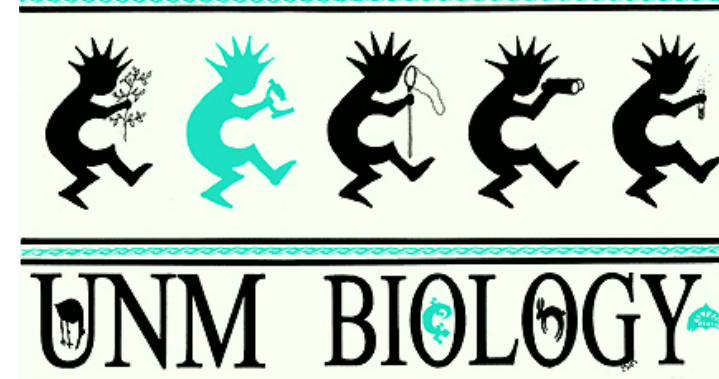




Daniel Warnock\*<sup>1</sup>, Marcy Litvak<sup>1</sup> and Robert Sinsabaugh<sup>1</sup>  
<sup>1</sup>University of New Mexico Department of biology



## Introduction

- Arid systems cover 40% of terrestrial surface
  - Store 2x the C as temperate forests (Anderson-Teixeira et al. 2011)
  -
- Fungi play large role in arid ecosystem processes
  - Plant root associated fungi should be especially important in these systems
  - NMEG to observe relationship between ecosystem respiration, net ecosystem exchange (NEE), soil moisture and soil temperature
- Established in 2007 (control) and 2009 (girdled)
- Monitor ecosystem processes
  - Instruments on tower measure Net carbon flux between ES and atmosphere
  - Other instruments measure soil respiration
- Currently, little is known about below-ground activities at NMEG sites

## Abstract

Piñon (*Pinus edulis*) - Juniper (*Juniperus monosperma*) (PJ) woodlands cover 17 million hectares in the western US. However, these numbers are currently shrinking, due to multiple, prolonged, drought induced die-offs among piñon trees. Further piñon mortality is likely affecting the rates at which litter deposition contributes to soil organic matter (SOM) pool, and soil carbon storage. To assess the combined impacts of piñon mortality on these processes, we deployed foliage litter bags under tree canopies, at two different field sites in New Mexico. One site included the widespread presence of girdled piñons, while the other site did not. Litter bags were deployed in February 2013, and harvested in March, June, and August. Time 0, and duff samples were also collected. We analyzed activity rates of alanine aminopeptidase, alkaline phosphatase,  $\beta$ -D-glucosidase,  $\beta$ -D-xylosidase, and  $\beta$ -N-acetyl glucosaminidase. The litter results showed that the mass loss rates within from the litter bag samples were negligible until August, when the mean OM fraction was 0.85g OM/ g litter which is beginning to show progress towards the mean OM fraction from the background litter, which was measured at 0.75g. Our EEA analyses showed distinct patterns when comparing EEA profiles across the different sampling periods. Activity rates from the initial, March, and June samples were all highly similar, while the August litter samples showed activity profiles nearly identical to the duff samples. Additionally, activity rates among the cell wall degrading enzymes,  $\beta$ -D-glucosidase,  $\beta$ -D-xylosidase, and  $\beta$ -N-acetyl glucosaminidase (NAGase), under junipers were all  $\geq 26\%$  higher at girdled, than beneath the junipers, at control. These results illustrate how mortality within one dominant tree species, i.e., piñons, can significantly affect the litter decomposition dynamics across a given field site. Further, the decomposition dynamics of this freshly deposited litter varies significantly across the growing season, in association with increased soil moisture due to summer rain events.

