National Park Service Fire Effects Monitoring Program

Rx Effects

Volume 1, Issue 1

Autumn 2000

From the Editor: Your Newsletter

Eric Miller (YELL)

You hold in your hands the first issue of the National Park Service's Fire Effects newsletter. In these pages you'll find information about your friends and neighbors in the world of Fire Effects Monitoring and Fire Research. As editor I have experienced an overwhelming interest in subscribing to a newsletter, suggesting a real need for communication between parks and with other agencies with prescribed fire programs. You are interested in what other programs are doing! However it's been a struggle for me to get submissions. Believe me, creative journalism is much more fun than battling the data entry software so what's the problem? Remember, this is an opportunity for you to boast your accomplishments, get your name in print, and impress your FMO. Of the people I've contacted (begged, really) the most common excuse was, "I don't know what to write." This is *your* newsletter. Its open-ended nature means that the newsletter will become what you want it to become. I see it evolving through the years to match the needs of the Fire Effects community. For now, read what these brave, intrepid Fire Effects pioneers have written and think about what you'd like to say in the next issue.♦

Henry Bastian explains how to construct a fire effects monitoring plot during Rx 80 in Grand Teton National Park this year.

Inside this issue:

Glacier "Plot Shots" Make Headlines

Bob Merrow (GLAC)

OK, so maybe the headline is an exaggeration. Cerro Grande and fires in the Northern Rockies stole the headlines, but plotshots continued in their pursuit of the perfectly squared plot nonetheless. What follows is a brief summary of what transpired for the Glacier National Park crew this field season.

The season began with plot installation at Big Hole National Battlefield. The weather was cool but cooperative & we managed to install a few plots in the new Ponderosa Pine monitoring type. As always, Tim Fisher went out of his way to make us feel at home in the beautiful Big Hole Valley.

Shortly, thereafter it was time to head on down to Grand Teton National Park for RX 80. This year's class was, in my humble opinion, a huge success. Diane Abendroth did a great job coordinating, the cadre was top notch, and Aspen Ridge provided the perfect environment for learning. The views of the Tetons were magnificent and a bull moose wandered through the field session proceedings.

"On the road again..." and so it was with our crew. Next stop Joseph, Oregon. We spent a week installing plots at Old Chief Joseph's Gravesite in a new Palouse Grassland monitoring type. Again, the weather was cooperative, this time 90° F and clear blue skies. Were it not for a large bottle of sunblock and our proximity to Wallowa Lake we may have perished. But, there were more plots to read, so we carried on.

Sometime in July we actually made it home to read our Ponderosa Pine plots. Of course, just as we reached the peak of flowering, fire season arrived in Glacier. Initial attack kept us busy & the Parke Peak fire grew to 2100 acres. Our compadres from Yellowstone, Eric and Brian, came to our assistance and we rallied to read the plots before the plants shriveled.

Not long after Brian and Eric left, another lightning bust came through & divided our attention again. This time the Sharon fire grew to 450 acres in two days. Fire season was really heating up. Then, as quickly as it came, it faded away with 2+ inches of precipitation in September.

Well, all of the data has been input, the plot files tidied up, the photos labeled, and the sesonals are terminating. The first snow of the season has come to the mountains & thoughts drift towards next field season. Until then, keep your tapes straight & your eyes to the herbaceous transect.

Fire Effects in the Tetons

Diane Abendroth (GRTE)

It was an interesting year of diverse activities and adventures for our interagency Fire Effects Crew. Grand Teton National Park and adjacent Bridger-Teton National Forest have several monitoring types including aspen, sagebrush, bitterbrush, Douglas fir, lodgepole pine, and whitebark pine. We are developing a willow (*Salix geyeri*) type in the moose and bear infested jungles near Jackson Lake, but the notion of stem counts leaves us quaking in our waterlogged boots. Our program seems inadequate without any ponderosa pine monitoring types so we have been secretly planting PIPO out at Aspen Ridge. So far seedling survival has been poor due to trampling by the Yellowstone Fire Use Module.

One of the parks we work with is Bighorn Canyon National Monument on the Montana-Wyoming border. This year we developed a *Juniperus osteosperma* type, and collected postburn and year 1 data on a greasewood type that was burned as part of a weed eradication project on formerly irrigated salt desert. Bighorn Canyon is a dramatic landscape with wild horses, bighorn sheep, and a diverse flora (which includes PIPO!)

