TECHNICAL NOTE

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GRAZING MANAGEMENT GUIDELINES

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Grazing Management Guidelines for Native Bunchgrasses (Jointed Species):

bluebunch wheatgrass	needle-and-thread
Idaho fescue	Thurber needlegrass
basin wildrye	big bluegrass
prairie junegrass	

'For native species, if growing point is removed during the boot stage, the reallocation of energy goes to roots; this throws the root-to-shoot ratio off resulting in a long term die-off of a portion of the plant.

A. Proper grazing use:

1. 50% of what is there during the growing season.
2. 60% when dormant.

B. Graze no unit more than half the growing season.

C. Graze no unit more than l out of 3 years during the critical period (boot through soft dough stage) Average critical periods are shown for 64 eastern Washington climate stations in NRCS-WA Range Technical Note 103.

D. Defer each unit 1 out of 3 years (growing season).

E. Grazing systems that are appropriate:

1. Deferred rotation.
2. Rest rotation
3. Intensive deferred rotation.

Rotation of grazing between critical and non-critical periods from one year to the next is acceptable when key areas are the sensitive areas of the pasture (or moderate utilization on upland key areas), range trend is toward, indicators of Rangeland Health Attribute rating for Soil/Site Stability show Slight to Moderate or less departure from Ecological Reference Sheet (ESD) and indicators of Rangeland Health Attribute rating for Hydrologic Cycle is Slight to Moderate or less departure for Ecological Reference Sheet (ESD).

Grazing Management Guidelines for Non-Jointed Species:

Kentucky bluegrass and Canada bluegrass	Regar brome
tall fescue	orchardgrass
pinegrass(not a true non-jointed)	perennial ryegrass
saltgrass (not a true non-jointed)	bermudagrass

A. Leave enough leaves and stems to keep plants producing at a high level. Graze above meristems and growing points.

1. Four (4) inch minimum stubble height for most species
2. Three (3) inches Kentucky or Canada bluegrass and bentgrasses.
3. Cattle need four inches to effectively graze.

B. Grazing systems that are appropriate:

1. Continuous but moderate use.
2. Rapid rotation started early but not prior to the 4-leaf stage to keep plants vegetative with a 21-25 day recovery period for each grazed unit during rapid growth.
3. Short duration.
4. Management Intensive grazing method.
5. Deferred rotation and rest rotation are overkill.

Grazing Management Guidelines for Introduced Jointed Species:

smooth brome	reed canarygrass
creeping meadow foxtail	annual ryegrass
timothy	Crested wheatgrass
intermediate wheatgrass	pubescent wheatgrass
Siberian wheatgrass	tall wheatgrass
quackgrass	

A. Proper grazing use:

1. 50% of what is there during the growing season.
2. 60% when dormant.

B. Graze no field more than half the growing season.

C. Graze no field more than 2 out of 3 years during the critical period (boot through soft dough stage).

D. Grazing systems that are appropriate:

1. Rotation of grazing between critical and noncritical periods from one year to the next.
2. Deferred rotation, rest rotation and intensive deferred rotation are overkill.

Management guidelines for forest grazing:

1. If all grasses are native bunchgrasses, use the criteria for native bunchgrasses.
2. If all grasses are jointed species (pinegrass, bluegrass), use the criteria for non-jointed.
3. If the area has both non-jointed and native jointed bunchgrasses:
   a) Fence separately and use separate criteria for each, or
   b) If cannot separate, use the criteria for native jointed bunchgrasses.

Management guidelines for riparian areas (key areas are the non-functional components of the system):

1. Fence out when:
    a) Banks are not stable.
    b) Sediment is not being filtered.
    c) Riparian area is large enough to create a riparian pasture.
2. Managing woody species:
    a) Reduce grazing intensity or establish rest on woody browse for 2 years
    b) Install a temporary fence.
    c) Defer summer and fall.
    d) Graze after spring runoff and let plants recover for the next runoff event.
2. Managing grasses and grass-like species:
    a) If grasses in riparian areas are non-jointed, use non-jointed criteria tempered with the woody criteria above.
    b) Most sedges will respond positively to management based on native jointed bunchgrass criteria.

