Appendix L: Oak Savanna Definition

Working Definition of "Savanna" for Restoration Efforts at Crane Meadows NWR

General Definition of Southern Dry Savanna:

Savanna habitat at Crane Meadows NWR, like savanna across its range, is a fire-dependent, dynamic community characterized by scattered trees or groves of trees, mostly comprised of oaks (*Quercus sp.*) with a canopy cover ranging from 10–70%, but more typically between 25-50%; and a basal area (BA) of 5-50 sq ft / acre. A wide range is used because canopy cover is not the most important characteristic that defines savanna and also because savanna ecosystems are dynamic and are associated with a natural range of variation through space and time. In addition, canopy cover can also vary at a small-scale (stand level), where areas of both scattered trees and areas with groves of trees are present within a stand. Essential variables when defining savanna habitat include tree species, tree size and shape, the presence and abundance of native savanna forbs and graminoids, shrub density, light penetration, and disturbance regimes. At Crane Meadows NWR on the Anoka Sandplain in Central Minnesota, bur oak (*Quercus macrocarpa*) and black oak are typically the dominant tree species interspersed with jack pine (*Pinus banksiana*), red oak (*Quercus rubra*),or northern pin oak (*Quercus elipsoidalis*) (or a hybrid of the two) (Buchanan 1996, Law et al. 1994, Minnesota Department of Natural Resources 2005).

Savannas are mosaic communities with variation of open, closed, and partially shaded areas. Thus, an important component when defining savanna is the composition of the understory vegetation. Savanna understory consists of a mosaic of both heliophiles typical of prairie as well as species well adapted to shaded environments under trees, shifting as the tree canopy becomes more open or closed. Herbaceous species typical of prairie and forest co-occur; in addition to a set of very specific savanna species (see lists below) that have high fidelity to this community type (Texler Personal commun., Drobney Personal commun. (Buchanan 1996). This spatial variation within the understory is a function of the varying degrees of species tolerance to shade and sun. Forbs are an essential component of the understory. Another important component of savanna understory is the shrub layer. The understory of savanna on the Anoka Sandplain, including those at Crane Meadows NWR, can be present with or without shrubs. The extent of shrub density is dependent on the subtype savanna classification and the frequency of fire (Law et al. 1994, Swanson 2008, Minnesota Department of Natural Resources 2005).

Along with shrubs, the presence of saplings and pole trees (consisting of canopy tree species) is important to maintain in some areas in the subcanopy layer or as a single-canopy area within a stand. Saplings and pole trees ultimately replace mature trees in the overstory that age and eventually drop out of the canopy. Thus, in order to maintain oak savanna in perpetuity, it is important to consider maintaining or managing areas for regeneration. Because it is difficult to manage for savanna habitat described above and maintain sapling and pole trees, different management scenarios should be implemented throughout the Refuge to maintain both mature trees in savanna habitats as well as areas varying in age classes (including saplings and pole trees). Areas managed for regeneration should maintain a range of 100-200 saplings and pole trees / acre and a minimum threshold of 40 saplings and pole trees/ acre to insure regeneration. There may

also be natural regeneration when a tree-fall gap is created in the canopy which allows for light penetration and localized regeneration within a stand.

Barrens Oak Savanna

There are many subtypes of oak savanna habitat that have been classified by the Minnesota Department of Natural Resources (2005). A common savanna type on sandy soils of the Anoka Sandplain is barrens oak savanna; a relatively open community with scattered or clustered (10-70% canopy cover, but more typically 25-50%), stunted (15-35 feet tall), open-grown bur oak and black oak trees, often interspersed with jack pine, and with grass-dominated herbaceous ground layer (Wovcha et al. 1995, MN DNR 2005). The understory vegetation is sparse or patchy with both native grasses (25-100%) and forbs (5-50%) (MNDNR 2005). Northern pin oak is sometimes present as a secondary tree species in the overstory or in the shrub layer. The density of shrubs is less than 30% in high quality occurrences (Dunevitz 1993).