Our fire effects program is fairly new and it is exciting to work with so many plant community types on the Park and Forest. Close coordination is needed with many resource managers with various needs and perspectives. The Bridger-Teton Forest prescribed fire program is growing by leaps and bounds, and we must take care to establish monitoring protocols that fit in with all the multiple range, timber, wildlife, and wilderness objectives. The official vegetation monitoring method for FS Region 4 is Nested Frequency, so we need to negotiate how to proceed.

Several large wildfires burned in Teton Park and the BT forest this summer, which added spice to our summer's activities. We were not able to install plots ahead of the flames, but we did manage to record photopoints and collect burn severity data from the ground and air (by foot, boat, horse, helicopter, and of course our snazzy dark green Chevy suburban assault vehicle...). We will use this to ground truth satellite images for severity and perimeter mapping. Next year we hope to team up with Yellowstone and Glacier to test the Normalized Burn Ratio method of mapping burn severity from pre- and post-fire LANDSAT images (*see Remote Sensing, p. 4 this issue*). This technology seems to have a great deal of potential for fire effects monitoring and planning for WFURB and Prescribed fires.

Now we are busy putting away our summer toys and looking at what our data is telling us. It was a great summer in the Tetons – who could ask for more? (OK, OK, lift the Rx

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Prescribed Fire Monitoring at the Arkansas Field Office of The Nature Conservancy

Douglas Zollner (TNC)

The Arkansas Field Office (ARFO) of The Nature Conservancy manages 33 ecologically sensitive sites with fire. In addition, ARFO burns ecologically sensitive lands for partner agencies such as the Department of Defense, Arkansas Natural Heritage Commission, Corps of Engineers, and in some instances private landowners. The fire program has steadily increased in number of prescribed burns and acres prescribed burned since it was established in 1988. Currently, ARFO runs two, 6-8 week long prescribed burn crews per year, generally from March - May and October - December, with summer (August and September) burns being conducted by permanent staff. ARFO averages 25 prescribed burns covering 2,500 - 3,500 acres per year. ARFO also holds at least one prescribed fire training workshop and conducts six to nine training burns per year.

Monitoring is an integral part of the ecological management of natural areas. The ARFO prescribed burn monitoring program asks and answers questions at four levels. Questions one and two are discussed in a single report within a few weeks of the burn. Question three is answered by the results of long-term plant community and sensitive species monitoring which feeds into site conservation plan updates. Question four is analyzed on a yearly basis.

Operations

1. Did the prescribed burn go as planned?

This question is asked and answered after every burn. Some of the factors that are measured and analyzed include:

Weather (forecasted, onsite, actual, deviation from plan)
Fuel conditions (actual, plan guidelines, drought indices, were plan guidelines appropriate)
Firelines (actual, plan guidelines, were the plan guidelines appropriate)

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Yellowstone: One Step Ahead of the Flames!

Mitch Burgard, Todd Carlson, Eric Miller (YELL) ***www.nps.gov/yell/technical/fire***

The Yellowstone Fire Effects Crew had a busy 2000 season. The extreme conditions in the Northern Rockies produced 29 natural ignitions in the park, four of which exceeded 100 hectares in size. The number and sizes of the fires allowed us to install five monitoring plots ahead of three naturally ignited fires. Installation of plots on natural ignitions (WFURB plots) allowed our program to continue research on the effects of wildland fire despite the moratorium on prescribed fire in the park service. It also allowed us to add information to an existing, long-term (21 year) dataset which we hope to analyze this fall. The first WFURB plot (Two-Smokes) was installed over a smoldering fire on the Pitchstone Plateau in the southwestern corner of the park in a stringer of forest within a large meadow complex. We couldn't fit an entire 1000 m2 plot in the tree stringer so reduced its size to half but managed to squeeze in the full complement of herbaceous vegetation and fuel transects. This plot burned in the following weeks and was resampled in mid-September.

We installed two more WFURB plots on the-Boundary Fire (~150 ha) at the south boundary of the park. This fire ignited in jack-strawed lodgepole pine from the 1988 fires. One plot burned one day after installation. The other burned about five days later. These two plots are interesting because this cover type was not expected to carry fire as well as it did. The data will be valuable to Yellowstone Fire Managers as they seek to predict how wildfires will behave in the extensive areas of regenerating lodgepole pine in the park that resulted from the 1988 fire season.

