2021 Cooperative Summer Internship Program

USGS Project Scientist	Amy Symstad
Project start date	5/10/2021
Duration	9 payperiods
Location	Wind Cave National Park (Hot Springs, SD)
Type of Intern	ESA
Title of Project	Examining the demographic and community response and recovery of northern Great Plains grasslands to droughts in the context of grazing and climate change
Background	The type of plant community that dominates a region's landscape is driven by the amount and timing of water availability. In general, water becomes limiting when potential evapotranspiration is greater than precipitation. In comparison with other ecosystems (e.g. deserts and forests), grasslands in the Great Plains exist at the edge of water limitation. This, combined with the precipitation variability in the region, forces the grassland community to deal with inter-annual shifts between states of water limitation and water abundance. Therefore, drought is a natural part of grassland ecosystems. Droughts can be described by their duration, timing, and intensity and different types of drought can produce different responses from the plant community. Climate models predict that annual precipitation for the northern Great Plains of western South Dakota and the surrounding vicinity will remain stable or increase, but projected increases in annual precipitation for the latter 21st century will primarily occur in the winter and spring with little or no change in the summer and fall. With increasing temperatures being consistently projected for the Great Plains, this will produce drier conditions in the summer and fall. The mixed-grass prairie of the northern Great Plains contains a mixture of C4 (warm-season) and C3 (cool-season) grasses. Due to C3 grass dominance, grassland productivity in the mixed-grass prairie of western South Dakota primarily occurs in the spring months of April through June. Cool-season grasses can begin stem recruitment in the fall when there is proper soil moisture. Invasive annual brome grasses also are known to recruitment in the fall and overwinter. Therefore, predicted water stress later in the growing season may not affect the primary growing season of C3 grasses but it could impact C4 grasses (particularly their late-season flowering) stem recruitment of C3 grasses in the fall, and recruitment of invasive annual bromes. Thus, in addition to the well-known, direct impact of drought on grass tiller growth and overall grassland productivity during the dry period, drought may also affect grass recruitment and even tiller growth rates after precipitation conditions improve, thereby affecting grassland recovery and leading to shifts in plant species composition. Northern Great Plains grasslands provide forage for both wildlife and domestic livestock. Therefore, grazing often occurs during drought but managers are concerned about what level of grazing is appropriate to ensure rapid

	and full recovery of the grassland following drought. Therefore, this project seeks to understand the effects of different types of drought, including those relevant to projected future climate, on northern mixed-grass prairie grass population dynamics and community composition in grazed grasslands. The project is a cooperative effort between the USGS (Northern Prairie Wildlife Research Center) and the U.S. Forest Service (Rocky Mountain Research Station, Grasslands and Shrublands Division). The work will be conducted on USDA (national grassland) property but has direct implications for bison management in nearby national parks.
Objectives	Examine how extreme early-season, extreme late-season, extreme season-long (all single-year), and the "new normal" precipitation regime (projected late 21st century average), affect plant demography, composition, and production during and after drought with and without grazing.
Intern Tasks	This is the first year of this project, so the intern will work in a team to help establish experimental plots and the infrastructure to protect them from cattle, install an array of soil moisture meters and dataloggers, and collect baseline (pre-treatment) data. Plant demography data collection will involve counting the stem density of important grass species. Community composition data collection will involve measuring the foliar cover of each plant species in a designated area, either visually or with a point-frame. Production data collection will require clipping plant biomass, sorting it to species or functional group, drying, and weighing it. The intern will also assist with data entry and checking. It is likely that the intern will also participate in similar activities for other ongoing, related projects as time permits.
Expected Results and Benefits to the Intern	The intern will learn a variety of skills related to completing plant population and community ecology field research, including identifying a large number of northern Great Plains grassland plant species. Also, because they will be working on this project at the outset, the intern will gain valuable knowledge about experimental design and the decisions that must be made when selecting specific locations for experimental plots (e.g., plot rejection criteria, random assignment methods). Because the intern will work with two different scientists (me and a Forest Service research ecologist) with different emphases (community vs. population ecology), backgrounds, and personalities (but both welcoming and dedicated), the intern will be exposed to a broad range of field plant ecology topics. In addition, the intern will gain knowledge not only about how the two science agencies work differently, but also about the different emphases of the two departments (Interior and Agriculture) they serve. Specifically, I work primarily with National Park Service units, whose fundamental purpose is to preserve native ecosystems and processes, whereas the USDA grasslands are multi-purpose and work much more with production ranching. As time allows, the intern will also work on projects related to invasive annual grasses, thus experiencing a broader range of vegetation data collection methods and locations worked in.
Skills and Interests of Candidates	The intern must be interested in plant ecology and able to work long days in the field with little shade and sometimes hot temperatures. The intern must be able to quickly learn to identify the specific plant species in the region, so at least some coursework in plant taxonomy or botany, or previous experience identifying herbaceous plants to the species level, is highly desired. Experience with dataloggers, GPS units, and/or field computers would be really nice but is not required.
Project Type	Field Work;
Project Discipline	Ecology;