



Effects of Forest Fuel Reduction on Black Bear Spatial Ecology in the White Mountains of Arizona



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Thanks to...



Apache-Sitgreaves National Forest



Eastern Arizona Counties Resource Advisory Committee



Federal Aid in Wildlife Restoration

Background

- Due to the increasing number of catastrophic wildfires, fuel reduction treatments at the Wildland Urban Interface (WUI) were started in 2007 around communities in the White Mountains of Arizona to help reduce the threat of wildfire



Introduction



- From 2006 through spring of 2011 we investigated resource selection and movements of marked black bears in response to WUI treatments around the communities of Greer, Nutrioso, and Alpine

Study Area

- Land ownership: Forest Service, State, and private
- Elevation: 1300 m – 3000 m
- Average monthly temp: -11°C – 28°C
- Precipitation: 52.8 cm annually, 139.4 cm snow
- Vegetation: Rocky Mt montane and subalpine conifer forests

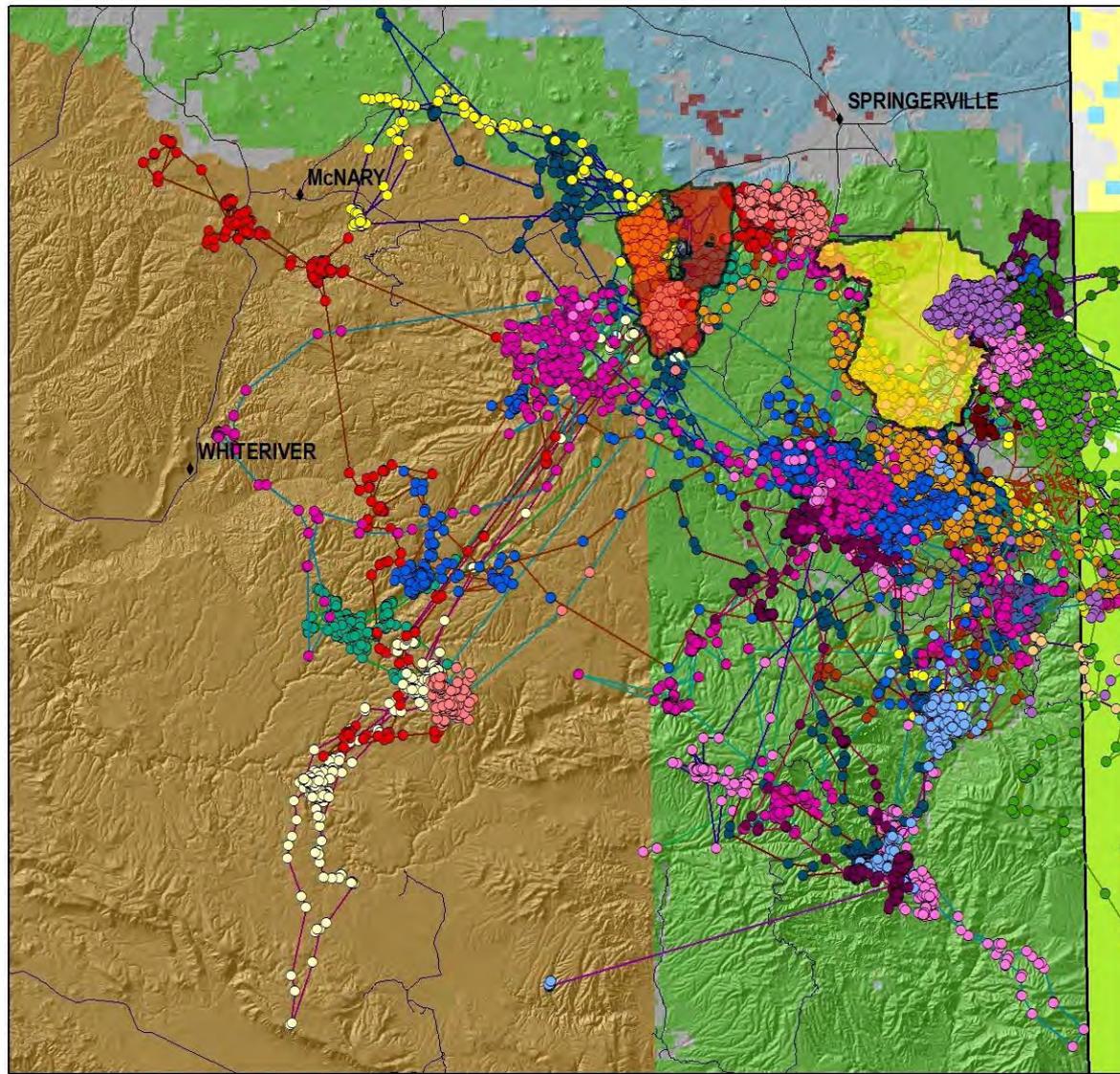


Methods

- Captured 47 black bears; fitted with spread spectrum, store-on-board, or satellite GPS collars
(16 Females and 31 Males)
- Collars were programmed to collect 4-6 locations/day and drop off after 1-2 years for data retrieval
- Captured bears near the proposed/completed WUI treatments



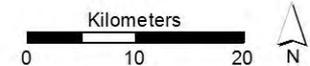
Preliminary Results (marked bear locations)



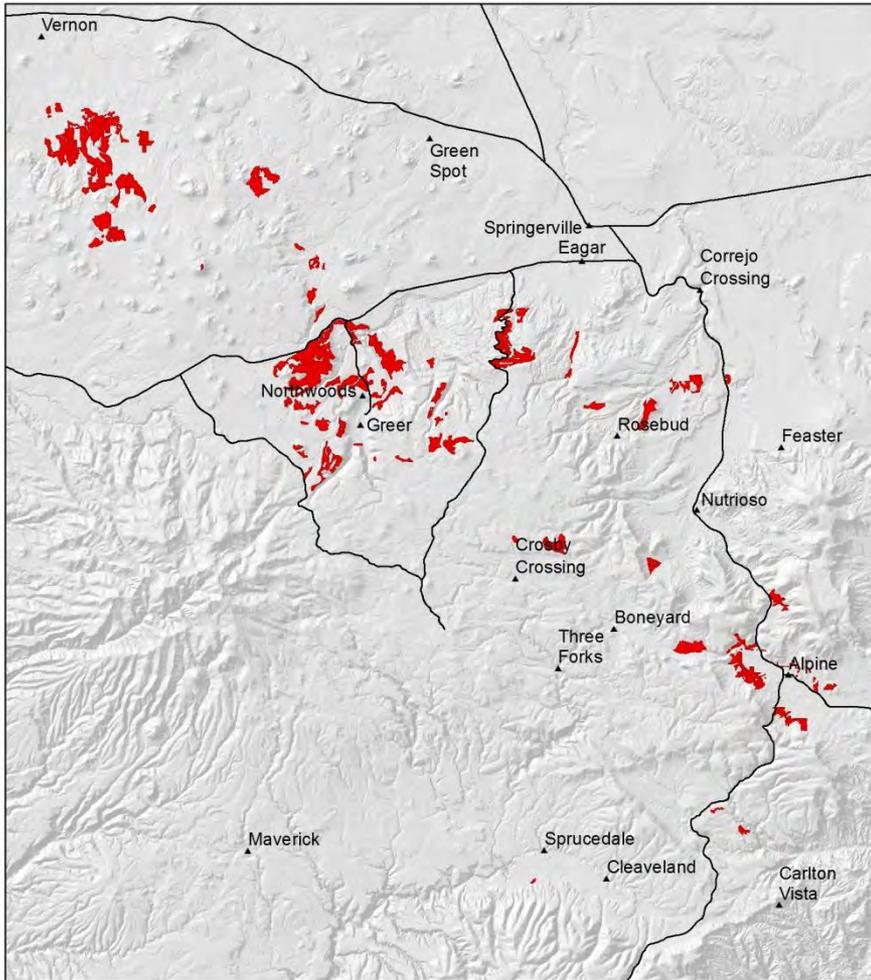
Bear Locations near
Greer and Nutrioso
Arizona