The last two WFURB plots were installed on the Plateau Fire (~1000 ha) but the weather changed and neither of them burned.

We also planned to install four transects in a natural burn which occurred on Labor Day 1998 on the Northern Range near the Blacktail Ponds. This fire burned up to the edge of the trail, presenting a perfectly paired treatment/ control experimental design. However several delays, mostly due to impending fire activity, allowed us to read only one of the transects on the burned side of the trail before the grasses went crispy. We are hopeful to sample the other transects next year. These plots will allow us to track changes in the Northern Range resulting from fires.

We also re-visited some vegetation plots installed by Don Despain (USGS, Northern Rocky Mountain Science Center). Don installed the plots, most of them ahead of wildfires, between 1977 and 1989. These plots have been re-read every few years. Needless to say this is a valuable dataset to the fire ecology community of the Northern Rockies. We presented some of our results at the Second USGS Wildland Fire Workshop in Los Alamos in early November (*Abstract on p. 5*). Currently, we are working toward publishing this information.

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Remote Sensing: Fire Effects Monitoring from Space

Mitch Burgard (YELL)

A two day course in remote sensing for fire severity was hosted at Glacier National Park by Carl Key (USGS Mid-continent Ecological Science Center), and Nate Benson, (Prescribed Fire Specialist, Everglades National Park). Carl and Nate presented a synopsis of their research on using satellite imagery as a measure of fire severity on Glacier's landscape fires from 1994 to 1999. To simplify, their work consists of two parts; the Normalized Burn Ratio (NBR) and the Composite Burn Index (CBI) field rating. The NBR is the index of radiometric values used to distinguish burn severity levels returned from remote sensing (basically all the satellite image tweeking that is done through various computer programs and formulas that give you a final severity map). The CBI is essentially the ground truthing portion of the analysis and assures that the values on the final severity map are accurate from the field to the computer and vice versa.

The Web Sites The ins and outs of LANDSAT banding and generation of the final image are too complicated to describe in their full glory in this article but the following web sites (authored by Carl and Nate) are an excellent resource for those wanting to delve deeper into the workings of their methodology. They also have some great full color examples of some final severity maps and lots of analyses.

For the NBR visit: http://www.mesc.usgs.gov/glacier/NDBR.htm
For the CBI visit: http://www.mesc.usgs.gov/glacier/cbi.htm

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Bryce Canyon and Zion: Results!

Henry Bastian (BRCA/ZION)

Examples from **Bryce Canyon** and **Zion National Parks** *of using the National Park Service Fire Monitoring Handbook establishing vegetation monitoring plots and using prescribed fire as the treatment. The original Posters/Papers were presented at the Steps Toward Stewardship: Ponderosa Pine Ecosystems Restoration and Conservation Conference held April 25-27, 2000.*

Bryce Canyon

For full details and information please see: Bastian, Henry V. 2000. The Effects of a Low Intensity Fire on a Mixed Conifer Forest in Bryce Canyon National Park, Utah. General Technical Report RMRS-GTR-XXX. Fort Collins, Co: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. XXp.

Abstract Prescribed fire was used to reduce fuel loading and tree densities. Permanent vegetation and fuel loading plots were randomly established within prescribed burn units. The plots were established in 1995 and were sampled, immediately post burn (within one month of the fire), one year after the burn and two years after the burn. The prescribed burns were implemented in August of 1995. Preliminary analysis of 11 plots shows fuel loading was reduced from 31.9 tons/acre to 11.4 tos/acre immediate post burn. White fir (*Abies concolor*) overstory was reduced 35%, poles 52% and seedlings 71% by the second year following the

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Zion

For full details and information please see: Bastian, Henry V. 2000. The Effects of Low Intensity Prescribed Fires on Ponderosa Pine Forests in Wilderness areas of Zion National Park, Utah. General Technical Report RMRS-GTR-XXX. Fort Collins, Co: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. XXp.

Abstract Vegetation and fuel loading plots were monitored and sampled in wilderness areas treated with prescribed fire. Changes in ponderosa pine (pinus ponderosa) forest structure tree species and fuel loading are presented. Plots were randomly stratified and established in burn units in 1995. Preliminary analysis of nine plots two years after burning show litter was reduced 54.3%, duff was reduced 34.7%, ponderosa pine tree density in the 10.2cm to 30.5cm DBH (Diameter at Breast Height) size class was reduced 18% and ponderosa pine tree density greater than 61.2cm DBH increased in Zion National Park.

