Rx Effects

National Park Service
U.S. Department of the Interior

Fire Effects Monitoring Program

VOLUME 1, ISSUE 8

FALL 2009 - PAGE 1

Integration of Fire and Exotics Management in Everglades National Park

Maya Vaidya, Fire Ecologist
Everglades National Park

At Everglades National Park, the Fire Ecology staff has started to discuss and examine the effects of fire on invasive plant species. We found that the FMH plots provided some, but not all of the story. Fire Ecology worked with the exotic plant management program to explore possible best management strategies for the use of fire and herbicide treatments in managing exotic plant species. Efforts focused on management and control of Brazilian pepper (*Schinus terebinthifolius)* and Old World climbing fern (*Lygodium microphyllum*), two of the most notorious invaders in Everglades National Park's fire adapted ecosystems. The need for more accurate population maps, lack of existing information regarding fire and herbicide treatment effects, collaboration and timing of prescribed fire and herbicide application, and the need for more targeted monitoring methods were some of the challenges we faced.

Brazilian pepper, native to South America, is a problem for several habitats in Everglades National Park. This invasive shrub grows rapidly, tolerates a wide range of environmental conditions, and is a prolific seed

(Continued on page 4)

Feat-FIREMON Integrated (FFI) Update

MaryBeth Keifer, Fire Ecologist
Fire Program Management Center

The next version of FFI is scheduled to be released this October. Based on input from the FFI user community, the major new and exciting features include:

- Flexibility to allow the columns on data entry forms to be moved, hidden, or frozen so the user can customize the data entry forms without changing the underlying database structure.
- Improved data loading speed in the Query Builder.
- Addition of an Export/Import utility for FFI data to export all or a subset of data from one database and append it to another.
- Ability to add a number of macroplots, sample events, and monitoring statuses at one time.
- Addition of monitoring status labels to the macroplot directory tree.
- And more new useful features!

Webinars will resume in the fall. Please see the FFI website for updates (http://frames.nbii.gov/ffi).

Inside this issue:

FFI
Ecological Monitoring Utilities

Visit the FFI Website hosted on FRAMES:
frames.nbii.gov/ffi

Searching for Ski Poles in Glacier National Park

Scott Lang, Fire Effects

1988 Red Bench Fire

Plot _884013DC _SECNR_N_8-27-1992

Plot_884013DC_SECNR_N_9-9-2008

Plot_884013DC_GC_9-9-2008

In early September 1988 the Red Bench Fire burned into the Northwest region of Glacier National Park, burning 27,500 acres of mostly Lodgepole and mixed conifer forest. The Red Bench Fire was considered a large fire at the time by fire management personnel in Glacier. How things have changed! Starting in October of 1988, 26 burn severity plots were established by USFS contractors working in Glacier. These plots were then re-read for a few years by Park Service early beta Fire Effects crews lead by Nate Benson.

In 2008, the 20th anniversary of the Red Bench Fire, Glacier's Fire Effects staff decided to re-read the plots. After contacting the 1988 contractors, Dutton and Cooper, the GLAC Fire Effects crew were given a map (not to scale) with hand drawn plot locations and were told plot centers were marked with downhill ski poles. This was pre GPS so all we had to go on was the map locations, aerial photos, some cryptic notes on data sheets, and the search image of a downhill ski pole. Downhill ski poles where used to mark plots due to their light weight compared to rebar. Not a bad idea! One plot was located 5.5 miles from the trailhead. Site descriptions provided on data sheets were as follows: Follow trail just above meadow; from 20" lodgepole pine travel due east 100 large steps to plot center. Quite frequently the center marker was down and buried in the litter or the reference tree was missing or down. Of the 26 plots searched for we located and re-read 16 plots. The remaining 10 were located in meadows where it is believed the ski poles were most likely removed by NPS personnel due to the intrusive visual nature of the markers.

We collected site descriptions, vegetation, fuels, photos, marked GPS locations, and tagged rebar on the plots. It was a unique opportunity to observe successional changes to forest ecosystems like this in Glacier 20 years post burn. So far the vegetation appears that it is headed back to pre fire forest types in most areas. Lodgepole stands are beginning to open up releasing larch, spruce, ponderosa, and Douglas fir conifers. Some areas that had pre fire disturbance have a few non-natives, but most undisturbed sites seem weed free. It will be very interesting to revisit the plots in 2028 with the help of GPS!

Combining Monitoring and Research Data to Manage Fire in Mexican Spotted Owl Critical Habitat on the North Rim of Grand Canyon

Windy Bunn, Fire Ecologist
Grand Canyon National Park

Grand Canyon Planning & Compliance, Wildlife, and Fire Management staff recently completed the Biological Assessment for the Park's new Fire Management Plan (FMP). This document summarized the past and projected future effects of fire management activities to T & E species and habitat. Of particular interest in that effort was understanding how managing for a mixed-severity fire regime affects the federally designated critical habitat of the threatened Mexican Spotted Owl (MSO).

Like most NPS sites, Grand Canyon uses burn severity mapping data to evaluate the landscape-scale distribution of fire effects. This data gives fire managers good information on the heterogeneity of fire effects, but it does not provide quantitative information on changes to specific habitat components that may be important for supporting wildlife species. In order to translate the green, yellow, orange, and red pixels of the burn severity mapping data into quantitative changes in critical MSO habitat components, we used a combination of FMH monitoring data and research data collected by Pete Fulé (Northern Arizona University; NAU) before and after fire events.

To date, 60 permanent plots in MSO restricted habitat have burned and 14 unburned plots have been monitored by NAU as control plots. Overall, 78% of the burned plots were burned in wildland fire use events, 12% in prescribed fires, and 10% in the Outlet wildfire. During burn severity mapping, 33 of the burned plots were classified as low severity, 10 as moderate-low severity, 6 as moderate-high severity, and 4 as high severity one year post-fire. Seven plots were burned prior to the initiation of the burn severity mapping program.

