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First name: Pat

Last name: Larson

Organization: Union County Cattlemen

Title: Secretary

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U. S. Forest Service

Director Forest Management, Range Management & Vegetation Ecology

201 14th Street SW

Suite 3SE

Washington DC 20250-1124RE: Rangeland Directives FSH 2209.16 CH 10

Dear Forest Service:

Thank you for the opportunity to participate in the formulation of the federal agencies grazing policy.

There are numerous inconsistencies in the Forest Service (FS) and Bureau of Land Management (BLM) Range vegetation management monitoring methods for observing livestock utilization and stubble heights on grazing lands. The flaws must be corrected and these directives are an opportunity to fix the problem which has been ignored for many decades.

Scientific monitoring must be conducted using random plot locations (Fischer, R.A. 1925), enough plots must be recorded to meet sample adequacy, and current height/weight relationships must be referenced to estimate livestock use (Lommasson and Jensen 1943). This requirement is due to the necessity of using a scientific method to sample a site rather than measure all plants in the target population. FS history shows Fischer was hired as a statistician 100 years ago to teach employees how to measure vegetation across the nation. Since then the agency has slowly picked up poor field measurement techniques and are today missing the mark when management decisions are made and permittees are issued penalties. Non-compliance is being determined through arbitrary and subjective methods for grazing and vegetation management standards.

The Forest Service should provide monitoring that is accurate and free of bias. Also, the agency should avoid using flawed methods that bias the assessment of livestock grazing. Monitoring must be conducted using random plot locations, numerous plots must be recorded to meet sample adequacy, and current height/weight relationships must be referenced to estimate livestock use.

The following comments are in reference to specific monitoring activities associated with grazing allotment administration.

1. Systematic sampling (Larson and Larson, 2019) is conducted by taking a first step or pace based on a random number, and subsequently stepping or pacing with same number thereafter. Systematic sampling does not have the virtues of random sampling, because the selection of a plot location is not free of personal bias (Schumacher and Chapman 1948). Observers cannot assume that Nature has been obliging enough to randomize plant populations or livestock tracks on streambanks. Therefore, plot selections must be made in a random pattern.
2. Random tenth-meter<sup>2</sup> plots are typically used to weigh vegetation and estimate the plant production (pounds per acre) for each site category in an Allotment. Vegetation heights are measured and averaged within the plots to establish the mean heights by plant community type and location. Sample adequacy must be met for each plant community (10% of mean at 95% confidence); mean heights must be compared between sites across the forest using analysis of variance (ANOVA, Excel). Regression analysis is used to calculate height/weight

equations for sites identified on an Allotment where the agency instructions identified specific management direction.

3. A sample is a collection of individuals that form part of a population while the process of selecting a sample is called sampling. This type of sampling is generally referred to as sub-sampling within a population. The aggregate of individuals in one category, such as the grasses and grass-like plants in a riparian area, composes a very large group of practically unlimited numbers of individual plants. A study of the group must be based on measurements or observations of small portions or samples in order to avoid having to measure each and every individual plant. For example, to obtain height or weight information relative to the production and/or utilization of the grasses and grass-like plants (plant community) it would be a daunting task if not impossible to measure the height and weight of each plant in a riparian pasture due to the infinite numbers of individuals that would have to be systematically counted.

4. The method of selecting a sample must not be correlated with an attribute under study. For example, it is easy to prove that sedges are grazed on a grazed riparian site, if the sample is selected to contain only sedges. Instead, the attribute under study on grazing allotments should be stratified to contain all grazed and un-grazed plants without specificity to any particular species. For the purposes of this report, plots may not have always fallen in a convenient area close to a road or trail. As a rule successive samples drawn from the same area will differ among themselves and differ from the infinite number of other individuals on a site. This variation is known as sampling variation and has to be considered whenever any conclusions are based on a sample. A common error committed is to ignore this variation, which leads to underestimating the magnitude of the effects due to chance. The safest way to select a sample is to use a random method of choice and the way to avoid errors due to variation is to take an adequate number of samples.

5. The use of transects to obtain one sample could easily lead to a wrong estimation of the overall character of the riparian vegetation. The chances are favorable that an individual sample may be within several inches of the true height or weight, yet an individual sample also could by chance give a completely erroneous impression. A sample of 2 or 3 transects would not be much better.

I urge you to consider these comments and act on them as soon as possible due to the errors being submitted to the official files as truthful and accurate when the data is very flawed.

Pat Larson  
Union County Cattlemen

#### References:

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- Larson, L. and P. Larson. 2020. Animal Track Accumulation on Streambanks of Four Eastern Oregon Streams. *Rangeland Ecology & Management* 73:224-226.
- Schumacher, F. and R. Chapman. 1948. *Sampling methods in forestry and range management*. Duke University. North Carolina. 222 pp.

U.S. Department of the Interior, Bureau of Land Management. 1999. *Utilization Studies and Residual Measurements*. Interagency Technical Reference: BLM/RS/ST-96-004 + 1730. BLM, National Applied Resources Science Center, Denver, CO. 176 pp. Technical Reference 1734-3

Three published articles are attached to these comments to show that research disagrees with the methods being used at the federal agencies.

