1-1-2007

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Vegetation re-establishment of Mojave Desert plant communities after 2005-2006 wildland fires

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Objective: Examine biotic and abiotic patterns that determine vegetative regrowth after wildfires to better inform land managers about what to expect after fires and how to manage restoration efforts.

Predictions:
1. Post-fire plant community composition is related to soil and environmental variables.
2. Burned and unburned communities are driven by different environmental, soil, and biotic variables.
3. Communities that were dominated by creosote pre-fire will recover more quickly than those dominated by blackbrush.

Key Findings:
1. Both post and pre-burn plant community composition can be described by soil and environmental variables.
2. Burned plant community composition is associated with soil texture and total soil N, whereas unburned plant communities are described by more complex micronutrients.
3. Two years after fires, initial community composition does not influence recovery rate.

In 2005 above average winter and spring precipitation led to increased desert biomass in 2005 alone. In 2006 wildfires across Nevada, Arizona, and California burned over 550,000 hectares of the Mojave desert in 2005 alone.

With wildfires becoming more prevalent across the Mojave landscape, we want to examine patterns driving fire recovery at the landscape scale. Therefore, our goals to understand vegetative recovery across the landscape are twofold:

1. Link initial vegetation, environment, and soils.
2. Elucidate patterns of natural revegetation that can then be applied to help determine post-fire management prescriptions.

In the Mojave desert of S. NV, there are a range of elevations, soil types, and plant communities (from creosote-ambrosia desert scrub to Joshua tree woodland). We want to examine the landscape level patterns to understand generalizable patterns and inform land managers.

Methods: Fire effects monitoring

- We sampled 15 fires across Clark County, NV during winter 2007 & spring 2008.
- Fires were limited to those in Mojave plant communities including creosote-bush, blackbrush, Joshua Tree.
- Size ranges from ~50 ac – ~82,000 acres.
- Elevation, topography, and soil vary.
- The inherent variation is important to detect generalizable patterns.

Environmental variables define burned and unburned communities

Elevation, longitude, and dominant species are related to community composition, species define burned plots

Non-metric multidimensional scaling ordination of plant species composition in burned and unburned plots. The length of the vectors are proportional to the correlations with ordination axes. Overlaps include the most significant environmental and species variables:

- Codex: UTM + Elevating, Elevation (m), EPPR = Eriophorum vaginatum, COLRAM = Coleogyne ramosissima, DENDRUM = Dendrometis californica, PSOFRE = Psorothamnus fremontii, PULFRE = Pleuraphis rigida, P50FRE = Pachycereus subtlemns

Factors explaining plant communities in burned and unburned plots differ

Burned
Unburned

We analyzed the data using a NMS ordination overlaying soil variables. Each point represents the community composition of a plot, with the shape of the point representing the soil type. There was no effect of soil type on plant community composition in burned or unburned plots (MRPP analysis), but the loamy sand plots grouped out in the unburned plots.

Unburned plots were correlated with smaller scale micronutrients, along with key species (species key: KRAERE = Krameria erecta, PLERIG = Psorothamnus fremontii, KRAAME = Krameria avenacea, PULFRE = Pleuraphis rigida, P50FRE = Pachycereus subtlemns, COLRAM = Coleogyne ramosissima)

The inherent variation is important to detect generalizable patterns.

Environmental variables

-Phosphorus, % Soil
-Ca, Mg, Pb
-Knows, Cr, Mo, Sr
-Elevations (plots ranged from 700 – 1400 m)
-UThs (Latitude and Longitude)

RESULTS

Richness: 1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
6.0
7.0
8.0
9.0
10.0
Burned
Unburned

Burned
Unburned

Burned
Unburned

Richness
Diversity
Evenness

Richness
Diversity
Evenness

Unburned
Burned
Unburned
Burned

ACKNOWLEDGEMENTS

Sampling of selected fires was supported through a cooperative agreement between UNLV, BLM Las Vegas Field office, and Lake Mead National Recreation Area.

FUTURE WORK:

- We are working toward conducting a chronosequence study, to build on what drives patterns of recovery and what associations we can derive between community types and soil and environmental variables.
- However, records of older fires are hard to find...
- Ultimately we want to understand vegetative re-establishment in a predictive manner to then guide land management strategies.

Pre-burn community type does not determine recovery

This figure illustrates that the species-space distance between burned plots and their unburned counterparts does not differ on average between creosote and blackbrush communities (visually evident through comparing average line length and was statistically confirmed using the semanen’s distance). In this figure, burned plots are standardized to their associated unburnt plots which is represented by the centroid. Burned communities that were dominated by creosote pre-burn are no more similar to the unburnt plots than the blackbrush communities.

Statistical Analysis

We conducted multivariate analyses using PC-ORD to examine community level patterns through NMDS (non-metric multidimensional scaling) ordinations to show community composition as an ordination. MRPP (multiple response permutation procedure) to test differences among groups, and NMS (non-metric multidimensional scaling) ordinations to show community composition as an ordination. We established randomly placed 10 m x 10 m plots within each fire, (3-6 plots per fire based on site size) for a total of 21 sites. We sampled 15 fires across Clark County, NV during winter 2007 & spring 2008.

Successional vectors show direction and distance between burned and unburned plots

Fire effects monitoring

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METHODS

Burned and unburned communities are driven by different environmental, soil, and biotic variables.

1. Both post and pre-burn plant community composition can be described by soil and environmental variables.
2. Burned plant community composition is associated with soil texture and total soil N, whereas unburned plant communities are described by more complex micronutrients.
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Environmental variables

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RESULTS

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Burned
Unburned

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Burned
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Richness
Diversity
Evenness

Richness
Diversity
Evenness

Unburned
Burned
Unburned
Burned

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