



**National Park Service
Chihuahuan Desert Cluster
(BIBE, CAVE, GUMO)
Fire Ecology Annual Report
Calendar Year 2006**

Summary

FY2005 and FY2006 saw the first significant fuels treatment activity for the Chihuahuan Desert Cluster (BIBE, CAVE and GUMO) since 2000. For Big Bend National Park these prescribed fire treatments involved major vegetation types where fire could play a significant ecological role and which there are legitimate questions as to what role fire does play. Previous prescribed fire activity involved very small sites having an esoteric fuel types limited in scope where resource management was taking the lead in monitoring and one site where fire has a very limited role due to the paucity of fine fuels (Desert Scrub) and was the subject of a graduate student's (Baylor) Masters Thesis research project. The fire ecology staff spent time relocating historic Fire Ecology plots that were established in the late 1970's and located within upcoming burn units. Additionally, FY2006 cumulated in the completion of two major research projects that will be key in the development of desired future conditions in the forest and woodlands at BIBE and GUMO . Prior to the completion of these Joint Fire Science funded projects there was little information on which to develop desired future conditions, a major challenge for the program.

Table 1. Management Objectives and Monitoring Results 2005

All statistical test for significance between pre- and post- treatment conducted at the 95% level. of confidence. Fuel reduction objectives/results are mean 10-hr and 100-hr from pre- and post-treatment as compared treatment objectives.

Monitoring Unit	Management Objective (Restoration)	Monitoring Results (Paired t-test 95% Confidence Level)	Objective Achieved?
BIBE Sotol- Grassland: Lehman lovegrass	Maintain-restore desert grasslands	Reduce shrub cover by 10 to 20%. Yr 2 post-treatment to pretreatment (n=15)	No – While post-yr1 reduction was achieved, significant growth in basal sprouters occurred in yr 2 to pretreatment levels.
		Increase native grass cover. (85% increase) p=0.01 n=15	YES
CAVE Rattlesnake springs	Reduce dead and downed fuels to mitigate fire behavior.	Reduce 10-hr time lag fuel to less than 1.0 on per acre. n=23	No
		Reduce 100-hr time-lag fuel loading to less than 1.0 acre. (p=0.01). n=23	Yes

Table 2. Fire Effects Plot Workload 2006

Complete the following table. In the “Total Plot” column, fill in total number of plots installed in the Monitoring Unit to date. Northern Great Plains is provided as an example. Denote any plots completed as pilot sampling.

Park	Monitoring Unit	Type of Plot (FMH, photo point, other)	Pre-burn	Immed. Post	Postburn (1-20 yrs)	Total Plots
Big Bend National Park	Desert Grasslands	FMH Brush plot	6	0	11	17
	High Forest	FMH Forest Plots	3	6	8	10
	Mexican Pinyon	Yale Forest Structure Plots (Pilot sampling)	65			65 (pilot)
	Emory oak	Yale Forest Structure Plots (Pilot)	20			20 (Pilot)
	Grey Oak	Yale Forest Structure Plots (Pilot)	36			36 (Pilot)
	Grave's oak	Yale Forest Structure Plots (Pilot)	18			18 (Pilot)
	Oak-Pinyon-Juniper	Yale Forest Structure Plots (Pilot)	14			14 (Pilot)
	Alligator juniper	Yale Forest Structure Plots (Pilot)	13			13 (Pilot)
	Lehman Lovegrass	Erleh Plots			18	18
	Long-term Fire Ecology Plots		18	1	1	20
					BIBE Total:	65 (184 pilot)
Carlsbad Caverns National Park	Redberry Juniper Plots	FMH Brush plot			4	4
	Muhly Plots	FMH Brush Plots			25	25
	Exotic Plots	FMH Brush Plots	6			6
					CAVE Total:	35
Guadalupe Mountains National Park	Muhly plots	Brush Plots			5	5
	Muhly seteria	Brush Plots	12			12
	Alligator juniper	Forest			6	6
	Douglas fir	Forest			6	6
					GUMO Total:	29
Total						129

Table 3. Fire Ecology Staffing 2005

Complete or devise a staffing and personnel development table for fire ecologist and monitors. Include fire training (e.g. S-290, RX-310), distance learning or on-campus college credit, technology training, NWCG taskbooks initiated or completed, conferences attended, etc.

