CHARACTERIZING GRASS AND SHRUB ECOSYSTEMS IN THUNDER BASIN

By Carolyn Mehl and Jonathan B. Haufler

INTRODUCTION

The Thunder Basin Grasslands Prairie Ecosystem Association is developing an ecosystem management plan for a 931,000-acre, mixed-ownership landscape in eastern Wyoming. The initial step in this process is an ecological assessment to characterize historical and existing ecosystem diversity at the landscape and ecosystem (community) level.

DEVELOPING AN ECOSYSTEM DIVERSITY MATRIX

To characterize ecosystem diversity, we have applied a tool termed the Ecosystem Diversity Matrix (Haufler et al. 1996, 1999). The Ecosystem Diversity Matrix (EDM) is a conservation-planning tool that classifies ecosystems within a landscape according to ecological site and successional pathways in response to historical disturbances. For Thunder Basin, we utilized the Ecological Site Descriptions (ESDs) [just described by Everet Bainter in these proceedings] as developed by the Natural Resources Conservation Service (NRCS), as a basis for delineating abiotic drivers of ecosystem diversity. We combined some ESDs to reduce landscape complexity, resulting in eight groupings of descriptions for the grass/shrub EDM. Each ESD includes a discussion and diagram of state-and-transition models for changes in vegetation communities occurring on each type of site in response to current management practices. We adjusted these state-and-transition models to represent historical disturbance regimes. The primary disturbance regimes included were grazing, fire, and prairie dogs (*Cynomys* spp). We further broke these disturbances down into the following categories:

- Active and inactive prairie dog colonies
- Grazing and short-interval fire regime (<35 years)
- Grazing and long-interval fire regime (>35 years).

Grazing was further broken down into categories of no/light grazing, moderate grazing, and heavy grazing. Using these criteria, we produced the EDM shown in Figure 1 on next page.

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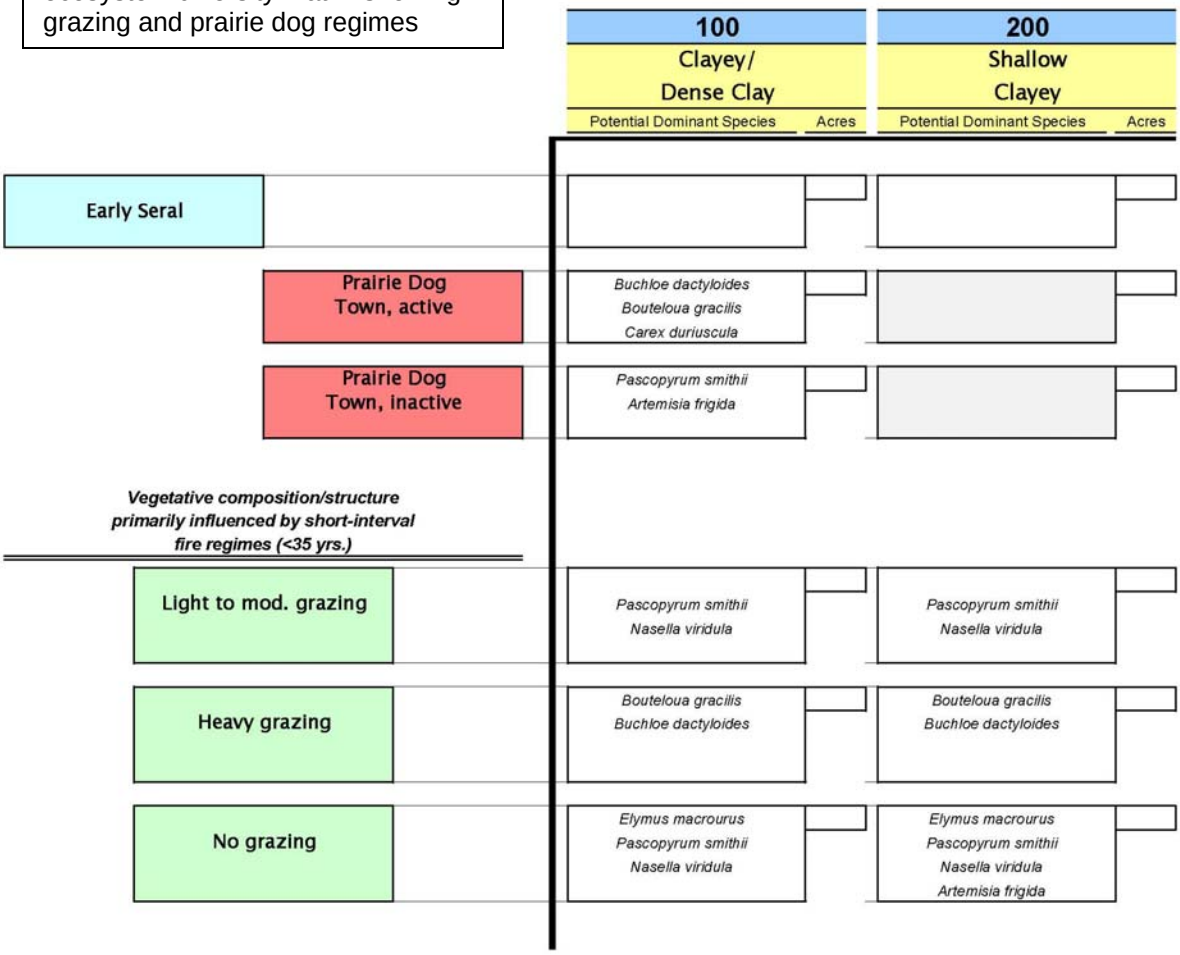
VEGETATION SAMPLING

