



**National Park Service
Everglades National Park
Canaveral National Seashore
Fire Ecology Annual Report
Calendar Year 2013**

A. Summary

The Everglades fire effects program had a successful year in which the monitoring of nearly all scheduled plots was completed; we were unable to monitor 1 coastal prairie plot due to lack of funding for helicopter flight and 2 short hydroperiod prairie plots that were inaccessible due to high water levels. Fire effects staff completed training for personal development and continued to support the compliance needs of the Fire Management Program at Everglades National Park and Canaveral National Seashore. The 2013 field season was completed with a partially staffed crew; and in October, Colleen Holland left to accept a position as lead wildlife technician with the BLM in Coos Bay Oregon.

Throughout the year, fire effects staff continued to monitor plots and refine methodologies in both Everglades National Park and Canaveral National Seashore. Monitoring continued in existing FMH plots, as well as fire and exotic plots. The temporary juvenile pine mortality plots were monitored and removed following the 1 year post read as were the temporary Lygodium plots. Monitoring of the effects of fire on Lygodium is will continue in the existing FMH plots. Due to a lack of prescribed burning in the pine rocklands, 11 of the 12 FMH pine plots monitored this year were in a 10 year post fire status, which is outside of the desired fire return interval of 3-7 years. The information collected from these plots will be valuable for analyzing and refining the desired fire return interval for the pine rockland ecosystem. There were 2 prescribed fires and 5 wildfires in Everglades NP this year, however no fire effects plots were burned in any of these fires.

A fire ecology program review was conducted in 2013 with assistance from the Regional Fire Ecologist Caroline Noble, Regional Fire Planner Liz Struhar and Great Smoky Mountains National Park Fire Ecologist Rob Klein. The Everglades Fire ecology/effects program would like to thank them for their effort and assistance in conducting the program review and providing guidance and recommendations for future refinement of the program.

Late in 2013, the Fire Management program transferred from the Visitor and Resource Protection Division, under the supervision of the Chief Ranger, to the South Florida Natural Resource Center (SFNRC) Division, under the supervision of the deputy director of SFNRC.

Table 1. Fire Effects Plot Workload (2013) and Total Plots Installed

Park	Monitoring Unit	Type of Plot	Pre-burn	Immed. Post	Postburn (3 mo-10 yrs)	Annual Total Visits (2013)**	Total Plots
Everglades	Pine Rockland	FMH Forest plot	0	0	12	12	27
	Short Hydro-period Prairie	FMH grass plot	0	0	11	11	28
	Long Hydro-period Prairie	FMH grass plot	1	0	4	5	17
	Coastal Prairie	FMH grass plot	0	0	5	5	18
	Butterfly Host plant Monitoring	Host-plant monitoring	N/A	0	0	0	4
	Melaleuca Monitoring*	Fire and exotic monitoring	0	0	4	4	23
	Lygodium Monitoring	Fire and exotic monitoring	0	0	6	6	6
	Juvenile Pine Mortality*	Circular tagged seedling plot	0	0	14	14	7
	Phenology Monitoring	Phenology monitoring	N/A	0	0	0	8
	Shrub Monitoring	Tagged individual shrub monitoring plot	0	0	0	0	6
	Insect Monitoring	Insect Monitoring plot	N/A	0	0	0	6
	1970's photo-point relocation plots	Photo Point	N/A	0	0	0	225 (26 relocated)

Canaveral	Slash Pine Flatwoods (<i>Pinus elliottii</i>)	FMH Forest plot	0	0	7	7	8
	Coastal Scrub	Photo Point	0	0	0	0	18
	Coastal Scrub	Photo Point, cover line	4	0	0	4	4
	Scrub Oak	Photo Point, cover line	0	0	9	9	9
Total			5	0	72	77	215

* Pilot sampling plots

**Number of visits to monitoring plots in 2013 (some plots were visited more than once)

In 2013, Everglades Fire Effects completed 40 visits to FMH plots. Along with the FMH plots monitored, the crew completed 10 visits to the exotics monitoring plots and monitored 7 juvenile pine mortality plots in the Pine Rocklands. There is no plan to resume post fire recovery monitoring of *Croton linearis* until reintroduction of prescribed fire in the pine rocklands occurs, which is expected in late 2014 or 2015 (figures 9-11). At Canaveral National Seashore, 7 pine plots and 9 scrub oak plots were monitored. In January, 4 new plots were installed in the Apollo coastal scrub units, however the units containing plots have yet to be treated with prescribed fire.

Table 2. Fire Ecology Staffing 2013

Ecologist and Monitors	Starting Date	Ending Date	# of Pay Periods	READ	Training and Development
Maya Tupaj	1/1/13	12/31/13	26	No	RT-130, Cape Sable Seaside Sparrow Symposium, Contracting Officer training, Resources and Visitor Protection Leadership 360 review leadership development workshop
Aerin Land	1/1/13	12/31/13	26	No	RT-130, Planning Section Chief (ENP Hurricane Team, Bridge Opening Ceremony, and Stranded Whale Incident), water ditching, worked on EVER fire crews during severity, Imperiled Butterfly Working Group meeting, assisted with teaching S-130/190, assisted with the PARK Teachers Grant, RADO wildfire assignment
Colleen Holland	01/01/12	10/1/13	20	No	RT-130, RT-212, ATV operator refresher, water ditching assisted with the PARK Teachers Grant program, presented career day for Girl Scouts of America worked on EVER fire crews during severity, Resource Unit Leader-Park Hurricane Team assisted with teaching S-130/190
William Graham	01/01/13 - 05/31/13	10/28/13 - 12/31/13	17	No	ATV operator refresher, RT-130, worked on EVER fire crews during severity, assisted Dispatch during severity, Biscayne National Park Science Symposium, Imperiled Butterfly Working Group, Operational Leadership

Table 3. Management Objectives and Monitoring Results

Monitoring Unit	Management Objective (Restoration)	Monitoring Results (XX% confidence interval)	Objective Achieved?	Year Last Analysis Completed (Range of years included in analysis)
Slash Pine Savanna	<u>Canaveral-</u> Limit mortality of <i>Pinus elliottii</i> overstory trees (>15cm BDH) to less than 30% as measured two years post burn.	Overstory pine mortality = 33% Figure: 1	No	2013 (2003-2012)
	Promote 20% recruitment of seedling and pole sized PIEL <15cm in DBH five years post burn.	Recruitment: -70% Seedlings: -68% Poles: -84% As of 2 years post following the second fire: Recruitment: -71% Seedling: -71% Poles: -95% Figure: 2 and 3	Combined: No Seedlings: No Poles: No Combined: No Seedlings: No Poles: No	2013 (2003-2010) 2013 (2003-2012)
	Increase cover of bare ground/open space to 25% bare ground / 75% vegetation cover 5 years post burn.	Open space = 8% Veg. cover = 92% As of 2 years post following the second fire: Open space = 11% Veg. cover = 89% Figure 4	No	2011 (2010) 2013 (2012)
Scrub Oak	Reduce cover of saw palmetto by 50-80% immediately post burn.	Saw palmetto cover reduction =81% Figure 5	Yes	2013 (2010-2012)