Grazing Management Guidelines for Annual Rangeland:

1. In the rare cases where the plant communities are 100% annuals:
    a) Graze so as to leave enough plant cover to protect the site from erosion (at least 30% cover).
    b) Use the Range Health Indicator Worksheet and Range Trend to assess ecological integrity.
2. When the plant community still has perennials present:
    a) Manage for the perennials.
    b) Graze early spring and fall:
        - In early spring move the livestock when they switch their diet from annuals to perennials.
        - In the fall graze no more than 60% of the perennial jointed bunchgrasses; maintain a stubble height so that 40% of the bunchgrasses are not eaten (usually about a 4 inch stubble height.)

GRAZING MANAGEMENT GUIDELINES SUPPORTING RATIONALE

1. **THERE IS NO SUCH THING AS RANGE READINESS FOR PLANTS.**
2. **THE CRITICAL PERIOD IS NOT EARLY SPRING.**
3. **REGROWTH PRIMARILY COMES FROM CURRENT PHOTOSYNTHATE OF EXISTING GREEN MATERIAL AND NOT FROM ROOT CARBOHYDRATE STORAGE.**

A. Effects of Grazing

1. Every plant function is affected by grazing: size of food factory (photosynthetic leaf area), food production, root growth, water and nutrient availability, and carbohydrate storage in base of stems.
2. The effect of grazing is dependent upon: season of use and the growth stage of the plant, grazing intensity (the amount green material removed) which directly reduces light interception, frequency of grazing (regrowth grazed), type of plant (warm season vs. cool season; forb or shrub vs. grass), availability of growing points and new tiller buds, shoot carbohydrate reserves, size of root system, and physical effects of grazing animals on plants and soil (trampling may be negative but nutrient cycling a positive response).

B. The risk of damage from grazing varies with the season of the year. (Note: The dates below are from Ephrata at 1500 feet.)

1. Low Risk

SUMMER	FALL	WINTER
6/25 – 8/30	**9/1 - 11/30**	**12/1 – 2/28**

a) Grazing has little effect on plant growth unless grazing is severe.

b) The reduction of tillers under heavy grazing is due to higher overwinter mortality rather than an inadequate number of tillers emerging in the fall. Fall green up is not free forage! It is the basis for next year's production.

c) Cured vegetation protects new tillers and provides energy. Green growth provides protein to animals.

d) Wolf plants are less likely to be avoided during this period.

2. High Risk

Myth #1: Grazing after range readiness is best for bunchgrasses. This is WRONG! The range readiness concept is outdated.

EARLY SPRING (Ephrata)

3/1- 4/15

a) Has little effect as long as grazing intensity is moderate (no more than 50% of current growth is removed) and duration and frequency is controlled.

b) Plants are set for vegetative growth and able to rapidly replace lost leaves and stems, if growing conditions are favorable.

c) Growing points are protected because they are not elevated.

d) All you need is the soil to be firm enough to prevent soil compaction and enough growth for the livestock. Consider the effect of leaf area and air temperature on growth rate and the likelihood of the forage supply staying ahead of the livestock.

e) You need enough old growth and magnesium blocks to avoid grass tetany.

3. Very High Risk

Dr. Ganskopp at Oregon State University studied Thurber needlegrass (Stipa thurberiana Piper) tolerance to the timing of a severe defoliation to a one (1) inch stubble throughout the growing season. Dates of treatment spanned vegetative through dormant stages of phenology. Response variables included: summer regrowth, number of reproductive stems, fall growth, and subsequent spring herbage production, change in basal area, and root mass. Vigor of Thurber needlegrass was reduced most by defoliation during the early-boot stage of development. Impacts were successively less severe from vegetative, late-boot, and anthesis treatments, respectively. Cumulative herbage production the year of treatment was reduced from 38 to 64% by defoliation at the early-boot stage. The same treatment reduced subsequent spring growth by 46 to 51% and root mass the next spring by 34 to 45%. Treatment effects were somewhat reduced when temperature and moisture regimes allowed substantial regrowth after defoliation. Defoliation during or after anthesis had little effect on plant response. Managers should be aware that a single defoliation, particularly during the boot stage, can significantly reduce subsequent herbage production and root mass and possibly lower the competitive ability of Thurber's needlegrass.

