QUAKING ASPEN MANAGEMENT IN THE BLACK HILLS[1]

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ABSTRACT

In the summer of 1984, 154 previously treated quaking aspen stands were sampled throughout the Black Hills of South Dakota to determine the most reliable and successful regeneration technique(s). Examples of treatments are clearcutting, thinning, and removing all aspen while leaving various numbers and size classes of conifers on the site. All sites were sampled for various site descriptors and regeneration status. Sites were separated into ten aspen groups based on geologic formation and soil genesis. The purpose of the treatment was to rejuvenate the aspen stand and the purpose of this study was to develop management directions based on the evaluation of treatment results. A dichotomous key was developed to aid managers in delineating the aspen groups.

INTRODUCTION

Quaking aspen (*Populus tremuloides*)is a clone forming species which is heavily utilized by wildlife due to its high density and diversity of microhabitats. Aspen stands also often provide excellent forage for cattle. Aspen stands of the Black Hills National Forest are managed primarily for wildlife habitat yet are often utilized by cattle. Management of aspen has usually been in the form of regenerating poor quality or decadent stands. Since aspen is a clonal species which exhibits apical dominance, regenerating it requires removing a signifcant portion of the apical meristems—this means cutting down most of the trees in the clone. After treatment, the aspen stand sends up scores of sucker sprouts from its lateral root system which lies a few centimeters under the soil surface.

Management to aid in the regeneration of aspen stands in the Black Hills National Forest was begun in the early 1970's. From that time until 1982, over 150 aspen stands (of various size and

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quality) were treated at various sites and times of the year with various methods. The treatment methods included clearcutting, clearcutting aspen while thinning conifers, general thinning, clearcutting with a bulldozer, partial cutting with a bulldozer, and clearcutting aspen while removing most conifers. Some of the treatment methods were successful and some were not. The purpose of this research was to evaluate the varying degrees of success among aspen treatments, and to thus develop recommendations for regenerating aspen in the Black Hills.

METHODS

Data were collected on 154 aspen stands in the Black Hills during the summer of 1984 (Table 1). The notable variables include stems per acre, average height, geologic parent material, soil qualities, elevation, and plant indicators. Other variables were also analyzed and are included in management recommendations.

TABLE 1

Data Values Collected at Aspen Sites

Stems per acre	Elk damage	Aspect
Average height	Cattle damage	Elevation
Sample date	Average annual rainfall	Soil series
% of site treated	Treatment type	% Damage
Maximum slope	Treatment season	Total animal damage
Geologic parent material	Protection (if any)	
	Treatment date	Slope position
Deer damage	Site size	

Geology, landform, and soil qualities, respectively, were the most incessant variables in the study. These characteristics were used to separate the sites into groups (Figure 1). The ten resulting aspen groups were then organized by site qualities into a dichotomous key (Table 2) to facilitate manager use.

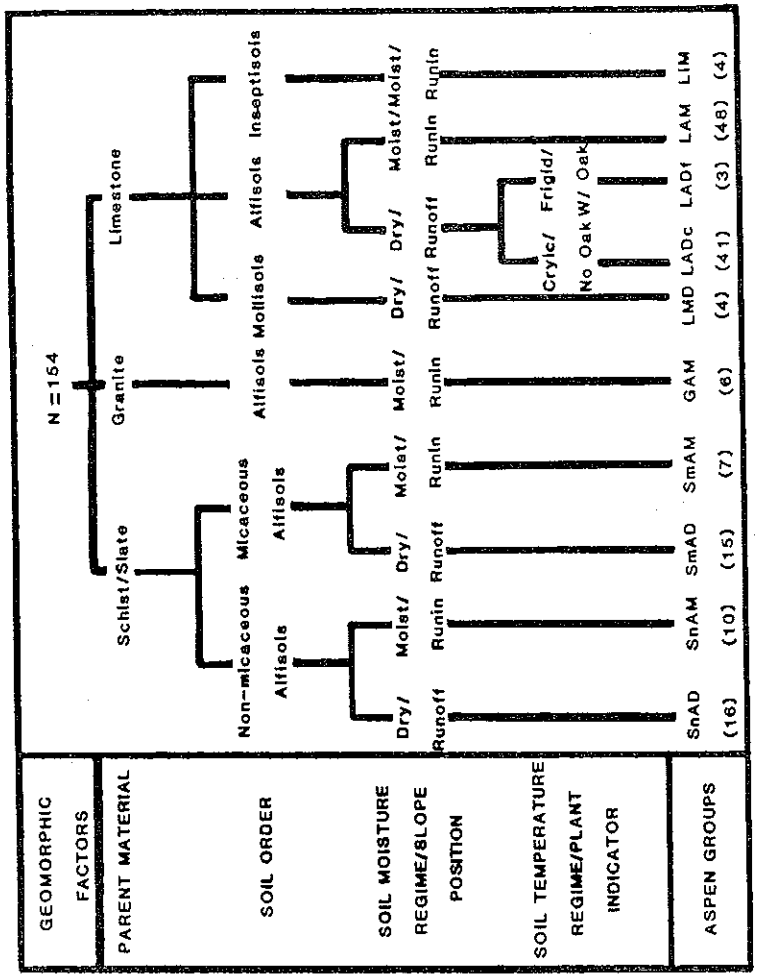

Figure 1. Separation of aspen study sites in the Black Hills into 10 aspen groups. Resulting acrostics represent the separation stages (e.g., GAM = Granite, Alfisolic, Moist/Runin sites).