	Reduce cover of live oak species by 40-60% immediately post burn.	Live oak cover reduction=82% Figure 5	No	2013 (2010-2012)
Slash Pine Savanna	Everglades- To maintain fire frequency return interval 1-5 yrs while maintaining up to 33% of the pinelands in a three year rough condition.	11% of the pinelands are within a 1-5 year FRI <1% of the pinelands are in a 3 year rough condition Figure 8	No	2014 (2004-2013)
Short Hydroperiod Prairie	Topkill >50% of encroaching woody species immediately post-burn	Based on visual analysis of photomonitoring data 99% of shrubs were topkilled immediately post burn	Yes	2010 (2003-2010) No plots were in immediate post burn status in 2013
	Reduce fine fuels >70% immediately post-burn	Did not complete cover transects	No data * Photomonitoring data not analyzed	
Coastal Prairie	Treat up to 100% of Old World climbing fern (<i>Lygodium microphyllum</i>) and/or Brazilian pepper (<i>Schinus terebinthifolius</i>) populations that have been identified by the Exotic Plant Management staff for fire treatment annually	<i>Lygodium microphyllum</i> : 7% exotic plant populations were treated <i>Schinus terebinthifolius</i> : No populations were identified for treatment	Yes	2014 (2013)

Monitoring Unit	Management Objective (Restoration)	Monitoring Results (XX% confidence interval)	Objective Achieved?	Year Last Analysis Completed (Range of years included in analysis)
Long Hydroperiod Prairie	Topkill >50% of encroaching woody species immediately post-burn	Based on visual analysis of photomonitoring data 51% of shrubs were topkilled immediately post burn	Yes	2010 (2001-2007) No plots were in immediate post burn status in 2013
	Reduce fine fuels >70% immediately post-burn	73% reduction in fine fuel biomass immediately post burn Figure 7	Yes	2013 (2012) No plots were in immediate post burn status in 2013

B. Fire ecologist accomplishments and areas of focus

In 2013 progress continued in the development of the Fire Management Plan Environmental Assessment draft. Significant revisions were made to chapter 3 of the EA and the special status species section of the EA was completed and will be used in formal section 7 consultation with the U.S. Fish and Wildlife Service. A cultural resource assessment strategy was developed to assist the park in completing section 106 compliance under the programmatic agreement. NEPA and Endangered Species compliance work is ongoing for annual project specific proposals as well. Maya Tupaj participated in several planning meetings and worked on the Environmental Assessment NEPA analysis and Endangered Species Act consultation with the USFWS. A categorical exclusion for NEPA analysis and consultation with the US Fish and Wildlife Service (USFWS) and the State Historic Presentation Office (SHPO) was completed for the 2013 prescribed fire projects NEPA, section 7 and section 106 compliance for WUI treatments and Hazardous fuel/exotic plant reduction projects.

Maya Tupaj collaborated with Inventory and Monitoring for the Natural Resource Conditions assessment, providing data and reviewing summaries related to fire management within the Park. Support and collaboration continued with Florida International University on the research regarding fire and lygodium and data was provided for a new study on fire effects on woody plants in the Coastal Prairies.

Maya presented a fire effects summary to South Florida Natural Resource Center (SFNRC) Staff as well as a poster at the annual SFNRC meeting.

Maya Tupaj continued to serve on several working groups and committees including the Everglades Wilderness Committee, and Cape Sable Seaside Sparrow Working Group. Maya Tupaj participated in a south Florida Department of Interior fire management collaboration meeting to discuss sharing DOI fire resources within south Florida. Education and outreach activities included revising and implementing an inquiry based fire ecology learning program with Everglades Environmental Education and Miami-Dade College, as well as working with a local elementary teacher with the Teacher Ranger Teacher program, introducing her to fire effects monitoring and fire ecology concepts.

Table 4. Fire Ecologist Accomplishments/Focus Areas

Category	Percent Time	Accomplishments and/or areas of activities
Planning	40%	Annual NEPA compliance, Sec 7 endangered species consultation, Sec 106 cultural resources consultation, Cape Sable Seaside Sparrow Fire Management Strategy, FMP EA Chapter 3 revision, Fire Management Plan Endangered Species informal consultation for Fire Management Plan Biological Assessment, Cultural resource inventory and assessment strategy for National Historic Preservation Act Fire Management Plan planning and compliance.
Presentations	<5%	Fire effects data summary presentation
NPS Meetings/ task groups	10%	Work with SFNRC, Wilderness Committee, Cape Sable Seaside Sparrow Working Group, DOI fire collaboration
Interagency work	10%	Work with SFNRC, USFWS
Fire Assignments	0%	
Research	5%	Support and consultation for research in Everglades National Park conducted by I&M, USGS, FIU and UF researchers and students, working with SFNRC to develop T&E species and exotics monitoring protocols, background research for planning and consultation
Data Management	5%	Data entry, quality checking and analysis
Outreach, education programs	5%	Conduct fire ecology based inquiry learning project with Environmental education department, worked with Teacher Ranger Teacher
Monitoring Field Work	5%	Assisted crew in monitoring fire effects plots in EVER and in CANA
Supervision/Admin	20%	Supervised fire effects monitors, completed EPAP evaluations for fire effects crew
Training	<5%	RT-130
Miscellaneous	5%	Staffing, assistance with other Fire Management projects, Wilderness committee, burn plan and project proposal reviews

C. Fire effects crew accomplishments and areas of focus

In 2013, the Everglades fire effects crew completed a total of 77 plot reads between Everglades NP and Canaveral NS. All data was entered into FFI and quality checked shortly after collection. The temporary juvenile pine mortality plots were monitored and then removed following the 1 year post read. The temporary *Lygodium* plots were also removed at the conclusion of the 2 year post burn read, but monitoring of the effects of fire on *Lygodium* is still ongoing in the existing FMH plots. Nearly all of the FMH pine plots monitored were in a 10 year post fire status due to lack of prescribed burning in the pine rocklands. The information collected this year will be valuable in analyzing and refining the desired fire return interval for the pine rockland ecosystem.

Fire effects monitoring data was used to determine unit treatment priorities and to schedule treatment in the WUI and Hazardous fuel reduction units in annual project specific proposals and compliance.

