORS. • Advised National Capitol Region parks in prescribed fire and mechanical treatments. • Continued working with NC State on the \$30,500 research request grant awarded to develop a fuels map for Shenandoah National Park. • Finalized FRSP fire effects monitoring plan.
Presentations	6%	• Presentation at Annual MTTs Fire Management meeting. • Presentation to FRSP Superintendent and park staff on monitoring efforts. • Presented Management and Strategic Objectives at local WFDSS training session. • Presentation to TNC and Forest Service on how FFI could be utilized to store Appalachian FLN data.
NPS meetings task groups	5%	• Held several meetings with Natural and Cultural Resource Management division and a contracted university facilitator to develop Desired Future Conditions (DFC's) for the park. • SHEN Natural and Cultural Resources on the Nature Serve landscape assessment meeting. • SHEN Natural Resources Condition Assessment planning meeting.
Interagency Work	2%	• Appalachian Fire Learning Network meetings. • FFI consultation to FS and TNC.
Wildfire Assignments	<1%	• CRWB(t) and FFT1 on two fires.
Prescribed Fire projects	<1%	• FEMO on one Rx Fire.
Non-fire fuels project	1%	• Advised National Capitol Region park on mechanical treatments.
Research	6%	• Literature research for SHEN Desired Future Conditions. • Coordinated SHEN fuels research request.
Data collection	<1%	• Assisted with very little data collection.
Data entry	<1%	• Assisted with very little data entry.
Data Analysis	10%	• Completed data summaries and analysis for APCO, FRSP, SHEN, RICH, DEWA and SARA.
Supervision & Administration	10%	• Hired permanent GS-7 lead fire effects monitor, GS-6 term assistant lead and GS-5 seasonal. • Developed performance standards for permanent and seasonal employees. • Lead, Assistant and seasonal performance evaluations.
Training	10%	• 10 day crew boss academy (S-230, S-234, L-280, I-200). • Data Analysis II: Ecological Modeling Using R. • GIS Project Design for Natural Resources • EVOC, Operational Leadership, Fire Refresher.
Miscellaneous	20%	• 10 Weeks of maternity leave for birth of baby girl #2, Rx Effects.

Table 5. Fire Effects Crew Accomplishments and Areas of Focus

Category	Percent Time	Accomplishments and/or areas of activities
FMH Plots	55%	8 NPS units serviced and/or supported. 112 plots evaluated including 95 grass plots and 17 forest plots. 60 FMH grass plots and 17 FMH Forest plots across 5 parks.
WUI Plots	0%	
CBI Plots	1%	GRSM Southeast CBI workshop.
Other plot work	5%	Collaborate with I&M crew on LTEM plots to collect fuels data. Collaborate with I&M to read Big Meadows fire transects. Collaborate with CACO (Crary research plots). ASIS prescribed fire plots.
Wildfire Assignments	1%	6 person days were completed on wildfire assignments on George Washington-Jefferson NF.
Prescribed Fire projects	<1%	FEMO on two prescribed burns. (Lead was hired late in the prescribed fire season)
Non-fire fuels project	0%	
Data entry	30%	100% of plot data has been entered into FFI and QA/QC for 2010.
Data Analysis	0%	
Supervision & Administration	4%	Lead supervised the crew of three and maintained time, travel and administrative paperwork.
Training	2%	GIS Project Design for Natural Resources. Rx-310, EVOC, Operational Leadership, Search and Rescue, Leave No trace, Fire Refresher.
Miscellaneous	2%	1-3 hours of physical training a week.

Table 6. Data Entry and Projects Monitored

Park	% 2010 Data Entered	% 2010 Data Quality Checked	# Prescribed Fires Monitored*	# Non-fire Fuels Treatments Monitored*	# Wildfires Monitored*	# BAER Treatments Monitored*
Appomattox Courthouse NBP	100%	100%	2	0	0	0
Assateague Island NS	**100%	**100%	1	0	0	0
Cape Cod NS	**100%	**100%	^6	0	0	0
Delaware Water Gap NRA	100%	100%	3	0	0	0
Fredericksburg and Spotsylvania NMP	100%	100%	1	0	0	0
Richmond NBP	100%	100%	2	0	0	0
Saratoga NHP	100%	100%	1	0	0	0
Shenandoah NP	100%	100%	4	0	0	0

*Number of treatment units with treatment efforts monitoring conducted. Include pre-burn and post-burn monitoring but not burn-day monitoring

**Data entry and quality checking performed by the park and data is maintained by park staff.

^SHEN assists but mostly done by Dave Crary at CACO.



Richmond National Battlefield Park (RICH)
Malvern Hill Mixed Grassland Unit
2010 Fire Effects Monitoring Annual Report

I. Introduction

Richmond National Battlefield Park is located 110 miles south of Washington, D.C., in and near the city of Richmond, Virginia. The park manages approximately 1200 acres in 13 individual units spread over a 132-square mile area. Established as part of the National Park System in 1936, the park protects Civil War battle sites where in 1862 and 1864-65 the Union Army attempted to take the city of Richmond, the capital of the Confederacy, and to destroy the Army of Northern Virginia.

Malvern Hill

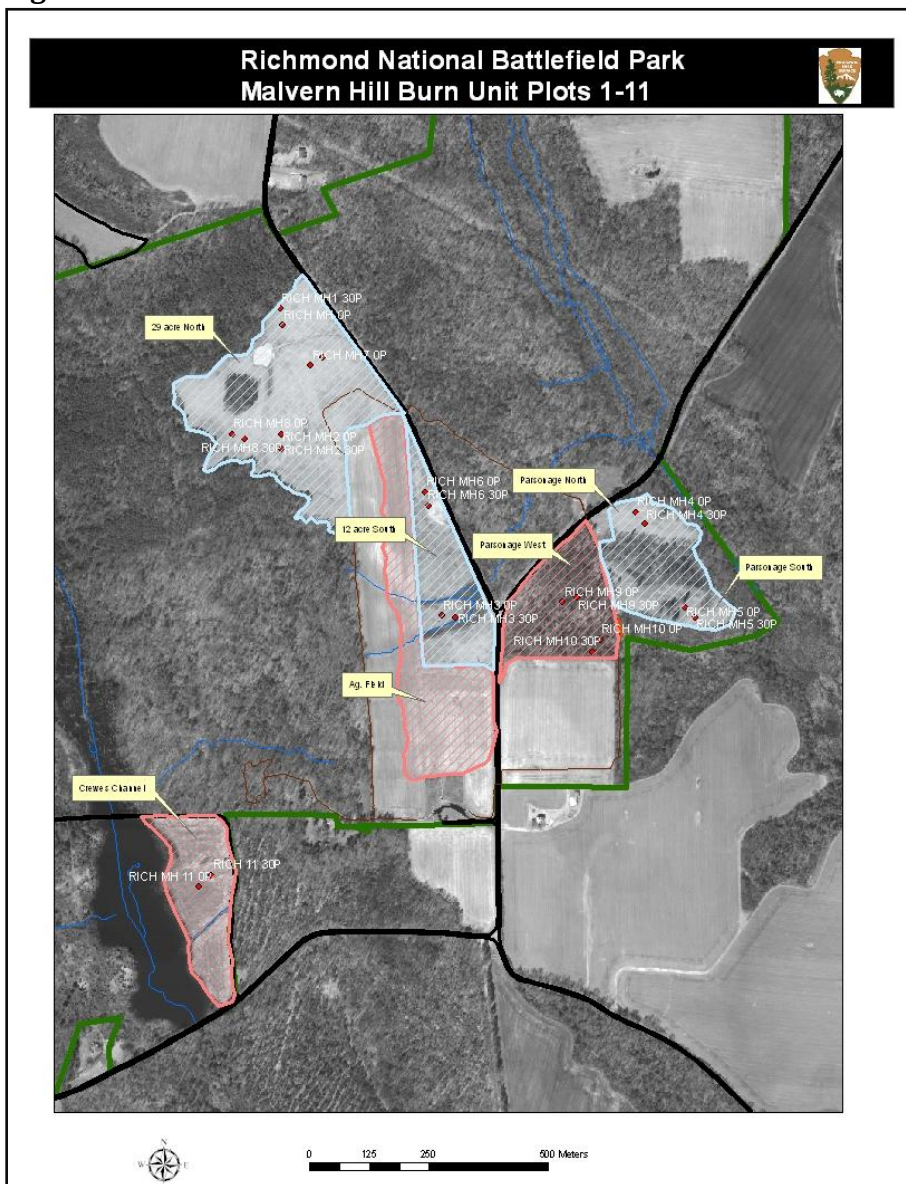
The Malvern Hill consists of approximately 1,040 acres of agricultural crop fields, mixed oak and hardwood-conifer woodlands, hedgerows, mown grass fields, lawn, and an interpretive facility. The field burn unit is partially surrounded by blacktop road and is fuel model 1 and 3. The area consists of warm season native grasses, cool season exotic grasses, and patchy shrub species to a height of 1- 3 meters. Prescribed fire is being used to reduce brushy fuels to open up the historic scene, maintain vistas, reduce invasive non-native species and promote the growth of native warm season grasses, so that park maintenance will no longer need to use time, equipment, and fuel to maintain these open fields, so that park visitors can get a feeling for the battlefield as it was during the Civil War, and to create grassland habitats suitable for a diversity of birds, herps and small mammals.

The Mid-South historically contained vast acreages of native grassland and savannas with scattered trees and shrub cover, which was maintained by fire. Through the years, these have been replaced with non-native grasses such as meadow fescue (*Schedonorus pratensis*). Agriculture, trees and suburban development have also replaced open fields with Native Warm Season Grasses (NWSGs). Native warm season grasses provide critical habitat for numerous songbirds and wildlife species. These native grasslands are the most endangered ecosystems in the Mid-South and as a result of their loss numerous wildlife and grassland bird species have experienced steep, long term declines.

The unit contains several invasive species of concern including Johnson grass (*Sorghum halepense*), Chinese bush clover (*Lespedeza cuneata*) and Japanese Honeysuckle (*Lonicera japonica*). These exotics are actively being treated with herbicide. Dense patches of meadow fescue (*Schedonorus pratensis*), an exotic cool season grass, are also being sprayed. This grass forms a dense carpet and prevents the establishment of desired native warm season grasses. Common native grasses include Broomsedge (*Andropogon virginicus*), purpletop (*Tridens flavus*), little bluestem (*Schizachyrium scoparium*) and Indian grass (*Sorghastrum nutans*). The shrub layer is dominated by winged sumac (*Rhus copallinum*) and blackberry (*Rubus* spp.). Common native forbs include ragweed (*Ambrosia artemisiifolia*) and gypsyweed (*Veronica officinalis*).

The crew began monitoring the Malvern Hill grassland unit in 2005. Currently, there are 13 FMH brush monitoring plots located in a complex of seven fields. In 2008 it was decided to analyze the fields in two separate groups relating to their management history. The first group, referred to as the cool season grass fields were planted with meadow fescue (*Schedonorus pratensis*) prior to the establishment of the current natural resource program. An objective for these fields is to remove the carpet of fescue and allow the NWSGs to re-establish. These fields include 29 acre North, Parsonage North and South and the 12 acre South field (not planted with fescue). The warm season grass fields have been planted with NWSGs and include Parsonage West and the Crewes Channel field. The objective for this group of fields is to maintain the planted NWSGs (Figure 1.)

Figure 1.



Note –Plots 12 and 13 were added to the newly converted Ag. Field, not illustrated on map.

II. Goals and Objective

Goal

The primary goal is to maintain the historic scene of July 1, 1862, while creating a diverse grassland habitat. This is being accomplished by mechanically removing the trees, herbicide treatment of exotic vegetation, bushhogging, and through the use of prescribed fire. It is desirable to reduce the density of woody species, as well as the exotic species of tree of heaven, Japanese honeysuckle, tall fescue, and orchard grass.

Burn Objectives

- Provide for personnel safety.
- 90% to 100% of overall area to be burned
- Limit mineral soil exposure to no more than 5% until greenup.

Monitoring Objectives

- **Percent cover of woody species < 25%.**
- **Percent cover of non-natives grasses and forbs < 25%.**

Resource Management staff measures from NRC A:

- proportion of plot cover in "non-natives"
- number of species per plot of "non-natives"
- proportion of total species "non-natives"

- **Percent cover of “meadow specialists” native grasses and forbs >75%**

Resource Management staff measures from NRC A:

- proportion of plot cover in "meadow specialists"
- number of species per plot of "meadow specialists"
- proportion of total species in "meadow specialists"

Monitoring Unit	Management Objective (80% C.I.) <i>a</i> .2	Monitoring Results	Objectives Achieved?	YR Last Analysis Complete
Malvern Hill	Maintain percent cover of woody species <25%	Cool Season Grass Fields Shrub Cover = 4% ($\pm .2$) Tree Cover = 16% (± 11) Warm Season Grass Fields Shrub Cover = 0 Tree Cover = 2 ($\pm .1$)	YES YES	2010
	Percent cover of non-natives grasses and forbs < 25%.	Cool Season Grass Fields Non-Native Grass Cover = 47 (± 12) Non-Native Forb Cover = 12(± 5) Warm Season Grass Fields Non-Native Grass Cover = .3 ($\pm .3$) Non-Native Forb Cover = *10(± 10) *Plot 10 LESCUN	NO YES YES	2010
	Percent cover of “meadow specialists” native grasses and forbs >75%.	Cool Season Grass Fields Native Grass Cover = 71(± 12) Native Forb Cover = 43(± 10) Warm Season Grass Fields Native Grass Cover = 150(± 4) Native Forb Cover = 13(± 3)	YES YES	2010

Figure 2.