Myth #2: The critical period is early spring. This is WRONG!

The critical period is late spring when plants are trying to make seed (boot stage through soft dough stage) (Brewer, et. al., 2007)

CRITICAL PERIOD - Ephrata

Late Spring 3/20 - 6/25

a) Grazing during the critical period can have a severe impact and even kill bunchgrasses.

b) Tillers (plants) are committed to seed production. The growing points are elevated and vulnerable.

c) If a tiller's growing points is removed, replacement tillers must develop, which is a slow process. The ability to replace lost leaves and stems is low and declining.

The critical period varies with location. NRCS-WA Range Technical Note 103 contains average critical periods for 64 climate stations. Calendar dates must be tempered with local knowledge and observed plant phenology and grazing behavior.

C. The magnitude of damage from grazing depends upon what's removed.

a) Leaf blades only - minimal if growing conditions are good.

b) Leaf sheaths - recovery will be delayed.

c) Apical meristem - tiller cannot replace green material and must be replaced by activation of basal buds (referring to those new tillers arising from the base of a previous tiller.)

D. Severe grazing reduces root growth and mass:

In 1984, Drs. Richards & Caldwell at Utah State University published a paper on root growth responses to defoliation. Roots were observed in the field with an improved root periscope technique. The grazing tolerant, introduced bunchgrass, crested wheatgrass, was compared with the very similar but grazing sensitive, native bunchgrass, bluebunch wheatgrass.

At 85% defoliation:

1. Root length growth of clipped crested wheatgrass was reduced 50% from that of intact plants.

   a) The reduced root growth in crested wheatgrass was correlated with the allocation of relatively more resources to aboveground regrowth, thus aiding reestablishment of the root: shoot balance.

   b) This balance was apparent in similar root mortality patterns of clipped and control crested wheatgrass plants in the season following defoliation.

2. Root length growth of clipped bluebunch wheatgrass was the same as intact plants.

   a) In clipped bluebunch wheatgrass root mortality increased in the winter following the clipping and continued into the subsequent growing season.

Crider (1955) monitored root growth of introduced forage species for 33 days after defoliation treatments

1. As long as no more than 50% of top growth is removed, grazing has little effect on the roots.
2. At 60% use, HALF of the roots stop growing for 12 days.
3. At 80% use, ALL of the roots stop growing for 12 days.
4. At 90%, use, ALL of the roots stop growing for 18 days.
    a) The growing season at Ephrata is 90-140 days (K. Guinn study). 12-18 days relates to 10-20% of the growing season when the plants are not producing.

Under progressively heavier grazing, roots will have fewer branches and become sparser, shorter, and more concentrated in the top portion of the soil profile. A balance between roots and top growth will always occur.

Perennial plants with a large, healthy root system minimize weed invasion. This is why we should graze no more than 50% of the current top-growth during the growing season.

E. The magnitude of damage from grazing depends upon where the growing points are on the plant.

1. **Jointed Grasses (bunchgrasses):** Grasses whose growing points typically enter the grazing zone must rely primarily on basal or rhizome buds to produce new leaves. As the growing point elevates on the stem, it becomes vulnerable to removal. Graze the growing points of stems, you not only kill the stems, but new growth must come from activating basal buds, which reduces next year's stems. Less than a 1: 1 ratio of stem replacement for next year may reduce the stand.
    a) Severe grazing cannot be expected to increase production of native bunchgrasses, especially in dry environments.
    b) Bunchgrasses may be eliminated by intensive, long-term grazing.
        - Decreased basal area of plant crowns.
        - Fragmentation of large plant crowns into smaller plant crowns.
        - Plant basal areas are reduced below critical size and tiller numbers are reduced.
2. **Non-jointed grasses:** Maintain their growing points on vegetative tillers below or at ground level most of the year. These grasses are resistant to close grazing. This is mainly because when grazed, their actively growing leaves continue to elongate. The active meristematic tissue is pushing them up from below and creating fresh new photosynthetic area. These grasses can be continuously grazed provided enough leaf area is left to produce maximum photosynthetic activity. Characteristics that provide resistance to grazing:
    a) Low growing points.
    b) Delayed elevation of growing points.
    c) Predominance of vegetative only shoots over reproductive shoots.
    d) Deep and expansive root system for added drought tolerance and acquisition of minerals.