Collaboration efforts:

Everglades fire ecology and fire effects staff continued to assist and collaborate with other departments in ENP, as well as with outside organizations. This year the crew continued to work closely with the ENP *Lygodium* Team, consisting of exotic vegetation management and fire management staff at Everglades NP. This is a cooperative effort to coordinate resources, monitor and treat the exotic climbing fern *Lygodium microphyllum*. The fire effects crew assisted with teaching portions of S-130/190 training and with the annual fire refresher. The crew continued to serve on several committees and working groups including the Everglades Wilderness Committee, the Imperiled Butterfly Working Group, Aerin Land lead the organization and planning of the 2013 Imperiled Butterfly Working Group Meeting.. Colleen Holland assisted SFNRC and the USGS as the NPS liaison for a pilot invasive Tegu lizard monitoring project. Fire effects staff assisted with exotic plant management projects in the park as well as exotic plant fuel reduction projects..

Outreach:

Colleen Holland spoke about wildfire and careers in fire ecology and management to a group of Girl Scouts visiting the Park. Maya, Colleen and Aerin continued to work with the PARK Teachers program and with a local elementary teacher from the Teacher Ranger Teacher program, introducing her to fire effects monitoring and fire ecology concepts. The crew also demonstrated monitoring protocols to visiting graduate students from Germany.

Presentations:

Colleen presented a poster on fire effects monitoring during the first SFNRC All Hands meeting that incorporated the Fire and Aviation Management Division.

Mechanical fuels treatments:

The fire effects crew continued to assist with hazardous fuel/exotic plant reduction and pre-burn prep treatment projects by removing exotic *Melaleuca quinquenervia* in the East Everglades burn units.

Fire Management:

The fire ecology and fire effects staff were involved in wildland and prescribed fire activities in 2013. The staff worked on 1 prescribed fire and 1 wildfire within ENP and went on 1 out of park assignments for wildfire and hurricane response details. The crew assisted with staffing engines, helicopter and fire dispatch locally. Aerin served as Planning Section Chief and Colleen served as Resource Unit Leader on the Everglades Hurricane Team. The crew also assisted the Everglades Fire program with staffing of dispatch, engines and the helicopter during severity. Aerin opened her DOCL and SCKN taskbooks.

Table 5. Fire Effects Crew Accomplishments/Focus Areas

Category	Percent Time	Notes
FMH plots	20%	12 PIEL, 11 MUFI, 4 COPR, 5 CLJA, 20 CANA, prep and new plot installs
WUI plots	N/A	
CBI plots	N/A	
Other plot work	20%	Exotic <i>Melaleuca</i> (<i>Melaleuca quinquenervia</i>), Exotic <i>Lygodium</i> , Juvenile pine survival
Fire Assignments\Details	1%	Wildfire assignment: Colville Indian Reservation in Nespelum Washington, Grants Pass Oregon Division of Forestry Jurisdiction, John Day Oregon- Malheur National Forest
Fuels Projects	<5%	Assisted the fire/fuels crew with exotics treatment, soil moisture monitoring, live fuel moisture sampling, historic plot relocations.
Prescribed Fire Projects	<5%	1 Everglades RX assists,
Data entry	15%	FMH Plots, EVER, CANA, MEQU, LYMI, Juvenile pines, Plot folder management, Photo management
Data analysis	5%	Juvenile pine mortality, <i>Lygodium</i> fire effects
Supervision/Admin	<5%	Travel, payroll and purchasing, paperwork, training personnel assisting on projects
Training	<5%	ATV, CPR, Communication training, annual refreshers, water ditching
Presentations/Conferences	<5%	Imperiled Butterfly Working Group, Biscayne National Park Science Symposium, South Florida Natural Resource Center annual meeting
Public Outreach	<5%	PARK Teachers grant program, Girl scouts of America Career Day
NPS meetings/task groups	<5%	ENP Hurricane Incident Management Team Meetings, <i>Lygodium</i> team meetings, Fire Program meetings, PARK Teachers Workshop
Interagency Meetings	<5%	Imperiled Butterfly Working Group, NPS/U.S. FWS informal consultation meetings,
Miscellaneous	20%	staffing dispatch, fire engines and helitack, ENP incident management, expanded project development,

		incorporating exotics monitoring, <i>Croton linearis</i> mapping, assist with exotics treatment in park
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D. Additional Program Information

Table 6. Planning - 2013

Park	Does Park have written DFCs? (yes or no)	Date Park-level Monitoring Plan completed (or revised)	Total # of Project- or Community-level Monitoring Plans (not just 2013)	Assisted with how many BAER plans in 2013?
Everglades National Park	no	2007	0	0
Canaveral National Seashore	no	-	0	0

Table 7. Monitoring - 2013

Park	% 2013 Data Entered	% 2013 Data Quality Checked	# Prescribed Fires Monitored*	# Non-fire Fuels Treatments Monitored*	# Wildfires Monitored*	# BAER Treatments Monitored*
Everglades National Park	100%	100%	0	0	0	0
Canaveral National Seashore	100%	100%	0	0	0	0

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

Table 8. Communicating Results - 2013

Park	# of Project Monitoring Reports completed in 2013	# of Annual meeting(s) with Park staff	# of Formal presentations of results	Do you use Minitab?*

Everglades National Park	2	2	1	No
Canaveral National Seashore	1	0	0	No

* This information will help to assess Minitab multi-user license needs.

Table 9. Research - 2013

Park	Are research needs identified in FMP or Monitoring Plan? (yes or no)	# of Proposals Submitted in 2013	# of Proposals Funded in 2013	# of Research Projects Supported in 2013*	Additional Comments
Everglades National Park	yes	0	0	2	
Canaveral National Seashore	yes	0	0	0	

*Number of funded research projects, new or ongoing, supported by the fire ecology program including logistical info or support, staffing, etc.

Reserve Fund Research: If your park(s) received Reserve Fund Research funding or completed a previously-funded project in the last year, please provide the following:

- Current project status (short description)
- Expected project completion date
- List of deliverables

Also, if a Reserve Fund research project is completed, please remember to submit an article to the Rx Effects newsletter by the last Friday in February (see <http://www.nps.gov/fire/wildland-fire/what-we-do/science-ecology-and-research/rx-effects-newsletter.cfm> for submission guidelines).

E. 2014 Direction

An approved FMP is not expected until mid-late 2014 or 2015. We expect to continue operating an annual prescribed fire program under documented categorical exclusions until the FMP is approved. With an approved FMP the prescribed fire program will begin treatment of many areas of the Park where prescribed fire treatments are currently restricted due to NEPA requirements. The fire effects program plans to be involved in the implementation of prescribed fire treatments as well as post burn monitoring in several areas that have not received fire and are currently in condition class 2 or 3. This includes a majority of the pine rockland ecosystem.

The fire effects program will be assessing objectives and monitoring methods within the following year. The information gained from the 2013 fire ecology program review and assessments from local ecologists will be used to refine the program. Data collected in long unburned pine rocklands will be valuable in refining objectives and the desired fire return interval for the pine rockland ecosystem.