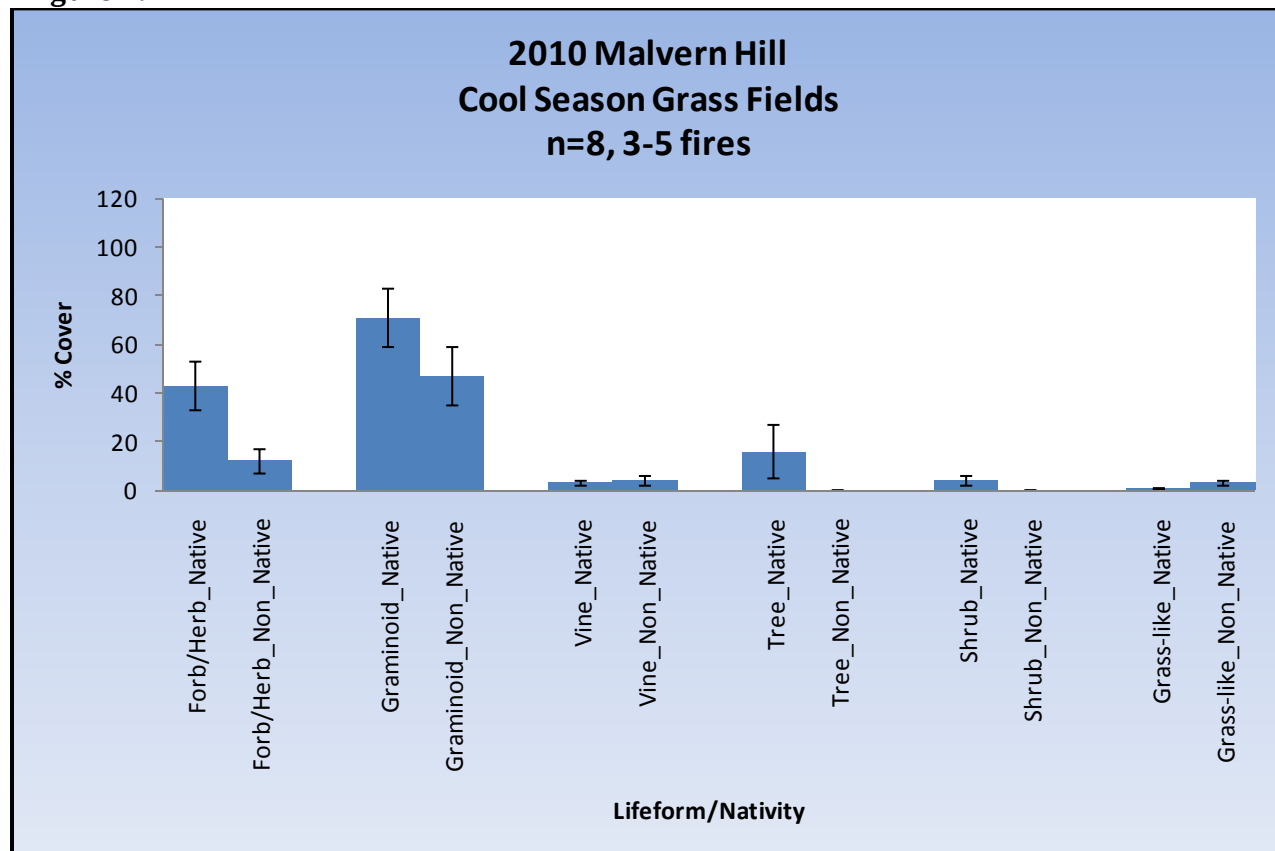
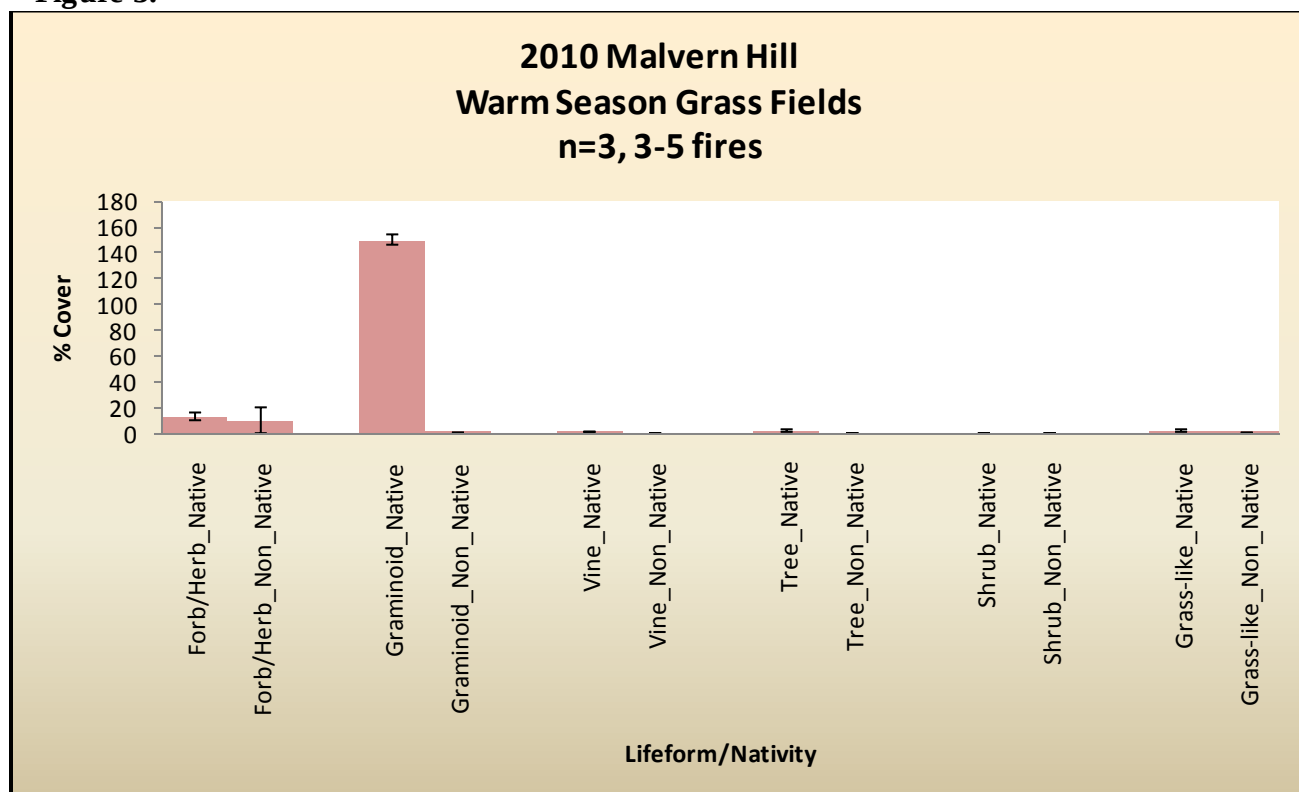


Figure 3.



III. Discussion

All objectives are being met with the exception of maintaining non native grass cover below 25 percent in the cool season grass fields. In the fall of 2010, 18 acres of meadow fescue (*Schedonorus pratensis*) in the largest cool season grass field, along with woody species throughout all of the fields were contracted and sprayed with herbicide. The non native honeysuckle (*Lespedeza cuneata*) will be treated during the summer of 2011. This year's prescribed fire had a very positive impact with a noted reduction of non native grass from 72% (± 16) in 2009 pre- treatment to 47% (± 12) (Figure 2) in 2010 after treatment. The burn day weather conditions (low RH, high temp.) allowed the fire to carry continuously through the fields. In the last three years native grass cover in the cool season grass fields has remained approximately the same. Hopefully, the spraying will provide more bare ground and allow native warm season grasses to germinate. The 12 acre south field, which is currently grouped in with the cool season grass fields, continues increase with NWSGs. The two plots in this field had 84% and 116% native grass cover, with only 2% and 0% non native grass cover. This field should be moved in with the warm season grass group and burn rotation.

The Native warm season grass fields continue to have exceptional native grass cover at 150% (± 4) and .3% ($\pm .3$) (Figure 3) non native grass percent cover. Native forbs also continue to increase from 5% (± 3) in 2008 to 13% (± 3) (Figure 3). Current research supports biannual spring burning and should allow for more native forbs to germinate. Plot 10 in the Parsonage West field was noted to have an increase in the non native invasive honeysuckle (*Lespedeza cuneata*). This should be treated as there are not many other native forbs in this field and it will likely quickly spread.

Cold Harbor

Cold Harbor Unit is predominately composed of a Coastal Plain Oak Heath Forest, with a Coastal Plain Acidic Seepage Swamp community bisecting the unit and running along Bloody Run Creek. Historically, Bloody Run Creek looked much like it does now, with deciduous trees in the overstory and thick underbrush, spreading up the hill and eventually mixing with the pine community on the uplands. The majority of the forest is 70-80 years in age and in fair health. During the Civil War most of the ridge areas were open farmland, and the slopes and streams were covered by woods; however, many of these fields have since been allowed to become mixed hardwood and coniferous forests. The understory vegetation along the drainage is an acidic seepage swamp community characterized by an extremely dense and brushy shrub layer.

The community that runs along the creek has an overstory dominated by blackgum and American holly, with an understory of sweet pepperbush, wild azalea and blueberry. The oak heath forest community is dominated by loblolly pine and black oak, white oak, northern red oak and American holly. The understory of these communities consists of saplings of tree species that dominate the overstory, with the addition of hickory, sassafras and blueberry. The herbaceous layer is sparse and dominated by muscadine, Virginia creeper and Japanese honeysuckle (*Lonicera japonica*).

This burn unit comprises an area of approximately 30 acres, which is in the central portion of the Cold Harbor Unit and is surrounded by a blacktop road Anderson and Wright Drive. The unit was first burned in 1997 before the establishment of monitoring plots. FMH forest plots were installed in 2003, and have been treated in 2004, 2005 and 2009. Plot design is consistent with the specifications for forest plots found in the NPS Fire Monitoring Handbook. Mechanical (lopping and chain sawing) and chemical treatments have also take place in the unit. A tropical storm impacted the area in 2005, falling numerous large trees.

IV. Goals and Objectives

Goal

The desired future condition for the Cold Harbor Unit is to maintain a “park-like” atmosphere for visitors, keeping the earthworks exposed for viewing and interpretation, and creating a more natural community that may have existed at this site before the suppression of fires.

Specifically:

- Reduce understory fuels to open up the historic scene.
- Open up and maintain vistas.
- Maintain and promote native warm season grasses.
- Minimize tall woody/shrubby vegetation from growing in the burn area
- Restore fire as a natural process.
- Reduce the amount of fuel used in tractors for mowing the area.
- Reduce hazard fuels.

Burn Objectives

- Provide for personnel safety.
- Limit mineral soil exposure to no more than 10% immediately post burn.
- 90%-100% of overall area will be burned.
- Limit flame height to be not more than 3 feet on average.

Monitoring Objectives

- >50% Reduction in pole size tree density after four burns. (change to condition? #).
- Increase native grasses by >75% after four burns.
- Maintain an open forested stand as it appeared at the time of the battle.

Monitoring Unit	Management Objective (80% C.I.) <i>a</i> .2	Monitoring Results 3 Treatments	Objectives Achieved?	YR Last Analysis Complete
Cold Harbor	Decrease pole size trees by 50% after four burns	Pre: 46 pole trees 03 YR02: 22 pole trees	YES	2010
	Increase relative percent cover of herbaceous species by >75% after 4 burns.	Pre: 1.2% 03 YR02: 7%	YES	2010
	Maintain an open forested stand as it appeared at the time of the battle.	Photo points ongoing.	YES	2010

Figure 1

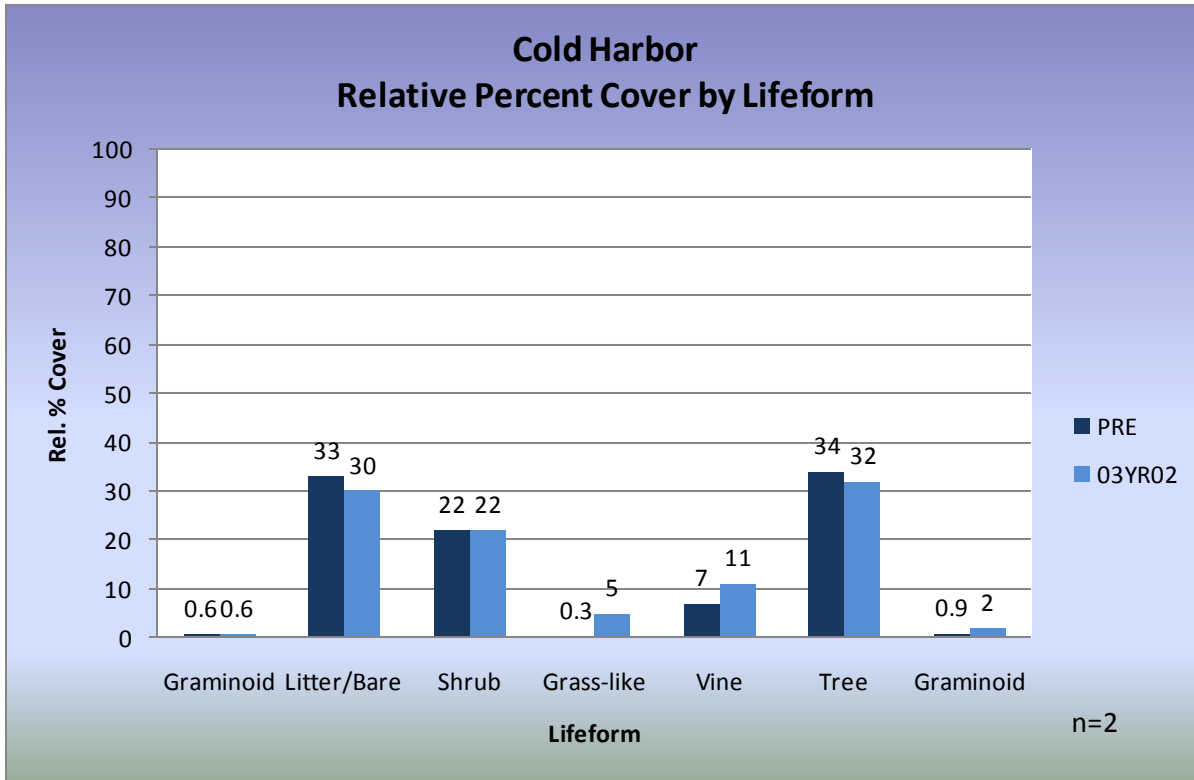
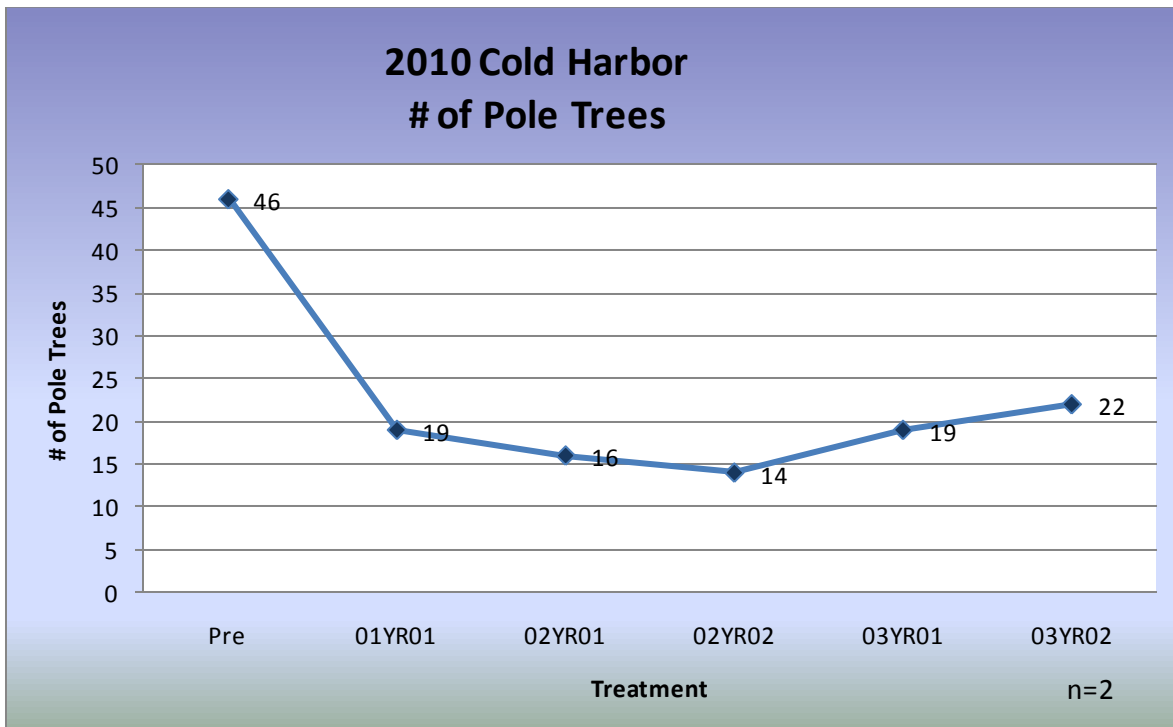