Locations from
5/2006 - 9/2011

- | | |
|--------------|-------------|
| Greer WUI | Bear 15 |
| Nutrioso WUI | Bear 18 |
| Bear 65 | Bear 19 |
| Bear 107 | Bear 20 |
| Bear 56 | Bear 22 |
| Bear 52 | Bear 23 |
| Bear 50 | Bear 30 |
| Bear 48 | Bear 31 |
| Bear 46 | Bear 32 |
| Bear 45 | Bear 33 |
| Bear 44 | Bear 35 |
| Bear 40 | Bear 72 |
| Bear 59 | Bear 65 |
| Bear 2 | Bear 565790 |
| Bear 3 | Bear 34 |
| Bear 4 | Bear 68 |
| Bear 7 | Bear 41 |
| Bear 9 | Bear 42 |
| Bear 100 | Bear 43 |
| Bear 10 | Bear 49 |
| Bear 11 | Bear 57 |
| Bear 12 | Bear 58 |
| Bear 13 | |
| Bear 14 | |

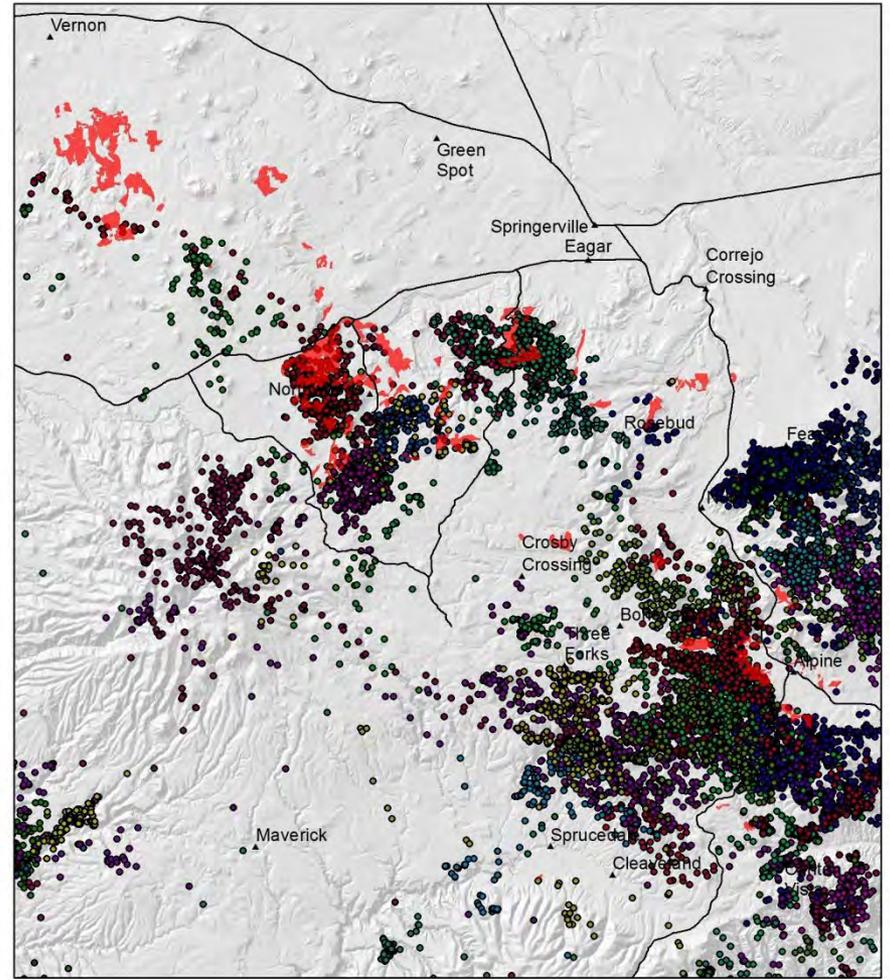
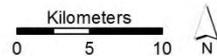