Additional projects are expected to be implemented in 2014 for fire and exotics monitoring including assessing the efficacy of fire as a tool in managing Brazilian pepper invasions in the pine rocklands and expansion of the fire and melaleuca project in the East Everglades Expansion Area.

Following Endangered Species compliance, it is expected that the fire effects program will work with the natural resource staff to assess endangered species monitoring needs regarding fire.

Changes in cultural resource and Wilderness monitoring requirements may be implemented for the Park and the fire effects program will continue to adjust as staffing changes, budget requirements and compliance needs evolve throughout the year.

F. Optional Information

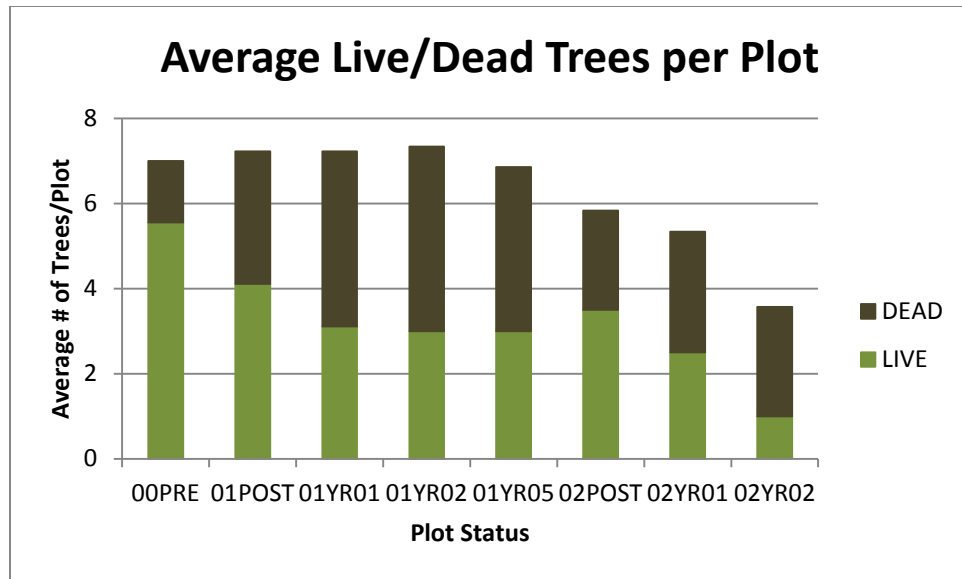


Figure 1: Average *Pinus elliottii* overstory trees per plot in the pine flatwoods of Canaveral National Seashore.

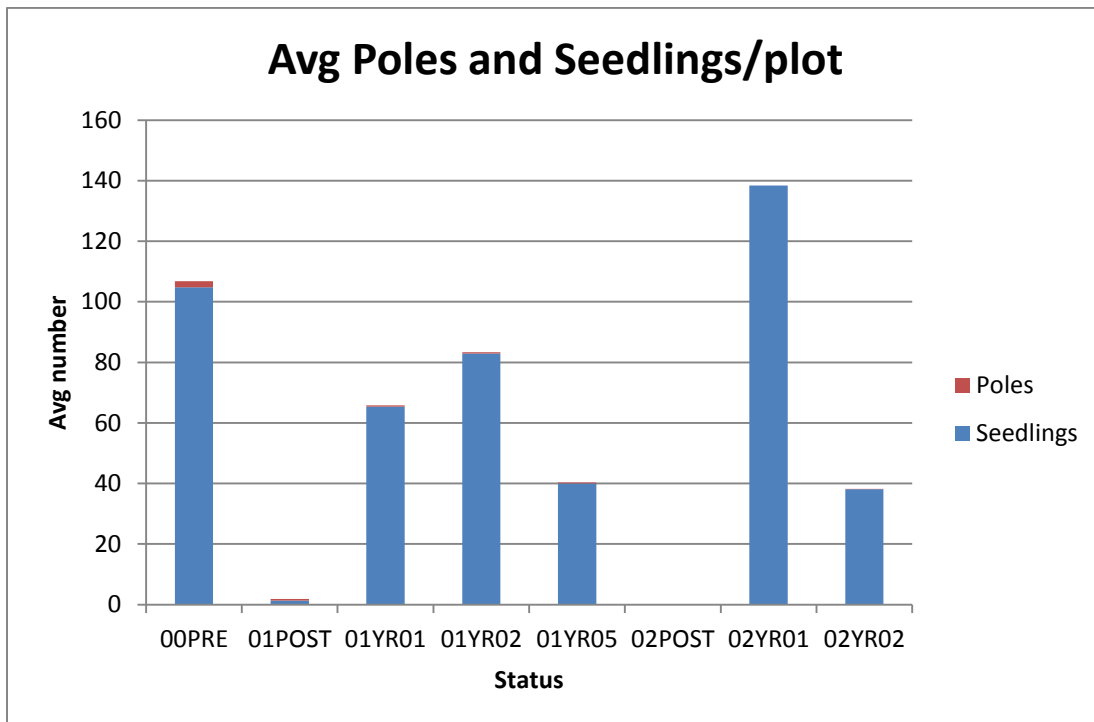


Figure 2: Average *Pinus elliottii* seedling and pole recruitment in the pine flatwoods of Canaveral National Seashore.

