Chapter 13    Dry Weight Rank (DWR) Method (Optional)

13.1 Overview
This chapter covers data elements relating to:

- Dry weight ranking by plant species using the Dry Weight Rank Method

13.2 What’s New

- Update of section 13.4.1 Conditions for Data Collection to reflect updates to land cover/use codes in Chapter 6.

13.3 Critical Points to Remember

- Dry weight quadrats are evaluated at regular intervals beginning at the 12.5 ft mrk; thereafter, every 12.5 ft.
- 10 quadrats are sampled on each transect making a total of 20 quadrats per point
- Use a 1.92 sq. ft plot quadrat where vegetation is relatively homogeneous and of short stature. Stands with greater heterogeneity, use a 4.8 sq. ft. quadrat.

13.4 Preliminary Steps

13.4.1 Conditions for Data Collection
This is an optional protocol for both pastureland and rangeland.

- For the non-Federal range sample, dry weight rank data can be documented for non-Federal points with land cover/use of grassland (LCU = 2001 Grassland defined as range or 2000 Grassland not defined as range) or scrub shrub (LCU = 2201 Scrub Shrub defined as range or 2200 Scrub Shrub not defined as range).
- For the non-Federal pasture sample, dry weight rank data can be documented for non-Federal points with land cover/use of grassland (LCU = 2001 Grassland defined as range or 2000 Grassland not defined as range) or scrub shrub (LCU = 2201 Scrub Shrub defined as range or 2200 Scrub Shrub not defined as range).
- For the BLM range sample, dry weight rank data can be documented for BLM-managed Federal points with land cover/use of grassland defined as range (LCU = 2001 Grassland defined as range) or scrub shrub defined as range (LCU = 2201 Scrub Shrub defined as range).

13.4.2 Ancillary Resources
In addition to the basic data collection materials noted in chapter 2, the following ancillary resources are required:

- Plant identification aids
13.5 Data Collection Procedure for Field Weight by Species

13.5.1 Definitions

Herbaceous Plant. A term used to reference vegetative plants with little or no woody component, usually graminoids and forbs. [NRPH]

Woody plant. A term used in reference to trees, shrubs, or browse that characteristically contain persistent ligneous material. [NRPH]

DWR quadrat (plot). A plot or quadrat established along the transect at predetermined intervals to provide areas for determining dry weight percent composition by species.

13.5.2 Procedure

1. Start at the zero (0.0) end of the NE-SW transect (transect 1).
   - For additional information on the plot and transect, refer to Chapter 3, Section 3.6, Procedure for Establishing/Documenting the Sample Plot and Transects.
   - Always stand on the south side of the transect to avoid disturbing the measurement area.
   - The line should be taut and placed as close to the ground as possible.

2. Determine the proper size frame by doing preliminary sampling on the site with different size frames. Select a frame size on the premise that most frame quadrats along each transect will contain three or more species.
   - A large frame size will require scanning so care must be taken to avoid errors of double counting or skipping an area of assessment. Generally, a 2.4 sq. ft. frame is the largest frame that can be viewed without having to scan the ground.
   - For homogeneous sod-forming pastures, with low stature, the 1.92 square foot quadrat works well. A square quadrat whose inside dimensions are 16 5/8” X 16 5/8”, or a rectangular quadrat whose inside dimensions are quadrat 1’ X 1’ 11 1/16”.
   - For vegetative stands with greater heterogeneity and taller stature, increase quadrat to 4.8 sq. ft. to accommodate at least 2 or more complete plant crowns.

3. For each quadrat (plot), place the sampling frame at the predetermined transect mrk. DWR quadrat transect mrks are located at 12.5, 25, 37.5, 50, 62.5, 87.5, 100, 112.5, 125 adn137.5-foot intervals on both transects. DWR plots overlap with quadrats sampled in standing biomass/production protocols. Access to quadrat mrk data entry cells can be adjusted by selecting the displayed radio buttons at the top of the CASI screen.
   - For rectangular and square quadrats, place the lower right hand corner of the quadrat frame at the predetermined transect mrk.
   - For circular quadrats, center the bottom of the frame or cable at the predetermined quadrat mrk. If using a cable or loop, arrange it to be as close to a full circle as is possible.