Monitor	Starting Date	Ending Date	# of Pay Periods	Training and Development
Richard Gatewood	1/1/03	12/31/06	26	S-290, worked on FEMO and FFTI taskbook
John Zubia	4/30/06	11/22/06	15	Helicopter Manger Refresher
Jessica Erickson	6/11/06	10/14/06	9	S-290
Alfonso Porras	7/18/06	9/15/06	4	none

Table 4. Fire Ecologist Accomplishments/Focus Area

This table deals with roles and functions of the ecologist. Identify accomplishments and/or focus areas along with a *rough* estimate of the amount of time spent in these areas (see table format and example below). This includes planning documents produced, reviewed, or collaborated (e.g. fire management plans, monitoring plans, prescribed fire or mechanical treatment plans, etc.), presentations given and audience, meetings and task groups attended, contracts reviewed, interagency collaboration efforts, volunteer hours managed, and scientific or research publications produced. For fire assignments, please provide both an estimate of percent time and the approximate number of shifts on wildland fires (prescribed and wildland fire use) and wildfires.

Category	Percent Time	Accomplishments/Focus Areas
Planning	10%	Mechanical Fuels Reduction Projects CAVE Rattlesnake Springs Drafted plan and developed prescriptions for Prescribed Fire Projects
Project Implementation	25%	- COTR on Rattlesnake Springs Mechanical fuels reduction project - FEMO on BIBE Rx Prescribed Fire SE Rim - FEMO CHIC West Rock Creek Rx Fire - PREP CHIC East Rock Creek and Buck Horn Unit
NPS Meetings/ task groups	<5%	IMR FMO Conference, Albuquerque, NM
Interagency work		Natural Resources Conservation Service: Collaborated on the developed Ecological Site Descriptions for soil mapping units within the TransPecos region of MRLA 42.
Fire Assignments	10%	- Kolob Fire, ZION NP Baer Team Leader - Red Eagle Fire, GLAC, Baer Team Leader
Research	10%	Validation of Fuels and Vegetation Maps for Davis Mountain Preserve
Field Work	20%	- Plot Install CHIC - Plot READ BIBE SE Rim - Plot Read GUMO Foothills Rx
Data entry	<10%	Estimated amount of time spent entering data from paper to PC

Data Conversion	<5%	Estimated amount of time to convert FMH data to FEAT; includes preparing species lists, error checking, learning conversion program, etc
Data analysis	<5%	This is expected to be very low number or zero for fire effect crew/lead monitor
Supervision/Admin	5%	Hiring, supervision, travel, payroll, ect
Miscellaneous		Things that don't fit in other categories. Feel free to add categories

Table 6. Fire Effect Crew Accomplishments

Category	Percent Time	Notes
FMH plots	35%	Estimated amount of time spent collecting plot data; includes any preparation time.
Other plot work	50%	- Long-term Ecology Plots (45%) - Lehmann Lovegrass (exotics) (5%)
Fire Assignments	10%	Fire Assignment Type 2 Crew
Data entry	5%	Estimated amount of time spent entering data from paper to PC

Optional.

- Defining desired conditions: One of the challenges of resource management is defining desired conditions for desert grasslands, pinyon-juniper-oak woodlands and mesic forests at BIBE, CAVE, and GUMO. Result from mixed-conifer forest and woodland JFS projects (GUMO Taylor, Penn State University and BIBE: Camp/ Mills Yale) became available for which the basis for development of desired conditions can begin. We anticipate that we will begin define desired conditions in FY06. Desert grassland desert conditions will take longer to develop.