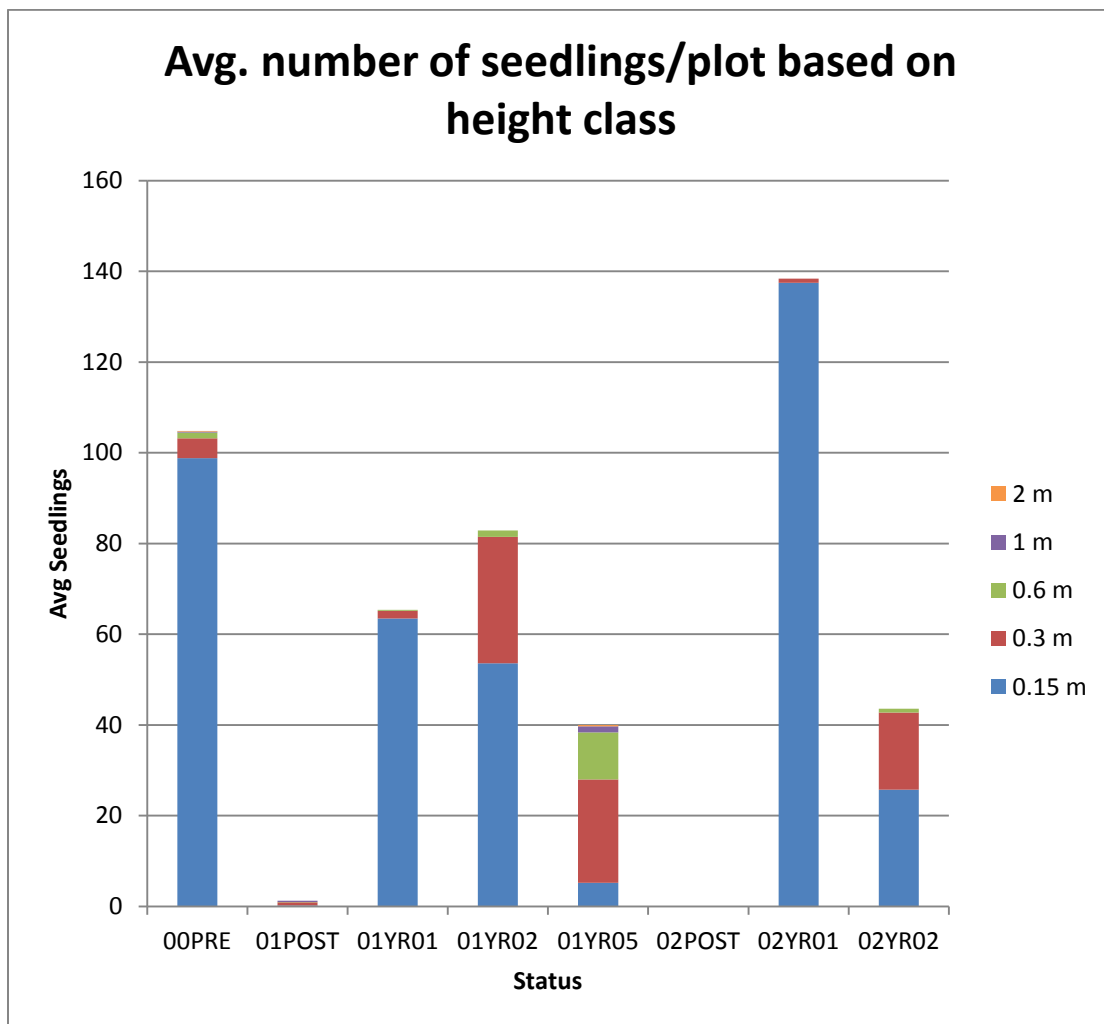


Figure 3: Average *Pinus elliotii* seedlings per plot by height class in the pine flatwoods of Canaveral National Seashore.

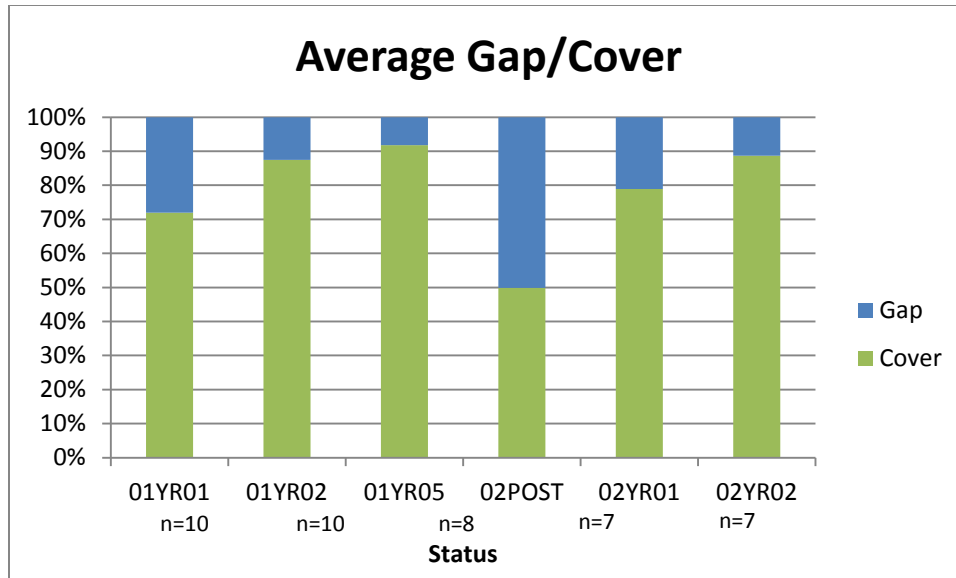


Figure 4: Average understory vegetation cover vs. open space (gap) in the pine flatwoods of Canaveral National Seashore. Open space and vegetation cover are assessed to monitor habitat conditions for the gopher tortoise (*Gopherus polyphemus*), indigo snake (*Drymarchon coraisi couperi*), and scrub jay (*Aphelocoma coerulescens*).

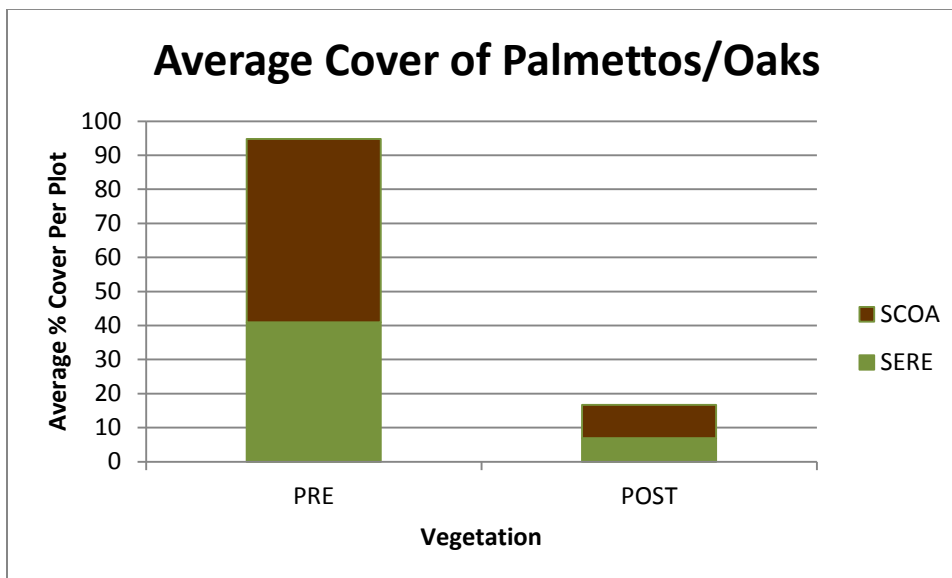


Figure 5: Average cover of oak species and saw palmetto in the Max Hoeck scrub oak habitat of Canaveral National Seashore.