Figure 2



V. Discussion

After the third burn, objectives are being met for the Cold Harbor unit. The objective to reduce shrub density cover was dropped last year due to the difficulty in accurately tallying *Ericaceous* species. There continues to be an increase in grasses and sedge species which is an excellent sign (Figure 1). This open pine habitat historically had a significant open grass understory. There have been very few non native species noted in the plot areas to date. The density of pole trees has been decreased by 50% (Figure 2.) after three burns. A few seedling trees have now moved into the pole size class, however the level still remains below half of pre burn levels. Standard error was not calculated for results due to the unit only having two plots with the entire area only 20 acres in size. This unit is on schedule to be treated again in 2013.



Fredericksburg and Spotsylvania National Military Park (FRSP)
Spotsylvania Burn Unit
2010 Effects Monitoring Annual Report

I. Introduction

Fredericksburg and Spotsylvania National Military Park is located approximately 50 miles south of Washington, D.C. The park is spread out over a 145-square mile area in the city of Fredericksburg, Virginia, at the junction of Interstate 95 and State Route 3, and in Caroline, Orange, Spotsylvania, and Stafford Counties. It is comprised of four separate Civil War battlefields: Fredericksburg, Spotsylvania Court House, Chancellorsville, and Wilderness, and four related sites: Salem Church, Chatham Manor, Jackson Shrine, and the Fredericksburg National Cemetery.

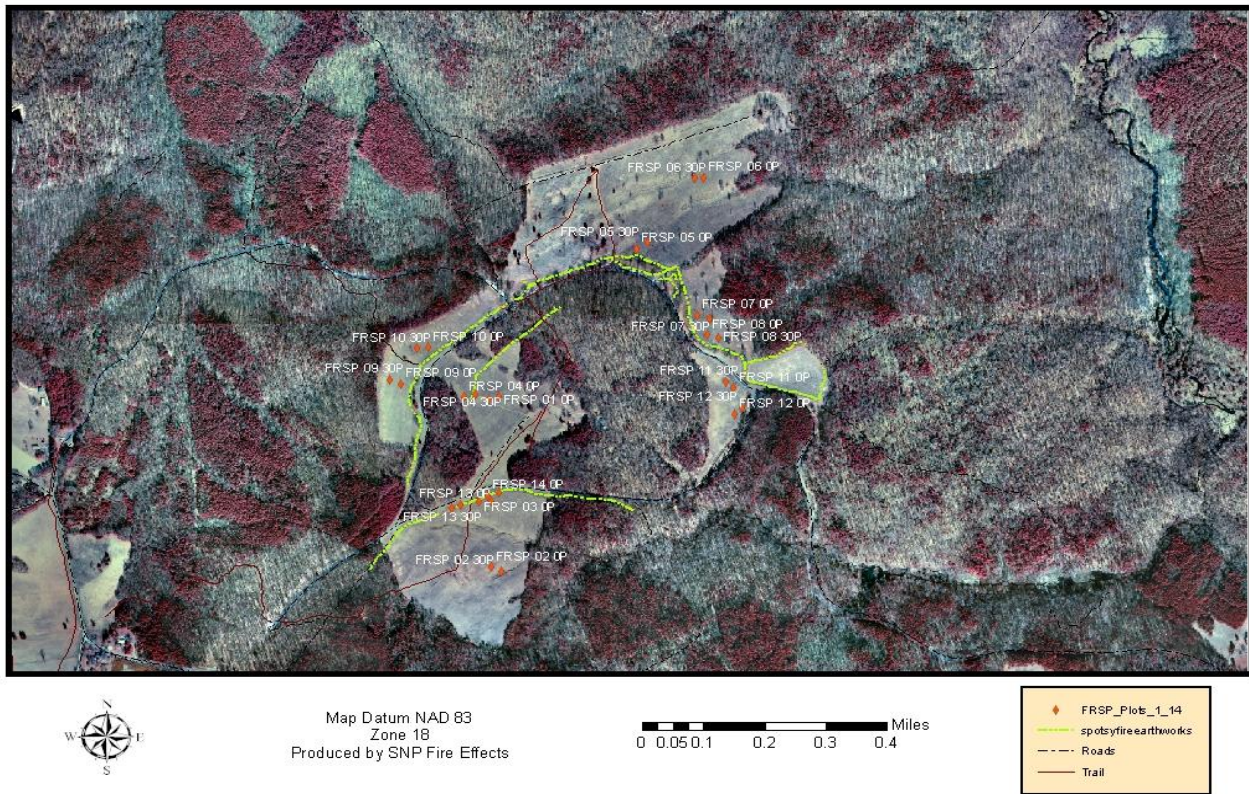
On four separate occasions, the main eastern armies of the United States and the Confederate States fought major battles in and around Fredericksburg, Virginia. The woods and fields of the battles are the primary resources of the park: federal lands encompass 1,200 ac of open fields, 6,000 ac of forest, 540 ac of wetlands, and 102 mi of boundary. In addition, the park has significant terrain features, historic roads and traces, structures, house sites, ruins, cemeteries, monuments, markers, and historic objects. A number of historic structures dating from the mid-19th century add to the park's significance, including more than 43 mi of earthworks built by the soldiers, Salem Church, the house where Stonewall Jackson died, Ellwood, Chatham Manor, and several other structures that were landmarks on the historic fields.

The Spotsy Fields Monitoring unit consists of open fields and earthworks. Open fields in Spotsylvania Court House Battlefield are considered cultural meadows. Cultural Meadow includes all mowed or maintained fields in the park, and are managed to maintain the open fields characteristic of Civil War battlefields. These meadows have a mix of native and exotic grasses and forbs with scattered shrubs. Dense stands of cool season grasses such as meadow fescue (*Schedonorus pratensis*) and orchard grass (*Dactylis glomerata*) typically occur.

Common vegetation encountered in fire monitoring plots include; native grasses and sedges such as, beaked panic grass (*Panicum anceps*), poverty oatgrass (*Danthonia spicata*), rosette grass (*Dichanthelium dichotomum*), broomsedge (*Andropogon virginicus*), little bluestem (*Schizachyrium scoparium*), Indian grass (*Sorghastrum nutans*) and sedges (*Carex spp.*). Shrubs include blackberry (*Rubus spp.*) and winged sumac (*Rhus copallinum*) and herbaceous plants include trailing bush clover (*Lespedeza procumbens*) yarrow (*Achillea millefolium*) and cinquefolia (*Potentilla spp.*) Tree seedlings include blackjack oak (*Quercus marilandica*), sweet-gum (*Liquidambar styraciflua*) and locust (*Robinia pseudoacacia*). Additionally, there are a few exotic species of concern found in the fields. Some of which include, but are not limited to, Japanese Honeysuckle (*Lonicera japonica*), colonial bent grass (*Agrostis capillaris*), sweet vernal grass (*Anthoxanthum odoratum*), cat's ear (*Hypochaeris radicata*) and red sorrel (*Rumex acetosella*).

The Northeast Region Fire Effects Monitoring Crew began monitoring fire effects at the park in 2004. Currently there are 14 FMH brush transect monitoring plots in a complex of seven fields for a total of 125 acres in size. Upton Field 11.8 ac, McCoull House Field 19.3 ac, Harrison House Field 29.7 ac, Crescent Field 5.3 ac, Native Grass Field 4.8 ac, Middle Field 7.2 ac, Landram House Field 46.4 ac.

Fredericksburg and Spotsylvania National Military Park Fire Effects Monitoring Plots 1 - 14



I. Goals and Objectives

Goal

Open fields would preserve the historic scene as it appeared at the time of the battle while providing critical habitat for birds and small mammals. Native warm season grasses would dominate the vegetation cover while non-native cool season grass cover would be minimal.

Burn Objectives

- Provide for personnel safety.
- 90% - 100% of overall area to be burned.
- Limit mineral soil exposure to no more than 5% until greenup.

Monitoring Objectives

- Maintain woody species < 25%.
- Percent Cover on non-native grasses and forbs < 25%.
- Percent cover of native grasses and forbs > 75%.

Monitoring Unit	Management Objective (80% C.I.) <i>a</i> .2	Monitoring Results Treatments	Objectives Achieved?	YR Last Analysis
Spotsylvania Mixed Grassland	Maintain percent cover of woody species < 25% .	Low Shrub Cover Fields Shrubs= 19 (± 4) Trees=19 (± 2)	NO	2010
		High Shrub Cover Fields Shrubs= 54(± 7) Trees=22 (± 4)	NO	
	Percent Cover of non-native grasses and forbs <25% .	Low Shrub Cover Fields Non-native grass = 2 (± 1) Non-native forbs = .3($\pm .3$)	YES	2010
		High Shrub Cover Fields Non-native grass = 21(± 5) Non-native forbs = .3($\pm .3$)	YES	
	Percent cover of native grasses and forbs >75% .	Low Shrub Cover Fields Native grass = 80 (± 4) Native forbs = 41 (± 3)	YES	2010
		High Shrub Cover Fields Native grass = 67(± 12) Native forbs = 67(± 10)	YES	

Figure 3

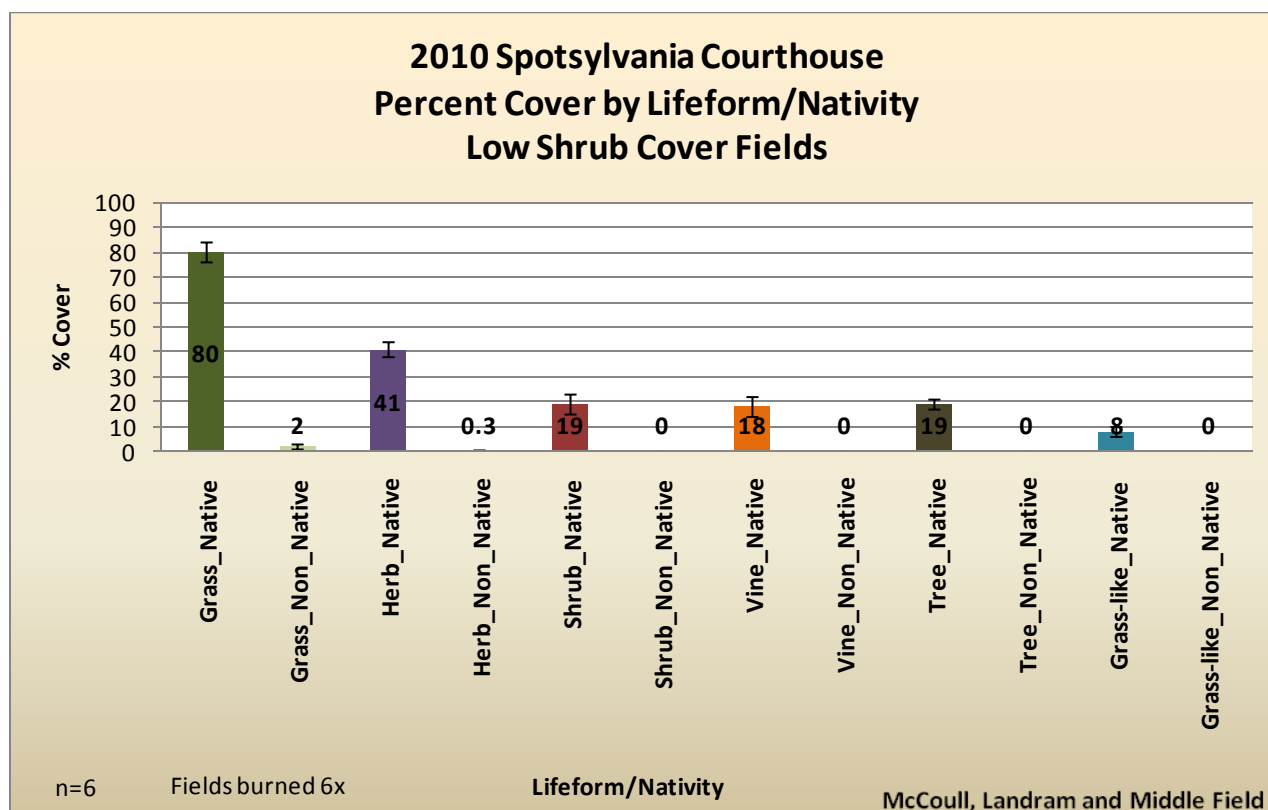
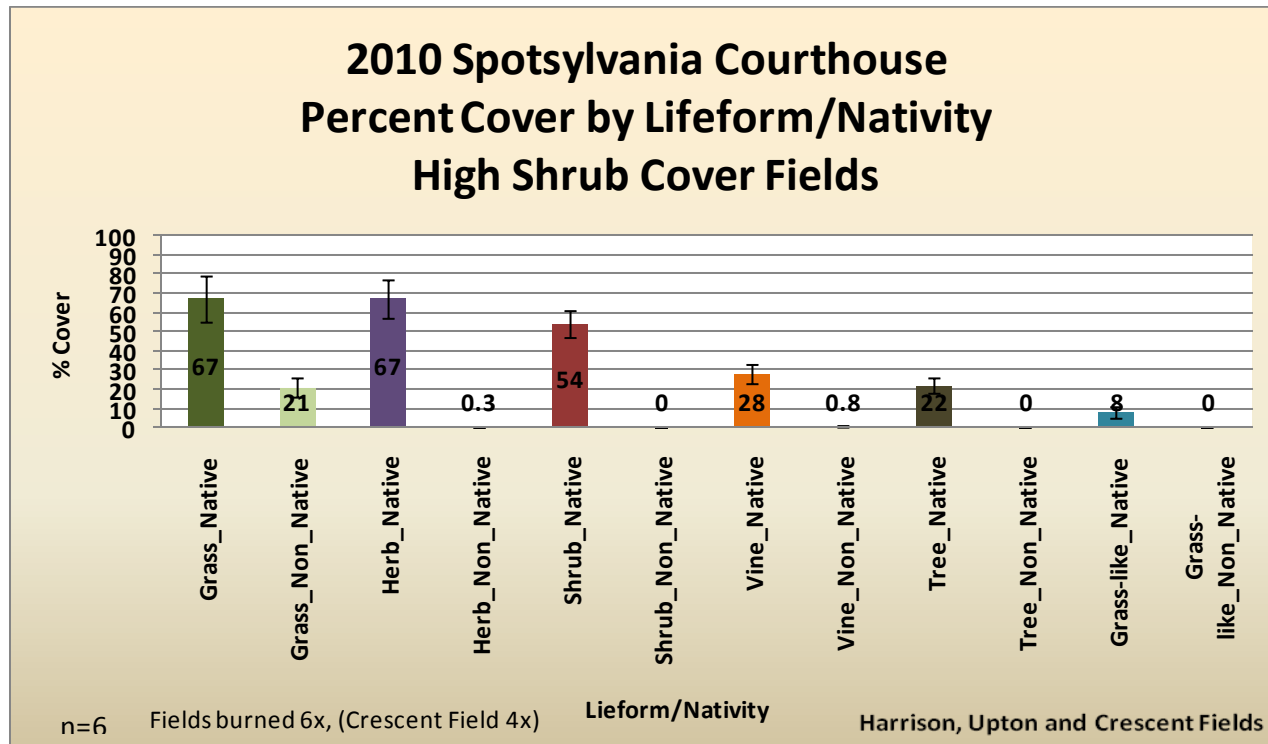