Rattlesnake Springs Fuels Reduction Project Assessment

September 26-October 18, 2006

By Richard Gatewood, Fire Ecologist
John Harwood, Engine Crew Supervisor

Summary

Fuel reduction work occurred in the Rattlesnake Springs unit of Carlsbad National Park from September 26 to October 18, 2006. The work focused on removing the woody debris ranging in size $\frac{1}{4}$ to 3 inches in diameter (10 an 100 hr lag fuel moisture size classes) with the arching objective of altering fire behavior order to provide for fire fighter safety and minimize fire effects to overstory species. About 90 cubic yards, or between 12½ and 15 tons of chipped material was removed from the project area of 23 acres. The goal of the Rattlesnake Springs fuels reduction project was to reduce that part of the dead and downed woody fuel loading most likely to contribute to a high severity (stand replacing) fire. To develop the treatment prescriptions fire behavior within the project area was modeled using BehavePlus version 3.0.1 (Andrews and others 2004) with the Very High Load Dry Climate Shrub (SH7) fuel model (Scott and Burgan 2005). This fuel model was chosen as best representative of the most extreme fuel loading conditions within the project area. Sensitivity analysis of the model indicated that the 10-hr ($\frac{1}{4}$ to 1 in. diameter woody debris) and 100-hr (1-3 inch diameter woody debris) time-lag fuels were the primary drivers to fire behavior, and thus were targeted for reduction. The analysis of this fuel model indicated that reducing each of these fuels to less than 1.0 ton (2000 lbs) per acre would reduce fire behavior to levels that would minimize fire effects, under the following weather

and fuel conditions: air temperature, 85°F; midflame windspeed, 15 mph, and 50% fuels shading and fuel moistures of 5, 4, and 4% for 1-hr, 10-hr and 100-hr, respectively. Sensitivity analysis indicated that fire behavior was not appreciably changed by increases in temperature or windspeed or lower fuel moisture content.