Pre-fire data indicate that these plots were dominated by ponderosa pine (*Pinus ponderosa*) and white fir (*Abies concolor*) with occasional quaking aspen (*Populus tremuloides*), Douglas fir (*Pseudotsuga menziesii*), Engelmann spruce (*Picea engelmanni*), and subalpine fir (*Abies lasiocarpa*) present in the overstory. As expected, post-fire data show that, in most cases, fire effects to critical habitat components differed by mapped burn severity class.

Change in tree density following fire differed by size class and burn severity class (Figure 1). In the low severity areas, density of trees smaller than 6 inches dbh decreased by an average of 63%, while in the moderate-low, moderate-high, and high severity areas density of small trees decreased by 90%, 93%, and 100%, respectively. The trend of higher reduction in tree density in the higher burn severity classes applies to the larger tree size classes as well. There was no change in tree density of the largest tree size classes in the low severity areas. In the moderate-low, moderate-high, and high severity areas, large tree density decreased by an average of 18 – 28%, 50 – 71%, and 100%, respectively.

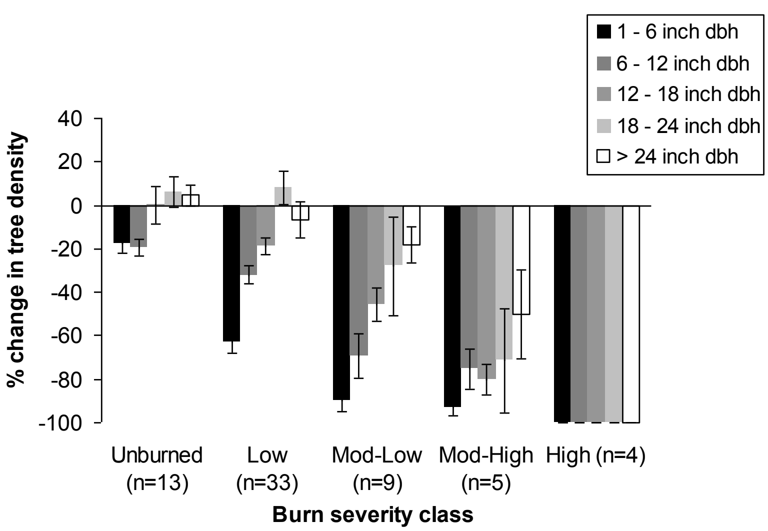

Fig. 1. Percentage change (±SE) in tree density between pre-fire measurements and measurements 2 years following fire in 20 m ´ 50 m mixed-conifer forest plots. Includes fires burned in WFU, prescribed fire, and the Outlet wildfire.

(Continued on page 5)

(Fire and Exotics in EVER, Continued from page 1)

producer that is threatening the biodiversity in Florida. The efforts surrounding Brazilian pepper management focused on taking advantage of improved access following prescribed fire and investigating the combined effects of fire and herbicide application. A study conducted by the exotics management staff in Everglades National Park indicated that the combination of prescribed fire with post herbicide treatment was more effective in preventing resprouting than fire alone, which supports previous research. The fire ecology program has also supported and participated in research efforts of the University of Vermont to study the effects of fire on Brazilian pepper mortality, growth rates and fecundity. Preliminary research indicates that in the pine rocklands, fire may reduce reproduction in both large and small Brazilian pepper individuals and is most likely to induce mortality where populations are less dense and individuals are smaller.

Another exotic, the Old World climbing fern, is native to Africa, Asia and Australia. The spores are wind dispersed with the potential to travel over great distances. Coastal prairies and tree islands in Everglades National Park have become heavily infested with thick mats which displace native vegetation. Fire has been used alone and following herbicide treatments to consume biomass of Old World climbing fern. Unfortunately, there is still limited research regarding the long term effects of fire on biomass accumulation, reproduction and overall productivity. Currently, fire ecology and exotics management personnel are working together to develop ways to monitor and test the effectiveness of fire in consuming aboveground biomass and reducing cover of Old World climbing fern. Methods to investigate the relationships between fire and spore production are also being developed in an effort to obtain information that may help mangers time the application of prescribed fire to inhibit Old World climbing fern reproduction and productivity.

Yet another way to monitor shrubs…

Scott Weyenberg
Great Lakes Ecoregion Fire Ecologist

Shrubs are notoriously difficult to quantify given the variability in size, density and distribution within a particular location. As a result there are innumerable methods used to sample them including point and line intercept, fixed radius plots, nearest neighbor, point quarter, wandering quarter, photo points and the list goes on. These methods often work well for monitoring shrub cover but are often time consuming, limiting the number of replicates one can achieve. After monitoring vegetation in the pine forests of Voyageurs NP, Minnesota and continuing to be dissatisfied with the results of various types of shrub plots, I decided to test/develop yet another method, the cover board. I understand it has been used at least once before by one researcher but have not seen anything written about it.

The method evaluates the cover of shrubs in a vertical plane to give a quantitative estimate of cover. The tools consist of a cover board (affectionately referred to as a Purina Board), measuring tape, compass, white board, two rebar stakes and a digital camera. The board itself is 60 cm by 240 cm with a series of alternating red and white squares 15 cm on a side. They are painted on a retractable window shade mounted inside a PVC pipe. Each square is divided into four parts and a 2 cm diameter black dot is painted inside each sub-square. The result is something similar to a dot grid. The device is essentially a densiometer used in the vertical plane. The board is placed 5 or 6 meters from the plot center, depending on the density of the vegetation. It is photographed and the cover estimate is determined from the luxury of your office chair (Figure 1).

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Wanted! New *Rx Fx* Editor!

Lisa McInnis has taken a job as a Natural Resource Management Specialist at the Natchez Trace Parkway. That said, we're looking for a new willing *Rx Fx* Editor! If interested, please contact Midwest Region Fire Ecologist Cody Wienk at (402) 661-1770 or cody_wienk@nps.gov.