## Materials and Methods

### Extracellular Enzyme Assays

Substrates	Target enzymes	Enzyme hydrolyzes
L-Alanine-7-amido-4-methylcoumarin	Amino peptidases	Proteins
4-MUB-phosphate	Phosphatases	Phosphoesters
4-MUB- $\beta$ -D-xylosidase	Cellulases	Cellulose and hemi-cellulose (Plant cell walls)
4-MUB- $\beta$ -D-glucoside	Cellulases	Cellulose and hemi-cellulose (Plant cell walls)
4-MUB-N-Acetyl- $\beta$ -Glucosaminide	NAGases	Chitin and Peptidoglycan (Bacterial and fungal Fungal cell walls)

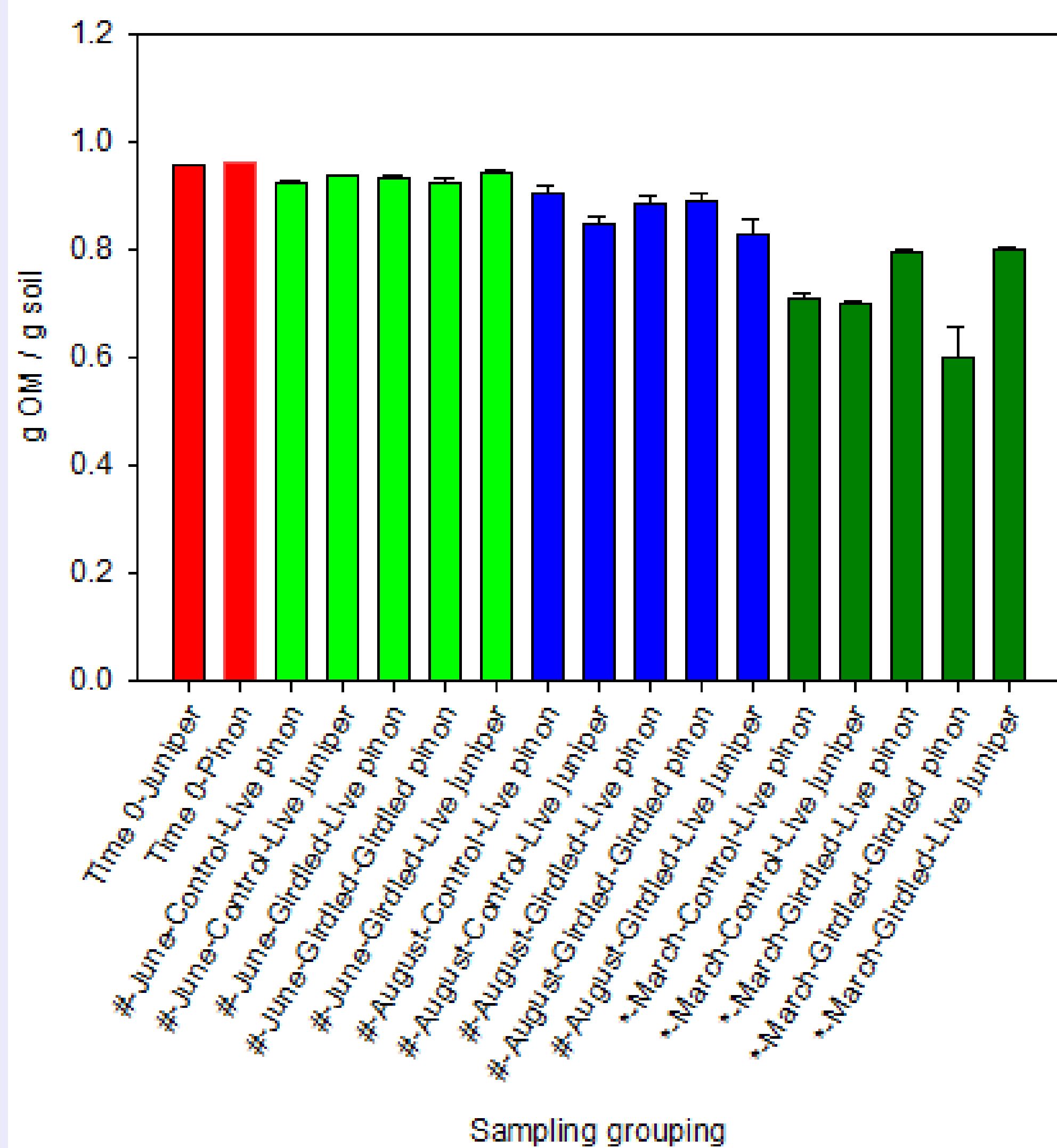
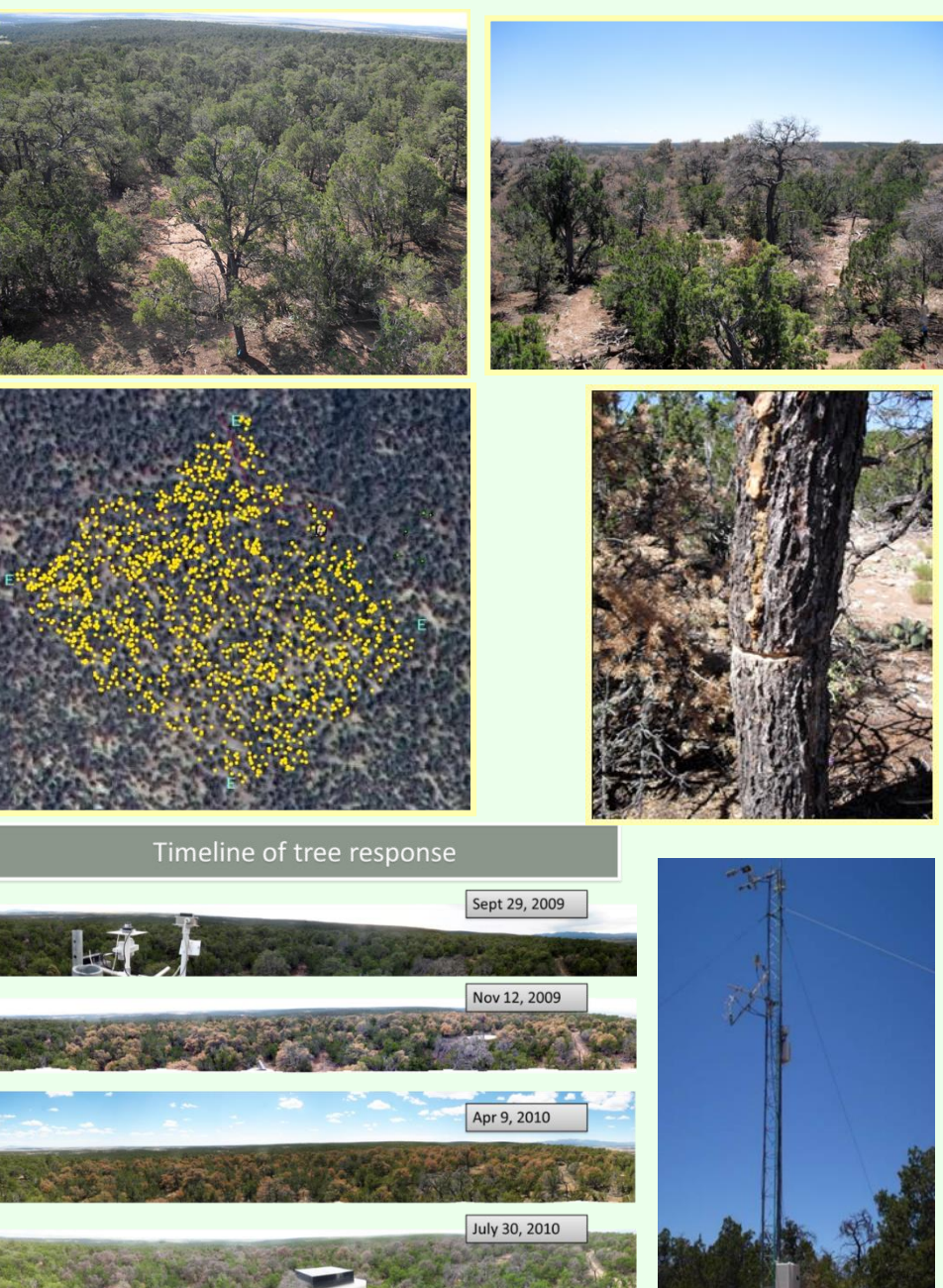
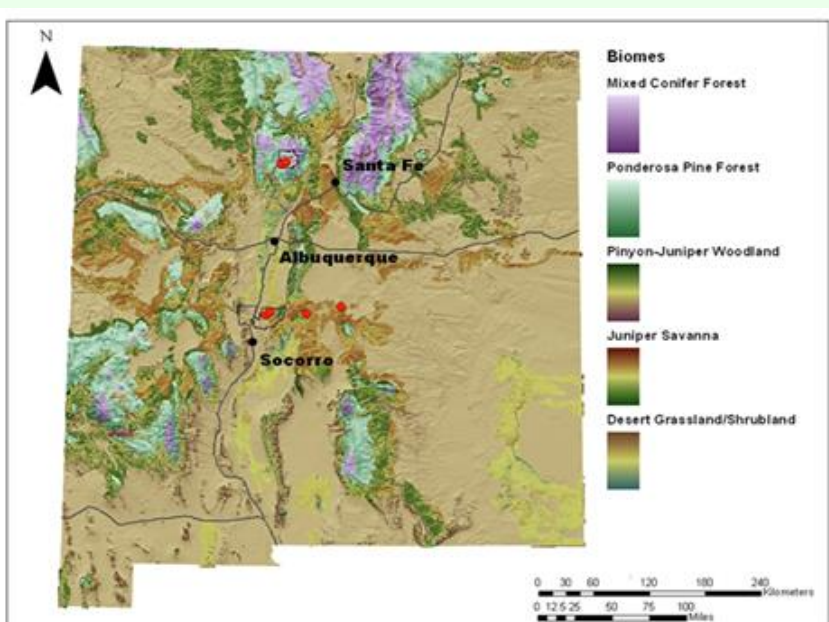