TABLE 2

KEY TO ASPEN GROUPS

1a. Soils derived from rocks of metamorphic or igneous origin ....(2)

1b. Soils derived from rocks of sedimentary origin, primarily limestone .....(6)

2a. Soils derived from rocks of igneous origin; granites. Aspen occurs primarily on bottom slope positions and in the south to east range of aspects. Aspen are located among igneous outcrops. High moisture indicator species such as paper birch (Betula paperyfera), chokecherry (*Prunis Virginiana*), and willow (Salix spp) are common on these sites .....GAM

2b. Soils derived from rocks of metamorphic origin, schists and slates. Aspen on a variety of slopes and aspects, with high or low moisture .....(3)

3a. Soils from micaceous schist, particularly Buska series. Aspen primarily occurs on middle to bottom slope positions in all but the west aspects, with high or low moisture .....(4)

3b. Soils from low or non-micaceous schists or slates, primarily Pactola and Virkula series. Aspen occurs primarily on middle to bottom slope positions in all but south facing aspects, with high or low moisture .....(5)

4a. Aspen occurs primarily in bottom slope positions within the south to east range of aspects. High moisture plant indicator species such as paper birch, willow, chokecherry, and red raspberry (*Rubus idaenus*) are common to these sites .....SmAM

4b. Aspen occurs primarily on upper and middle slope positions within the north to east range of aspects. High moisture indicator species are rare on these sites; low moisture indicators such as common juniper (Juniperus communis) are common .....SmAD

5a. Aspen occurs primarily on upper and middle slope positions within the north to east range of aspects. High moisture indicator species are rare on these sites; low moisture indicator species such as common juniper and white spruce (*Picea glauca*) are common .....SnAD

5b. Aspen occurs primarily on middle to bottom slope positions within the north to west range of aspects. High moisture indicator species such as paper birch,

TABLE 2 (Continued)

common chokecherry, silver buffalo berry (*Shepherdia canadensis*) and red raspberry are common on these sites .....SnAM

6a. Sites exhibit relatively deep soils (mollisols); common soil series include Redbird, Judy, Heath, and Paunsaugunt. Aspen occurs at high elevations (6500-6600 ft) on middle to bottom slope positions, generally within the south to east range of aspects. Low-moisture indicator species such as common juniper are common .....LMD

6b. Sites exhibit moderately deep to shallow soils (inceptisols and alfisols) at a wide range of elevations (4,900-6,850 ft), slope positions and aspects .....(7)

7a. Sites exhibit moderately deep soils (inceptisols) and occur at less than 5,600 feet elevation. Soil series such as Vanocker and Citadel are common. Aspen occurs at various slope positions of eastern aspect. Moist indicator species such as paper birch, common chokecherry and saskatoon serviceberry (*Amelanchier alnifolia*) are common on these sites .....LIM

7b. Sites exhibit shallow soils (alfisols) and occur at a wide range of elevations (4,900 - 6,850 ft) slope positions, and aspects .....(8)

8a. Sites dominated by the Citadel soil series (type CBE) and occur at a wide range of elevations (4,900-6,700 ft). Other prominent soil series include Stovho, Cordeston, and Marshdale.[1] Aspen occurs primarily on middle to bottom slope positions with the north to east range of aspects. Moist indicator species such as paper birch, common chokecherry, and saskatoon serviceberry are common on these sites with frequent occurrence of drier indicators such as bur oak (*Quercus macrocarpa*) .....LAM

8b. Sites drier; aspen occurs predominantly on upper to middle slopes .....(9)

9a. Cryic sites (occurring above 6000 feet elevation). This group is dominated by the Stovho soil series. Constituent soil series include Lail, Trebor and Maitland. Aspen occurs within the south to east range of aspects. Dry indicator species such as common juniper are common. Bur oak is rarely present .....LADc

9b. Frigid sites (occurring at below 6000 feet in elevation). This group is dominated by the Citadel Soil Series. Aspen occurs on all but southern aspects. Dry indicator species such as common juniper are common. Bur oak is normally present .....LADf

[1]A constituent in the soil unit: Cordeston-Marshdale loams.