Figure 4



II. Discussion

Objectives are currently being met at the Spotsylvania Court House burn unit with the exception of maintaining woody vegetation below the 25% threshold. A meeting was held in November of 2010 with the parks Superintendent, Chief of maintenance and staff, Chief of natural resources and park FMO, cultural resources specialist, MTTS area FMO and fire ecologist, to discuss concerns of the visual appearance of the fields. The park had received a few complaints regarding overgrown vegetation impacting the historic vista. In past years, the park bush hogged all of the fields in this unit annually. However, when prescribed burning began in 2004 the amount of bush hogging was significantly scaled back. An analysis of our data shows an increase in the desired native warm season grasses and herbs, however no detectable decrease in woody vegetation. Small diameter shrubs and tree species appear to be top killed, however vigorously re sprout. The reduction in bush hogging has also resulted in taller vegetation with the stems rarely consumed by the fire. As a result of this meeting, it was decided to re-implement bush hogging on a biennial (every other year) basis rotating thorough all the fields. Bush-hogging will occur during the late summer to have the most effect on killing woody vegetation. The fields were divided into two groups. The low shrub cover fields include; McCoull, Landram and Middle fields. The high shrub cover fields include; Harrison, Upton and Crescent fields. The fields with the highest percent of woody vegetation (high shrub cover fields) will be treated with prescribed fire beginning the Summer of 2011. Recent literature supports rotating burning during the growing season to kill woody vegetation in conjunction with burning in the spring to promote the growth and establishment of native warm season grasses. Bush-hogging will also be used to control the height of woody species thereby preserving the historical vista. Bush-hogging will take place in the late summer after ground nesting birds have fledged and fire effects monitoring plots have been read.

Tentative Cutting / Summer - Spring Prescribed Burning Schedule for 2011 - 2016

	2011	2012	2013	2014	2015	2016
Upton Field	Summer RX	Bush - hog	Summer RX	Bush - hog	Spring RX	Bush - hog
Landram Field	Spring RX	Spring RX	Bush - hog	Spring RX	Bush - hog	Summer RX
Harrison Field	Summer RX	Bush - hog	Summer RX	Bush - hog	Spring RX	Bush - hog
McCoull Field	Spring RX	Spring RX	Bush - hog	Spring RX	Bush - hog	Summer RX
Middle Field	Spring RX	Spring RX	Bush - hog	Spring RX	Bush - hog	Summer RX
Crescent Field	Summer RX	Bush - hog	Summer RX	Bush - hog	Spring RX	Bush - hog
Native Grass Field	Spring RX	Spring RX	Bush - hog	Spring RX	Bush - hog	Summer RX

Percent cover of non-native grasses and forbs still remain below the 25% threshold for both the low shrub cover fields (Figure 3) and the high shrub cover fields (Figure 4). Non native herbs are barely detectable at .3% (± 3) (Figure 3 and 4) in both groups of fields. In contrast, the high shrub cover fields have a much larger proportion of non native grasses 21% (± 5) (Figure 4) than the low shrub cover fields 2% (± 1) (Figure 3). A decrease in woody vegetation in the high shrub cover fields should allow for the germination of the desired native warm season grasses. The percent cover of native grasses and forbs is excellent with the low shrub cover field having 80% (± 4) and 41% (± 3) (Figure 3) respectively and 67% (± 12), 67% (± 10) for the high shrub cover fields (Figure 4).

Appomattox Courthouse (APCO) 2010 Fire Effects Monitoring Annual Report

I. Introduction

APCO is located in Appomattox County, Virginia, and is comprised of 1,743 acres that contain a number of nationally significant cultural resources, the majority of which are historical in nature. Natural resources include woodlands, wetland systems, cultivated fields and grasslands, and various small creeks that, altogether, present a landscape relatively unchanged since 1865. The acreage of the park is comprised of: 45% agricultural fields (approximately 400 acres are leased), pastures, and lawns, 45% forests, 6% streams /wetlands, and 4% developed areas.

On April 9, 1865, after four years of Civil War, approximately 630,000 deaths and over 1 million casualties, General Robert E. Lee surrendered the Confederate Army of Northern Virginia to Lieutenant General Ulysses S. Grant, at the home of Wilmer and Virginia McLean in the rural town of Appomattox Court House, Virginia.

The fire Effects monitoring crew began monitoring Ferguson Field in 2008 and the NC woodlot in 2010.

Ferguson Field

Most of the grassland areas in the park have been managed in one form or another for years. Currently, approximately 400 acres of grasslands are managed for cool-season grasses (primarily fescues) for hay production (~200 acres) and for pasture for cattle grazing (~ 200 acres) through the Historic Property Leasing Program. Fifty-four acres (Sweeney Prizery Field and Village Back Field) are managed as native, warm-season grasses for hay production through the same program. Forty-two acres (Ferguson Field and Upper Nash Field) are managed as a mature grassland community.

The Mid-South historically contained vast acreages of native grassland and savannas with scattered trees and shrub cover, which was maintained by fire. Through the years, these have been replaced with non-native grasses such as meadow fescue (*Schedonorus pratensis*). Agriculture, trees and suburban development have also replaced open fields with Native Warm Season Grasses (NWSGs). Native warm season grasses provide critical habitat for numerous songbirds and wildlife species. These native grasslands are the most endangered ecosystems in the Mid-South and as a result of their loss numerous wildlife and grassland bird species have experienced steep, long term declines.

The vegetation of the Ferguson Field is characterized by native perennial grasses include *Andropogon virginicus*, *Tridens flavus*, *Sorghastrum nutans*, *Panicum virgatum* and *Andropogon gerardii*. Non-native perennial grass is mostly meadow fescue (*Schedonorus pratensis*). Annual grasses include many *Panicum* species. Native forbs, shrubs and trees include *Solidago* species, *Erechites hieracifolia*, *Symphoricarpos orbiculatus*, *Rubus* species, *Juniperus virginiana*, and *Pinus virginiana*. Invasive, non-native vegetation includes *Rosa multiflora* and *Centaurea maculosa*.

Ferguson field was a pasture utilized for cattle grazing until 2001. The field was treated with a selective herbicide in 2002 to reduce non-native perennial grasses and replanted with a mixture of Native Warm Season Grasses (NWSGs) including *Sorghastrum nutans*, *Panicum virgatum* and *Andropogon gerardii*. The field was first burned in the spring of 2009. A few weeks following the initial prescribed fire, the Mid Atlantic Exotic Plant Management Team re-treated the newly re sprouting cool season meadow fescue (*Schedonorus pratensis*). This combination of burning and follow up spraying was notably successful at reducing the coverage of this non native grass.

II. Goals and Objective

Goal

The primary goal is to maintain the historic scene of April 9, 1865 that the park commemorates, while creating a diverse grassland habitat. This is being accomplished by mechanically removing the trees, herbicide treatment of exotic vegetation, bushhogging, and through the use of prescribed fire.

Burn Objectives

- Provide for personnel safety.
- 90% to 100% of overall area to be burned.
- Limit mineral soil exposure to no more than 5% until greenup.

Monitoring Objectives

- Percent cover of woody species < 25%.
- Percent cover of non-natives grasses and forbs < 25%.
- Percent cover of native grasses and forbs >75%.

Monitoring Unit	Management Objective (80% C.I.) $\alpha .2$	Monitoring Results	Objectives Achieved?	YR Last Analysis Complete
Ferguson Field Mixed Grassland	Percent cover of woody species < 25%.	Woody species = 9 (± 3)	Yes	2010
	Percent cover of non-natives grasses and forbs < 25%.	Non-native grass = 38 (± 7) Non-native forbs = 10 (± 4)	No	2010
	Percent cover of native grasses and forbs >75%.	Native grasses = 83 (± 7) Native forbs = 13 (± 4)	Yes	2010