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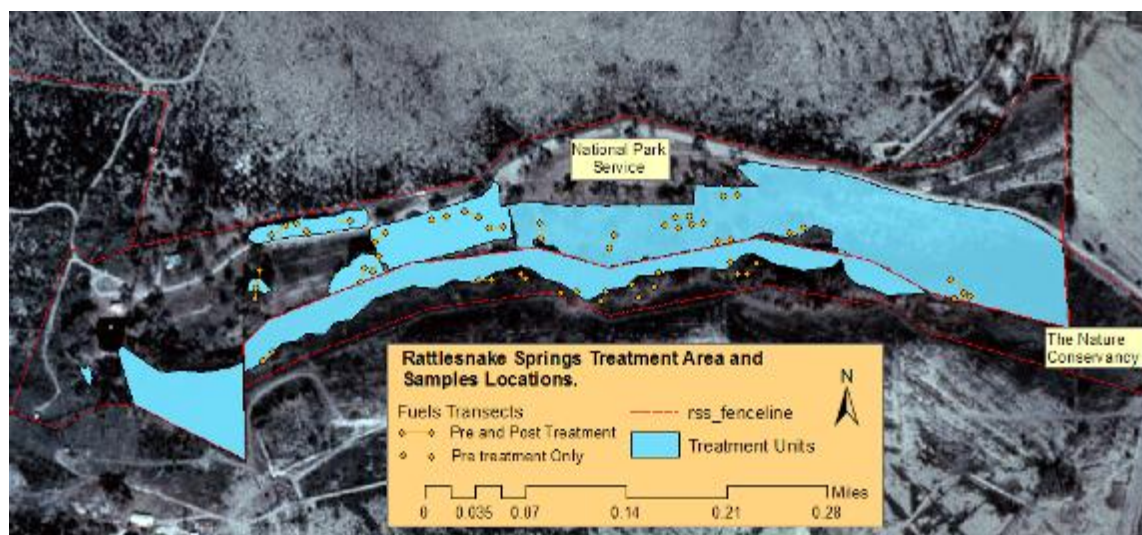
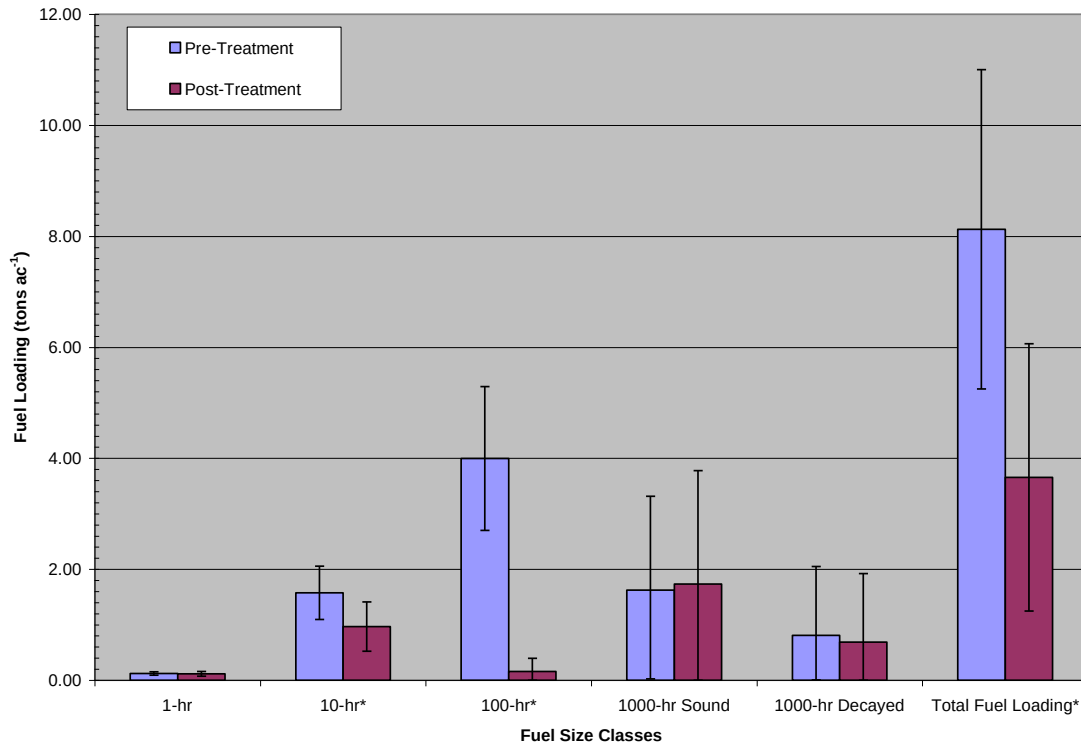


Figure 1. Treatment area and sample location within the project area. Lines between the transect origin and end point are sites where pre- and post- treatment data was collected. Sites where post treatment data was not taken was not treated.

Following the treatment, fuel loading for the 100-hr class was reduced from about 4.0 tons (8000 lbs) to 0.16 tons (320 lbs) per acre. The 10-hr fuel loading was reduced from 1.57 tons (3140 lbs) to 0.97 tons (1940 lbs) per acre. These reductions resulted in total fuel reduction, by over a half from 8.1 to 3.7 tons per acre. Fire behavior modeled at these fuel loading levels reduced rate of spread (ROS) to between 14.1 chains (931 ft) per hour, flame lengths of 2.9 ft, and a probability of cottonwood mortality of 20%. Based on this analysis, the project achieved the objectives set forth in the Rattlesnake Springs Fuels Reduction Plan (2006).

Objectives and Methods of the Assessment

This assessment was conducted to determine the level of fuel reduction achieved by the contractor, Zara Environmental of Buda Texas, under the specifications set forth in the contract statement of work and if the project objectives were met. Initially 30 sites were sampled throughout the project area, 21 located on National Park lands and 9 on Nature Conservancy property (Figure 1). All sites were marked with rebar stakes and GPS coordinates obtained for post-treatment and future monitoring. Seven of the plots were excluded from the analysis when it was found they were located outside the treatment area when the project boundary was flagged. All of these plots were on Nature Conservancy Land. Estimates of dead and downed fuel loading were conducted following Brown (1982). The sizes classes sampled included 1-hr ($< \frac{1}{4}$ in. dia), the targeted size classes of 10-hr ($\geq \frac{1}{4}$ to 1 in dia.) and 100-hr (1 to < 3 in dia) fuels and the 1000-hr (≥ 3 in dia.) fuels. After the second reading all rebar and associated flagging was removed from the site. High accuracy GPS locations were obtained and post processed using the GPSanalysis (Trimble 2006) extension within