(Combining Monitoring and Research at Grand Canyon continued from page 3)

Average large snag (>12″ dbh) density was unchanged between pre-fire and two year post-fire measurements in low and moderate-low severity areas. Large snag density increased by an average of 37 snags/acre (from 14.6 ± 4.0 snags/acre prior to fire to 51.8 ± 13.9 snags/acre two years after fire) in moderate-high severity areas and by an average of 57 snags/acre (from 24.3 ± 5.7 snags/acre prior to fire to 81.0 ± 2.9 snags/acre two years after fire) in high severity areas.

Shade canopy decreased from 59.1 ± 2.5 percent prior to fire to 50.2 ± 3.0 percent one year after fire in low and moderate-low severity areas. Shade canopy decreased from 59.8 ± 4.5 percent prior to fire to 36.8 ± 6.0 percent one year after fire in moderate-high and high severity areas. Coarse woody debris (>3″ diameter) density decreased an average of 29% two years after fire in low severity areas, an average of 52% in moderate-low severity areas, and an average of 32% in moderate-high severity areas. Average coarse woody debris density remained unchanged in high severity areas as fire-killed trees fell and replaced woody debris consumed in the fire events.

In low severity areas, the average amount of understory plant cover decreased from 18.4 ± 2.2 percent prior to fire to 13.1 ± 1.5 percent two years after fire (Figure 2). Average understory plant cover remained unchanged following fire in the moderate-low and moderate-high severity areas. In the high severity areas, the average understory plant cover increased from 13.1 ± 1.9 percent prior to fire to 48.0 ± 13.5 percent two years after fire.

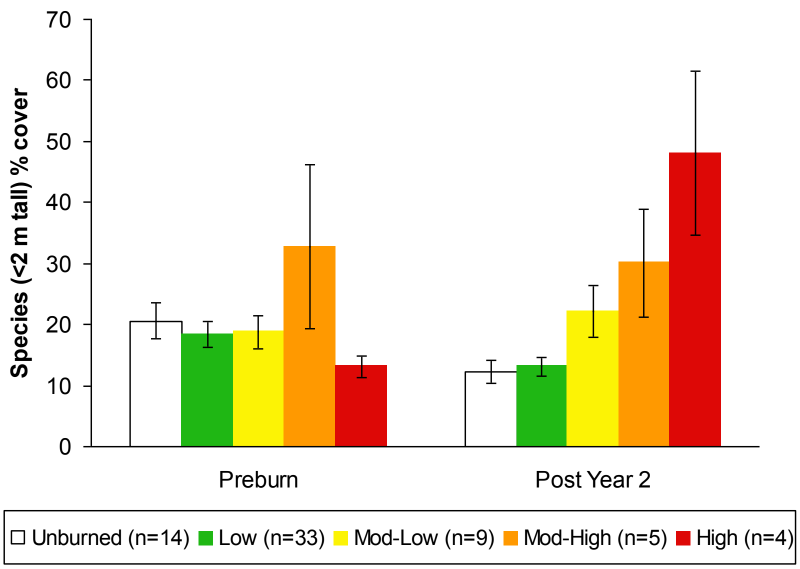

Fig. 2. Mean (±SE) percent cover of understory species <2 m tall in 20 m ´ 50 m mixed-conifer forest plots by burn severity class. Includes plots burned in WFU, prescribed fire, and the Outlet wildfire.

With this information and past data on the distribution of burn severity classes within the mixed-conifer restricted habitat, Grand Canyon managers are better able to assess the effects of past fire activity and to predict the potential effects of future fire management activities on the habitat components important to MSO. This will assist the Park in simultaneously meeting two of the overriding goals of the new FMP: to restore and maintain park ecosystems in a natural, resilient condition and to protect the park's natural, cultural, and social values.

Stats 911

Persistent Issues with Paired (or more repeats) Data for Fire Ecologists

Ken Gerow, Professor
Department of Statistics, University of Wyoming

This is the first in what I hope will be a series of columns on topics that I perceive to be of broad interest to fire ecologists. Feel free to contact me (gerow@uwyo.edu) with questions and suggestions. I would welcome them.

Paired data for fire ecologists usually means temporally paired: pre- and post- burn. I will take that temporal setting as the context for this discussion (and use B (for before) and A (for after) when such shorthand suits me), but much of it applies to other sorts of pairing. When you analyze paired data, or data with more than just two points in time, there are several points of interest that I've been asked about frequently. One is the freedom on your part to do something different than the usual paired analysis (which is based on simply subtracting: B – A or A – B, whichever suits the researcher); a second is the role of Normality, and its place vis à vis sample size; the third is to consider options other than simply a repeated measures analysis for data taken at three or more points in time. I'll save that latter topic for another column, as I think the first two are enough to swallow in one go.

Incremental differences are only one option

Historically, paired data have been analyzed by taking differences within each pair, and then analyzing those differences with, usually, a one-sample *t*-tool. The important point is to reduce the two paired sets of data to a single set, and incremental differences (as I'll call them) are but one choice. Other choices (limited here mostly by my imagination) include variations on relative change. For instance, for some variable expected to decrease (like fuel loads), $100\% \times \left(\frac{B-A}{B}\right)$ measures the size of decline, relative to the amount before (and the $"100\%\times"$ scales the change to a percentage). Likewise, for something expected to increase, $100\% \times \left(\frac{A-B}{B}\right)$ would measure relative increase. Other possibilities occur: for instance, $100\% \times \left(\frac{A}{B}\right)$ would measure the relative amount after, as compared to that from before. You can choose whatever comparison best suits the tale you are trying to tell with your data, with some care when it comes to the Normality issue. Any way you choose to measure the effect, the critical point is that a paired data set leads to an analysis on a single data set. A classical paired *t*-test *is* a one-sample *t*-test done on the sample of differences.

Are My Data Normal?

The only thing that matters ultimately is whether the chosen summary statistic (for a paired data, that statistic would be the mean of (incremental or relative) differences) has an approximate Normal distribution. First of all, you might ask, in what sense can the mean of your data have a distribution? It is only one number, and doesn't change no matter how many times you re-calculate it, unless the batteries on your computer are running low. It is an important question, worthy of a digression.

