National Park Service Fire Effects Monitoring Program

Rx Effects

Volume 1, Issue 5

Spring 2005

Northern Great Plains News

Cody Wienk
Northern Great Plains Network

As we approach another field season, we are preparing to venture into unfamiliar territory. About a year and a half ago, I sat down with members of the Northern Great Plains Inventory and Monitoring (NGP I&M) and Exotic Plant Management Team (EPMT) networks and started talking about how our three programs might work together to provide the most efficient vegetation monitoring for the parks in our network. Several meetings, phone calls, and emails later we will be hitting the ground this summer for the first phase of this collaborative effort. We've decided that the first step to take is to develop monitoring protocols that will meet the needs of both the Fire Ecology and I&M programs. To do that, we are starting a pilot sampling project to compare herbaceous vegetation sampling protocols. After a meeting of brainstorming and discussion, we decided that vegetation cover was the preferred variable to measure and we wanted to compare visual cover estimates with point-intercept estimates.

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Inside this issue:

Potential Ecological Benefits of Fall Burning for Maintaining Yellow Pine Ecosystems at Great Smoky Mountains National Park

Virginia McDaniel and Rob Klein
Great Smokey Mountains NP

Abstract

Great Smoky Mountains National Park uses prescribed fire to restore and maintain yellow pine communities. Fire suppression has enabled fire-intolerant species like red maple, blackgum, and white pine to out-compete yellow pines, and as a result their community structure and composition is changing. Between 1997 and 2004, we collected monitoring data in seventeen 0.1 hectare plots located in five separate prescribed burned areas. We observed a significant reduction in both pole-sized tree density and duff depths one-year post-burn. These reductions were positively correlated with an increase in yellow pine seedling density. We noticed, however, thresholds for duff depth and pole-tree mortality whereby few pines would germinate if duff was greater than 3 centimeters or if pole-tree mortality was less than 85% (Figures 1 and 2). Two burns (Tabcat A and Wedge Ridge) achieved these thresholds and thus had significant pine regeneration, while the other three burns (Arbutus Ridge, Stony Ridge and Tabcat B) did not and had very little pine regeneration. Time of year and duff moisture level when burns occur appear to play an important role in fire severity and pine seedling regeneration.

Discussion

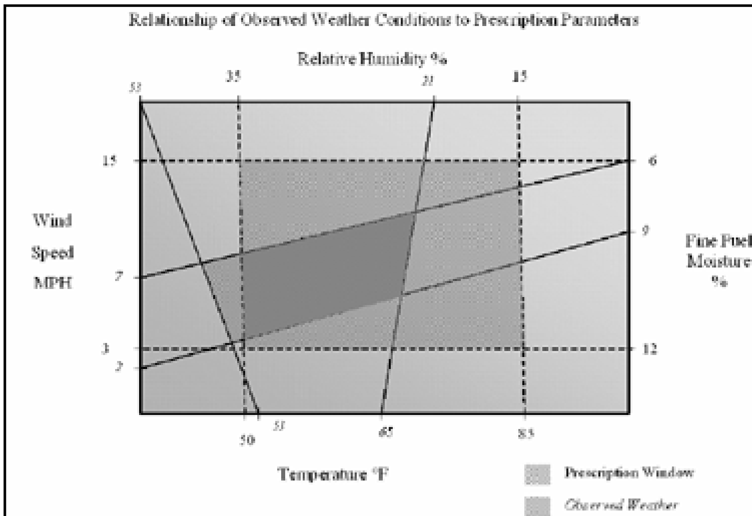
It appears that fires that kill more trees and con-

(Continued on page 4)

Linking the fire environment to long term fire effects

Mack McFarland, Diane Abendroth (GRTE) and Eric Miller (YELL)

Abstract Perhaps the most common quantifiable data collected during wildland fire and prescribed fire events is information about the conditions in fire environment. During fire incidents this data aids in predicting short term fire behavior and weather during the event. This methodology utilizes fire environment conditions (temperature, relative humidity, fine fuel moisture and winds) collected during fire events to link those environmental conditions to fire effects (severity, regeneration, species composition, etc) Similarly, this methodology may be used to graphically display prescription parameters described in prescribed burn plans compared to actual conditions during the event to determine the effectiveness of prescriptions in meeting project objectives. Data groupings of environmental conditions from historical fires may be produced and compared to fire effects that have been observed since the event. These groupings are then used to benchmark environmental conditions on prescribed fires against those conditions on wildland fire. This comparison links long term fire effects with environmental conditions experienced. The link is applied to other events of prescribed or wildland fire to more accurately predict the long term fire effects that would be expected to develop following the fire. Managers use this link to refine prescriptions, determine trigger points, and better understand the potential for system changes in vegetative communities in response to fire. This methodology is also useful in public education/information forums for displaying current and expected fire site conditions especially in relation to benchmark fire events.