Figure

2. Fuel loading at Rattlesnake Springs Project area pre- and post-treatment for 1-hr, 10-hr, 100-hr, 1000-hr sound and 1000-hr decayed time-lag fuel moisture size classes and total dead and down fuel loading. Error bars are 95% confidence intervals. Asterisks indicate size classes having significantly different pre- and post-treatment means at the $p=0.05$ confidence level)

ArcGIS. ver 9.1. Paired t-test was used to test for significant differences between the pre- and post- treatment means for each size class at the 95% confidence level.

Results

Fuel loading

Prior to treatment, total fuel loading averaged 8.13 tons (16,260 lbs) per acre with over two-thirds (68.5%) composed by the targeted 10-hr and 100-hr fuels. The 10-hr fuels averaged 1.57 tons (3140 lbs) comprising about 20% of the total fuel loadings. The 100-hr fuels averaged 4 tons per acre, accounting for about half of the total fuel loading. Following treatment both the 10-hr and 100-hr fuels was found to be significantly reduced resulting in an overall total fuel loading from 8.13 to 3.7 tons per acre, a reduction of about 55%. The 10-hr fuels was reduced ($p=0.0255$) to just under 1 ton per acre, a 39% reduction and a contribution of 14% to the overall total fuel reduction. The 100-hr fuels was reduced ($p=0.00$) to 0.16 tons per acre, a 96% reduction and a contribution of 86% to the overall total fuel loading reduction. The 1-hr, 1000-hr sound and 1000-hr decayed fuel size classes

Table 1. Effects of treatment on fire behavior and fire effects as predicted from Behave. Windspeed conditions of 15 mph, air temperature 85°F, at the low end of the

	Pre-Treatment	Post-Treatment*
Rate of Spread (Chains hr ⁻¹)	55.8	14.5
Flame Length (ft)	10.0	3.0
Scorched Height (ft)	46.0	2.0
Probability of Mortality (%)	98.0	20.0

was not significantly different ($p=0.05$) following treatment indicating that the contractor focused primarily on the targeted fuel size classes.

Fire Behavior

Initial fire behavior for the project was assessed using a fuel model characterized as a very high load dry climate shrub. Based upon this assessment, fuel size classes were identified that would have the greatest effect in reducing fire behavior in terms of rate of spread (ROS), flame length, scorch height and tree mortality. BehavePlus version 3 was used to model fire behavior under fire weather conditions common in the late winter and spring that contribute to large rapidly spreading fires. These conditions are generally midflame windspeeds of 15 mph and air temperature of 85°F, and for Rattlesnake Springs 50% sheltered. Increasing wind speed or air temperature did not appreciably exacerbate fire behavior.