Figure 1: Organic matter fraction from above ground litter samples collected at both field sites. # = Litter bag sample, \* = Background litter sample.

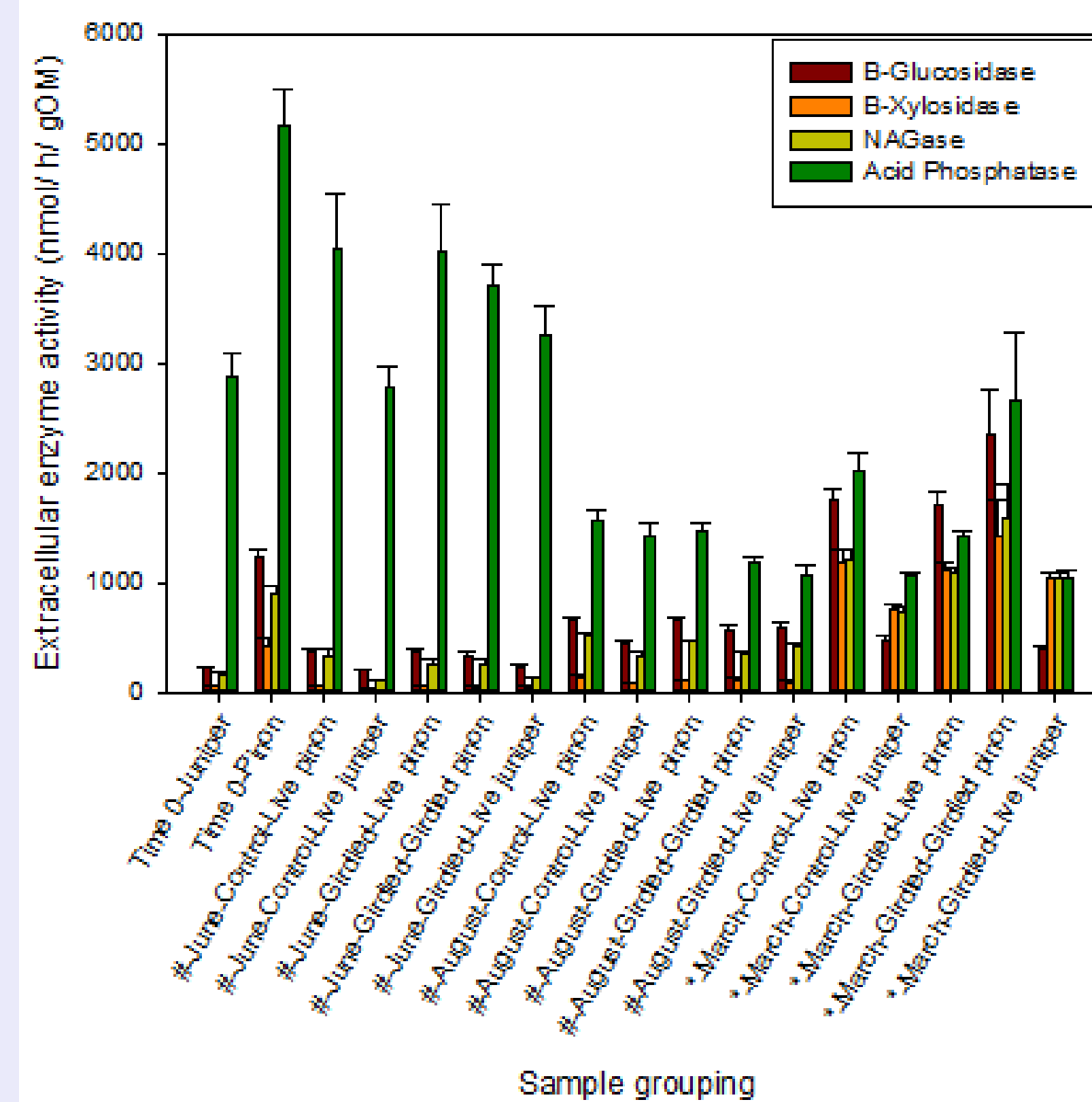
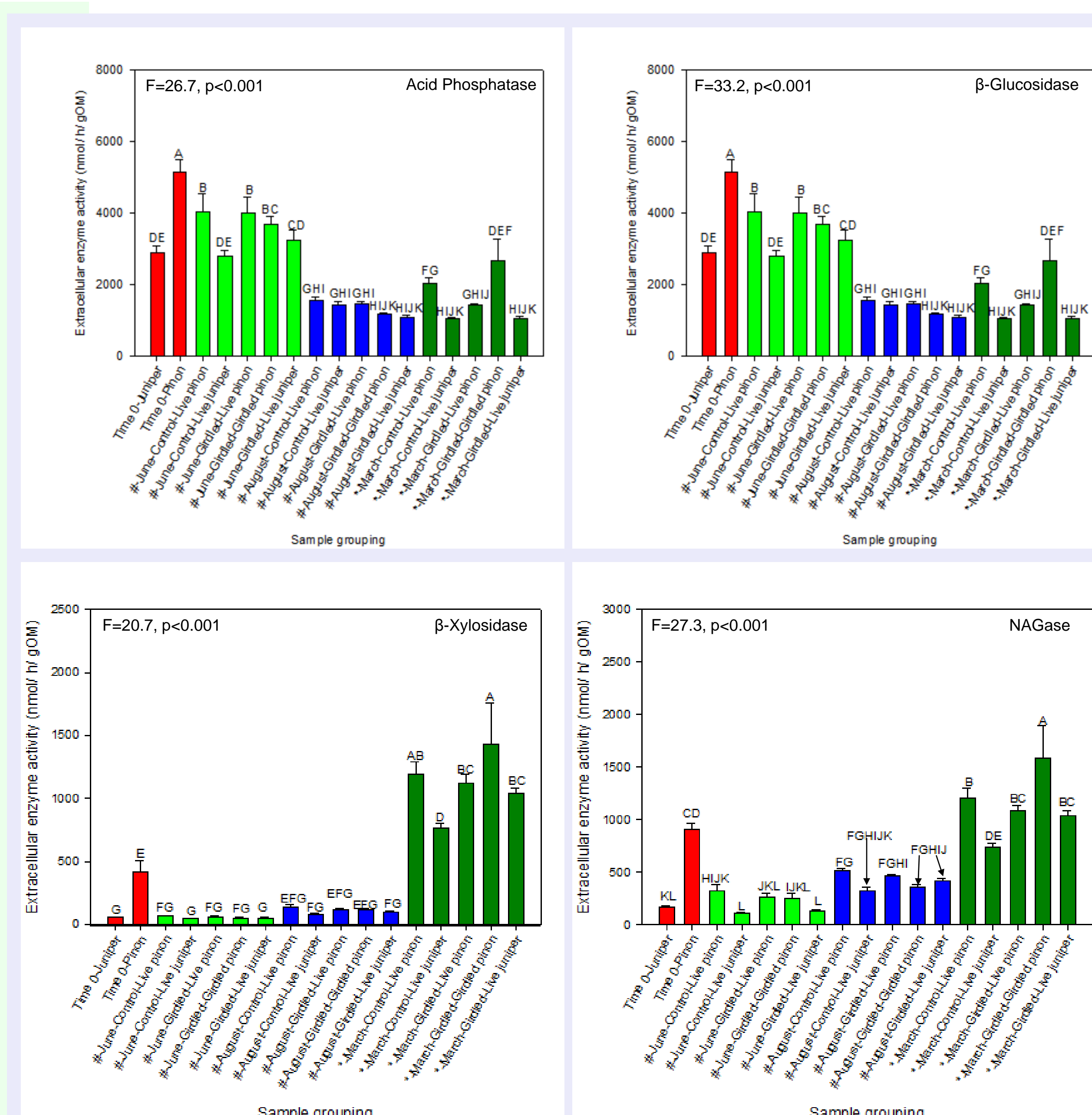