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Twenty Years of Post-fire Vegetation Development in Yellowstone National Park

Don G. Despain (USGS) and Eric A. Miller (YELL)

Presented to the 2nd Annual USGS Wildland Fire Workshop in Los Alamos 31 Oct-1 Nov 2000

Abstract Much of what we know of the effects of wildfire on plant community succession comes from plots established prior to low intensity prescribed fires or from plots sampled immediately after high intensity crown fires. There seems to be little information on the effects of crown fire where pre-fire vegetation conditions are well documented. Moreover, little information exists regarding plant community succession in the extensive areas of Yellowstone National Park that burned in 1988. We address these issues by analyzing a set of permanently marked vegetation sampling plots that were established ahead of wildfires in the late seventies and in 1988. Some plots were sampled prior to burning, annually for five years, and every several years thereafter. Others were established post-fire in forest types where we were unable to establish pre-fire plots. It is hoped that these plots can be continually sampled into the future.

In this presentation we present data on three sites with vegetation records spanning 21 years. Two plots were installed before burning in 1979, one of which reburned in 1988. One was installed post-fire in 1977. We used Detrended Correspondence Analysis (DCA) to reduce the complexity of the dataset allowing us to analyze trends in plant communities. By using DCA we hope to be able to plot gross trends in community composition with time. We used simple plots of species cover and frequency versus time to track changes in individual species. Our preliminary findings indicate an obvious change in community structure. Species associated with older forest (e.g. *Erythronium grandiflorum, Thalictrum occidentale, Orthilia secunda, Pedicularis racemosa*) that are present but not common drop out altogether. Other species survive and become more abundant at first then begin to decrease but still dominate during early post-fire succession (e.g. *Arnica cordifolia, Epilobium angustifolium, Aster* spp., *Senecio* sp.) Fire sensitive species such as *Vaccinium scoparium* and *Fragaria virginiana*) initially decrease in abundance after fire and recover slowly, particularly at the reburned sites. We see invasion by exotics at all three sites, particularly *Cirsium arvense* and *Taraxacum* spp. After the reburn in 1988 we see invasion of some new exotic species (e.g. *Rumex acetosella*) and an increase in cover of existing exotics. Graminoid cover also increases after reburning (e.g., *Poa* sp., *Bromus* sp., *Calamagrostis* sp.)

Help Improve FMH Software Development

Are you tired of the old FMH software? In case you haven't heard, we have a plan to get better software for the FMH database. We're looking for comments from any FMH user. Let us know what isn't working for you now, and what you want the software to do. If enough people show interest, we can get new and better software. Email or call Peggy_Herzog@nps.gov (415) 663-8160.♦

Teton

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fire moratorium and hand me a drip torch…?!)♦

I think Diane was too modest to include something about the great RX 80 course which she and Grand Teton National Park hosted at Aspen Ridge. Good job! —Ed.

Yellowstone

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We are also working with Despain to adapt our protocols in order to satisfy FMH yet also complement and continue to add to his long-term dataset.

We are developing a GIS database of old fires in the park using archived maps and records. Bob Flather and the Fire Effects crew are working with the Yellowstone Spatial Analysis Center to develop a database of fires stretching back to the 1930s. This database will allow wildland fire managers to quickly access a landscape-level spatial history of fires in the park. The information can be used to predict how wildfires will behave at the perimeter of old burns.

This year we continued to expand our crew's experience through exchanges with other parks. In 1999 we invited the Saguaro Fire Effects crew to help us out on our plot work and we learned a lot from them. We owe them special thanks for their excellent record keeping and written directions to the plots (We easily re-located their plots inside a huge unit this spring on written directions alone). This year

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Bryce Canyon

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burn.

Poster Highlights Many factors influence vegetation succession and how a fire burns across the landscape, but both are mainly affected by land use or management practices. "A comparison of today's landscape at Bryce Canyon National Park with the landscape shown in historic photographs indicates that a major change has occurred in the Park's vegetative mosaic" (Roberts et al. 1993). "Journals from early settlers in Garfield County [Bryce Canyon area] describe open forests, where visibility was several hundred yards. These early ranchers and farmers tell of being able to take a wagon and team of horses through the forests on top of the Paunsaugunt Plateau". What caused the change in the vegetation and landscape as described above?