Figure 5

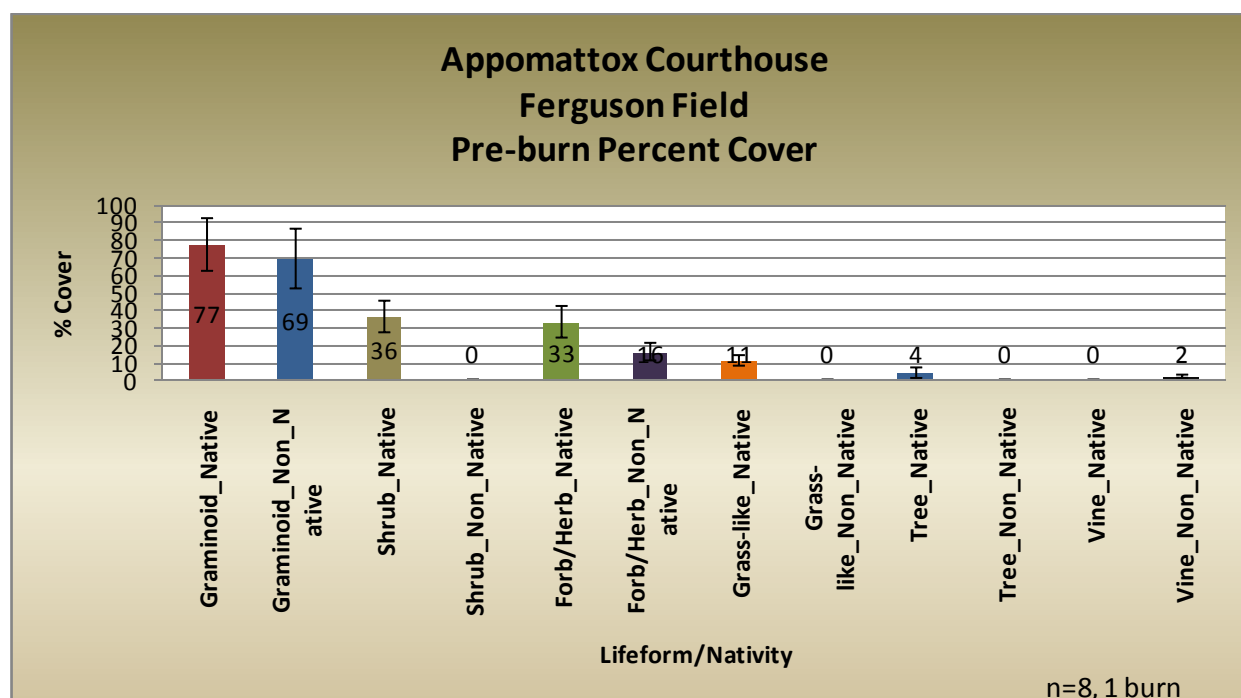


Figure 6

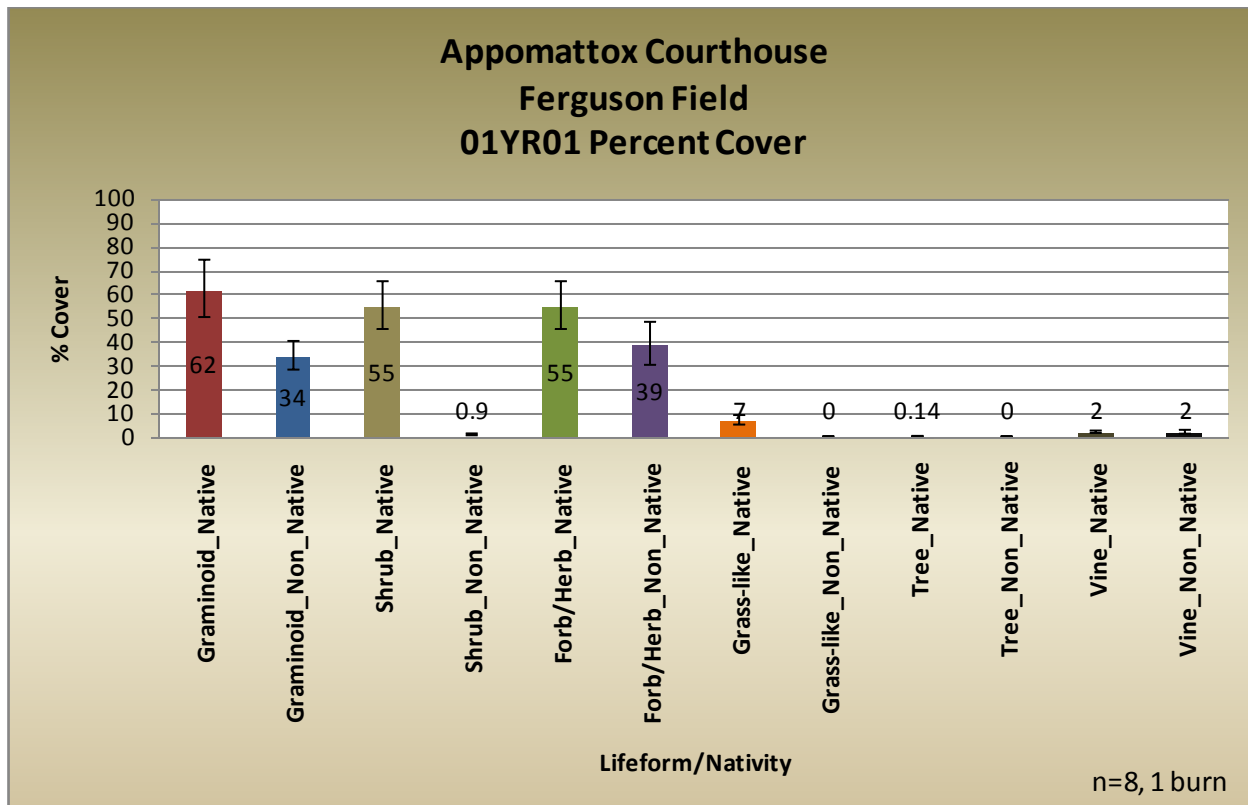
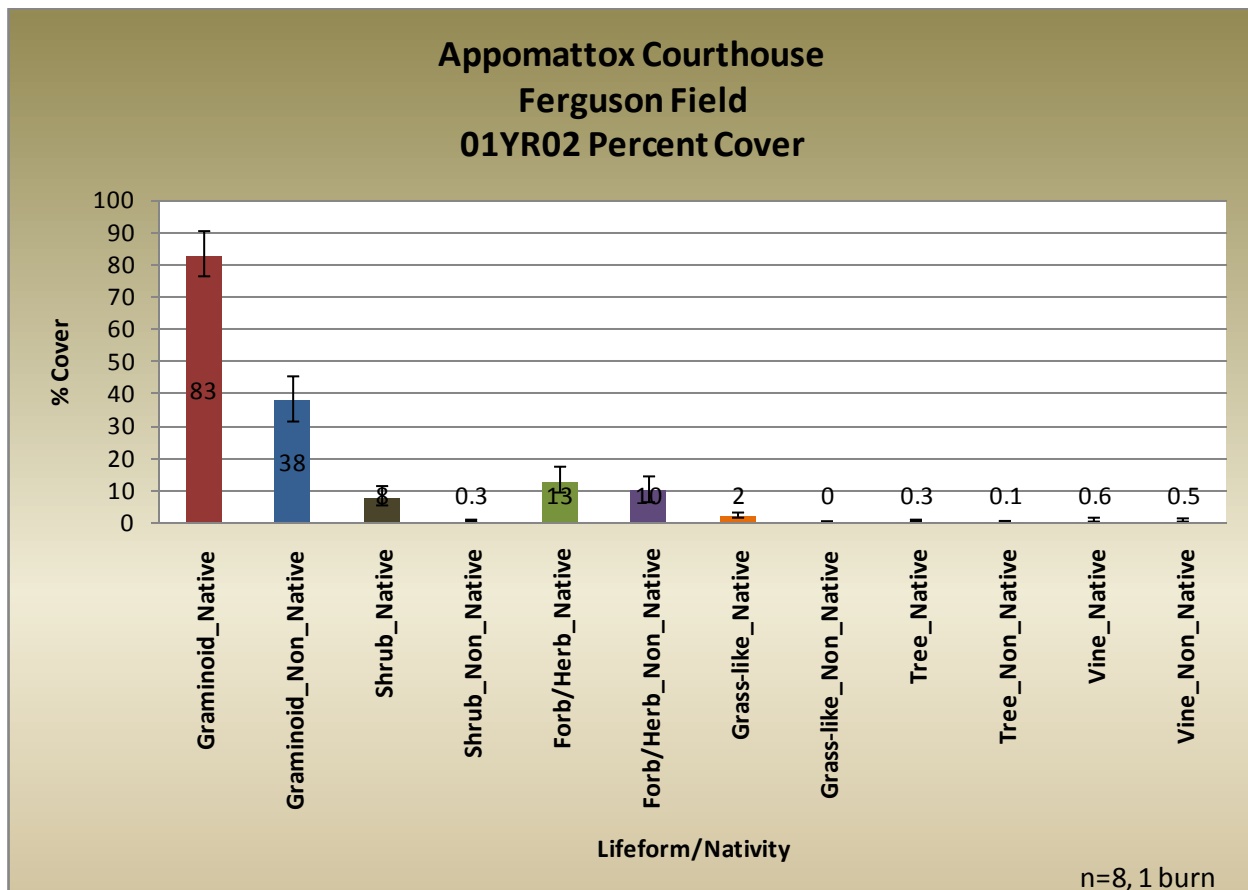
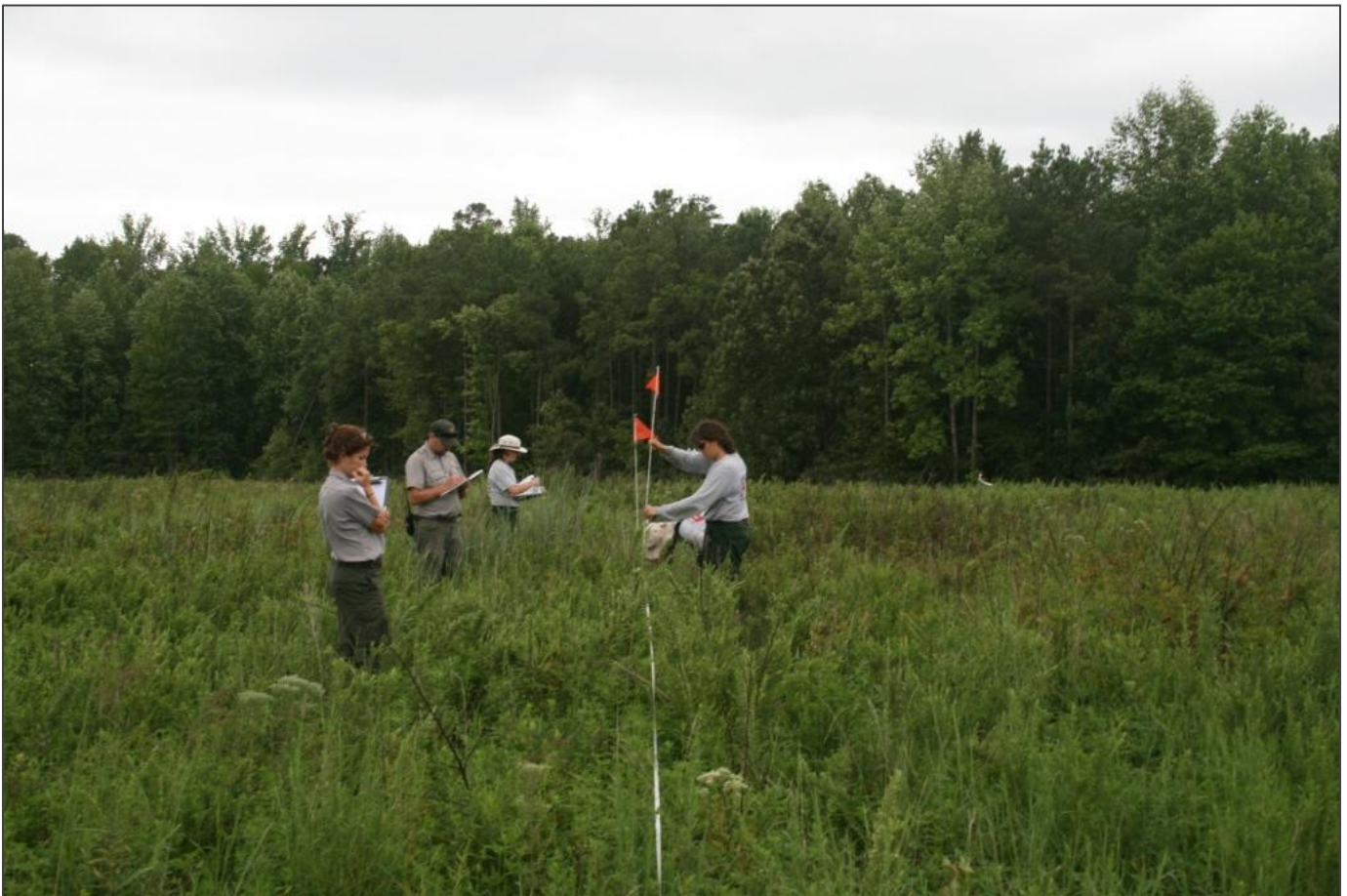


Figure 7



III. Discussion

A combination of prescribed fire and herbicide treatment has been used throughout the field to meet management objectives. Native warm season grasses have continued to show an increase in the second year of monitoring after the initial prescribed fire. Percent cover of native grasses is 83% (± 7) (Figure 7) in 2010 compared to 77 (± 15) (Figure 5) in pre burn monitoring. More remarkably non native grasses have decreased from 69% (± 17) (Figure 5) to 38% (± 7) (Figure 7). In early 2010 the Mid Atlantic Exotic Plant Management Team (EPMT) treated large patches of fescue with the herbicide Glyphosate. While non native grass cover still exceeds the objective to maintain cover $< 25\%$, significant progress has been made after one burn in meeting this objective. Furthermore, shrub levels have decreased from 36% (± 9) (Figure 5) in pre burn monitoring to 8% (± 3) (Figure 7). The Mid Atlantic EPMT also treated much of the field with Garlon 4 in early spring/summer 2010 to control the highly invasive non native herb spotted knapweed. The spotted knapweed rosettes accounted for 55% (± 10) (Figure 6) cover after the initial burn treatment. After the herbicide treatment, percent cover had been reduced to 10% (± 4) (Figure 7). The herbicide application also impacted native herb cover with a decrease from 55% (± 10) (Figure 6) in 2009 to 13% (± 4) (Figure 7) in 2010. Native herbaceous plant cover are expected to rebound in the next few years as the knapweed is kept in check through spot herbicide treatments. This multi faceted approach of burning and herbicide application appears to be effective in restoring this native warm season grass fields after being managed as pasture lands for many years.



Delaware Water Gap National Recreation Area (DEWA) 2010 Effects Monitoring Annual Report

I. Introduction

Delaware Water Gap National Recreation Area is the largest natural area in the entire National Park System between Virginia and Maine and one of the largest protected natural areas in the metropolitan corridor extending from Washington, D.C., to Boston, Massachusetts. The recreation area encompasses 67,000 acres of mountain ridge, forest, and floodplain on both sides of the Delaware River in the states of New Jersey and Pennsylvania. Forty miles of the Middle Delaware River are within the park unit. The park is the tenth most visited area in the National Park System with almost 5 million recreational visits each year.

The mission of the park is to provide outdoor recreation opportunities while conserving the natural, cultural and scenic resources of the recreation area. The park has a significant number of threatened species including 49 plant, 9 fish, 13 mammals, 7 reptiles and 10 amphibians.

Agriculture, trees and suburban development have replaced open fields with Native Warm Season Grasses (NWSGs). Native grasslands with scattered trees and shrub cover, maintained by fire, have also been replaced with non-native grasses such as smooth brome (*Bromus inermis*) and Kentucky bluegrass (*Poa pratensis*). Native warm season grass fields provide critical habitat for numerous songbirds and wildlife species.

II. Goals and Objective

Goal

The overall objectives of these burns are to perpetuate the native species, perpetuate the open space character of the landscape, maintain wildlife habitat, control invasive exotic species, maintain fire dependent ecosystems, and reduce hazard fuel concentrations by disrupting fuel continuity.

Burn Objectives

- Ensure the public experience no injuries
- Ensure fire personnel receive no lost time injuries

Monitoring Objectives

- Maintain native grass cover by $\geq 75\%$ as determined one year post burn.
- Maintain native herbaceous cover by $\geq 75\%$ as determined one year post burn.
- Reduce shrub and brush cover by $\geq 10\%$ as determined one year post burn.
- Reduce exotic invasive cover by $\geq 25\%$ as determined one year post burn.

Monitoring Unit		Management Objective (80% C.I.) α .2	Monitoring Results	Objectives Achieved?	YR Last Analysis Complete
Delaware Water Gap National Recreation Area	Darrones and Silver Spray Units	Percent cover of native grasses and herbs >75%.	PRE Native Grass = 11% ($\pm$ 2) 01 YR01 Native Grass = 15% ($\pm$ 4) PRE Native Herb = 113% ($\pm$ 13) 01 YR01 Native Herb = 95% ($\pm$ 12)	NO YES	2010
		Reduce shrub and brush cover by $\geq$ 10% as determined one year post burn. <i>*Recommend changing to Percent cover of woody species < 25%.</i>	PRE Shrub = 17% ($\pm$ 2) 01 YR01 Shrub = 17% ($\pm$ 2) (Probably lower, some shrubs should be grouped with herbs).	YES	2010
		Reduce exotic invasive cover by $\geq$ 25% as determined one year post burn. <i>*Recommend changing to Percent cover of non- natives grasses and forbs < 25%.</i>	PRE Non-native Herbs = 43% ($\pm$ 8) 01 YR01 Non-native Herbs = 42% ($\pm$ 8) PRE Non-native Grass = 127% ($\pm$ 12) 01 YR01 Non-native Grass = 94% ($\pm$ 12)	NO	2010