4. Shift any vegetation lying underneath the frame to the side of the frame it is rooted on.

5. Determine the order of dry weight production of the top three plant species in the quadrat regardless of the forage value of the species. Rank the three dominant plant species (usually) in the frame according to the criteria in Table 13-1.
• In some cases there will be less than 3 species in a quadrat. Follow the instructions in table 13-2 when entering ranking information in the CASI.

• **Each quadrat must have at least one species with a ranking of 1.** If rankings 2 and 3 are excluded, they will be automatically credited to the plant ranked 1. Refer to section 13.6 for specific examples.

6. Record species from the CASI choice list and rank according to weight rank as described in step 5.

• This protocol also uses the line point intercept and plant census plant choice list. Searching for plants also works the same here as in other protocols where plant name are used. Refer to Appendix A for more information on using plant names in the CASI.

• Each DWR CASI screen can hold up to 7 plants, additional screens can be created by

Table 13-1. Ranking criteria for the Dry Weight Protocol

<table>
<thead>
<tr>
<th>Rank</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Plant species with the highest weight in quadrat, most or very dominant</td>
</tr>
<tr>
<td>2</td>
<td>Plant species with 2&lt;sup&gt;nd&lt;/sup&gt; highest weight in quadrat, not as dominant as 1 but not the least productive in the quadrat</td>
</tr>
<tr>
<td>3</td>
<td>Plant species with 3&lt;sup&gt;rd&lt;/sup&gt; highest weight in quadrat, least productive but still dominant in the quadrat</td>
</tr>
</tbody>
</table>

Table 13-2. Species composition and Rank Category Options

<table>
<thead>
<tr>
<th>Species composition in frame by species number</th>
<th>Rank Category Options in CASI</th>
<th>Production Distribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Only one species in the frame</td>
<td>Rank 1 (No rank 2 or 3 given.)</td>
<td>100% to species 1</td>
</tr>
<tr>
<td>Only two species in the frame</td>
<td>Option 1: Rank one species as 1 and the other species as 2. (No rank 3 given).</td>
<td>70% to species 1</td>
</tr>
<tr>
<td></td>
<td>Option 2: Rank one species as 1 and the other species as 3. (No rank 2 given).</td>
<td>30% to species 2</td>
</tr>
<tr>
<td>Three species or more in the frame</td>
<td>Rank top three species as 1, 2, and 3 according to visual percent composition.</td>
<td>90% to species 1</td>
</tr>
<tr>
<td>Ties</td>
<td>Favor the species with the lower annual biomass production (see table 13-1) with the higher rank. <strong>Ties are not allowed.</strong></td>
<td>70% to species 1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>20% to species 2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10% to species 3</td>
</tr>
</tbody>
</table>
tapping the add button to create additional screens as needed to accommodate more plant species.

- Key out any plant species if in doubt. Record weedy species as well as forage species if they have enough dry matter to rank in the top 3 in a quadrat. Plant keys that use vegetative characteristics are the best to use since seed heads or flowers are not often present in grazed fields.

7. Adjust the relative quadrat yield as necessary. Refer to section 13.6.3 for specific guidance. A full stand quadrant relative yield rating is assumed to be 5. This value is displayed at the top of each quadrat column. Adjust the relative yield down if:

- A quadrat contains primarily lower yielding species (e.g. common white clover, annual bluegrass, dandelion, or carpetgrass) while the other quadrats are mostly higher yielding species.
- A quadrat falls on areas with a noticeably thinner stand of grass or forbs (unvegetated gaps present) than the densest quadrats within the macroplot.

8. Repeat this for the remaining 19 quadrats entering new plants in the CASI list as encountered. Complete the quadrat column for applicable species by individual quadrat. Some previously entered species will be skipped depending upon the composition in a particular quadrat.

9. A summary of Dry Weight Ranking for the point can be displayed by tapping the summary button.

13.6 Supporting Materials

13.6.1 Overview

The Dry Weight Rank method is a non-destructive visual estimation procedure to measure botanical composition by weight. Dry Weight Rank has been tested against actual clipping and weighing of separate species on a variety of pasture and range types in a variety of climates. Potential biases are adjusted for by combining Dry Weight Rank with Relative Yield and Cumulative Ranking. The method produces an estimate of percent composition by weight for the PSU plot as accurate as other methods but is faster and repeatable for long-term monitoring.