Wolff Ridge, Rx Fire Fall 2002

For the Eighth Biennial Scientific Conference on the Greater Yellowstone Ecosystem: A Century of Discovery, Hard Lessons, and Bright Prospects, October 17–19, 2005, Mammoth Hot Springs Hotel, Yellowstone National Park

Project Status: Currently graphs are produced either by hand or by cumbersome spreadsheets. We have plans to streamline the process with a JAVA program.

18 Plot Situations That Shout Watch Out

Jim DeCoster (MWRO), Caroline Noble (SERO), and Dana Sandifer (REWO)

1. Maintenance Log not consulted before heading off to the plot.
2. You are in a park you are not familiar with, and no employee of that park knows who you are, where you are, or what you are doing.
3. The parking spot was not GPS'd, and nobody knows how to get back.
4. Lightning has been observed in the sky, and you are carrying a backpack full of rebar.
5. Four people are running tapes simultaneously, and nobody knows where anybody else is heading.
6. Instructions and assignments not clear.
7. You have been following the GPS for hours, and are no longer in communication with supervisor/fellow crew members.
8. Installing plot without knowing rejection criteria.
9. Installing plot on a 60% slope.
10. Attempting plot installation amidst a field of chaparral.
11. A wall of poison oak between you and the next rebar.
12. You cannot see the plot origin, and are not in contact with anyone who can.
13. On a hillside where a bypassing car could ignite a fire below.
14. It is only 8 am, and the weather is getting hotter and drier.
15. Someone breaks wind in your vehicle.
16. Getting frequent needle-jerk on your compass.
17. Terrain and fuels make installing rebar difficult.
18. You are attempting to work a ten hour day without taking a nap.

When Nonparametric Tests?

Ken Gerow, Statistical Whiz, University of Wyoming, Laramie

Once upon a time, in a millenium once removed from us, nonparametric tests were the salvation of ecologists with small, non-Normal data sets. In this note, I shall put them into what I see as their appropriate place in current times. I'll begin with a class of tests that are (almost) always valid, then compare and contrast those with the Normality-based and the nonparametric tests. The discussion here covers the one-, two-, and multiple-sample settings (t- and F-tests in the parametric world, Kruskal-Wallis and the others in the nonparametric world); for simplicity, I will use the "two independent samples" setting as illustration.

Data are measurements made from independent randomly selected population units. Let's take the data to be counts of wasps in figs from two different species of trees (general ecology) or number of pole-sized trees in standardized plots from two different landscapes (Northern versus Southern aspect, mesic versus xeric, whatever). Pick your poison. The data are counts. And… let's have equal sample sizes.

Randomization tests

Data are measurements made from independent randomly selected population units. That's it for assumptions, making these tests by far the most widely applicable. According to the null hypothesis, the sampled values come from a single population, and the fact that they are in two piles (sample A and sample B) is just random chance. To perform the test, randomly assign the values to two piles (A and B). Compute and record the difference in means. Repeat a large number of times (likely 200 is enough, but 1000 is likely no problem with computers these days). The result will be a resampling estimate of the sampling distribution of your chosen statistic supposing the null hypothesis to be true. The proportion that are as or more extreme than your actual statistic (i.e. the observed difference or ratio of means or medians or whatever) is the p-value of the test.

Means or medians?

One fundamental difference between nonparametric tests and parametric tests is that the nonparametric tests are tests of differences in medians, whilst the parametric tests focus on means. Biological data often come from skewed distributions, so the mean and the median of the population are different beasts. Which should you focus on? The median is always reasonably interpretable as a "typical value", so if you want your reader to invoke that notion, the median is preferable. The mean, on the other hand, is intimately connected to the total in the population: if you know the mean count per sample, and know how many sampling units there are in the population, you have a ready estimate of the total. In many studies, this connection is more attractive than the notion of "typical". Still can't decide? Historically, the mean has been the parameter of choice, so you could choose based on your predilection towards or against conformity.