If I were to fairly flip a fair coin, and ask you to tell me the chance it comes up heads, the usual answer would be 50%. The basis for that answer is your understanding that if I were to repeat the coin flip a very large number of times, it would indeed come up heads approximately 50% of the time. I don't need to repeat the flips a very large number of times; it only requires you to be able to imagine it, and

(Continued page 7)

1 One reason that incremental differences were the summary of choice historically is that for these, it is easy to clarify the circumstances under which the *t*-distribution is a reasonable tool to use. I'll come back to this point when I discuss the role of Normality.

2 This arithmetic should be applied to the data within each pair, reducing the data to a single variable, just as do incremental differences.

(*Persistent Issues with Paired (or more repeats) Data for Fire Ecologists,* ***Continued from page 6)***
when to apply your understanding of that long run to the immediate coin flip. What you imagine is a distribution with 50% "H" and 50% "T". So it goes with means; indeed, with any statistic.

If we can successfully argue that we know, at least approximately, what distribution of values that statistic would take if we were to repeat the experiment a very large number of times, then we can use our understanding of that distribution to make statistical inference. Very early on in the history of statistics as a discipline, statisticians were able to show that for all but pathologically weird distributions of values, means of data from random samples would have approximately a Normal distribution, provided that the sample size was reasonably large[4].

If the population[5] whence came your data has itself a Normal distribution, then the distribution of the mean[6] is also Normal, for any sample size. When random values from (almost) any distribution are added together (which is part of the arithmetic to get the sample mean) or subtracted one from another (which is part of the usual paired data procedure), the distribution[7] of the resulting values is closer to a Normal distribution than the distribution of the original values themselves. The more of such values that are added together (e.g. a larger sample size for computing a mean), the more this is so. This result, with many variations covering a wide array or circumstances, is called the Central Limit Theorem. Note I said adding or subtracting. When values are divided, one by another, it is not so certain that the result will be more Normal than the distributions of the original values. So the usual paired procedure leads to Normality for the distribution of the mean in two ways: the distribution of the sample of incremental differences is more Normal than the distributions of the original values (perhaps only slightly), and the mean thereof is more Normal yet. When you choose to use relative differences, you can't be sure the first step leads in the right direction, but you can be sure the distribution of the mean of the relative differences will be more Normal than the relative differences themselves.

Insofar as Normality in the data[8] themselves may be relevant[9], my above discussion about paired data reducing to a single data set of differences (however calculated) implies that Normality in the original values (the Before and After) is of no interest. If you care to check for Normality in the data, you should do so by checking for it among the summarized values, not the original values. It turns out that I don't have much regard for checking the data for Normality, for the following reasons. One, any attempt to deduce from the sample a picture of the distribution of the population whence came the data is quite untrustworthy for small sample sizes; at the risk of suggesting a rule where none really exists, I'll define small as being less than 20. Much of your work as fire ecologists is done with sample sizes that are small. For these, it is really common for populations of values that have a Normal distribution to yield samples that look quite skewed, or for skewed populations to yield samples that may look quite symmetric. Simply, the shape of the distribution for small samples is very erratic, and not to be trusted.

For larger sample sizes, the Central Limit Theorem will take effect, and give you at least an approximate Normal distribution for the sample mean even if the distribution in the population of values is itself not Normal. I note that a sample size of 20 is in the unhappy position of being small enough that you might not quite trust the distribution of the sample to truly reflect the population, and large enough that maybe, but only maybe, the Central Limit Theorem might be working in your favor. To put it over-simply, testing for Normality is a waste of time: either you have a small sample size, in which case you can't trust the test, or you have a large sample size, in which case you don't really need the data to have a Normal distribution. In that case, you don't necessarily care about the results of the test.
(Continued page 16)

[3]This is purely a virtual repeating: the imagining is for a very large number of repeats, under identical circumstances, taking place in the blink of an eye.
[4]Typically, biological data are skewed; the greater the skew, the larger the sample size required.
[5]Here I mean the population of all possible data values (i.e. the differences, however you have chosen to calculate them) from studies like yours. This population may also be hypothetical in that the particular circumstances under which you have done your study might be unique.
[6]The distribution of the mean (or any other statistic) sometimes goes by the name, "sampling distribution of…". I don't like the name; the adjective "sampling" adds nothing useful to the meaning, I think, and can be confusing because the word "sample" and it grammatical variations has already so many uses.
[7]In the sense of the distribution one would get from the aforementioned large number of instantaneous, virtual repeats of the study.
[8]It turns out that even considering Normality in the data is the wrong place to do that, for almost all statistical settings, except for when you are analyzing a single sample (which is the case with paired data). A quirk of convenience in collusion with a typical "model and assumptions" textbook presentation of introductory statistics has misled many students to a misunderstanding of the role of Normality. I'll reserve a deeper discussion of that for a later column.
[9]The correct question here is really, Is the distribution of values (from which I have a sample) Normal? You have to use the distribution of the sample itself as an "estimate" of the distribution of the population whence it came. In other words, it doesn't matter, really, if the sample itself has a Normal distribution; It matters that whether the distribution in the population is approximately Normal or not.

Monitoring an Alaskan Tundra "Mega-Fire"

Eric Miller and Randi Jandt, BLM Alaska Fire Service

Large fires north of the Brooks Range in Alaska are rare events. Records kept since 1956 include a total of only 134 fires (Fig. 1). The Anaktuvuk River fire took fire managers by surprise when it burned 256,000 acres late into the autumn of 2007 (Figs. 2,3). Due to the drought and lateness of the season, burn severity—as measured by depth of consumption of the organic moss and duff layers—was higher than typical for tundra fires. Thick smoke from the fire caused one of the turbines at a pump station to shut down, choked Anaktuvuk Pass and the Toolik Field Station, and caused concern from residents all over the North Slope. Drought conditions in September were coincident with record low Arctic Ocean pack ice adjacent to the coast, which may have brought abnormally warm and dry conditions inland (Figs. 4,5). The effects of changing climate, pack ice, and length of the fire season on vegetation, wildlife, and arctic communities are speculative. Monitoring the Anaktuvuk River fire may provide insight into the future of tundra fires in the arctic.