13.6.2 Ranking Procedure

The observer assigns ranks of one, two, and three based on the individual species relative contribution to the total dry weight contained within the frame at the time of viewing. View the frame from above. When estimating weight remember that a high proportion of the yield is in the lower layers. It is essential to gauge the density of material in these lower layers and it may be helpful to handle the pasture mass. Points to consider are:

- the amount of plant material
- the area of bare ground between plants
- height
• percentage of attached dry leaves
• differences in moisture content of different species
• differences in the spatial arrangement of the leaves of different species

It is faster to rank plant species than to assign direct percentage composition. However, a coarse visual percentage of composition by weight is used to rank the species.

Ranking has standardized values. A rank of 1 corresponds to 70% composition, rank 2 to 20%, and rank 3 to 10%. The 70/20/10 split will seldom match the coarse visual percentage distribution within a frame. That is OK. The total of all frames along the transects is how the percent composition by weight is determined. This method of calculation has been tested for accuracy and repeatability.

13.6.2.1 Cumulative Ranking

There will occasionally be some frames with less than three species. The procedure is to assign more than one rank to a species. This is termed Cumulative Ranking.

- When only one species is found in a frame it should be given rank 1. This species will then be credited with 100% of the plot production.
- When two species are found: the first species may be given ranks 1 and the second species given ranks 2 or 3 depending upon the relative amounts of the two species in the plot. Refer to table 13-2 for ranking options for two species plots

Do not use Cumulative Ranking when three or more species occur in the frame unless the coarse visual percent composition by weight of the dominant species exceeds 85 percent.

Do not use Cumulative Ranking when pastures have a species that is consistently dominant and at least two more species are within the frames. This is to recognize minor species that may be key to management either desirable or undesirable.

13.6.2.2 Ties

Ties of dry weight estimates, and therefore ranking, seldom occur though there are many close calls. If the tie cannot be quickly broken by close examination of the two competing species, the favor goes to the species of generally lower annual biomass production capability (see Tables 13-3 and 13-4 for Relative Yield Values for Mixed Grass Stands).
13.6.3 Comparative Yield Method

Pastureland NRI comparative yield method eliminates biases caused by the potential treatments applied and seasonal effects that will be encountered on the randomly selected pasture points.

Comparative Yield Method compares relative total standing biomass for each frame on the dry weight rank protocol transects. Rather than estimating the weight directly within each frame.

<table>
<thead>
<tr>
<th>Forage</th>
<th>Relative Yield</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alfalfa</td>
<td>1.2</td>
</tr>
<tr>
<td>Alsike Clover</td>
<td>0.4</td>
</tr>
<tr>
<td>Big Bluestem</td>
<td>0.8</td>
</tr>
<tr>
<td>Birdsfoot Trefoil</td>
<td>0.8</td>
</tr>
<tr>
<td>Broomsedge</td>
<td>0.2</td>
</tr>
<tr>
<td>Caucasian Bluestem</td>
<td>0.7</td>
</tr>
<tr>
<td>Common Bermudagrass</td>
<td>0.6</td>
</tr>
<tr>
<td>Crimson clover</td>
<td>0.4</td>
</tr>
<tr>
<td>Crowntetch</td>
<td>0.7</td>
</tr>
<tr>
<td>Eastern Gamagrass</td>
<td>1.0</td>
</tr>
<tr>
<td>Indiangrass</td>
<td>0.8</td>
</tr>
<tr>
<td>Kentucky Bluegrass</td>
<td>0.6</td>
</tr>
<tr>
<td>Ladino Clover</td>
<td>0.5</td>
</tr>
<tr>
<td>Lespedeza, Annual</td>
<td>0.4</td>
</tr>
<tr>
<td>Orchardgrass</td>
<td>1.0</td>
</tr>
<tr>
<td>Red Clover</td>
<td>0.9</td>
</tr>
<tr>
<td>Red Top</td>
<td>0.4</td>
</tr>
<tr>
<td>Reed Canarygrass</td>
<td>1.1</td>
</tr>
<tr>
<td>Ryegrass, Perennial</td>
<td>0.8</td>
</tr>
<tr>
<td>Sericea Lespedeza</td>
<td>0.5</td>
</tr>
<tr>
<td>Smooth Bromegrass</td>
<td>1.0</td>
</tr>
<tr>
<td>Switchgrass</td>
<td>0.9</td>
</tr>
<tr>
<td>Tall Fescue</td>
<td>0.9</td>
</tr>
<tr>
<td>Timothy</td>
<td>0.8</td>
</tr>
<tr>
<td>White Clover</td>
<td>0.4</td>
</tr>
</tbody>
</table>