Nonparametric Tests

'Tis simple, really. Nonparametric tests are identical to randomization tests on medians. The test procedures were constructed before computers as we know them existed; the business of creating ranks and so on was just a way of getting to the p-values such that, for a given set of sample sizes, test results could be put into a table, and hold for any data sets with the same sample sizes.

Parametric Tests

If your sample size is large enough or if your data come from a Normal distribution, it turns out there is a shortcut to the p-value (at least, approximately) from the randomization test: it's called a t-test (or F-test, depending on the circumstances). Some of these (F-tests, old-fashioned two-sample t-test) also require equal variances in the sampled populations.

Estimation

We often wish to do estimation as well as testing. The t-tools will of course produce confidence intervals readily. There are randomization-based tools that do it also, but they require enough data that you can likely count on parametric procedures to work well. The nonparametric tools have no such facility.

Maintaining Yellow Pine Ecosystems at Great Smoky Mountains National Park (Cont'd)

(Continued from page 1)

sume more duff have more pine regeneration. What made the Tabcat A and Wedge Ridge fires more severe than Arbutus Ridge, Stony Ridge and Tabcat B? We speculated on several factors but found duff moisture and time of year the burn occurred to be the most important.

Duff consumption is directly related to duff moisture: the drier the duff, the more that is consumed. In the east, we use a drought measurement called the Keech Byrum Drought Index (KBDI). The scale runs from 0 to 800 with 0 being totally saturated with water and 800 being completely dry. The average KBDI for the hot burns was 348, while for the cool burns it was 43. In the hot burns over 70% of the duff was consumed while in the cool burns less than 20% was consumed (Fig 3).

Second, time of year appears to play an important role. The two hot burns occurred in the fall. The three cooler burns occurred in the spring. Is it drier in the fall? Looking at a KBDI graph from 1997 to 2003 the answer appears to be yes. The highest KBDI values for the longest duration consistently occur in the fall. Second, perhaps fall burns prepare a seedbed for the pines which drop their seeds in the fall, while in spring burns the seeds drop the previous fall and give the re-sprouting hardwoods an entire season to preempt light and nutrients.

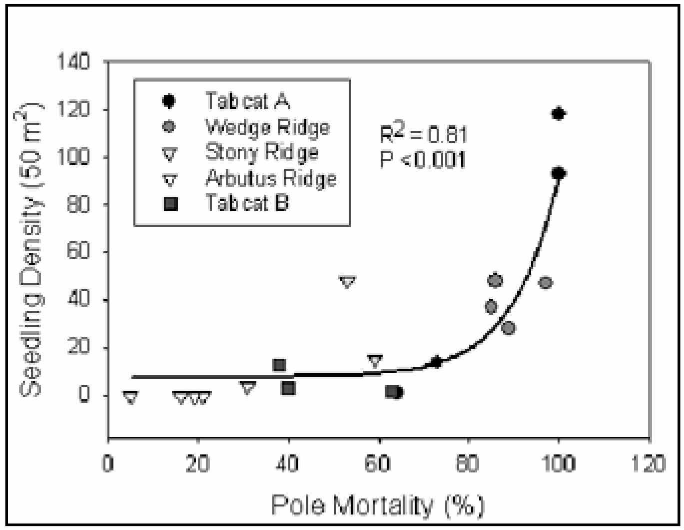


Figure 1. Relationship between pine seedling density and pole mortality grouped by burn unit.

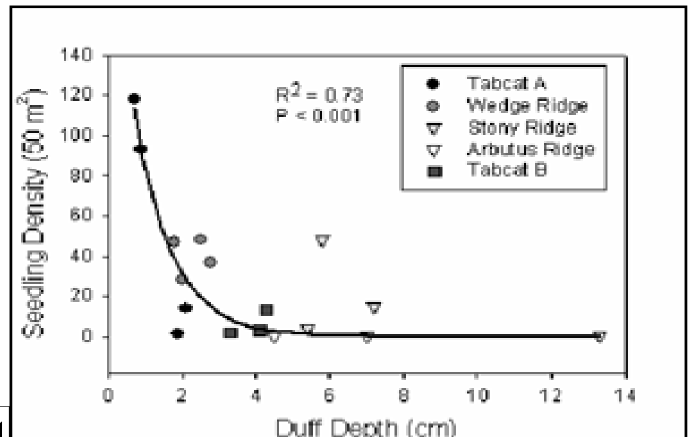


Figure 2. Relationship between pine seedling density and duff depth grouped by burn unit.