In 1995, eleven mixed conifer (*Abies concolor/ Pinus ponderosa*) vegetation-monitoring plots were established according to the Western Region Fire Monitoring Handbook Protocols (USDI, NPS 1992).

The pre-burn fuel loading was 31.9 tons/acre. Fuel loading was reduced 64% to 11.4 tons/acre immediate post burn. Total fuels have achieved 52% of the pre fuel loading level to 16.5 tons/acre two years after the burn. White fir overstory trees had a density of 81.7 trees/acre pre-burn and ponderosa pine had a density of 22.8 trees/acre. Two years after the burn, overstory white fir was reduced 35% to 53 trees/acre and overstory ponderosa pine was reduced 16% to 19.1 trees/acre. White fir poles decreased 52% from 169.2 trees/acre to 80.9 trees/acre two years after the burn and ponderosa poles decreased 50% from 5.9 trees/acre to 2.9 trees/acre. Seedling white fir decreased 71% from 1604.1 trees/acre to 463 trees/acre two years after the burn, while ponderosa pine seedlings decreased 40% from 36.8 trees/acre to 22.1 trees per acre.

Fire behavior and intensity can vary from burn to burn, and will vary across the landscape producing different effects. These changes move the forest vegetation structure toward a less crowded forest where future prescribed or natural fires may function in maintaining an open vegetation mosaic. This is an example of what prescribed fire may do in this vegetation type.♦

Roberts, D.W., M.J. Jenkins, D.W. Wight (1993). "Historical Vegetation, Fuel Loads, and Integrated Resource Information System for Bryce Canyon National Park". Final Report USDI Contract No. 88-264: 249.

USDI National Park Service. (1992). "Western Region Fire Monitoring Handbook". Western Region Office, San Francisco, CA.

Zion

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Poster Highlights: Historically, lightning and human caused fires influenced vegetation structure. Vegetation is constantly growing and changing and fire provides a natural means of checks and balances for many landscapes. Fires reduced fuel accumulations and maintained open, grassy forest stands.

West and Madany (1981) cited Alter (1942) with a description from Priddy Meek's journal. [This description is of the land just to the northeast of what is presently Zion National Park.] In June of 1852, Priddy described the area as; ". . . Rich soil, plenty of grass and timber . . . so that a team and wagon might be driven any place . . . We traveled three days amongst this timber, which is of the best quality and clear of underbrush". What caused this open vegetation structure? Many studies have shown that ponderosa pine vegetation systems have evolved with fire and require it for growth and recruitment. West and Madany (1981) researched the fire history of Zion National Park and stated that, "From the fire scar record we can safely state that any location within a ponderosa pine forest burned at least once, and more likely twice, every decade in the time before white settlement." This conclusion fits comparable descriptions from early settlers of the West and demonstrates that many fire cycles have been missed in this fire regime. Using prescribed fire in wilderness areas may help restore this scene of open forests

Ponderosa pine vegetation monitoring plots were established according to the Western Region Fire Monitoring Handbook Protocols (USDI, NPS 1992). Nine plots were stratified randomly within the prescribed burn units.

Plots were burned between 1100 and 1600 hours. Weather conditions during prescribed fires included: ambient air temperatures of 55^{o} F to 70^{o} F, relative humidity of 13-33%, mid-flame wind speeds of 0-18km per hour, and 0-70% shade. Fire behavior observations included: flame lengths of .2 to .6 meters, flame zone depths of .4-.8 meters, rates of spread for backing fires of 5 to 17 meters per hour(m/hr), flanking fires of 5 to 15 m/hr., and head fires of 11 to 18 m/hr.

Litter was reduced 55.3% from 1.03 kg/m2 to .46 kg/m2 at the immediate post burn sample. Duff was reduced 34.7% from 4.52 kg/m2 to 2.97 kg/m2 immediate post burn. Total fuel loading was reduced 34.5% from 6.89 kg/m2 to 4.50 kg/m2 immediate post burn.

Ponderosa pine overstory in the 10.2 – 30.5cm DBH size classes was reduced 18% from 138.9 trees per hectare to 114.4 trees per hectare and trees greater than 61.2cm increased from 1.1 to 7.8 trees per hectare within two years after the burn.