Figure 8

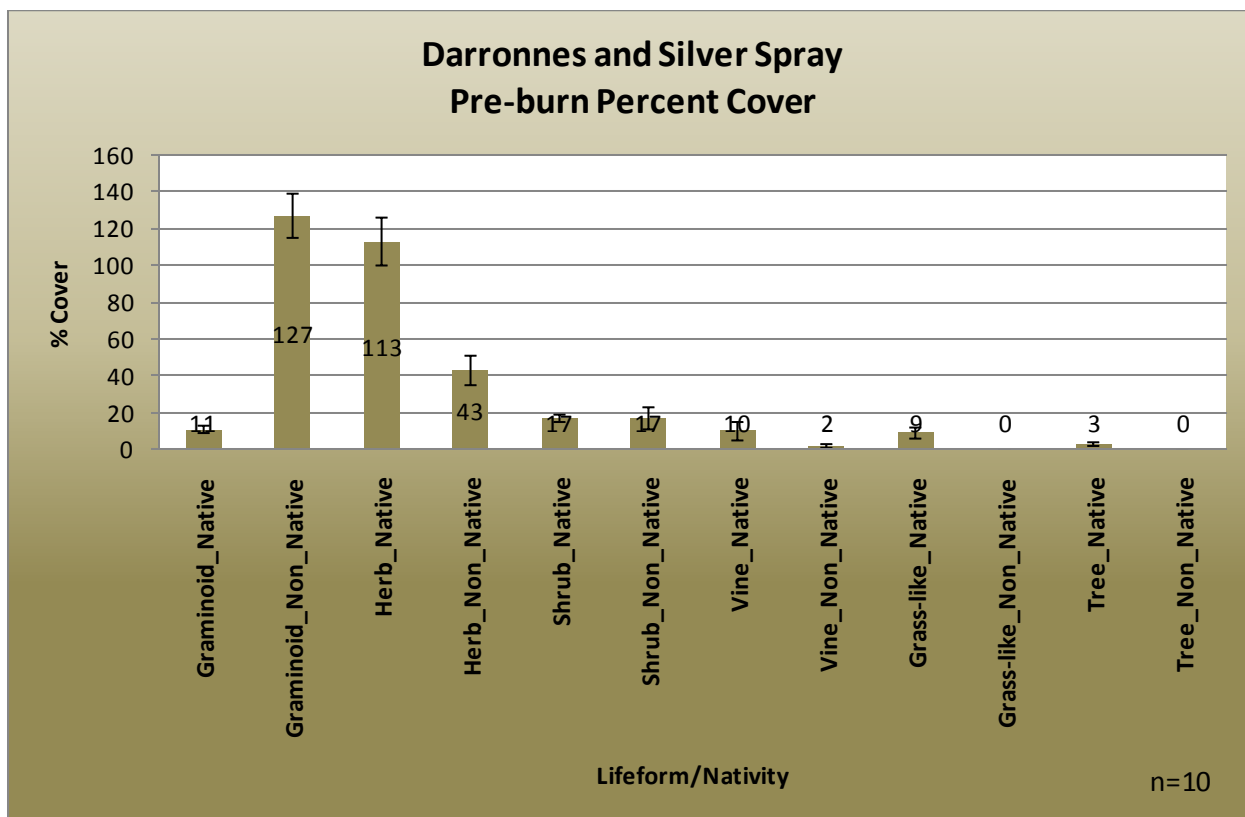
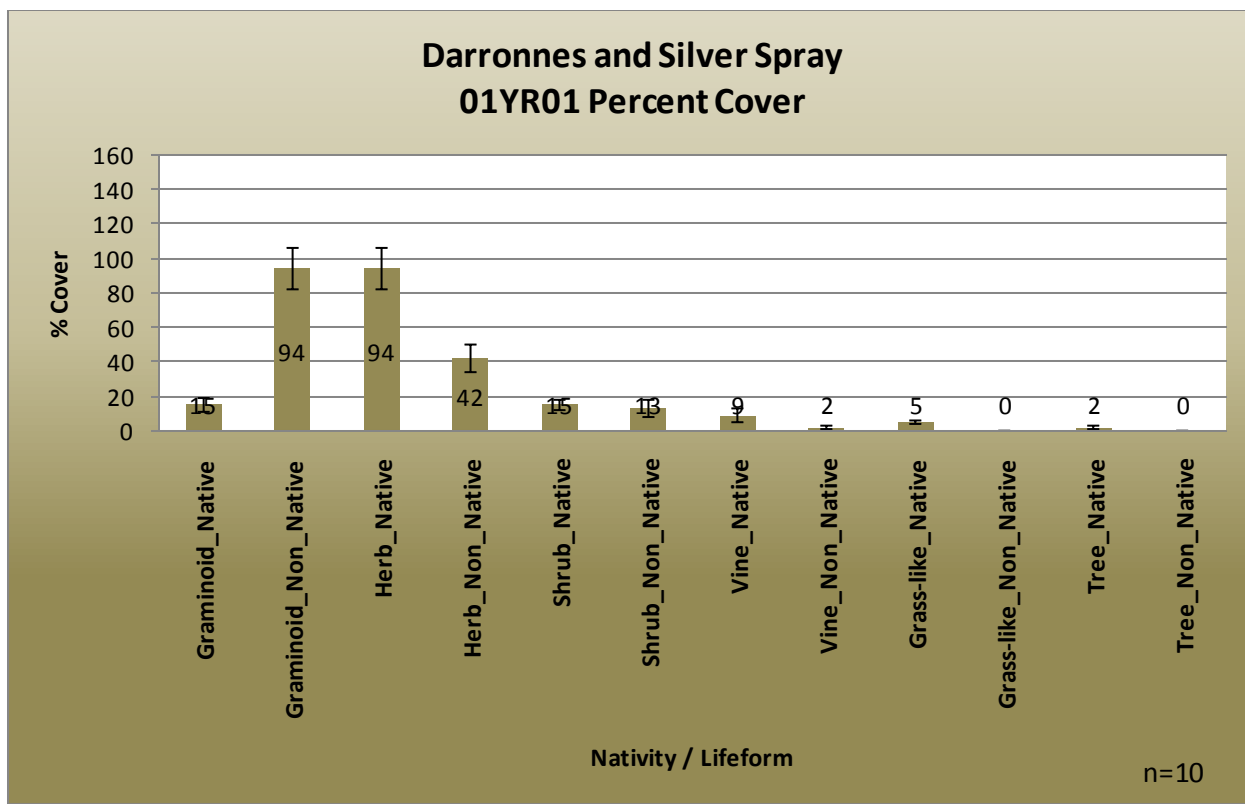


Figure 9



III. Discussion

Native herbaceous cover is excellent at 94% (± 12) (Figure 9). This exceeds the objective of maintaining percent cover of native herbaceous plants greater than 75%. However, native grass cover is abysmal at 11% (± 2) pre burn levels and 15% (± 4) (Figure 8 and 9) after one burn. One of the reasons for this lack of native grasses is due to the prevalence of non native grass cover. Pre burn cover for non native grass was 127% (± 12) and post burn 94% (± 12) (Figure 8 and 9). This indicates a small decrease in cover, however, non native grasses clearly still dominate the fields. Of particular concern is smooth brome (*Bromus inermis*) and Kentucky bluegrass (*Poa pratensis*).

These non native grass species frequently co occur together. There is a difference in the timing of the most susceptible phenological stages of the two species. However, there is a small window of overlap when both of the species are vulnerable to fire. The optimal time to burn Kentucky Bluegrass is in *early spring* before flower and smooth brome while still in the boot stage (i.e. the flowering head is still enclosed within the sheath) or *late spring*. Prescribed burning may reduce smooth brome if repeated annually in mid to late spring. As noted earlier, this is later than would be recommended for control of Kentucky bluegrass. Smooth brome is a good target for selective control by timed close mowing or use of herbicides. One close mowing when the plants are 18-24 inches tall, or treatment with glyphosate at 0.5 to 1.1 kg/ha before flowering, may improve chances of selectively controlling this species. The literature supports, prescribed burns need to be repeated for several consecutive years because a single burn would allow smooth brome to recover the following year. A multifaceted approach will be needed to control these two species. There was some pockets of native warm season grasses such as little blue stem (*Schizachyrium scoparium*) which responds positively to fire and should continue to increase as non native grasses are controlled. Non native herbaceous cover level remained the same from preburn to postburn levels 43% (± 8) and 42% (± 8) respectively. However, as noted earlier, the the fields still remain surprisingly diverse with native herbaceous cover at 94% (± 12). Goldenrods are particularly diverse in the Silver Spray field. Shrub cover also remained the same with 17% (± 2) in both preburn and postburn measures. A few species that were analyzed as shrubs can also be considered herbaceous so the percent cover is likely even lower than reported.

Saratoga National Historical Park 2010 Fire Effects Monitoring Annual Report

I. Introduction

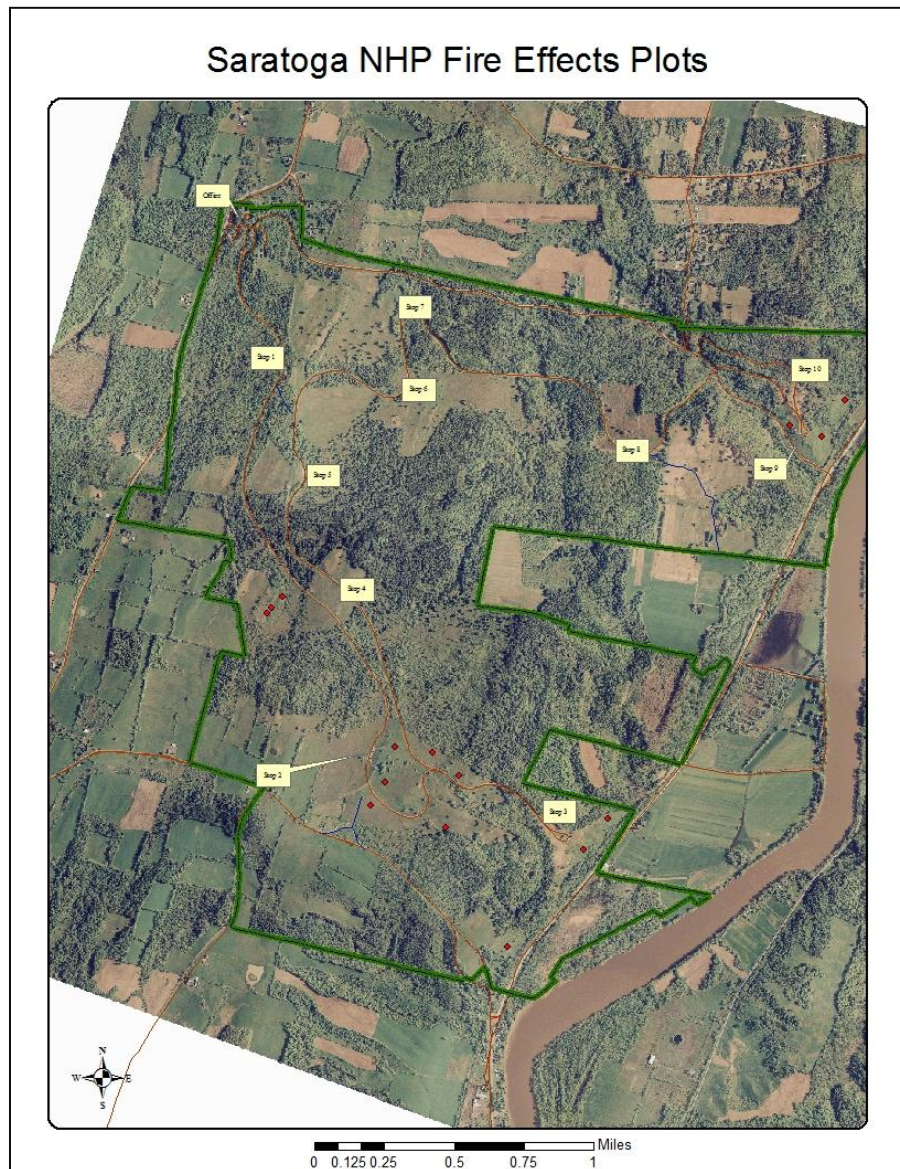
Saratoga National Historical Park is located in the towns of Stillwater and Saratoga, in Saratoga County in upstate New York, about 30 north of the state capital at Albany. Although a neighbor to the highly urbanized “Capital District,” the park is rural in character and farming is the major use of adjacent lands. The park comprises 2,912 ac preserving the sites associated with a significant American military victory during the Revolution. In 1777 American forces met, defeated, and forced a major British army to surrender, an event which led France to recognize the independence of the United States and enter the war as a decisive military ally of the struggling Americans. The Battlefield Unit, 2,843 acres, was made part of the national park system in 1938 when Saratoga National Historical Park was authorized by the United States Congress.

Agriculture, trees and suburban development have replaced open fields with Native Warm Season Grasses (NWSGs). Native grasslands with scattered trees and shrub cover, maintained by fire, have also been replaced with non-native grasses such as meadow fescue (*Schedonorus pratensis*) and Kentucky bluegrass (*Poa pratensis*). Native warm season grass fields provide critical habitat for numerous songbirds and wildlife species.

Vegetation is grassland vegetation dominated by bluestem (*Schizachyrium scoparium*), sedge (*Carex* spp.), panic-grass (*Dichanthelium* spp.), and fescue (*Festuca* spp., *Schedonorus pratensis*). Common forbs include yarrow (*Achillea millefolium*), knapweed (*Centaurea* spp. - an invasive exotic), bedstraw (*Galium* spp.), cinquefoil (*Potentilla* spp.), goldenrod (*Solidago* spp.), and thyme (*Thymus* spp.). Woody species including dogwood (*Cornus* spp.), black cherry (*Prunus serotina*), buckthorn (*Rhamnus* spp.), sumac (*Rhus* spp.), brambles (*Rubus* spp.), poison ivy (*Toxicodendron radicans*), viburnum (*Viburnum* spp.), and grape (*Vitis* spp.). Ferns are common to dominant in one field (Field 37, called The Fern Field) and include lady-fern (*Athyrium filix-femina*), sensitive fern (*Onoclea sensibilis*), and royal fern (*Osmunda regalis*).

The Northeast Region Fire Effects Monitoring Crew began monitoring fire effects at the park in 2001. There are 24 plots installed throughout the fields. In 2010, it was decided to retire 9 of the plots that were primarily located in mow areas. Fifteen plots still remain active as of 2011. Due to varying location, topography and treatments, plots were broken up into three analysis groups. The first group, hillside plots, are located on steep slopes and are maintained with fire to reduce woody vegetation and eliminate the need for mowing. The second group, Neilson Farm plots, are maintained with fire to reduce woody vegetation and also reduce the invasive exotic herb knapweed. The third group, Chatfield Farm, are maintained with fire to reduce woody vegetation and control knapweed. The Chatfield Farm fields have also been experimentally burned in the summer to eliminate woody vegetation.

Plots in these three groups will be burned at the same time and analyzed together. Since the park has an extremely complex history of mowing, burning and chemically treating vegetation over the last 20 years, plots were compared by years instead of “preburn” and “postburn” reads. It is recommended to modify the current change objectives to condition objectives for this reason.



II. Goals and Objective

The Saratoga NHP Fire Management Plan states the objective to, “Maintain and rehabilitate park fields, meadows, and historic landscapes through the application of prescribed fire and other techniques.

Old Monitoring Objectives (change due to different treatment schedules in the past and problems discerning “pre burn” time period.)

- Reduce the density of woody stems by 70% to 90%.
- Reduce the cover of nonnative herbaceous species, expressed as a percent of the total cover of herbaceous species, by 20% to 40%.
- Increase the cover of native herbaceous species, expressed as a percent of the total cover of herbaceous species, by 20% to 40%.

New Monitoring Objectives?

