



10.6 Response of rangeland to drought

2016 EXT 22

Response of rangeland to ecosystems to extreme drought

Project Lead:

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Collaborating Partners:

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MBFI Location(s):

Brookdale and Johnson Farm Sites

Start Date:

May 2016

Status: In progress

10.6.1 Introduction

Terrestrial ecosystems are known to vary dramatically in their responses to drought. With climate change, droughts are expected to increase in frequency and magnitude, and thus become more extreme. However, the mechanistic basis underlying how ecosystems respond to drought limits our ability to project drought impacts. Following the protocol of the International Drought Experiment¹, the project will impose a drought that represents a statistically extreme deviation in annual precipitation relative to long-term records. A drought treatment will be imposed year-round over a four-year period using infrastructure that passively reduces each rainfall event by a fixed percentage. In collaboration with the International Drought Experiment this project will contribute data that will permit comparisons across western Canada and globally. Improved understanding of the impacts of drought on rangeland ecosystems will help improve existing models to help manage rangeland resources, including the plants and soils that sustain them.

10.6.2 Objectives

In response to drought, the experiment will monitor the aboveground productivity, soil nutrient

concentrations, and plant community composition of an upland rangeland community. Data collected following four years of drought treatment will be combined with those collected from an international network of stations.

10.6.3 Project Design and Methods

Drought will be imposed using fixed shelters (2.5 x 2.5 m) that passively reduce precipitation events by a constant, site-specific percentage. Core measurements inside each shelter will include aboveground productivity and standing biomass (destructive sampling of < 25% of subplot, separated into live/dead biomass, by growth form and current vs. previous season's growth), plant community composition (cover, density), light availability (portable light meter), meteorological measurements (daily precipitation, air temperature), and soil characteristics. Each shelter will be replicated five times and matched with the same number of infrastructure controls (unsheltered frames). Each shelter will be trenched (to a depth of > 0.5 m) along the border in order to hydrologically isolate each plot. The drought manipulation will occur year-round for four years (2016 to 2019), with measurements of soil, vegetation, and meteorological measurements occurring each year. Shelters will be set up at the Brookdale Farm in a fenced off wetland area where no grazing has previously occurred.

Following the protocol of the International Drought Experiment¹, the project will monitor soil C and N concentrations, once during the first year of treatment and in year four of the drought. For each plot, two to three soil samples will be collected to a depth of 0 to 15 cm and composited. In addition, soil moisture content will be measured for the drought and control treatments. Soil moisture content will be measured at a depth of 10 cm, biweekly, using a portable soil moisture probe. Other measurements of soil health will include root production, biomass and an index of decomposition. Site level measurements will include average water table depth.

10.6.4 Results and Discussion

To date, 10 rain shelters have been installed at the Brookdale Farm. The first year of the experiment is designed to collect baseline data, including a site description, vegetation inventory, and measurements of light intensity and soil moisture. These were completed between July and August 2016.

10.6.5 Summary

Drought manipulations will begin in the second year of research (2017). Roofing tiles will be installed in May 2017 and five of the 10 shelters will be trenched and lined with an impermeable membrane to reduce ground flow of moisture. Above-ground productivity, standing biomass, and plant community composition will be measured. Qualitative plant trait data will be recorded for all plants rooted in the experimental plots. The performance of the shelters will be assessed using measurements of light and soil moisture. In addition, root production and biomass, and decomposition will be estimated inside each shelter.

10.6.6 Acknowledgements

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10.6.7 References

¹International Drought Experiment. Available from:

http://wp.natsci.colostate.edu/droughtnet/files/2015/01/The-International-Drought-Experiment_Draft-Protocol_v2.pdf



Fig. 10.6.1. Drought structures 2016; photo by Rafael Otfinowski.



Fig. 10.6.2. Drought structures 2016; photo by Raphael Otfinowski.