RESULTS AND APPLICATIONS

The following information is strictly baseline data for management purposes. Similar findings abound in the literature. Non-site specific management recommendations include the following:

1. *Always clearcut aspen.* In this study, aspen regeneration by clear-cutting was found to be superior to clearcutting aspen while thinning pine and general thinning (Riley, 1986). Clearcutting has also been consistently the most commonly prescribed treatment for regenerating aspen in the literature (Garret and Zahner, 1964; Schier and Smith, 1979; Brinkman and Roe, 1975; Stoeckler and Macon, 1956; Walters et al., 1982; Baker, 1925; Bates, 1917; Jones, 1976; and Zehngraff, 1949).

2. *Always attempt to treat aspen sites in the dormant season.* Aspen build up large quantities of carbohydrates in their root system in the growing season (Tew, 1970). These carbohydrates are then made available for future uses of the plant. Large amounts of carbohydrates are utilized by aspen to produce leaves and to grow — especially in the spring. If sites are clearcut in the growing season, fewer carbohydrates will be available for regeneration than if treated in the dormant season (Tew, 1970). Dormant season treatments exhibited increased regeneration over growing season treatments (Riley, 1986).

3. *Treated aspen sites commonly need protection from grazing animals.* The most cost effective protection is leaving slash on the site after clearcutting to impede large herbivore traffic. Some sites may require additional protection in specific situations (Table 3).

4. *When paper birch are treated in Black Hills Aspen stands, always leave at least one stem alive and standing per clump.* Birch are common in Black Hills aspen stands (Table 3) and are often lost after clearcutting due to grazing pressure. Leaving one stem per clump provides the plant time to regenerate itself and will help conserve this species in Black Hills aspen stands.

TABLE 3

Group Specific Management Factors

Aspen Group	Birch Presence	Additional Protection Beyond Slash Management
SmAD	No	Fencing or grazing rest may be required
SmAM	Yes	Fencing or grazing rest may be required
SnAD	No	Fencing or grazing rest may be required
SnAM	Yes	Does not appear necessary
GAM	Yes	Consider if located near large herbivore congregation area
LADc	No	Consider if located near large herbivore congregation area
LAM	Yes	Consider if located near large herbivore congregation area
LADf	No	Leaving slash may not be possible;[1] fencing or grazing rest may be required instead
LIM	Yes	Leaving slash may not be necessary; fencing appears ineffective for increasing regeneration enough to warrant expense
LMD	No	None

[1]LADf has increased with burning in the Black Hills and if burned after treatment, no slash will remain.

TABLE 4 — PART I

Summary of Location and Resource Potential for Ten Aspen Groups

Group	Location in Black Hills[a]	Geology[b]	Soil Great Group	Soil Moisture/ (Temp)[c]	Aspen Response (# x Vigor)[d]
SmAD	N - S	Sm	Alfisol	Dry	M
SmAM	S	Sm	Alfisol	Moist	M
SnAD	N - S	Sn	Alfisol	Dry	MH
SnAM	S	Sn	Alfisol	Moist	L

TABLE 4 — PART I (Continued)

GAM	S	G	Alfisol	Moist	L
LADc	N - S	L	Alfisol	Dry (Cryic)	L
LAM	N - S	L	Alfisol	Moist	M
LADf	N	L	Alfisol	Dry (Frigid)	M
LIM	N	L	Inseptisol	Moist	VH
LMD	S	L	Mollisol	Dry	VL

[a]S=south (Includes Custer, Elk Mountain, Harney, and Pactola Ranger Districts). N=north (Includes Bearlodge, Nemo, and Spearfish Ranger Districts).

[b]S=schists/slate parent material. M=micaceous origin. N=non-micaceous origin. G=granite parent material. L=limestone parent material.

[c]Cryic=occurring above 6000 feet MSL. Frigid=occurring below 6000 feet MSL.

[d]L=low, M=moderate, H=high, V=very.

TABLE 4 — PART II

Summary of Location and Resource Potential for Ten Aspen Groups

Group	Pine Regeneration[a]	Range Forage Potential[a]	Present Grazing Presrure[a]	Woody Plant Diversity[a]	Big Game Wildlife Hab. Potential[a]
SmAD	M	MH	MH	L	L
SmAM	L	H	L	H	M
SnAD	L	H	M	M	L
SnAM	L	L	ML	MH	M
GAM	L	L	ML	MH	M
LADc	H	M	H	M	M
LAM	L	M	VH	H	MH
LADf	L	L	L	M	L
LIM	L	L	MH	VH	VH
LMD	L	M	ML	MH	MH

SUMMARY

One hundred and fifty-four pre-treated aspen stands were sampled on the Black Hills National Forest during the summer of 1984. The sites were separated by geomorphic qualities into ten aspen groups. To facilitate use by managers a dichotomous key was prepared to identify specific groups. Both general and site specific management recommendations to enhance regeneration success were devised. Aspen managers on the Black Hills National Forest are now provided with baseline management directions derived from their previous treatments.

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