- Percent cover of woody species < 25%.
- Percent cover of non-natives grasses and forbs < 25%.
- Percent cover of native grasses and forbs >75%.

Figure 10

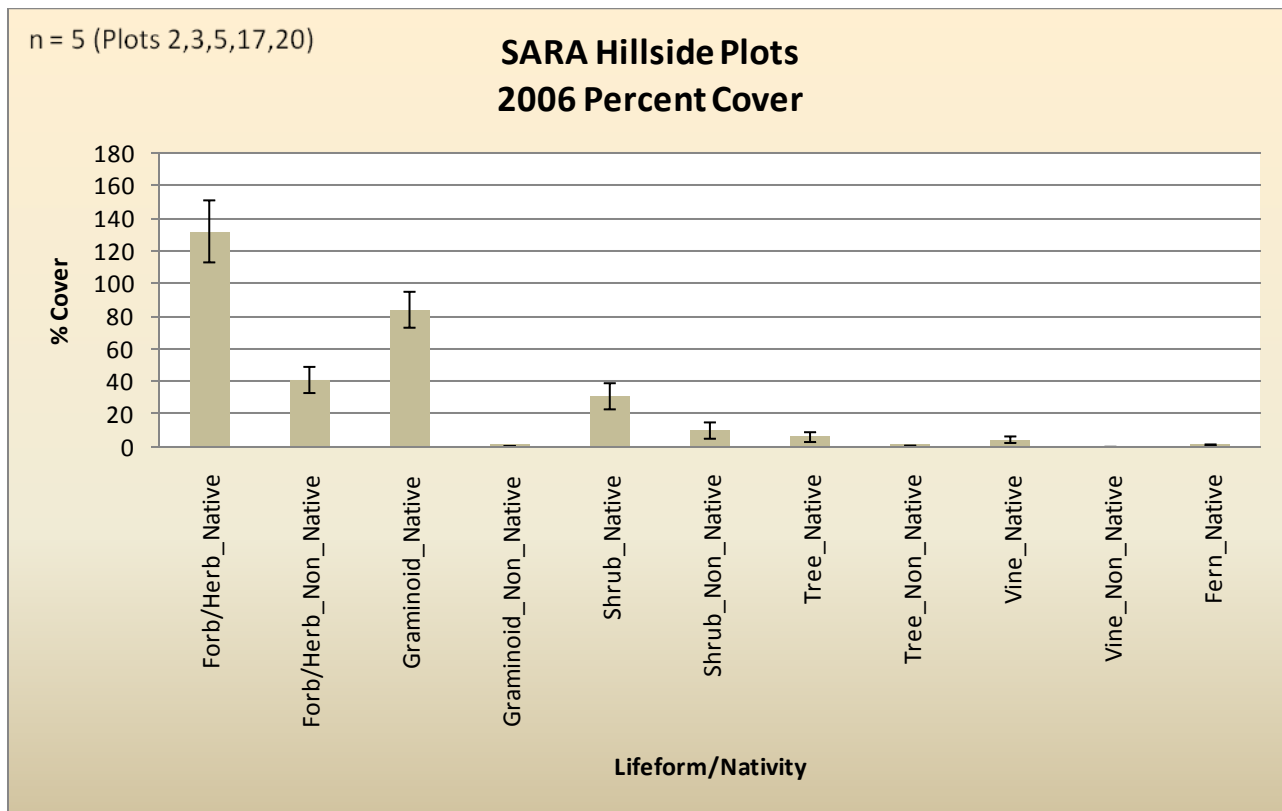
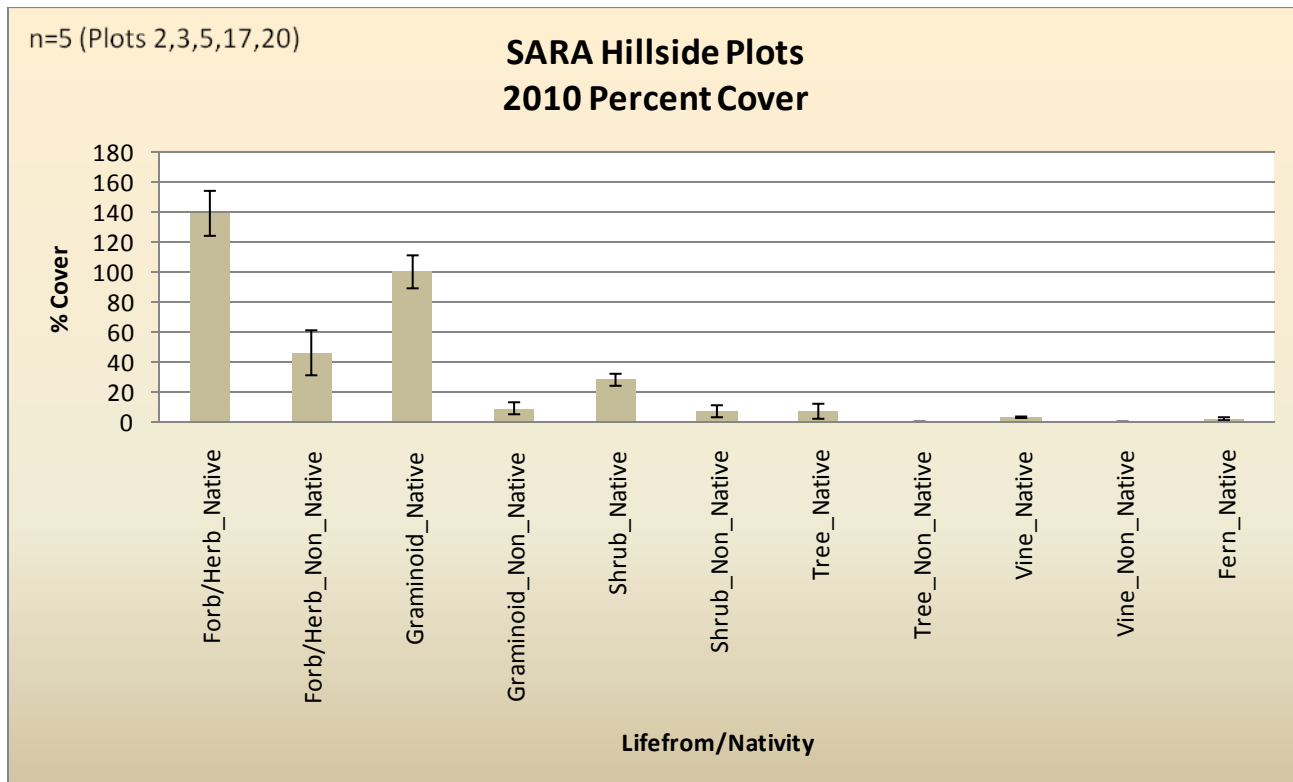


Figure 11



Monitoring Unit		Management Objective (80% C.I.) <i>a .2</i>	Monitoring Results	Objectives Achieved?	YR Last Analysis Complete
Saratoga National Historical Park	Mixed Grassland	Percent cover of native grasses and herbs >75%.	2006 Native Grass = 84% (± 11) 2010 Native Grass = 100% (± 11)	YES	2010
			2006 Native Herb = 132% (± 19) 2010 Native Herb = 139% (± 15)	YES	
	Hillside Plots n=5 (Plots 2,3,15,17,20)	Percent cover of woody species < 25%.	2006 Native Shrub = 31% (± 8) 2010 Native Shrub = 28% (± 4)	NO	2010
			2006 Non Native Shrub = 10% (± 5) 2010 Non Native Shrub = 7% (± 4)	YES	
		Percent cover of non-natives grasses and forbs < 25%.	2006 Non-native Herbs = 41% (± 8) 2010 Non-native Herbs = 46% (± 15)	NO	2010
			2006 Non-native Grass = .4% ($\pm .2$) 2010 Non-native Grass = 9% (± 4)	YES	

Discussion

Native grass and herb cover is excellent with Native Herb 139% (± 15) and Native Grass 100% (± 11) (Figure 11) respectively. Percent cover of shrubs has remained the same or decreased slightly. The current percent cover is still above the desired threshold of < 25%, but it is getting closer. Recent literature supports burning during the late summer to achieve a higher mortality of woody species in fields. Cover of non native grass is still very low at 9% (± 4) (Figure 11) in 2010. However, non-native herbs are above the desired threshold of <25% with 41% (± 8) (Figure 11) in 2010. Plots 2 and 3 at Stop 10 have high concentrations of spotted knapweed which influence the high amounts of cover.

Figure 12

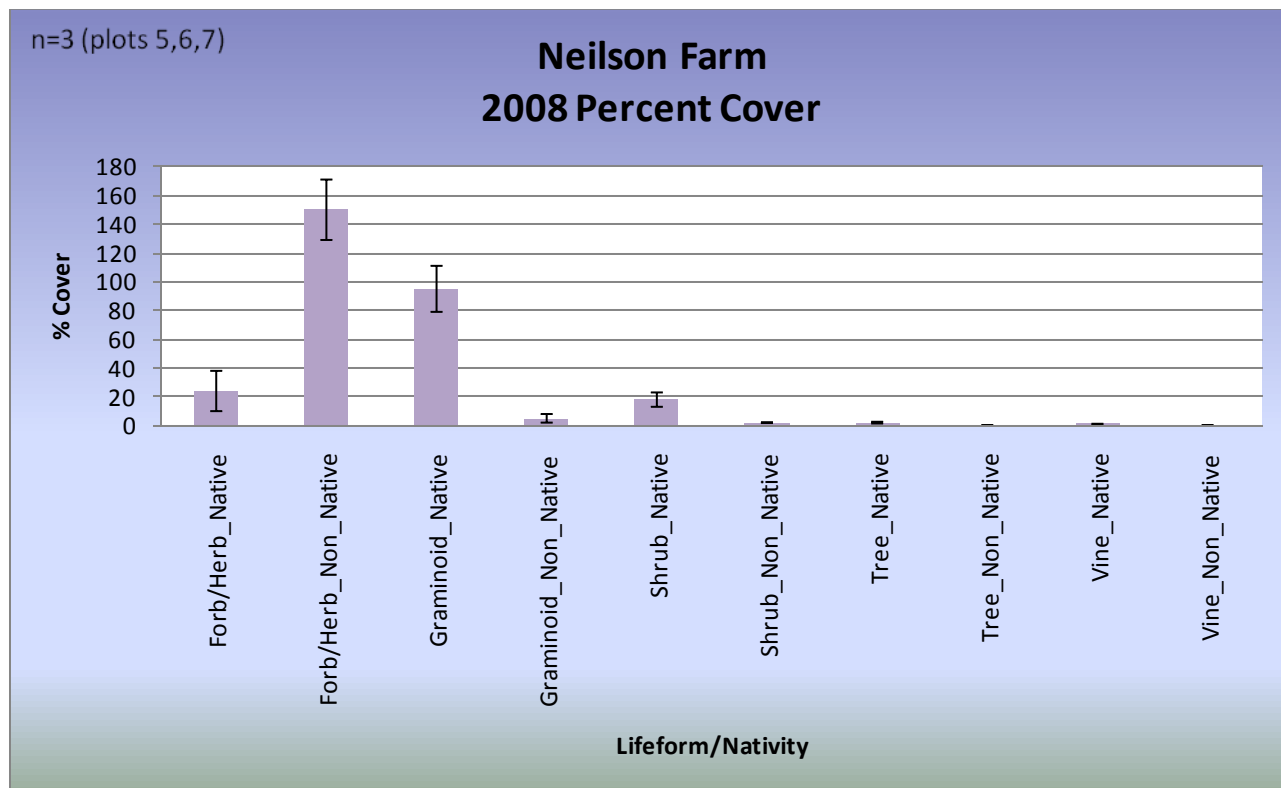
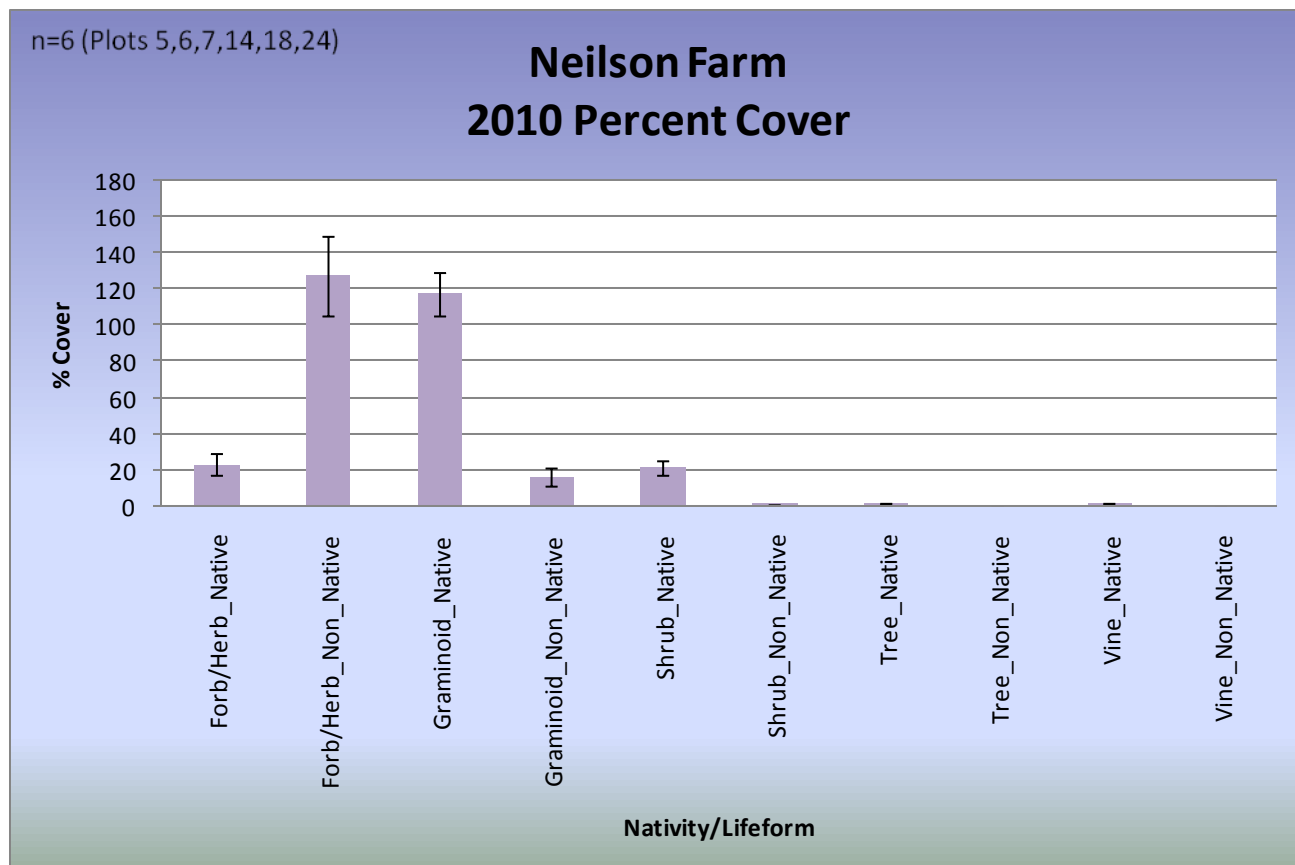