Needle/litter fuel load layer was reduced 54%. This meets the objective to reduce it by 40-60%. Duff fuel loading was reduced 35%. This is close to meeting the objective. Pole sized trees were reduced 18%, which is well below the objective of attaining a 30-60% decrease in this size class. These results provide some evidence that prescribed burning can be an important step in restoring some vegetation structure described in the past. Continued burning and monitoring may help restore the natural range of variability in these vegetation communities

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The Nature Conservancy

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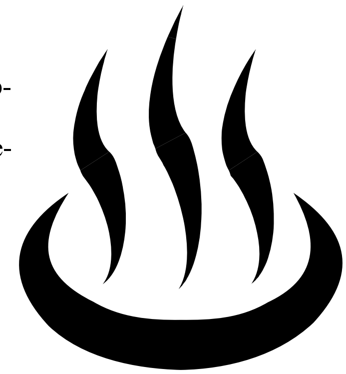
Equipment (was the equipment in the plan available, did it work, was it appropriate)
Crew (were the crew number, training, and assignments appropriate)
Timing (was timing of ignition, securing the perimeter, interior ignition, and burn out appropriate)
Fire behavior (was the rate of spread, flame length, torching, and other behavior as predicted)
Smoke (did the smoke go where it was supposed to)
Mop-up (was mop-up completed as planned)
Safety (are there new safety concerns)
Public relations (were public interactions satisfactory)
Were there problems during the burn (what were they, recommended plan adjustments)



Immediate Post Burn Effects

1. Did the prescribed burn meet specific (1st order) objectives?

This question is asked and answered after every burn. Some of the factors that are measured and analyzed include:

Area covered (percent of unit)
Area covered (by plant community or fuel type – percent)
Burn severity organic substrate (impact on soil, duff, litter)
Fuel (reduction and creation 1, 10, 100, and 1000 hour fuels)
Burns severity on herbaceous and shrub layers (understory)
Char height and degree (overstory)
Scorch height and degree (overstory)
Did the fire achieve burn objectives (recommended burn plan adjustments)

Site (management unit) Ecological Goals

1. Are the prescribed burns overtime meeting measurable (2nd order) plant community and sensitive or indicator species goals?

This question is asked and answered over time by a plant community and sensitive species monitoring plan imbedded within the site conservation plan. Some of the factors measured and analyzed include:

Plant community composition (sensitive and indicator species, type, intensity, frequency, and seasonality of burns, ignition patterns)
Plant community structure (density and spatial arrangement of plants, type, intensity, frequency, and seasonality of burns, ignition patterns)
Plant community mosaic (size, shape patchiness, configuration of fuels and burn units)
Fauna (sensitive and indicator species, type, intensity, frequency, and seasonality of burns, ignition patterns)

Program Goals

1. Is the prescribed fire program meeting the conservation mission? (or are you just burning up leaves?)

This question is asked and answered yearly. Some of the factors measured and analyzed include:

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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 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 magnetic files through e-mail). The goal of the newletter is to let the Fire Effects community know about you and your program.

Rx Effects is issued each year in the Autumn. The next submission deadline is 28 September 2001. If you would like a subscription or more information please see our website www.nps.gov/yell/technical/fire/rxfx.htm or contact Editor, Rx Effects, 307-344-2474. Wildland Fire, P.O. Box 168, Yellowstone National Park, WY 82190-0168.♦

The Nature Conservancy

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Acres burned per year
Safety
Finances
Training conducted
Acres of ecological burning conducted by other programs
Public response and perception of prescribed burning
Fuels reduction and lessening of severe wildfires

Monitoring is a necessary part of the stewardship of natural resources. Adaptive management is impossible without it. Due to public scrutiny, financial cost, and the risk associated with using prescribed fire as a management tool, effective monitoring is extremely important in our ability to explain the benefits and indeed the necessity of prescribed burn programs.

Yellowstone

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we had the opportunity to detail two of our crew with Bob Merrow and the Glacier crew. We've found these exchanges to be mutually edifying, not to mention a lot of fun. We hope to continue exchanges in the future.

Last year, Yellowstone hosted Rx 80 (Preburn Inventory Techniques) in West Yellowstone, Montana. Janet Hobby (former Yellowstone fire monitor now with Wrangell-St. Elias and other Alaska parks) did an excellent job facilitating. This year we sent our three fire effects technicians, our fire monitors (Steve Petrick-Underwood, Travis Neppl, Brian Sorbel), our wildland fire interpreter (Tiffany Potter) and our Prescribed Fire Specialist (Jim Kitchen). We brought our new folks up to speed and those who have taken the course previously assisted in instruction and learned some new things as well. Rx 80 is always educational as well as an excellent way to meet people with similar interests.