Note: 200#/Ac. Nitrogen applied to grass pastures

* If a small component, production is low. Other grasses suppress it. If a high component, production increases at end of growing season by threefold.
relative ranks are recorded. The present standing biomass in a frame is compared to reference frames 1, 2, 3, 4, and 5. The best fit reference frame is recorded. The five reference frames represent 20% breaks in standing biomass with five being the highest. The reference frames represent the range in dry weight of standing crop that will be commonly found along the transect and not the extreme.

Once a set of reference frames are established (see Comparative Yield Training Protocol) the transect quadrate frames will be compared and rated back to these reference frames.

It is best if the same observer reads each frame throughout the transect to ensure accuracy.

**Comparative Yield Training Protocol to be conducted prior to field data collection:**

1. Five reference frames are subjectively located. References 1 and 5 are located first.
   - The first frame (reference 1) is placed in a low-yielding area which represents the low-yielding situations commonly encountered on the site (avoid bare or nearly bare frames).
   - Reference 5 is determined by placing a frame on a high-yielding area, excluding unusually dense patches of vegetation which would have a rare chance of being sampled.

2. The examiner should make a mental note of the amount of production in each of the reference frames. These references are then clipped and weighed.
   - If the clipped weight in reference 5 is more than five times the weight found in reference 1, then two new sites should be selected as references 1 and 5.
   - **Note:** In establishing the initial reference frames, the weight in reference 5 is usually too high and the weight in reference 1 is too low. Make sure reference 5 does not represent a rare situation.

3. Once references 1 and 5 have been selected, reference 3 is located by placing a frame in an area considered to have a yield halfway between references 1 and 5. References 2 and 4 are located the same way by selecting the midpoint yield between references 1 and 3 and references 3 and 5, respectively.

4. All five reference frames are clipped and weighed to compare the reference frames to a linear distribution of frame weights. This process is repeated by clipping additional frames until the weights of the five reference frames are approximately linear and observers are confident in their ability to rank frames relative to one of the five references.
   - If the rankings are not linear, the precision of the method will be reduced.
   - If more than five percent of the frames have no production, then a larger frame should be used.

**13.6.4 Examples**

1. Only one species in the quadrat
   - One species occurs in plot 1: tall fescue. If only one species is found in the quadrat, rank as 1. It will be credited with all the production.

2. Two species in the quadrat
   - Two species occur in plot 2: tall fescue and white clover. Tall fescue is very dominant,
rank tall fescue as 1. White clover is subdominant, rank as 3. (Tall fescue will get the unranked 2 portion here.)

- Two species occur in plot 3: tall fescue and white clover. Tall fescue is dominant; however, white clover is also dominant but not quite equal to tall fescue. Rank tall fescue = 1 and white clover = 2.
- Two species occur in plot 4: tall fescue and white clover. Each species is equal in production and tied for dominance. Refer to tables 13-3 and 13-4 for relative yield levels. Since white clover has a lower relative yield value, it receives a higher rank. Rank white clover = 1 and tall fescue = 2.

3. Three species in the quadrat

- Three species occur in plot 5: tall fescue, white clover, and dandelion. Tall fescue is clearly very dominant, white clover is subdominant, and dandelion is minor. Rank tall fescue = 1, while clover = 2, and dandelion = 3.
- Three species occur in plot 6: tall fescue, white clover, and perennial rye. Tall fescue is dominant, however white clover and perennial rye are tied for 2nd. Rank tall fescue = 1, white clover = 2, and perennial rye = 3 (based on relative yields in table 13-3).
- Three species occur in plot 7: tall fescue, white clover, and dandelion. Tall fescue and white cover are tied, and dandelion is minor. Rank white clover = 1, tall fescue = 2, and dandelion = 3 (based on relative yields in table 13-3).

13.7 References