Figure 2: Extra cellular enzyme activity rates in foliage litter samples collected from both sites. # = Litter bag sample, \* = Background litter sample.

## Results summary and Discussion

Mass loss in foliage litter:

- Litter mass loss rates within from the litter bag samples were negligible until August when the
  - Mean OM fraction 0.85g OM/ g litter
  - OM fraction from the background litter measured at 0.75g OM/ g litter

Enzyme activity rates:

- EEA analyses showed distinct patterns when comparing EEA profiles across the different sampling periods.
  - Initial, March, and June samples all highly similar
  - August activity profiles nearly identical to the duff samples

Discussion:

- Activity rates among the cell wall degrading enzymes,  $\beta$ -D-glucosidase,  $\beta$ -D-xylosidase, and  $\beta$ -N-acetyl glucosaminidase, under junipers were all  $\geq 26\%$  higher at girdled, than beneath the junipers, at control.
- These results illustrate how mortality within one dominant tree species, i.e., piñons, can significantly affect the litter decomposition dynamics across a given field site
  - Junipers at girdled site may be providing fungi with more substrates
- Decomposition dynamics of this freshly deposited litter varies significantly across the growing season, in association with increased soil moisture due to summer rain events.

## Acknowledgments

I would like to thank my coauthors for their support and for their assistance with interpreting the results from this study. I would like to thank the summer 2011 Sevilleta REUs for their help with sample collection and processing.



UNM Sevilleta Field Station