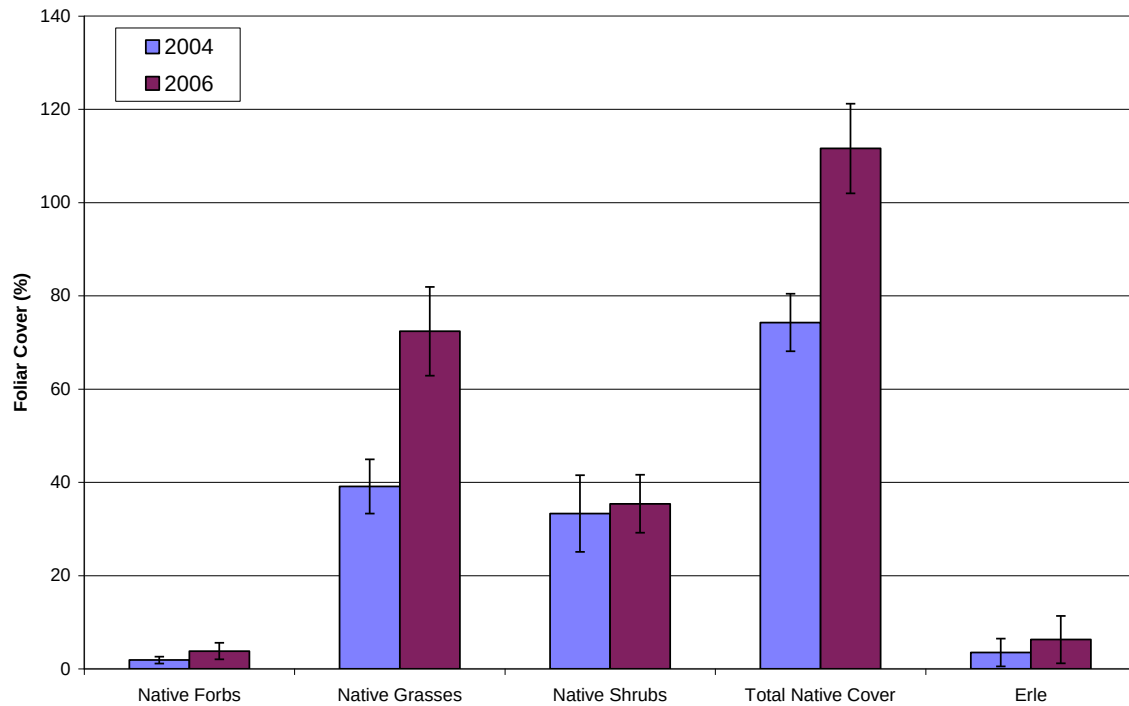
Discussion and Conclusions

The level of fuel reduction achieved in the 10-hr and 100-hr fuel loadings, has achieved the objectives of the Rattlesnake Springs fuel reduction project. The reduction in fuel loadings and the subsequent reduction in fire behavior will provide more favorable conditions for reducing fire effects on the desirable overstory species and a more favorable environment for fire fighters in the event a fire occurs. The Rattle Snake Springs will remain as condition class 2 due to the continued presence of the exotic species Russian Olive, Bermudagrass and Johnsongrass as well as the highly altered state of the area will keep the project area in condition class 2. Overall the project met the project objectives of reducing the 10 and 100-hr fuel size classes to less than 1.0 ton per acre, thus the project was an overall success.

Literature

- Andrews, Patricia L.; Bevins, Collin D.; Seli, Robert C. 2004. BehavePlus fire modeling system, version 3.0: User's Guide. Gen. Tech. Rep. RMRS-GTR-106. Ogden, UT: Department of Agriculture, Forest Service, Rocky Mountain Research Station. 132p.
- Brown, JK, RD Oberhue, CM Johnston. 1982. Inventorying surface fuels and biomass in the Interior West. Ogden (UT): USDA Forest Service, Intermountain Forest and Range Experiment Station. Gen Tech Report INT-129. 48 p.
- National Park Service. 2006. Fuel Reduction Plan: Rattlesnake Springs, Carlsbad Caverns National Park New Mexico. Plan on File Carlsbad Caverns National Park.
- Scott, Joe H. and Robert E. Burgan. 2005. Standard Fire Behavior Fuel Models: A Comprehensive Set for Use with Rothermel's Surface Fire Spread Model. Gen. Tech. Rep. RMRS-GTR-153. Fort Collins, CO.: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 72 p.

BIBE: 1314 May 2005 Rx Fire Desert Grassland



Comparison of native plant life form and an exotic grass, Lehmann lovegrass, pre- and 2 year post in a May 2004 prescribed fire in desert grasslands at Big Bend National Park, TX. Paired one tailed t-test found that 2006 foliar cover of native forbs, grasses, total cover and Lehmann lovegrass were all significantly greater than 2004 values at the 95% confidence level. Error bars are 95% confidence intervals.

BAER Assignments:

Kolob Fire Zion NP.

In July, supported the burned area rehabilitation (BAR) planning for the ZION.