Preliminary Results- WUIs/marked bear locations



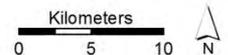
Forest Treatments from
2001 - 2012

 Treatment Areas



Forest Treatments from
2001 - 2012 and Bear Locations
from 2006 - 2011

 Treatment Areas



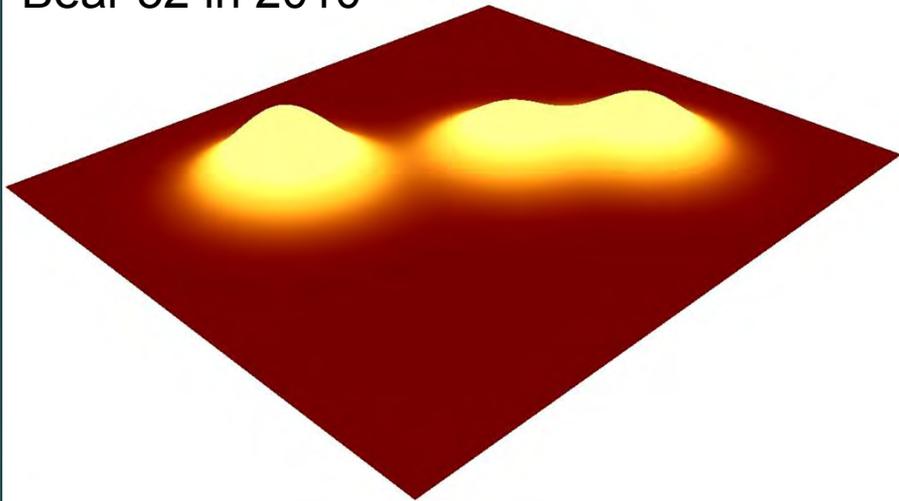
Methods- Analysis

- Selected bears for analysis
 - Location data for a minimum of 80 days
 - Buffered completed WUIs for each year by the maximum average daily movement
 - Selected only bears that had locations within the buffered treatment area
- Selected one location per individual/day to calculate Utilization Distributions (UDs)



Methods- Analysis

Bear 52 in 2010



- Overlaid UDs onto GIS layers: distance to treated area and potentially influential covariates (veg type, slope, ruggedness, distance to major roads, elevation, etc)
- Randomly selected 500 points from each UD for analysis
- Used height of UD (Probability Density Estimate) as the dependent variable in multiple regression analysis

Habitat Covariates

Covariate	Description	Type of measure	Source
Distance to Treatment Area	Shortest distance (m) from each 30-m ² pixel to a pixel classified forest treated to reduce fuels.	Meters	US. Forest Service unpublished data
Distance to Vegetation Class (n = 12)	Shortest distance (m) from each 30-m ² pixel to a pixel classified as each of 12 vegetation class.	Meters	ReGAP (Regional GAP Analysis) Modified categories regrouped from 28-12
Slope	Slope (%) of individual 30-m ² pixel.	Percent	USGS DEM
Solar Radiation	Watt hours/square meter, calculated for each individual 30-m ² pixel, and based on the annual solar radiation.	Continuous measure	
Ruggedness	Index of ruggedness over a 150 m x 150 m area (22,500 m ²) centered on each 30-m ² pixel.	Index	USGS DEM
Elevation	Elevation (m) of individual 30-m ² pixel.	Meters	
Distance to major roads or railroad	Shortest distance (m) from each 30-m ² pixel to a major road (interstate, highway, access ramp, or arterial) or railroad.	Meters	TIGER

Habitat Covariates

	Vegetation Types
1	Spruce-Fir Forests and Woodlands
2	Mixed Conifer Forests and Woodlands
3	Aspen Forest and Woodland
4	Pine Woodland
5	Oak Woodland and Shrubland
6	Riparian Woodland and Shrubland
7	Grassland and Shrubland
8	Juniper Woodland and Savanna
9	Canyon/Cliff/Tabeland
10	Chaparral
11	Developed
12	Other