Figure 13



Monitoring Unit		Management Objective (80% C.I.) <i>a .2</i>	Monitoring Results	Objectives Achieved?	YR Last Analysis Complete
Saratoga National Historical Park	Mixed Grassland Neilson Farm 2008 n=3 (Plots 5,6,7) 2010 n=6 (Plots 5,6,7,14,18,24)	Percent cover of native grasses and herbs >75%.	2008 Native Grass = 95% (± 16) 2010 Native Grass = 117% (± 12) 2008 Native Herb = 24% (± 14) 2010 Native Herb = 23% (± 6)	YES NO	2010
		Percent cover of woody species < 25%.	2008 Native Shrub = 18% (± 5) 2010 Native Shrub = 21% (± 4) 2008 Non Native Shrub = 2% ($\pm .3$) 2010 Non Native Shrub = .5% ($\pm .2$)	YES YES	2010
		Percent cover of non-natives grasses and forbs < 25%.	2008 Non-native Herbs = 150% (± 21) 2010 Non-native Herbs = 127% (± 22) 2008 Non-native Grass = 5% (± 3) 2010 Non-native Grass = 16% (± 5)	NO YES	2010

Discussion

Native grass cover is excellent with Native Grass at 117% (± 12) (Figure 12). In contrast, native herbaceous cover is abysmal with 23% (± 6) (Figure 12) in 2010. This low native herb cover is likely the result of an extremely high percentage of non native herbs 127% (± 22) (Figure 12), mostly the invasive exotic herb spotted knapweed. Non native grass cover still remains below the <25% threshold at 16% (± 5) (Figure 12). Native and Non native shrub cover were below the <25% threshold with 21% (± 4) and .5% ($\pm .2$) (Figure 12) respectively.

Figure 14

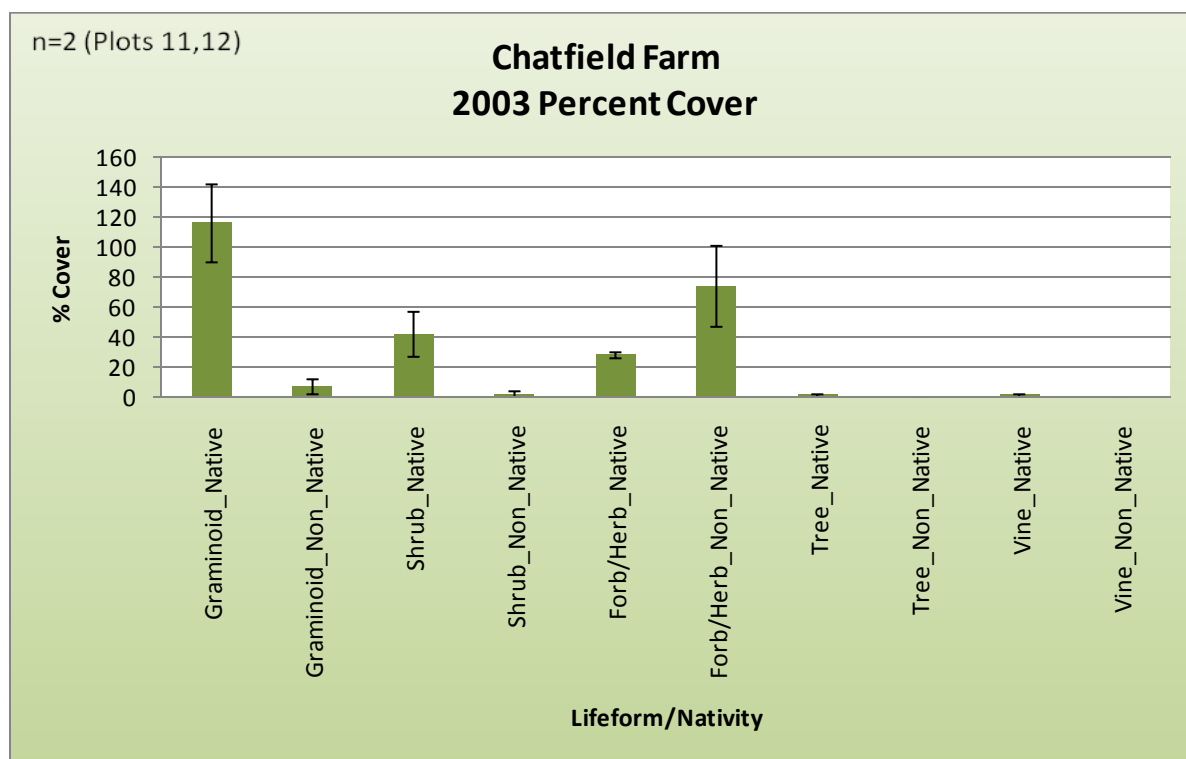
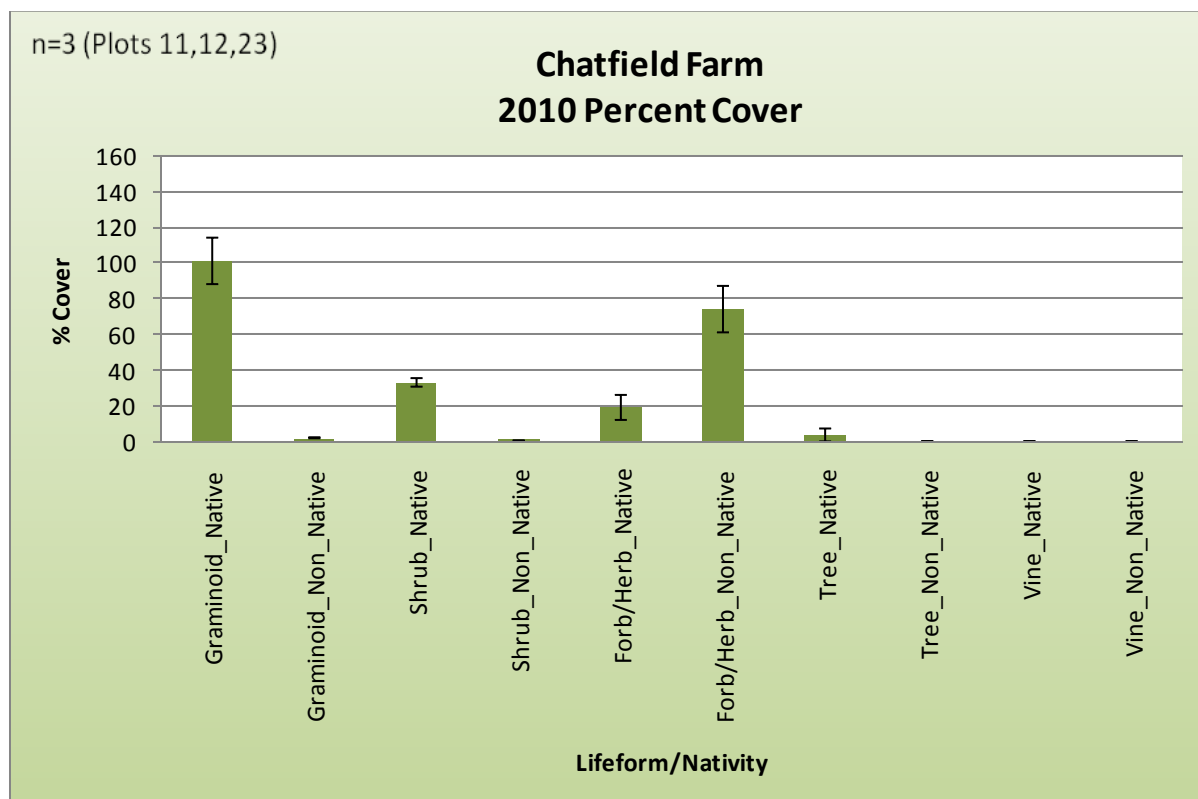


Figure 15



Monitoring Unit		Management Objective (80% C.I.) $\alpha .2$	Monitoring Results	Objectives Achieved?	YR Last Analysis Complete
Saratoga National Historical Park	Mixed Grassland	Percent cover of native grasses and herbs >75%.	2003 Native Grass = 116% (± 26) 2010 Native Grass = 101% (± 13) 2003 Native Herb = 28% (± 2) 2010 Native Herb = 19% (± 7)	YES NO	2010
	Chatfield Farm				
	2003 n=2 (Plots 11,12)	Percent cover of woody species < 25%.	2003 Native Shrub = 42% (± 15) 2010 Native Shrub = 33% (± 2) 2003 Non Native Shrub = 2% ($\pm .3$) 2010 Non Native Shrub = .3% ($\pm .3$)	NO YES	2010
	2010 n=3 (Plots 11,12,23)	Percent cover of non-natives grasses and forbs < 25%.	2003 Non-native Herbs = 74% (± 27) 2010 Non-native Herbs = 74% (± 13) 2003 Non-native Grass = 7% (± 5) 2010 Non-native Grass = 2% ($\pm .3$)	NO YES	2010

Discussion

Native grass cover remains high with 101% (± 13) and non native grass is low with 2% ($\pm .3$) (Figure 15) in 2010. Similar to the Nielson Farm area, non native herbaceous plants remain high with 74% (± 13) (Figure 15) measured in 2010. This area appears to have less knapweed then the Neilson Farm, however, native herbs are still outnumbered almost 3:1 by non native herbs. In 2010, native herbs were measured at 19% (± 7) (Figure 15). Woody vegetation remains above the 25% threshold in 2010 (33% (± 2) (Figure 15), however there has been approximately a 10% decrease since the “preburn” measure in 2003 (42% (± 15) (Figure 14), suggesting the possibility that summer burn treatments may be having a positive effect in reducing shrub cover.

Assateague Island National Seashore (ASIS) 2010 Fire Effects Annual Report

Assateague Island is a 37-mile long barrier island located off the eastern coast of Maryland and Virginia. It is best known for its herds of feral horses, pristine beaches, and the Assateague Lighthouse. Assateague became a National Park in 1965 and together with the U.S. Fish & Wildlife Service Refuge and State Park, the land and water boundaries of Assateague Island total over 48,000 acres in Maryland and Virginia. Assateague Island National Seashore (ASIS) was established for the purpose of protecting Assateague Island in the states of Virginia and Maryland. Assateague is administered to provide recreational use and enjoyment consistent with the perpetuation and maintenance of the seashores natural environment.

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. *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. Common reed is a serious threat to the rare and fragile habitat ASIS was established to protect.

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. In 2010, an additional 260 acres were burned. The Northeast Region Fire Effects monitoring crew assisted the natural resource staff at Assateague Island National Seashore in monitoring the results of these spray and burn treatments with a newly designed monitoring scheme in 2010. The monitoring design and results of this study were prepared by the parks new ecologist Helen Violi.

2010 Results (prepared by park Ecologist Helen Violi)

The native coastal communities of Assateague Island National Seashore (ASIS) are threatened by the rapid expansion of *Phragmites australis* (common reed) an aggressive non-native, invasive plant species. Assateague Island contains the only natural barrier island habitats left in the state of Maryland and at the mid-Atlantic regional scale represents the largest contiguous expanse of native coastal communities that still collectively function as an undisturbed, intact barrier island ecosystem. Given the comparative rarity of undisturbed coastal areas present elsewhere throughout the region and the conservation mandate expressed by Congress in ASIS' founding legislation, the park has undertaken a large scale project to document, treat and restore native coastal communities to areas currently infested with *P. australis*.

For large, monotypic stands of *Phragmites* on ASIS, aerially herbicide spraying and burning were deemed necessary to significantly reduce *Phragmites* cover and to promote regeneration of native vegetation. Analysis of spatial data indicates that aerially spraying and burning reduced the infested area by ~60%. One year post-treatment significant reductions in remaining *Phragmites* infestations density (measured as percent cover) were also detected. However, two-years post-treatment, treated areas are becoming re-infested at rates between 19-24% per year. In these patches cover doubled or tripled in most study plots between 2009 and 2010. Monitoring has revealed that treated areas, perhaps in response to disturbance, are also becoming invaded by new populations of *Phragmites* as well as other non-native plant species. Overall remaining *Phragmites* populations (in treated and untreated areas) are

mostly smaller, more numerous and more sparsely distributed across the landscape. For instance, between 2008 and 2010, the number of infestations in a large survey area climbed from 119 to 379 but the estimated acreage dropped from 533 to 123.

Plots were established in either burned, sprayed and burned or “control” areas post-treatment. Non-target effects associated with spraying and burning may have been severe per woody plant mortality data. Estimates of woody plant mortality are significantly higher in areas that have been aerially sprayed with herbicide and burned (ANOVA: $F_{2,35} = 3.41$, $P < 0.0456$). An estimated ~40% of mature woody plants are dead in both burned, and burned and sprayed areas, compared to ~17% in adjacent untreated areas (Fig. 1a). Mean dead woody plant cover is ~91% higher in these treated areas than in untreated areas.

Analysis of plant community data was performed by dummy coding treatments. Contrasts were between burned and unburned areas or sprayed and unsprayed areas (no areas were only sprayed). Species richness was significantly higher in burned and sprayed areas; although, overall diversity was highest in control areas (Fig. 1; b, c and d). Cover by undesirable and non-native species is significantly higher in burned and sprayed areas (Fig. 1 e-h). Specifically, cover non-native grasses (excluding Phragmites), non-native forbs and sedges are all significantly higher in burned and sprayed areas.

Results from ASIS are similar to those found for other areas; typically, such large well-established stands need to be treated every 3-5 years to maintain control. Given current rates of Phragmites spread, further control efforts are necessary to prevent dense stands from becoming re-established in treated areas. Ground-based re-treatment of these areas should result in Phragmites control and not result in significant damage to native vegetation.

Fig. 1. a. (ANOVA: $F_{2,35} = 3.41$, $P < 0.0456$).;b. ($t = 2.44$, $P < 0.020$).;c. (no statistical analyses performed on indices) ;d. ($t = 2.71$, $P < 0.011$).;e. ($t = 3.40$, $P < 0.002$).;f. ($t = 2.54$, $P < 0.016$).;g ($t = 2.34$, $P < 0.026$) and h ($t = 2.08$, $P < 0.045$).