The BLM has engaged partners from the USFS Boreal Ecology Cooperative Research Unit at the University of Alaska, Fairbanks (UAF), the Arctic Long Term Ecological Research program (LTER), the North Slope Borough Department of Wildlife, the FWS, and the USGS to assess the fire. The North Slope Borough provided a field assistant from Anaktuvuk Pass who became part of our field team. We addressed burn severity, potential plant community shifts, carbon production, and effects on permafrost. Field sampling of the fire took place in July 2008. Funding has been secured for a second visit this summer.

Fourteen permanent transects were established within the burn for long-term monitoring of revegetation and fire effects. Two control transects were also established. Plant and shrub abundance were estimated, tussocks density was measured, and site condition was documented with photo-imagery. Burn severity information (Composite Burn Index) was collected for calibration of satellite imagery. Active layer depth (depth to permafrost) was measured in the burn and on two paired, unburned transects. Organic matter remaining and other allometric, biological markers were used to determine the total amount of material consumed by the fire.

More than 40% of the points were rated "high" severity indicated by >20% mineral soil exposure and/or >60% tussock basal area consumption. Tussock bases, similar to the boles of live trees in forested areas, are virtually never completely consumed in fires. This level of severity is very atypical of tundra fires, which are generally light severity, with little or no mineral soil exposure. The level of consumption and the scale of the burn are arguably unprecedented in tundra areas of Alaska. Consumption of feather mosses and ericaceous shrubs was very high throughout the burned area, creating a challenge to observers trying to reconstruct the pre-burn environment to assess the level of disturbance. Frequently, almost all evidence of mosses (other than sphagnums) and dwarf shrubs was obliterated, or only charred remnants of the roots and rhizomes remained in a few centimeters of deeply charred lower duff.

Analysis and integration with Arctic LTER's larger study plan are ongoing with several analysis products planned, including: burn severity map, summary of early post-fire vegetation recovery, annotated photo file, soil and active layer analysis, soil germination experiments for colonizing species, estimates of pre-fire shrub density, and a slide presentation suitable for public presentations to interested managers and the general public. Continued monitoring of this fire will provide hints of fire behavior, extent, and effects to come in North Slope tundra if current climate trends continue.

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Monitoring an Alaskan Tundra "Mega-Fire", Continued from Page 8

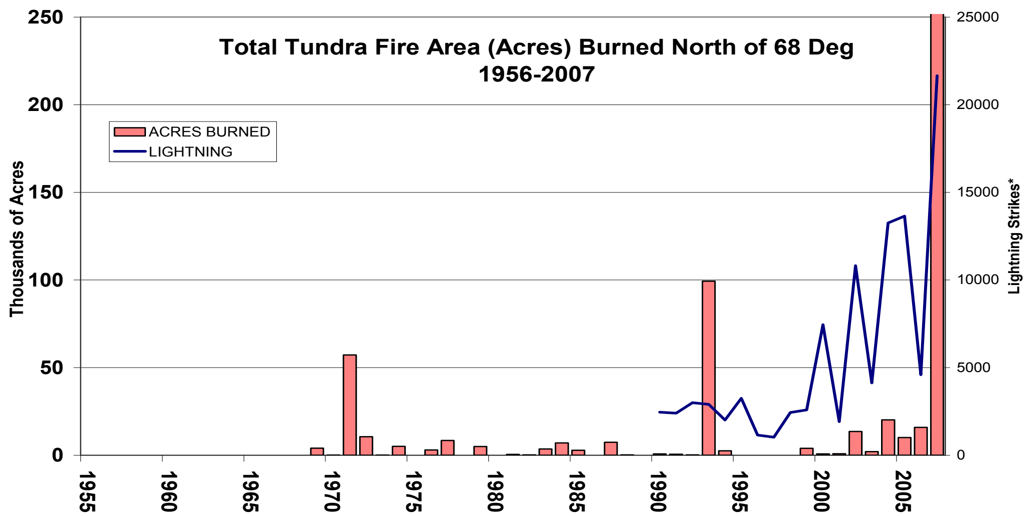

Figure 1. Fire sizes and lightning frequency for the North Slope.

Figure 2. The 2007 Anaktuvuk River fire during an active burn period 11 Sep 2007.

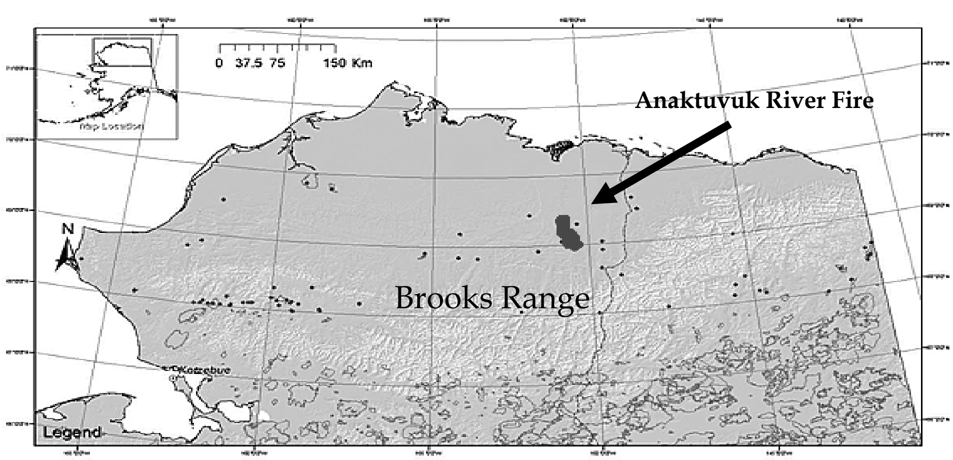

Figure 3. Location and perimeter of the Anaktuvuk River fire.