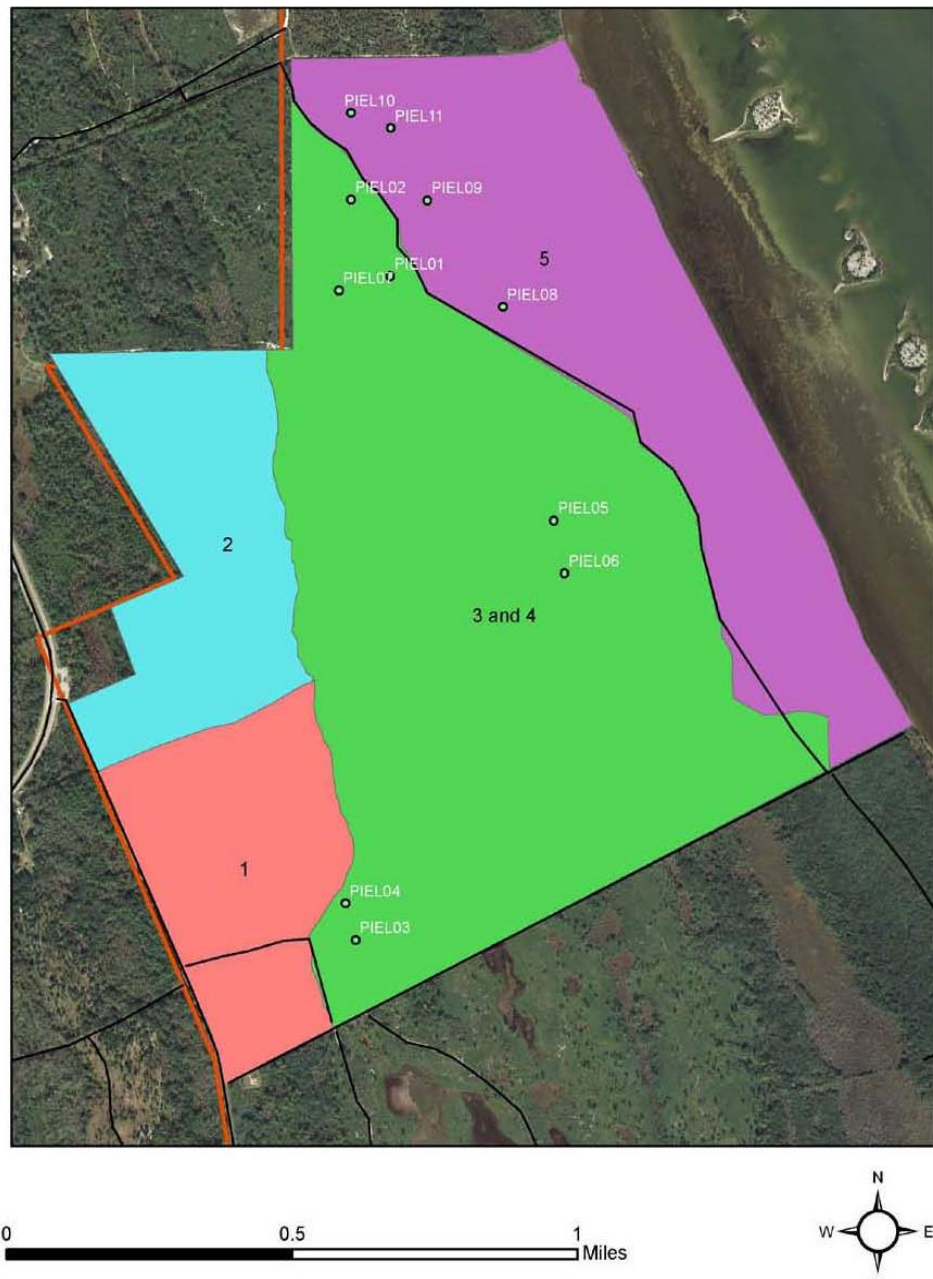


Figure 6. Pine Flatwoods plots located in the Bill's Hill Burn units. Plots PIEL03 and PIEL04 were destroyed when a bulldozer constructed fire line through the middle of the plots to contain a wildfire in July 2012.

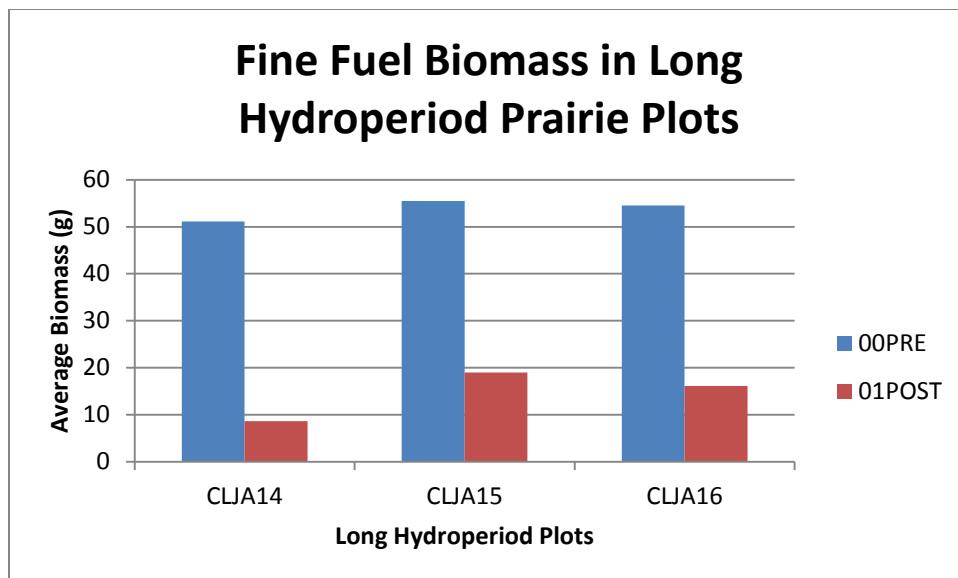


Figure 7: Reduction in fine fuel biomass in the Long Hydroperiod plots located in the River of Grass NE burn unit in Everglades National Park.



Figure 8: Fire Return Interval of Everglades National Park Pine Rocklands.

Appendix A. Juvenile Pine Mortality – Pilot Fire Effects Monitoring

Fire Effects Monitoring – Post Fire Survivorship of Juvenile Slash Pine in Everglades National Park.

Introduction

Many portions of the ENP Pine Rocklands have experienced a dramatic increase in pine seedling regeneration in recent years. For example, in FMH PIEL 01, located in Block J, 122 seedlings achieved pole tree status (dbh > 2.5cm) during a 5 year period from 2007 through 2012; compared with the preceding 6 year period (2001 through 2007) when only 3 seedlings achieved pole tree status. In June 2012, Fire Management decided to investigate the effect of different ignition patterns (i.e. backing fire, strip ignitions, head fire, etc) on dense clumps of juvenile Slash Pine trees. Plots were installed in the Boy Scout Camp and Pine Island burn units, areas that experienced pine regeneration similar to that in PIEL 01, in order to test the hypothesis that in dense stands of juvenile Slash Pine trees, different ignition patterns will result in different mortality rates.