Measurement Scale:

Post assessments of oak savanna restoration activities must be measured and quantified to evaluate whether management is producing the desired outcome and the Refuge oak savanna habitats comply with this definition. The scale used to evaluate savanna restoration efforts at Crane Meadows NWR will include both the designated Fire Management Units (FMU) and the land most suitable for oak savanna restoration as defined by the Comprehensive Conservation Plan (CCP).

For more details, refer to "Field Guide to the Native Plant Communities of Minnesota: The Eastern Broadleaf Forest Province" pgs. 89 and 289; and/or "Minnesota's St. Croix River Valley and Anoka Sandplain: A Guide to Native Habitats" pg. 68-77.

Oak Savanna Native Plant Species for Crane Meadows NWR: Target species for management

Barrens Oak Savanna (Wovcha et al. 1995, MN DNR 2005 Ups14a)

Canopy

Bur oak (*Quercus macrocarpa*)

Black oak (*Quercus velutina*)

Northern pin oak (*Q. ellipsoidalis*)

Jack pine (*Pinus banksiana*)

Shrub Layer

Chokecherry (*Prunus virginiana*)

Oak (*Quercus sp.*)

New Jersey tea (*Ceanothus americanus*)

Prairie willow (*Salix humilis*)

Smooth sumac (*Rhus glabra*)

American hazelnut (*Corylus americana*)

Ground Layer

WOODY SPECIES

Leadplant (*Amorpha canescens*)

Poison ivy (*Toxicodendron radicans*)

Prairie rose (*Rosa arkansana*)

FORBS

Western ragweed (*Ambrosia coronopifolia*)

Hairy puccoon (*Lithospermum caroliniense*)

White sage (*Artemisia ludoviciana*)

Gray goldenrod (*Solidago nemoralis*)

Hairy golden aster (*Heterotheca villosa*)

Horseweed (*Conyza canadensis*)

Large-flowered beard-tongue (*Penstemon grandiflorus*)

Purple prairie clover (*Petalostemon purpureum*)

Silky prairie clover (*P. villosum*)

Ground-cherry (*Physalis virginiana*)

Missouri goldenrod (*Solidago missouriensis*)

Prairie bird-foot violet (*Viola pedatifida*)

Prairie larkspur (*Delphinium virescens*)

Rough blazing-star (*Liatris aspera*)

Rigid sunflower (*Helianthus rigidus*)

GRAMINOIDS

Junegrass (*Koeleria pyramidata*)

Porcupine grass (*Stipa spartea*)

Hairy grama (*Bouteloua hirsuta*)

Little bluestem (*Schizachyrium scoparium*)

Big bluestem (*Andropogon gerardii*)

Sand reedgrass (*Calamovilfa longifolia*)

Panic-grass (*Panicum sp.*)

Umbrella sedge (*Cyperus schweinitzii*)

Pennsylvania sedge (*Carex pensylvanica*)

Characteristic Plant Species

Sand reedgrass (*Calamovilfa longifolia*)

Sea-beach needlegrass (*Aristida tuberculosa*)

False heather (*Hudsonia tomentosa*)

Muhlenberg's sedge (*Carex muhlenbergii*)

Silky prairie clover (*Petalostemon villosum*)

Old field toadflax (*Linaria canadensis*)

Geyer's spurge (*Euphorbia geyeri*)

Cream gentian (*Gentiana alba*)

Kitten-tails (*Besseya bullii*)

Kalm's brome grass (*Bromus kalmii*)

Rare Plant Species

Small-leaved pussytoes (*Antennaria parvifolia*)

Sea-beach needlegrass (*Aristida tuberculosa*)

Rhombic-petaled evening primrose (*Oenothera rhombipetala*)

James' polanisia (*Polanisia jamesii*) – SE

Tall nut-rush (*Scleria triglomerata*)- SE

False heather (*Hudsonia tomentosa*)

Kitten-tails (*Besseya bullii*)- ST

Blunt sedge (*Carex obtusata*)

Hill's thistle (*Cirsium hillii*)

* SE = State Endangered

* ST = State Threatened