Monitoring an Alaskan Tundra "Mega-Fire", Continued from Page 9

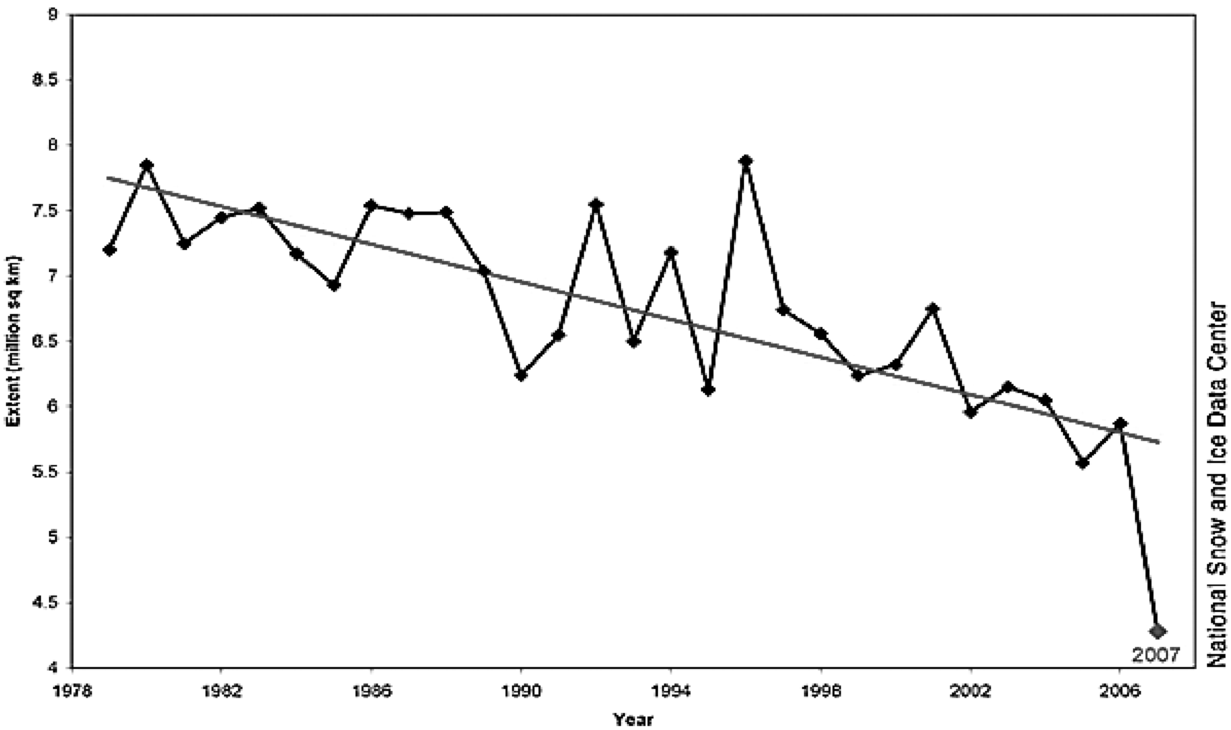

Figure 4. September polar sea ice extent.

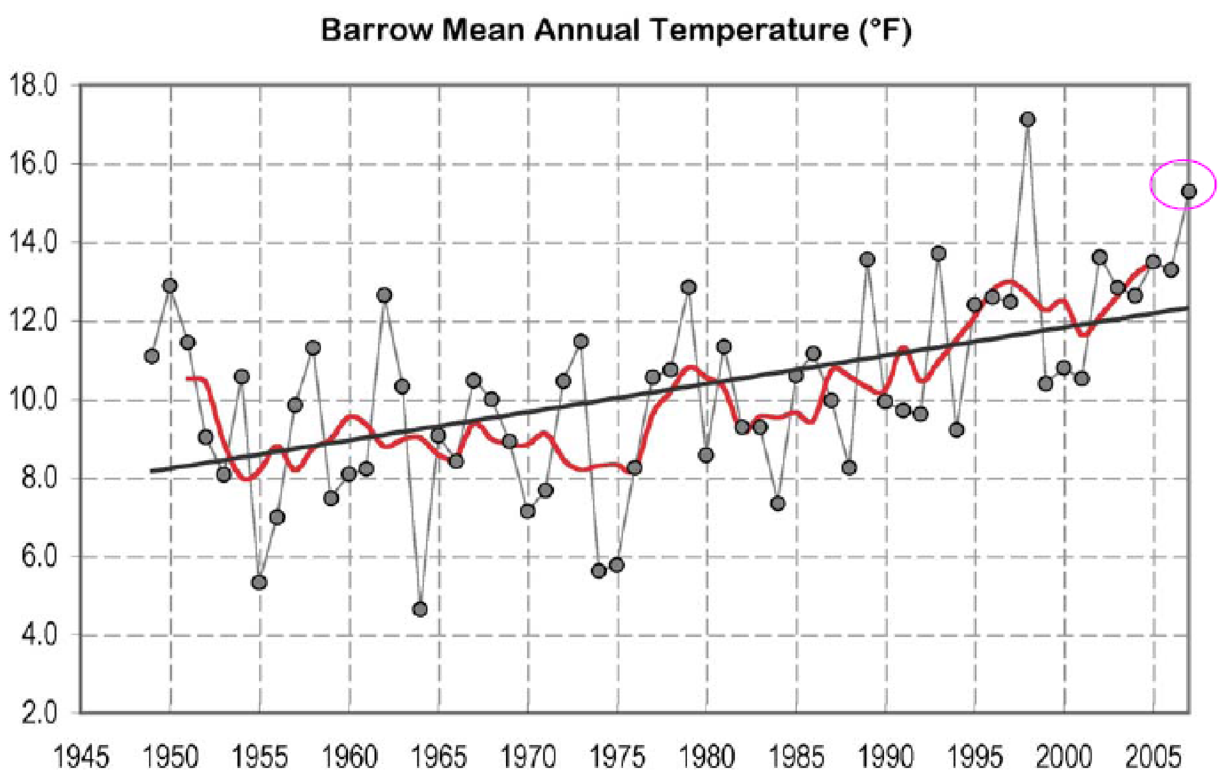

Figure 5. Mean annual temperature, Barrow, Alaska.