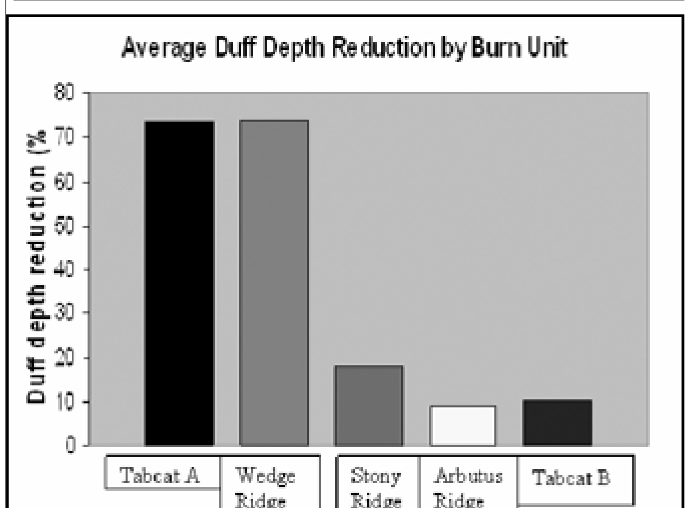


Figure 3. Percent duff reduction by burn unit.

IAWF Fire Behavior and Fuels Conference

The International Association of Wildland Fire, in association with the U.S. National Fuels Group, will be hosting the first in a series of conferences on Fire Behavior and Fuels. This conference is named "1st Fire Behavior and Fuels Conference: Fuels Management--How to Measure Success". The program will include: methods for fuel characterization, wildland urban interface, working across boundaries, collaboration to get the fuels treated, wilderness, parks, and roadless areas, case studies, learning from successes and failures, computer modeling tools, modeling fire behavior related to changes in fuels, international experiences, qualifications and skill levels, expanding the work force with contracting, policy, practices, and procedures, vendor displays. It will be held on the banks of the Columbia River in Portland, Oregon, March 27-30, 2006. A call for papers will be issued in the future. For more information and updates, please check the IAWF website at: http://www.iawfonline.org.

Northern Great Plains News (Cont'd)

(Continued from page 1)

The two primary objectives of the pilot project are: 1) compare the repeatability among observers for the two methods, and 2) compare the efficiency of the two methods. We selected four parks in the network (Agate Fossil Beds, Wind Cave, Devils Tower, and Theodore Roosevelt) for the project to give us a wide range of vegetation types to include in the study. We intend to install a total of 60-70 plots in 8 general vegetation types in the four parks. These vegetation types are riparian herbaceous, grassland, prairie dog town, ponderosa pine forest, shrubland, woody draw, riparian forest, and badlands sparse vegetation. A few of these are new vegetation types for us, so we will undoubtedly be encountering some new plants this season.

We've had the advantage of having USGS-BRD research ecologist, Amy Symstad, stationed at the NGP I&M office. She has been very involved throughout the process and has taken the lead on developing the vegetation monitoring protocols for the I&M program. Also, the NGP Network has hired two seasonal biological technicians to assist on the project. We plan to make them a part of our crew for the field season. They will assist us on fire effects plots and we will work with them on the pilot plots. I think this will be a good test of how our two programs can work through some of the administrative challenges that can come with two different programs working this closely together. Andy and I are looking forward to the challenges of the field season. Never a dull moment on the Northern Great Plains.