As a young program, Yellowstone continues to develop its prescribed fire program. This fall we plan to write our Fire Effects Monitoring Plan in conjunction with revision of the Fire Management Plan. Since our park is heavy on fire use and light on prescribed burning, this is an opportunity to figure out how to fit ourselves in the larger picture of fire research. We also plan to evaluate our pilot plots and make necessary changes in protocols. For example, we have dropped the belt transect for brush density because the shrubs encountered in Yellowstone are compact enough to be accurately measured in the herb transects. We have also elected to go with Daubenmire frames instead of point intercept in order to match Despain's long-term dataset. This year we began coring several dominant trees in each plot to obtain an estimate of stand age. Stand age will allow us evaluate a forest's seral stage and fire history. It will also allow us to give our Fuels Specialist estimates of fuel accumulation rates in various cover types.

Other ongoing projects include the establishment of a wildland fire library focusing on lodgepole pine ecosystems, and continuing to improve our GIS capabilities in conjunction with Yellowstone's Spatial Analysis Center. For

Zion

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to a self-sustaining state.

Alter, J.C., ed. 1942." Journal of Priddy Meek's". Utah Historical Quarterly 10:145-223.

USDI National Park Service. 1992. "Western Region Fire Monitoring Handbook". Western Region Office, San Francisco, CA.

West, N. E., and M. H. Madany 1981. "Fire History of the Horse Pasture Plateau". Final Report USDI Contract No. CX-1200-9-B048. USU. 77 & 191 p.

Remote Sensing

(Continued from page 4)
The Lame Layman's Description Understanding the entire process as a member of a fire effects crew is not essential but it is worth knowing the basics to comprehend the results of the final product. Though the process may be hard to describe or understand for those that haven't worked much with LANDSAT, one of the reasons the NBR is so innovative is it's relative ease and simplicity. Those familiar with remote sensing will appreciate how easily a severity map can be produced with two quality images. According to Carl, once the images are purchased, they can be used to generate a grey scale severity map within just a few hours.

Using NBR to create the initial severity map At the risk of oversimplifying the process, a grey scale map with each pixel representing 30 square meters and returning over 1000 possible values per pixel is produced using NBR. To do this, two LANDSAT images are required: one pre-fire and one post fire. For Glacier the best images are produced in June (i.e., a fire severity map is produced using pre– and post-fire June images).

Remote sensing satellites return images from up to 9 different bands, each band representing a different portion of the light spectrum (from visible to infra-red and others). These bands are essentially different levels of visible and invisible reflectance from the earth. Fire, being a major disturbance on the earth, returns a different reflectance value on the post fire image depending on how severely it burned. By adding, subtracting and dividing a combination

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Remote Sensing

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of bands 4 and 7 the NBR essentially 'normalizes' the two images by standardizing radiance, reflectance, day to day differences in images (sun angle etc.). Once this normalizing process is completed the two images can be compared with each other. Unburned areas from spring to spring tend to appear 'washed out' and dark grey on the final composite because there were few changes in reflectance between the two images. Where fire occurred, however, the images have obviously changed dramatically and are represented by an increasingly white image as changes (severity) are more defined. You can view examples of some of these images on the web sites.

Besides the obvious benefit of producing a perimeter that is much more accurate and ultimately more cost effective than aerial or ground mapping a landscape fire, the grey image (even without ground truthing) returns a good representation of fire severity. An added benefit of using remote sensing for monitoring fire severity is that it can be used for landscape fires back into the mid to late 1980's (though accuracy would probably decline a bit with increased time).

Using CBI for ground truthing Though the grey-scale image is a good representation of change on the landscape, the final image returns over 1000 value possibilities per pixel, which is more than the human mind (or even the computer's color scheme) can handle. This is where the CBI, ground truthing and fire effects staff come in.

A good portion of our course time was spent in the field quantifying fire severity. To do this, representative sites of equal severity were chosen from the grey scale map. The course participants then had the enviable task of visiting these sites and wandering around Glacier in last years Anaconda Fire. The most difficult part of the plot work was avoiding the distraction that the fire enhanced mountain views presented.