Yet Another Way to Monitor Shrubs, continued from page 4

Just like any method it has its advantages and disadvantages. The variable being measured, cover through a vertical plane, is not common and it is somewhat intangible compared to counts, diameters and heights. However, it does well in tall shrubs that can be difficult to quantify using other methods. The main disadvantage with the cover board method is that one cannot determine the species composition without sampling via another method. This can be resolved without an excessive time requirement. Below is a list of several advantages and disadvantages.

Advantages:
Works well in areas with tall uniform shrub cover.
Sampling is easy and repeatable.
Sampling is quick.
It is more consistent than density measures (see explanation below).
Provides a quantitative measure for photo points.

Disadvantages:
May not work well for clumped vegetation.
Vegetation close to the camera has a greater influence than that further away.
Data is not comparable with others since the method is rarely used.
It measures relative cover since it does not capture cover in the normal horizontal plane.
It does not differentiate between species, measuring all understory vegetation regardless of lifeform; Species composition must be determined via another method.

I decided to compare the cover board method with the next best alternative method, fixed radius plots. Shrub stems density was assessed via tallies within a 2.5m radius plot and relative cover assessed using a cover board as described earlier. Our data showed no relationship between stem densities and percent cover (Table 1). Pre-burn cover among the plots was relatively consistent at around 75%, while stem densities varied greatly. Post-burn cover had one outlier with stem densities again having a high degree of variability.

The test revealed a problem with using shrub stem density to assess change or describe a site ecologically. The problem is that similar densities are not equivalent in cover, which is usually the variable of interest. Five larger stems can create the same amount of cover, or ecological impact, as 50 smaller stems. In such an instance, there can be a large variation in stem density with little variation in cover as was found at our site. The use of size classes can get around this issue but increases the time spent collecting, entering and analyzing the data.

We found the cover board easy to use and repeatable by different observers, if rules regarding counting and photography are well established. It worked quite well for our site, which had tall, dense-shrubs of uniform distribution, and provided a quick quantitative assessment of shrubs. We hope to test it in other situations particularly as an alternative to photo points used to monitor shrub encroachment into prairies.

(*Yet Another Way to Monitor Shrubs, continued*)

Table 1. Pre- to post-burn changes in stem density and percent cover by plot.

	Pre	01Yr01		Pre	01Yr01	
Plot	**Density stems/ac**	**Density stems/ ac**	**% Change**	**% Cover**	**% Cover**	**% Change**
1	22,600	33,200	47%	75%	27%	-64%
2	12,200	7,000	-43%	74%	34%	-54%
3	21,000	14,200	-32%	90%	6%	-93%
4	8,200	2,200	-73%	71%	41%	-42%
Average	16,000	14,150	-12%	78%	27%	-65%
p-value			0.34			0.01

A. B.

Figure 1 A & B. Pre (A) and post-burn (B) cover board photos from plot 2.

Using Prescribed Fire to Reduce Fuels at El Malpais National Monument, New Mexico

Laura Trader, Fire Ecologist
Bandelier National Monument

El Malpais National Monument is located on the southeastern edge of the Colorado Plateau in western New Mexico. The landscape within The Monument contains a diverse assemblage of vegetation communities and includes 114,272 acres of flatlands, mesas, canyons, foothills, mountains, lava flows, and cindercones.

Frequent (every 5 to 12 years), low intensity surface fires are one of the primary natural disturbance processes that have shaped and maintained the vegetation communities and landscapes of El Malpais. Consequently, most of the vegetation communities are now fire dependent, fire tolerant, or enhanced by fire.

The historic, frequent fire regime was disrupted by both grazing (1880's) and widespread fire suppression (1940's). With more than sixty years of fire absence, the vegetation communities at El Malpais have changed substantially. Of particular concern to fire and resource managers is the accumulation of forest fuels, such as litter, duff, and dead and down fuels. These fuels create potential for high intensity fires that can damage forest vegetation, produce deleterious effects on plant root systems and soil properties, and threaten human life, property, and wildlife.

El Malpais has been using prescribed fire to reduce the threat of wildfires and initiate the restoration of several vegetation communities, including pinyon-juniper woodlands, ponderosa pine savannas and forests, and grasslands. The effects of low intensity, mixed severity, spring and fall prescribed fires that occurred in the Monument in 1999, 2003, 2006, and 2008 are monitored by El Malpais's Fire Ecology Program. Pre and post burn results, combined for all prescribed fires over the ten year period, show changes in dead and down forest fuels, litter, and duff.

Prescribed fire in a pinyon-juniper woodland, El Malpais. 2006.

Data collected in pinyon-juniper woodlands from 1999 to 2008 show a significant reduction in litter and duff load from pre burn levels of 2.2 tons/acre to post burn levels of 1.5 tons/acre (N=10, alpha= .05, p= .03) (figure 1). The data also show a nearly significant reduction in total fuel load from 4.1 tons/acre at pre burn to 2.7 tons/acre at post burn (N=10, alpha= .05, p=.06). One, 10, 100, and 1000 hour fuels also appear to have reduced from pre burn levels, although the results were not significant.