Preliminary Results

Mean Estimate of unstandardized β

Year	N	Dist to treated	Dist to Oak	Dist to Pine	Dist to Mixed Conif	Dist to Spruce/fir
2006	5	-5.94	-526	-6.4	10.24	-3.53
2007	9	29.83	2.32	-20.19	-47.03	-8.26
2008	5	162.68	-89.49	346.97	-265.53	-82.58
2009	4	-94.94	14.38	45.07	8.42	12.68
Total	23					

Distance to Pine

Year	N	Dist to Pine	Significant	Not Significant	Selected Against (+)	Selected For (-)
2006	5	-6.4	1	4	3	2
2007	9	-20.19	5	4	5	4
2008	5	346.97	3	2	3	2
2009	4	45.07	2	2	3	1
Total	23		11	12	14	9

Distance to Treated Area

Year	N	Dist to treated	Significant	Not Significant	Selected Against (+)	Selected For (-)
2006	5	-5.94	3	2	1	4
2007	9	29.83	8	1	5	4
2008	5	162.68	3	2	2	3
2009	4	-94.94	3	1	1	3
Total	23		17	6	9	14

Distance to Mixed Conifer

Year	N	Dist Mixed Conif	Significant	Not Significant	Selected Against (+)	Selected For (-)
2006	5	10.24	3	2	1	4
2007	9	-47.03	8	1	0	9
2008	5	-265.53	3	2	2	3
2009	4	8.42	4	0	2	2
Total	23		18	5	5	18

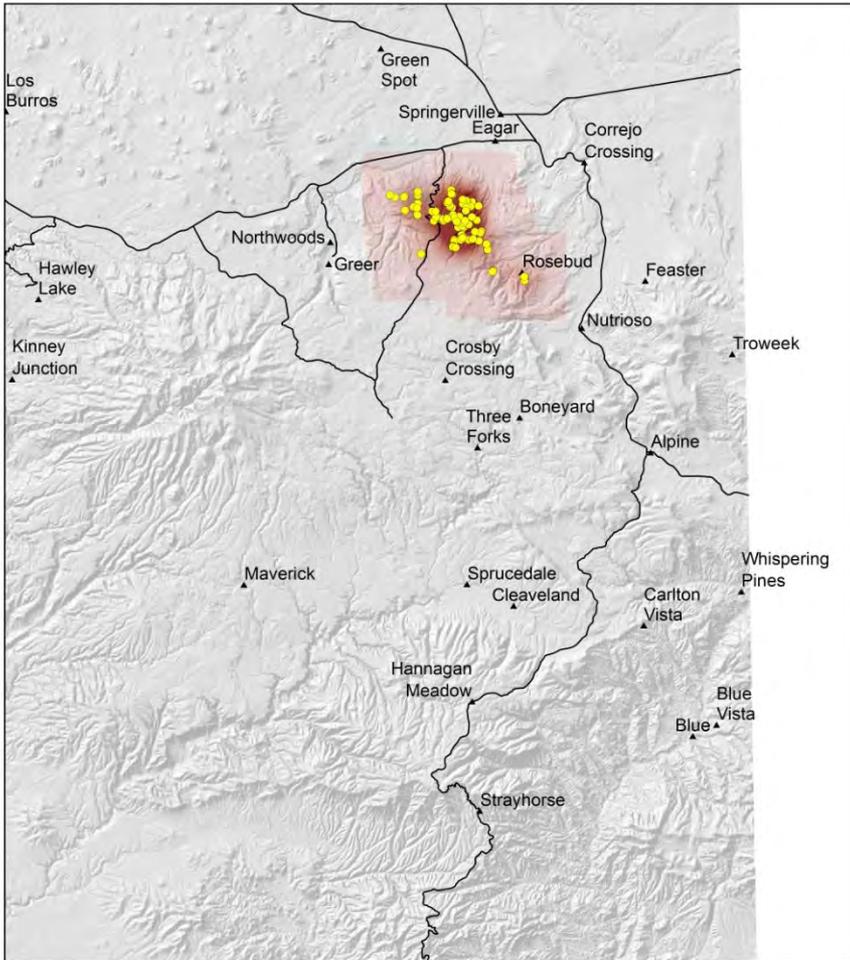
Distance to Oak

Year	N	Dist to Oak	Significant	Not Significant	Selected Against (+)	Selected For (-)
2006	5	-526	2	3	2	3
2007	9	2.32	6	3	6	3
2008	5	-89.49	4	1	1	4
2009	4	14.38	3	1	3	1
Total	23		15	8	12	11