A severity rating matrix, designed by Nate and Carl, was used to record severity in the circular 20 meter plots. Like the NBR, the CBI shows its genius in it's relative simplicity. Though the severity matrix has changed slightly from the one displayed on the web site, the new form still uses a 7 point severity scale from 0 (no effect) to 3 (high severity). The matrix is broken into an understory category (including substrates, low shrubs and herbaceous vegetation and mature shrubs and saplings) and an overstory category (returning scorch, torch, char and other values for intermediate and mature overstory trees). Depending on severity and complexity, each plot can be examined in less than 30 minutes…a breath of fresh air for those that have spent hours on FMH plots!

The values returned from the plots are then taken back to the computer to calibrate the grey scale into 5-7 color categories. The 1000 plus values are broken down into 5-7 categories of severity and a color map is generated. This combination of the NBR and CBI data results in a final severity map that fire managers, researchers and almost anyone with an interest in severity can utilize to answer their questions or use as a starting point for further research. As presented by the web site, the final map can be utilized for a plethora of reasons, whether you are 'interested in habitat enhancement, erosion potential, future fire breaks, weed invasion, biodiversity, how wildfires burn, or just a good place to find woodpeckers.' Other possibilities are endless.

Why you were subjected to all of this For those of us in parks that experience landscape scale natural or prescribed fires, FMH protocols present a problem in that it is difficult (in fact impossible) to use our data to generate an accurate severity map for thousands of acres-- at best we have a few snapshots of a very large area. Prior to this technology, the best we could do is hand map severity aerially or from the ground, but the results returned are subjective and costly considering their quality. Once calibrated, the NBR/CBI process returns values for what are essentially thousands of 30 meter plots across the entire burn area and eliminates much of the subjectivity of hand mapping.

Remote sensing is not a panacea for the daunting task of understanding the effects of landscape scale fires, but is probably the best starting point we have. Using satellite imagery in conjunction with other research, such as FMH plots, we suddenly have a much more powerful research tool. Not only can we examine our data based on monitoring types but, by utilizing the severity maps, we can examine our plots based on severity. In a similar fashion, information generated from our plots (especially if we watch them burn) can be fed into the severity classes to describe the effects of fire in greater detail.

How fire effects staff are getting involved Carl and Nate graciously shared their methodology in hopes of testing the process in several different ecosystems. A few agencies outside of the Rocky Mountain Region are already utilizing NBR and CBI in a pilot program. Due, in part, to very similar research that Brian Sorbel (Yellowstone's fire GIS specialist) has already conducted as part of his master's thesis, several agencies in the Greater Yellowstone Ecosystem have taken an interest in participating in the pilot study.

After this meeting all the participants enthusiastically agreed that Grand Teton National Park, the Bridger-Teton National Forest and Yellowstone will begin sharing GIS specialists (for NBR) and fire effects staff (for CBI) to test the method and calibrate it to our region. Because all three of our areas experienced an extreme fire season in 2000 and (as an added stroke of luck) the satellite image for the area just hap-

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Welcome to the Fire Effects Newsletter!

Elizabeth Anderson

This is the inaugural issue of the Intermountain Region Fire Effects and Fire Ecology Newsletter. This newsletter has been established to serve as a forum for fire effects monitoring and fire ecology discussions. The newsletter is open to contributions from anyone working with fire effects monitoring, fire ecology, prescribed fire or wildland fire-use monitoring issues. All agencies involved in these efforts are encouraged to participate.

We want this to be an opportunity for open discussion about fire effects monitoring issues. Submit articles about:

- what monitoring techniques have worked for you and what have not,
- what kind of sampling design modifications you have found to be useful,
- what additional and optional variables are you monitoring and why,
- how the adaptive feedback loop into fire management planning is working,
- and any other monitoring ideas that you want to discuss.

This is a format for you to ask questions and generate discussion. We will also discuss new technology and applications, such as the use of satellite imagery to monitor fire effects for wildland fire-use fires.

Our overall goal is to make the fire effects monitoring and fire ecology programs the most effective that they can be. The best way to do that is through open exchange of information. I strongly encourage anyone who is involved with fire effects monitoring and fire ecology efforts to submit articles to this newsletter.

I want to thank Eric Miller and the fire management staff of Yellowstone National Park for their commitment to making this newsletter a reality. I would greatly appreciate feedback on the newsletter format and content. I can be reached at elizabeth_anderson@nps.gov or at (303) 969-2883.♦

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