Available nitrogen is a main resource limiting plant production. In temperate grasslands, free-living N\textsubscript{2} fixation has been estimated to range from 0.1–21 kg N × ha\textsuperscript{-1} × yr\textsuperscript{-1} (Reed et al. 2011) and has the potential to affect plant productivity. The regulators of free-living N\textsubscript{2} fixer activity are thought to be ecosystem specific (Fig. 1). Little is known about fire effects and regulators in temperate semiarid grasslands.

## Methods

Using qPCR, we measured nifH DNA and mRNA as an analog for N\textsubscript{2} fixation. N\textsubscript{2} fixation has been positively correlated with the copy number of nifH (nitrogenase functional gene) DNA (r\textsuperscript{2}=0.35, 0.81) (Reed et al. 2010, Wakelin et al. 2009) and mRNA (r\textsuperscript{2}=0.72, 0.84) (Bürgmann et al. 2003). Analyses were then performed to determine the best predictor of variation in nifH copy number.

We sampled 18 plots from a mixed-grass prairie site in the Northern Great Plains. Plots were sampled five times from September 2011 - August 2012 (Fig. 2) producing 90 samples (18 × 5).

## Results

- Variation in nifH mRNA was best explained by a model (F\textsubscript{4.43} = 5.9, P<0.001, R\textsuperscript{2} = 0.35) with temperature and three soil properties (Fig. 3).
- Evaluation of the sem\textsuperscript{2} which better (but not fully) accounts for variable collinearity revealed that temperature, iron, and sulfur contribute equally and more than manganese in explaining variation in nifH mRNA.

## Conclusions

- Drought was a main predictor of temporal variation in nifH activity (Fig. 2).
- We failed to support our prediction that time since fire, nitrate, or phosphorus were useful predictors of nifH (Fig. 3).
- Several soil properties (Fig. 3) were moderately useful predictors of nifH variation. However, associations were complex due in part to collinearity among soil properties [e.g. manganese correlated with sulfur (r=0.42), iron (r=0.80), and CEC (r=-0.53)].