Objective

Evaluate seedling mortality, under 3 different firing applications (head, flanking, backing), up to 1 year post burn.

Methods

Plot Design:

Plots were designed to be similar in size to that of the seedling portion of FMH Pine Plots (250m²). Due to land ownership issues, plots needed to be temporary and relatively unnoticeable.

After considering the above factors, five circular plots (9m radius) were installed within the Boy Scout Camp burn unit and two plots were installed within the Pine Island Blocks O and P burn units. Within each plot, one juvenile pine tree was randomly selected as the plot center. Trees were numbered and tagged at the base to limit the visibility to park visitors. While Plot locations were randomly selected, they had to meet the following criteria: located in areas with dense seedling and pole trees that were also visible from fire breaks so that FEMOs could observe the type of firing technique that impacted each plot.

Plot Protocols:

Within each plot, all living trees with the following characteristics were tagged and mapped.

- taller than 1.37m (DBH height)
- DBH < 8cm
- visible terminal buds (indicating that it is still growing in height)

The height category and live/dead status of the tree was recorded during plot installation, live/dead status is recorded during immediate, 6 mo., and one year post visits. This monitoring schedule should capture any delayed mortality or post fire recovery.

Photos are taken from the four cardinal directions, at a distance of 10m, point towards the center tree. The 2m range pole will be tied to the center tree as a reference feature.

Post burn severity will be completed along two crossed transects (18m from North to South and 18m East to West). Each tagged tree will also be evaluated post burn for percent scorch and char height.

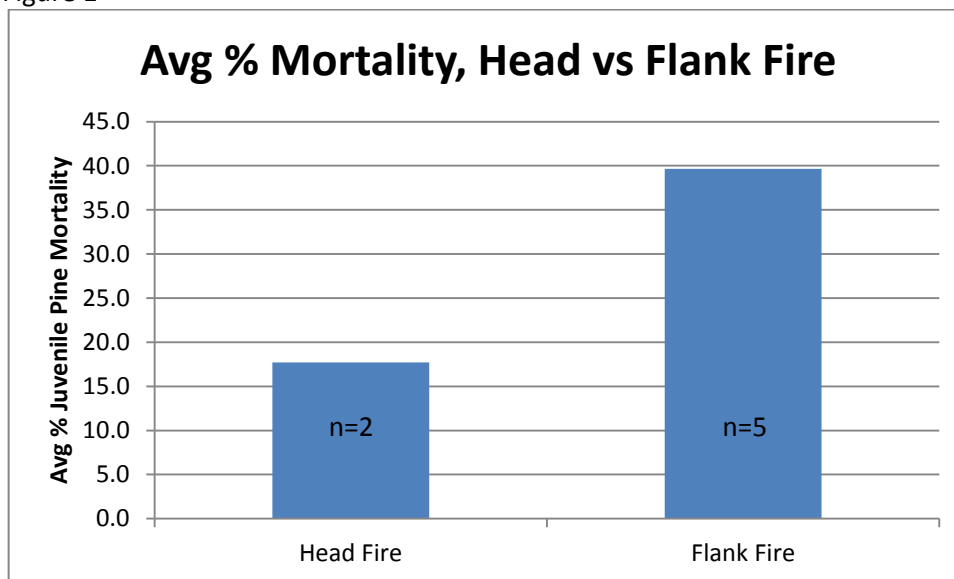
Results

Fire techniques were influenced by field and weather conditions on the days of the prescribed fires, so that sending a backing fire towards the fire effects plots was not possible. Two plots in the Boy Scout Camp (BSC) unit were burned by head fires and 3 plots were burned by flanking fires. In the Pine Island units, one plot was burned in a flanking fire, while the other was burned when 2 flanking fires came together.

Due to safety considerations, FEMOs were unable to directly observe the burning of Plots 5 and 6 in the BSC RX. Although no direct observations were made, it is believed that those plots were impacted by a flanking fire, based on the ignition patterns and observed fire behavior in the general area.

At 1 year post burn, Juvenile pine mortality per plot ranged from 11% to 67%, with the highest mortality occurring when two flanking fires converged within Plot 07. On average, juvenile pine mortality in plots impacted by flanking fires was more than double the mortality in plots burned by head fires (Figure 1)

Figure 1



While some correlation was detected between mortality and juvenile pine density (figure 2.), as well as between mortality and average char height measured post fire (Figure 3.), mortality appears to be most strongly correlated with the average height of the juvenile pines, as measured prior to the implementation of the prescribed fire (Figure 4.).