Distance to Spruce/Fir

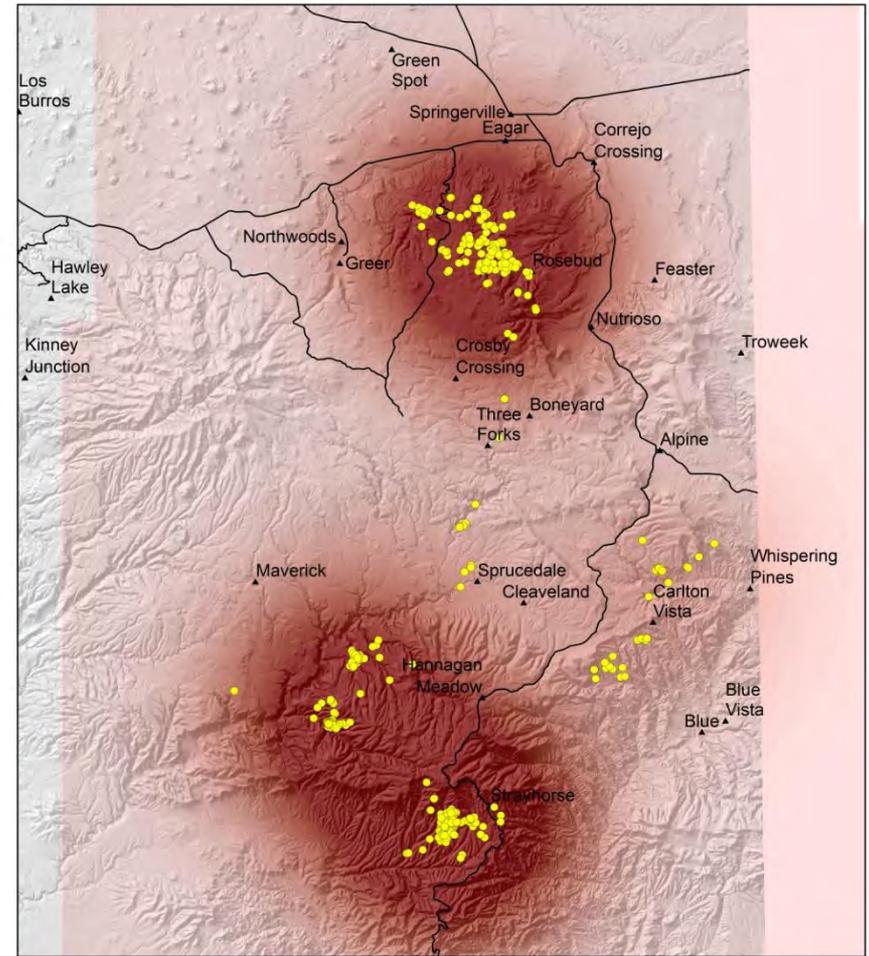
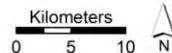
Year	N	Dist to Spruce/fir	Significant	Not Significant	Selected Against (+)	Selected For (-)
2006	5	-3.53	2	3	1	4
2007	9	-8.26	5	4	3	6
2008	5	-82.58	4	1	3	2
2009	4	12.68	3	1	3	2
Total	23		14	9	10	14

Preliminary Results



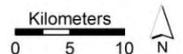
Utilization Distribution for Bear # 2
for year 2007

● Bear Locations



Utilization Distribution for Bear # 22
for year 2007

● Bear Locations



Future analysis

- Analyze data from 2010
- Effect of potentially correlated variables
- Use different smoothing parameters for UD's
- Effect of treatment age
- Effect of seasons
- High Vs low mast production years
- Micro-habitat data at bear locations and random sites

Questions?

