

MMRPBA 2019 Report  
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**Aboveground Biomass:**

We marked five random individual trees in each of five height classes: <1 m, 1-2 m, 2-3 m, 3-4 m, and >4 m tall and five grassland control plots on two ranches located in Gregory County, SD along the Missouri River in 2019. Height, diameter breast height, basal diameter, and canopy diameter (in two perpendicular dimensions) were measured for each tree. Herbaceous forage biomass was estimated by clipping two 0.25 m<sup>2</sup> quadrats adjacent to the trunk of each tree and in 10 open grassland control plots at each ranch in late-July. Analysis of variance and regressions were conducted on forage biomass and tree class, height, diameter, and volume. Average forage biomass reduction was 70% across all tree classes compared with grassland controls ( $P < 0.01$ ). There were no significant differences detected among the tree height classes <2 m tall. Tree height was the best predictor ( $r^2 = 0.59$ ,  $n = 60$ ,  $P < 0.0001$ ) among all variables we measured. There was a linear decrease in forage biomass (kg/ha) across tree height classes expressed by the equation  $Y = 3200 - 6 \times \text{tree height (in cm)}$ . Our results suggest rangeland managers should monitor tree height and apply appropriate tree removal before it reaches critical height (>1m) to avoid large forage biomass reduction.

**ERC Tree Growth and Encroachment**

We marked five random individual ERC trees in each of the five height classes: <1 m, 1-2 m, 2-3 m, 3-4 m, and >4 m within permanent control sites at three locations in Gregory County, SD. Height, diameter breast height, basal diameter, and canopy diameter (in two perpendicular dimensions) were measured for each tree and will be monitored annually for growth rate. Additionally, within the same three control sites, six 10 m<sup>2</sup> permanent plots were randomly assigned in open grassland areas adjacent to high density, mature ERC trees for ERC encroachment assessment. ERC trees present within the plots were counted and measured for height, diameter breast height, basal diameter, and canopy diameter (in two perpendicular dimensions). Growth rates, as well as new ERC encroachment within the plots, will be monitored annually.

In the spring of 2019, 144 ERC seedlings were planted in Brookings County in order to examine survival of ERC seedlings by vegetation type (cool season introduced vs. warm season native) and grazing intensity (no clipping vs. clipping to maintain 6cm stubble height). Initial seedling height (cm) and basal diameter (mm) were measured and will also be monitored annually.

**Soil Microbial Communities and Soil Nutrients:**

Three ERC trees were randomly selected on two ranches in each of the five height classes: < 1m, 1-2m, 2-3m, 3-4m, and > 4m. Multiple soil cores (2-cm dia. X 15cm depth) were extracted under each tree to form one composite sample per tree as well as in three adjacent grassland areas for comparison. Further, soil cores were taken from six randomly selected locations within each of the following five treatment areas located on one ranch: one, two, and three years post fire; grassland control; and ERC forest control. Phospholipid fatty acid (PLFA) and soil nutrients will be analyzed for all samples to assess soil community structure and abundance and soil nutrient availability.

**Other Soil Measures:**

Water infiltration and runoff were assessed within three burned sites located on one ranch (burned in 2019, 2018, and 2017), which were heavily encroached by ERC, as well as in adjacent grassland and ERC forest control sites for comparison in order to assess the effects of ERC encroachment and burn treatments on water infiltration and runoff. Additionally, multiple soil samples were collected under ERC forest canopies (including the three burned sites) and in adjacent grasslands on three ranches for soil bulk density, soil moisture, soil aggregate stability testing, and soil texture assessment to supplement other analyses.