Figure 2

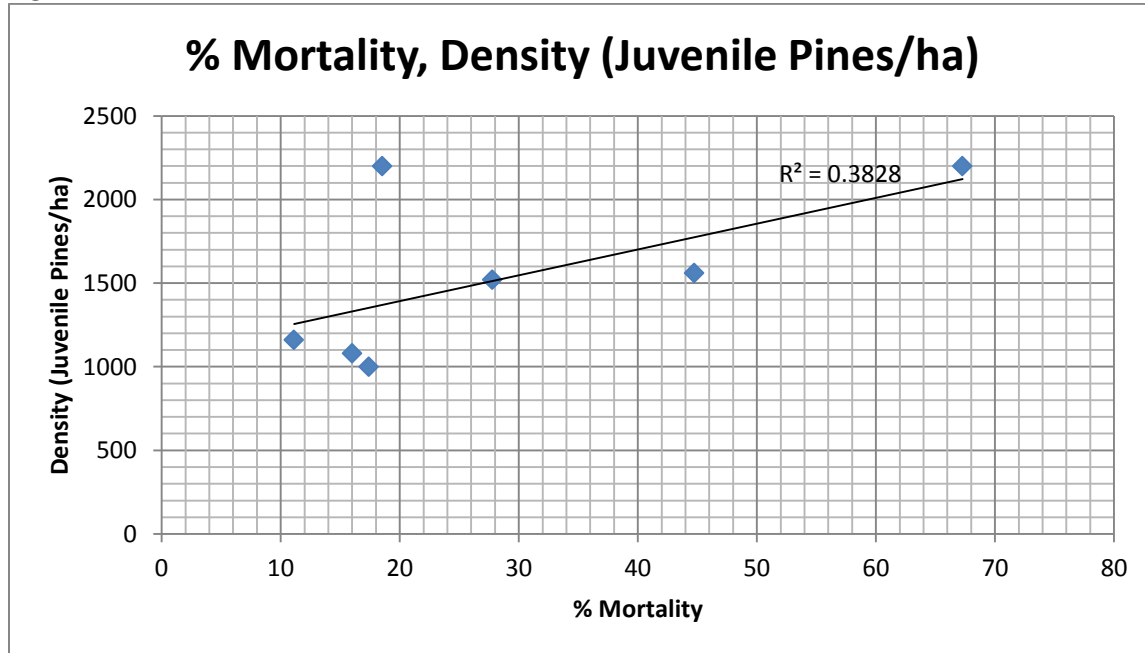


Figure 3

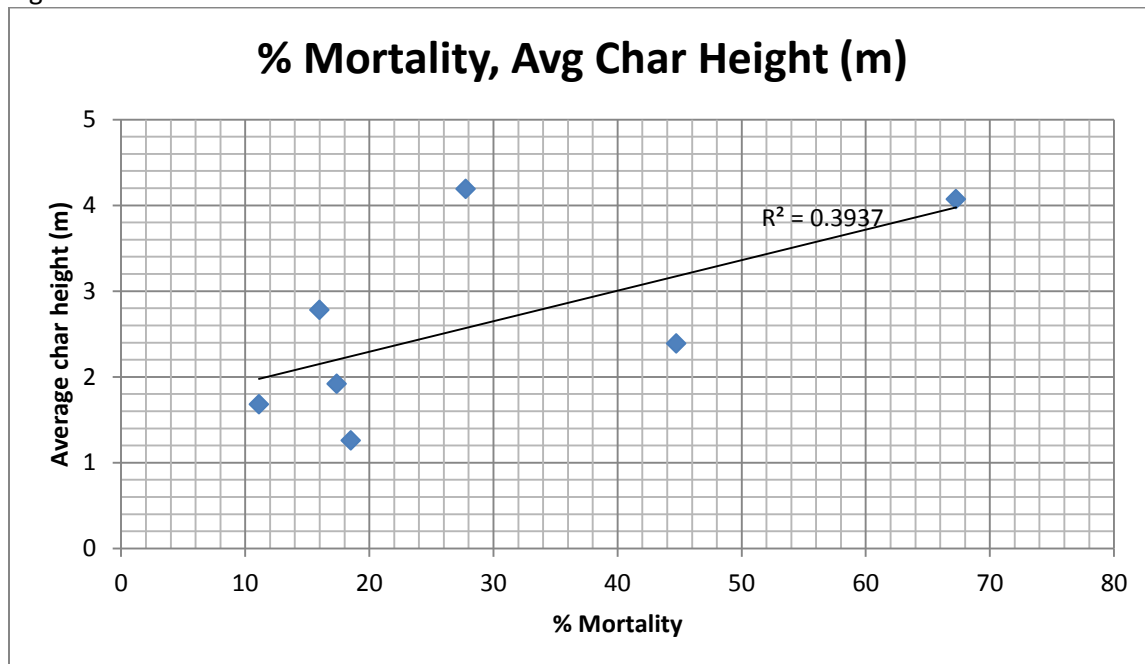
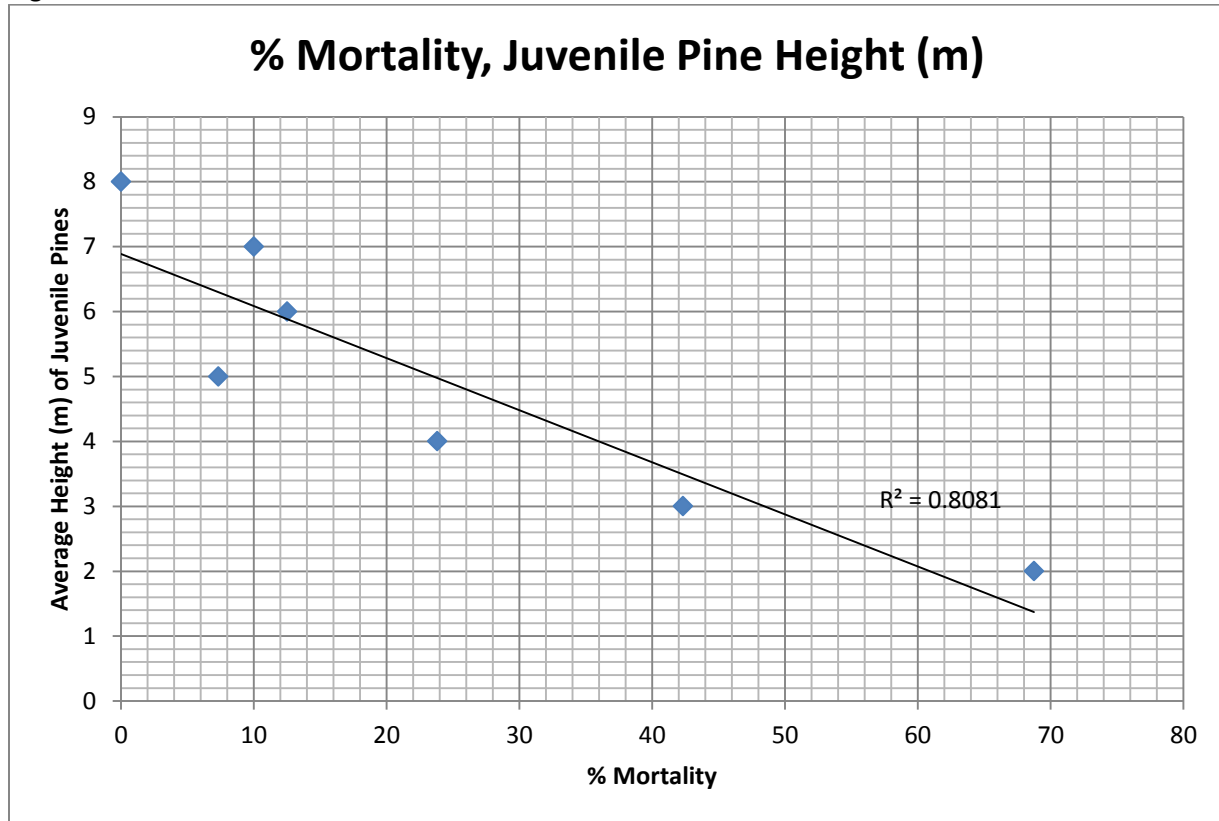


Figure 4



Conclusion

Fire managers with interests in maintaining or reducing juvenile pine trees in the pine rocklands habitat of ENP may consider the density and average height of the juvenile pines and as well as the firing technique (head vs. flanking fire) that is most likely to produce the desired outcome.

There were variations in results between 6 month post burn and 1 year post burn, mostly due to more juvenile pines falling in the "dead" category at 1 year than at 6 months. Therefore, it is best to monitor through 1 year post burn to ensure that any delayed mortality or recovery has been captured.

The potential exists to continue monitoring the impacts of firing techniques on juvenile pine mortality by utilizing the permanent FMH fire effects plots located throughout the Pine Rocklands. This may be beneficial, as the impact of backing fires on juvenile pine mortality is still unknown and an increase in the sample size of plots burned by flanking and head fires will strengthen the dataset and allow for greater confidence in the observed correlations between % mortality and firing technique, juvenile pine density, char height and juvenile pine height.