And since I'm writing this at the stats workshop, it's only appropriate that I include some data analysis results. Figure 1 includes total cover by year on grassland plots at Theodore Roosevelt and annual precipitation recorded from four weather stations surrounding the park. Out of curiosity, I ran a regression on total cover versus same-year precipitation and on total cover versus previous year's precipitation. Previous year's precipitation was a much better predictor (R^2 = 47%) of total cover than same-year precipitation (R^2 = 13%). Next, I performed a $\log_{10}$ transformation on both variables and was surprised by the results. Both relationships improved considerably, but previous year's precipitation was only slightly better (R^2 = 99%) than same-year precipitation (R^2 = 98%) at predicting cover (Fig. 2). It appears that precipitation one year is a very good predictor of total cover in grassland areas at THRO the next year.

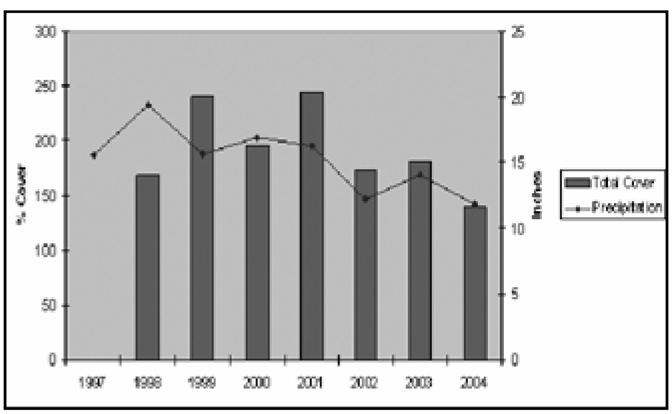
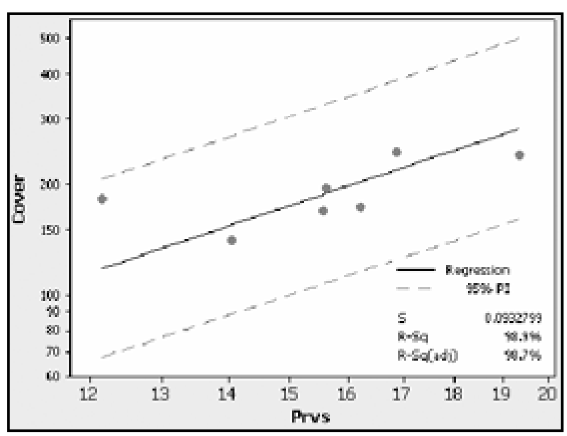


Figure 1. Total cover from grassland plots at Theodore Roosevelt National Park and annual precipitation recorded from four weather stations around the park.

Figure 2. Fitted line plot of the $\log_{10}$ transformation of previous year's precipitation (Prvs) versus the $\log_{10}$ transformation of total cover (Cover) on grassland plots at Theodore Roosevelt National Park.



Midwest Regional Meeting for Fire Ecology Staff

Jim DeCoster
Midwest Regional Fire Ecologist

The Midwest Fire Ecology Program met in November 2004 at the Regional Office in Omaha. The primary focus of the meeting was to help each other become more proficient at FEAT, but time was allocated to discuss monitoring of mechanical treatments, adaptive management, success stories, FRCC, monitoring plans, and other pertinent topics.

MW Fire Ecologists and Fire Effects Monitors on a field trip to a local TNC preserve (l to r): Scott Weyenberg, Andy Thorstenson, Adam Luraas, Alicia Sasseen, Dan Swanson, Amy Manke, Cody Wienk, Tyler Schmidt, Jim DeCoster.

The 50 meter tape contest during a break from the meeting: Adam Luraas, Alicia Sasseen and Tyler Schmidt try their darnedest to reel in the tape the fastest, as Cody Wienk looks on in amusement. Tyler walked away with the gold, despite Adam's trash talk.