(Continued page 14)

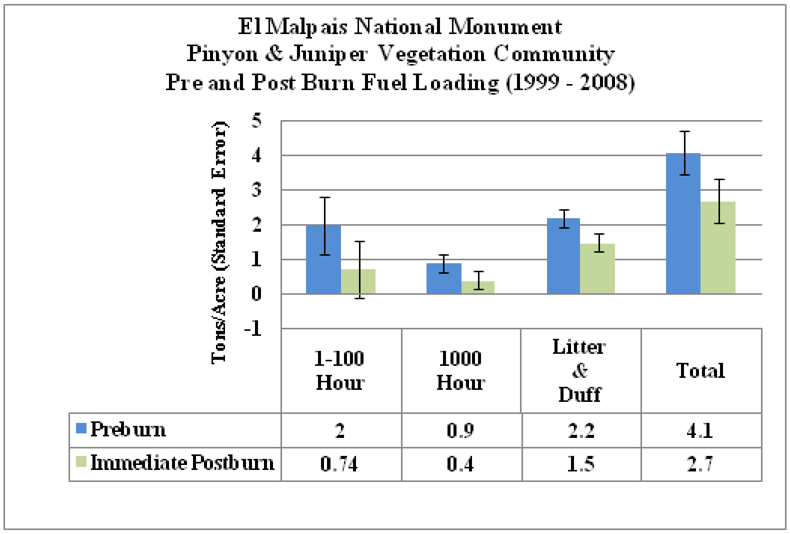

Figure 1. Pre and post burn fuel loading in El Malpais's pinyon-juniper vegetation community.

From 1999 to 2008, in El Malpais's ponderosa pine forests and savannas, total fuel load was significantly reduced from 9.2 tons/acre at pre burn to 4.6 tons/acre at post burn (N=20, alpha=.05, p<.0001) (figure 2). Thousand hour fuels were significantly reduced from 3 tons/acre (pre burn) to 1.2 tons/acre (post burn) (N=20, alpha=.05, p=.01). The data also show significant reductions in litter and duff load and depth, from 5.5 tons/acre to 2.7 tons/acre (N=20, alpha=.05, p=.003) and from .88 inches to .50 inches (N=20, alpha=.05, p=.005), respectively.

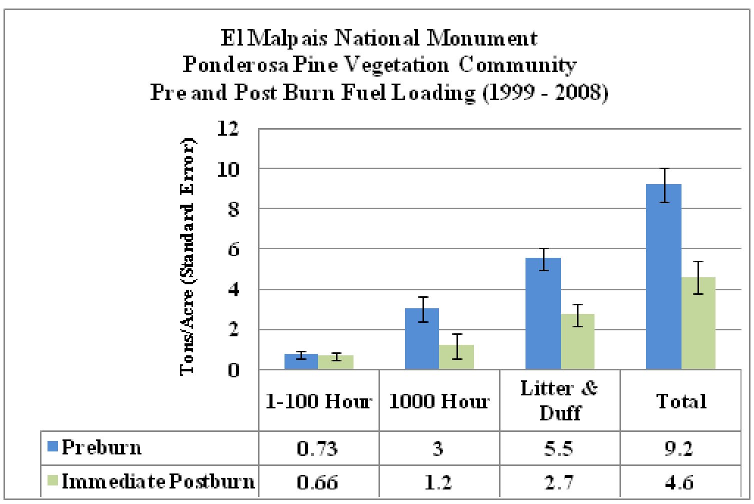

Figure 2. Pre and post burn fuel loading in El Malpais's ponderosa pine vegetation community.

The sample size for data collected in the grasslands is currently not large enough for analysis. However, the sample size will increase as El Malpais continues to implement prescribed fires in grassland areas. Data from these prescribed fires will be available in the future.

Total fuel load across both vegetation communities in El Malpais was reduced by 7.3 tons/acre after prescribed fires that occurred in 1999, 2003, 2006, and 2008. This is a substantial reduction in fuels, highlighting the accomplishments of El Malpais's prescribed fire program.

Upcoming Conferences

2010 EastFIRE Conference
May 25-28, 2010
Fairfax, Virginia

NPS Division of Fire and Aviation Workshop
February 1-5, 2010, in San Antonio, Texas

RxFx Subscription and Submission Information

Rx Effects is the newsletter of the Fire Effects Monitoring Program in the National Park Service. It is an outlet for information on Fire Effects Monitoring, FMH, fire research and other types of wildland fire monitoring. The newsletter is produced annually for the National Park Service but we encourage anyone with an interest in fire ecology to submit information about their program or research. Examples of submissions include: contact information for your program, summaries of your program's goals, objectives and achievements, monitoring successes and failures, modifications to plot protocols that work for your park, hints for streamlining collection of data, data entry and analysis, event schedules and abstracts of papers or posters resulting from your program. Submissions will be accepted in any format (e.g., hard copy through the mail or electronic files through e-mail). Please see our website for author instructions. The goal of the newsletter is to let the Fire Effects Monitoring community know about you and your program.

Rx Effects is issued each year in the summer. The **deadline for submissions** is the last Friday in July. If you would like a subscription or more information please see our website **www.nps.gov/fire/fire/fir_eco_rxeffects.cfm** or contact:

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Thanks to all who submitted articles for this issue, including Maya Vaidya, MaryBeth Keifer, Scott Lang, Windy Bunn, Scott Weyenberg, Ken Gerow, and Laura Trader for their submissions. Submissions not included in this edition will be saved for future additions.

(Stats 911, continued from page 7)

In your situation as fire ecologists, with, often, small sample sizes, you need to look to larger data sets (or create them by combining data sets appropriately) to examine the question of Normality. How to do that properly is not necessarily dead simple, so that might be the subject of another column also. If anyone wants to work with me to tackle that question for specific variables, let me know. Having a case study or two would make that discussion work better. If combining data sets appropriately is not feasible, it behooves you to be cognizant that p-values from tests and limits from confidence intervals need to be acknowledged as "approximate" and not be treated too rigidly.

Fire Effects Photo Contest

There is only one category, something having to do with fire effects. Photos can be of cool plants, field-weary monitors, fire employee babies—the possibilities are endless. We didn't receive any submissions for this year, so once again you are subjected to the limitations of the editor's photo collection. Submit your entries to the Acting Editor at cody_wienk@nps.gov.

This edition's winner:

The mighty veg pole-wielding fire effects monitor. Amidst the ferns, Lead Monitor Wylie Paxton (GRSM) exhibits proper technique for fending off imposters (Little River Canyon National Preserve). Thanks to Wylie, Rob Klein, and the Great Smoky Mountains Fire Effects crew for helping Natchez Trace Parkway Fire Effects crew over the years.