We used the EDM to conduct stratified random sampling of existing vegetation communities. Our purpose for this sampling was as follows:

- To describe existing ecological communities using the EDM framework
- To evaluate the EDM framework for explaining species distributions and abundances

Figure 1--Example of an ecosystem diversity matrix showing grazing and prairie dog regimes



Our sampling design stratified plot distribution on the basis of ecological site; active and inactive prairie dog colonies; and whether a site was dominated by shrubs or grasses. During the 2003 field season, our crews accomplished the following:

- located 313 stratified random plots
- rejected 31 of these plots due to either having >85% annual brome, being heavily grazed, or having been cultivated
- sampling 282 plots

We conducted analyses on the data collected during the vegetation sampling. We found a total of 143 species occurring on the 282 sampled plots. We compared the classification of ecological sites with a non-parametric ANOVA and found that 58 of the 143 species differed significantly (p,0.05).

We plan additional vegetation sampling in 2004. We will augment the sampling from 2003 with additional plots stratified across the different ecological sites and vegetation states. We will also be sampling recently burned sites to initiate a fire-response monitoring program.

NEXT STEPS

The next steps in our development of the ecosystem management plan are as follows: First, we will complete characterization of the grass/shrub EDM with the additional sampling planned for 2004. We will conduct further analyses of the vegetation data to better describe each existing cell of the

matrix in terms of its composition and structure. Second, we will conduct an analysis of historical disturbance responses. We will quantify the range of historical variation in amounts of each cell of the matrix over a defined (historical reference) time period, such as 500 years prior to European settlement. Third, we will develop a finer scale map of existing vegetation conditions, which will allow us to quantify the amounts of specific ecosystems (cells of the EDM) that are present today. Fourth, we will compare historical amounts of each ecosystem with amounts present today. This will allow us to identify those ecosystems that are in good amounts today compared to their historical amounts, and to identify those ecosystems that may be lacking or in small amounts relative to their historical amounts. This comparison will allow us to identify ecosystems that may be under-represented from an ecosystem-diversity planning standpoint, and to make recommendations for restoration of additional amounts of specific ecosystems. These analyses will provide us the information to develop the ecosystem management plan that will provide for ecosystem diversity as well as for ranching, energy production, and other human uses of the landscape.

CONCLUSIONS

We are partway through an ecological assessment of the planning landscape in eastern Wyoming. Our work characterizing and describing ecosystem diversity for grass/shrub ecosystems is progressing well. We completed one year of field sampling in 2003, and have plans to conduct additional sampling in 2004. The ecosystem diversity matrix we have developed will provide a tool to characterize and quantify both the historical ranges in amounts of each specific ecosystem, as well as the existing amounts of each ecosystem. Comparisons of these two amounts will reveal which ecosystems exist in good amounts today relative to their historical amounts, and which ecosystems are lacking or exist in small amounts at the present compared to the past. The ecosystem management plan we are developing will use this comparative information in establishing goals for ecosystem representation. We will continue to conduct the ecological assessment and will begin the development of the ecosystem management plan.

REFERENCES

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