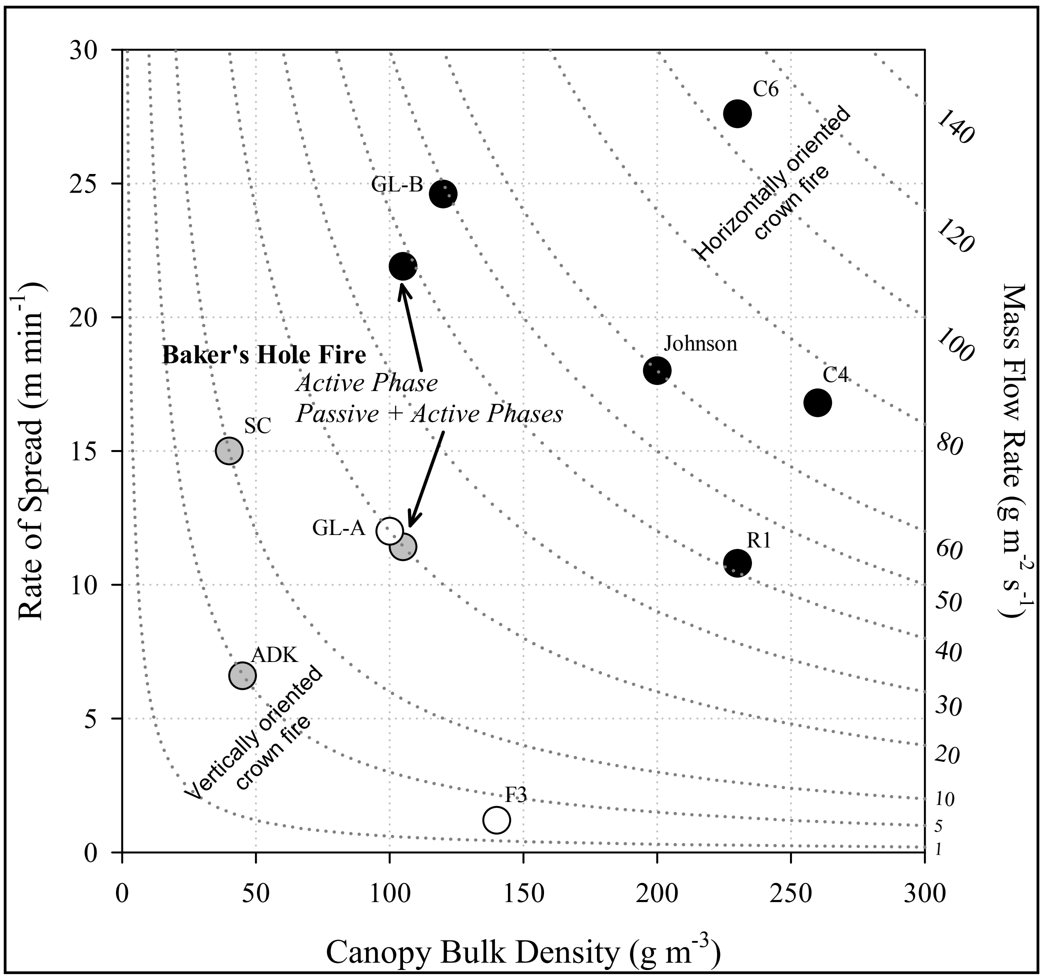
A Case Study of Canopy Fuels and Crown Fire Behavior in a Lodgepole Pine Forest, Montana, USA.

Eric A. Miller, Rebecca J. Seifert, Emily R. Moss, Sean C. McEldery, and Shawn J. Jackson.
Yellowstone Fire Management

Abstract

Mathematical models have great potential as predictors of crown fire behavior and for estimating target conditions for hazardous canopy fuel reduction projects. However models are poorly verified in the field because canopy fuels are difficult to measure, few prescribed fires call for crown fire intensities, and opportunities to observe naturally occurring crown fires are uncommon, unpredictable, and logistically difficult to monitor. We offer a case study of the Baker's Hole Fire, a free burning crown fire in a lodgepole pine (*Pinus contorta*) forest in Montana, USA in the context of weather and fuel conditions with the goal of improving our understanding of crown fire behavior. Our measurements of the mass flow rate of canopy fuel through the flame front was 20 g $m^2 s^1$ for some unknown combination of passive and active crown fire and, more tenuously, 38 g $m^2 s^1$ for active crown fire. Hazardous canopy fuel treatment projects designed to drop the mass flow rate below a threshold of 50 g $m^2 s^1$, as given by a previous study, may not be as resistant to crown fire as expected. Our study augments the few available data for mathematically modeling crown fire behavior in lodgepole pine forests.

For submission to International Journal of Wildland Fire



Mass flow rates (MFR) for crown fires in Van Wagner (1977). White, gray, and black circles indicate surface fires, and passive and active crown fires, respectively. ADK, C4, C6, F3, GL-A, GL-B, R1 and SC are crown fires in jack pine (*P. banksiana*) and various conifer forests in Canada. Johnson is a boreal conifer forest (Johnson 1992 cited in Agee 1996). Van Wagner estimated the critical mass flow rate to sustain active crown fire at 50 g $m^2 s^1$.