F. Where does regrowth come from?

Myth #3: Root carbohydrate reserves are most important for regrowth following a severe grazing. This is WRONG!

1. There is no indication that root reserves are mobilized for shoot growth.
2. Most reserves are located in stem bases but these reserves only support regrowth for 2-7 days following grazing.
3. Current photosynthesis is the most significant source of carbohydrates (88-99 %) (Richards & Caldwell, 1985).

G. Four criteria determine the susceptibility to grazing and the rate of recovery:

1. The amount of leaves and stems remaining after defoliation.
2. The susceptibility of growing point to damage or removal:
    a) Growth form (jointed (bunchgrass) or non-jointed).
    b) Ratio of reproductive to vegetative tillers.
    c) Height and location of growing point (time of year).
    d) Time of grazing.
    e) Ability of plants to produce new tillers.
    f) Ability of plants to allocate resources to maintain a favorable shoot-root ratio.

H. Recovery by non-jointed species

1. Rancher decision to control intensity, duration, and timing of grazing.
2. Growing points are protected.
3. Easily produces new tillers, but moisture will most likely be limiting.
4. No problem with shoot-root ratio.

I. Recovery by jointed grasses (bunchgrasses):

1. Rancher decision to control intensity, duration, and timing of grazing.
    a) Brewer, et. al. (2007) concluded that on rangelands where bluebunch wheatgrass receives moderate or light defoliation during the critical period, grazing during the critical period should be limited to no more than 2 successive years.
    b) Brewer, et. al. (2007) concluded that on rangelands where bluebunch wheatgrass receives heavy or severe defoliation during the critical period, grazing during the critical period should not be grazed for 2 successive years during the critical period.
2. Growing points are vulnerable depending on growth stage.
3. Ability to produce new tillers is quite limited.
4. Maintaining shoot-root ratio following defoliation:
    a) Maintenance of shoot-root ratio is variable among grass species, which is why they have different-grazing management guidelines for amounts of biomass removed and/or remaining and appropriate grazing systems.
    b) **Crested Wheatgrass**: Introduced from Asia; evolved with heavy grazing pressure. Reduces root growth after defoliation and allocates more resources to shoot growth. Quickly re-establishes a favorable shoot-root ratio.
    c) **Bluebunch Wheatgrass**: Native (Washington state grass); evolved without heavy grazing pressure. Roots grow at the same rate after defoliation. Unable to re-allocate resources to grow additional leaves and stems. Ratio between shoot and roots becomes very unbalanced, which in subsequent years results in Excessive root die off, poor plant health and vigor, and plant death
    d) The response differences between crested and bluebunch is why introduced and native jointed species have different grazing management guidelines. The response difference is related to rapid replacement tiller production in crested.

Conclusions on Grazing Management:

1. Only two factors of plant growth are within our control:
   a) Size of leaf area remaining after grazing. (Intensity)
   b) Time of grazing. (Timing and Duration)
2. The size of leaf area remaining after grazing and time of grazing should be the primary focus of rancher's management.
3. A cow is a management tool to manipulate and improve plant communities.
4. Do not forget the two natural laws:
   a) If we keep down the shoot, we kill the root
   b) Nature abhors empty space; abuse the good plants and undesirables will invade.
5. Over-grazed grasses cannot remain healthy, vigorous and productive any more than a steer can gain weight on a maintenance ration.
6. Leave enough leaf area to ensure photosynthesis.
7. For native jointed bunchgrasses minimize the severity of grazing when grasses are most susceptible by:
   a) Grazing no field more than half the growing season.
   b) Grazing only I in 3 years during the critical period (2 out of 3 for introduced jointed).
   c) Deferring each field l out of every 3 years during the growing season.

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