Pacific West Region Fire Ecology Meeting

MaryBeth Keifer
Pacific West Regional Fire Ecologist

The 2005 Pacific West Region's Fire Ecology Program meeting was held May 10-12 at Sequoia and Kings Canyon National Parks. The meeting was attended by 14 of the fire ecology staff members from throughout the region as well as a representative from Spatial Dynamics. Meeting in the park's historic Recreation Hall (complete with not-so-historic rodent residents), the group spent the first day with an introduction to the newly released FEAT2 desktop and learning FEAT mobile (beta version), led by Jen Hooke, Karen Kopper, and Austin Streetman. The second day began at the Beetle Rock Education Center in the renowned Giant Forest area of the park. As the woodstove slowly warmed the room, the group heard excellent presentations by Dr. Nate Stephenson, Tony Caprio (Climate change and fire patterns), Jen Hooke (Burn severity effects in spruce-fir forests of NW Wyoming), Tim Bradley (Remote sensing and other Central American adventures), and Paul Reeberg (Fireshed analysis). After lunch, the group donned hats and gloves to wander through the still snow covered Giant Forest, one of the focus areas for the parks' prescribed fire program over the last 20 years. Discussions included how the "black bark" controversy jumpstarted the parks' monitoring program in the 1980's, large sequoia tree damage and mortality issues, sequoia regeneration following fire, restoring and maintaining areas burned, and recent removal of major park facilities from Giant Forest and subsequent restoration. The last day of the meeting was dedicated to business including the budget outlook, annual report format, current work plans, and Resource Advisor, BAER, and BAR updates. In addition, a presentation by MaryBeth Keifer was given (30 years of counting sticks - research meets monitoring) and the group spent some time brainstorming a list of needs for FEAT to provide feedback to the FEAT Working Group. The annual meeting was a fine way to hear about all the great work everyone is doing throughout the region, share information and ideas, and enjoy good company!

The group took a field trip to the Washington Tree (pictured above). Pictures submitted by Tony Caprio and MaryBeth Keifer.

Fire in Eastern Oak Forests Delivering Science to Land Managers

November 15-17, 2005
Fawcett Center, The Ohio State University, Columbus

Please join us for this conference featuring invited presentations and posters by scientists and managers on a wide range of topics related to using fire to manage eastern oak forests. Our target audience is the management community, ranging from on-the-ground practitioners to administrators representing government agencies, the private sector, and nongovernmental organizations. A poster session and more than 20 invited talks will be given on fire history; forest change after fire suppression; fuels and fire behavior; fire effects on soils, air quality, flora (native and introduced), and fauna; social constraints on fire use; and prescribed fire law and litigation. A peer-reviewed conference proceedings will be available after the conference. For registration and other information, see the conference web site: *http://www.fs.fed.us/ne/delaware/4153/fireconf.html.* Registration, a reception, vendor and other displays, and the poster session will be held from 4-9 PM on November 15th. Space will be provided to post resumes and job announcements. Invited presentations will occur all day on November 16th and 17th. Conference certified for 15 Category I CFE credits from the Society of American Foresters. Abstracts for posters will be due on 15 October 2005. For more information, contact: Matthew B. Dickinson, Research Ecologist, Delaware, OH, 43015-8640, email: mbdickinson@fs.fed.us, 740-368-0096.

RxFx Subscription and Submission Information

This year's Editor: Becky Seifert (YELL)

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 annually produced 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). The goal of the newletter is to let the Fire Effects Monitoring community know about you and your program.

Rx Effects is issued each year in the Spring. The next submission deadline is 28 April 2006. If you would like a subscription or more information please see our website **www.nps.gov/yell/technical/fire/rxfx.htm** or contact Eric Miller 307-344-2474. Fire Management Office, P.O. Box 168, Yellowstone National Park, WY 82190-0168.

Rx EFFECTS

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National Park Service Fire Effects Monitoring

http://www.nps.gov/fire/fire/fir_ecology.html

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www.nps.gov/yell/technical/fire/rxfx.htm