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Monitoring New Mexico Rangelands

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Approximately 80% of New Mexico consists of rangelands with almost half being federally managed. Developing a management plan is critical to the preservation or improvement of rangeland resources. Monitoring is the way this occurs and is defined as the orderly collection, analysis, and interpretation of resource data, over time, to evaluate progress toward meeting management objectives (Society for Range Management, 1998). Producers and ranchers often possess the greatest knowledge about these lands, which is derived from life-long on-the-ground experience. However, it is often stored as mental notes (qualitative) that is difficult to portray in a manner that supports management objectives. Physical, quantitative records of rangeland conditions can help bolster qualitative knowledge and prevent conflict and misunderstanding.

There is a variety of methods used to collect rangeland data, ranging from simple to complex. Additionally, there are abundant items that can be measured from precipitation and water to vegetation dynamics and soil health. When all these factors are taken into consideration for a monitoring plan, the task can appear daunting and discouraging. Not all variables need to be measured and can be tailored to management objectives and time availability. For instance, New Mexico State University developed a step-wise three-level approach to monitoring that caters to producer comfort and time availability (Allison et al., 2002). As efficiency of data collection increases, other parameters can be considered in the monitoring procedures. Thus, the following is a basic synopsis of range monitoring that can help move forward with a monitoring plan.

Where to Monitor

Selecting an area that is representative of a larger area is the first step in monitoring and is critical for future management decisions (Allison et al. 2007). Understandably, rangeland pastures and allotments vary greatly depending on location. Thus, there is no set guidelines in site selection but some general factors need to be considered to best portray representative resource data. First, the monitoring site should most closely match that of the whole area. For instance, if trees or shrubs comprise 20 percent of the landscape, then the monitoring area should also comprise a similar proportion. Although distribution and vegetation percentages may not be known, a relative estimate can be made. Second, grazing and browsing animals tend to forage in areas of reduced slope, closeness to water, and easy of travel (Holechek et al. 2011). Areas that appear to be congregation points or areas of high animal densities, should be avoided, although these areas should be noted as focal points that may need future improvement. One monitoring method outlines some specific criterion for selection, such as a quarter to one mile from water sources, slopes less than 15%, soils in satisfactory conditions, and an overall area greater than 5 acres (Allison et al. 2007). Third, if the area of use is large or greatly varies in topographical uniformity, multiple areas can be selected to encompass the variability. The data can be combined as an average to encompass pasture variation but again should be representative of the whole area. No matter the specificity of

the selection criteria, the goal of selecting a site is to have a representation of the whole area. Finally, if a producer is using federally managed land, it is best practice to include a representative from the regulatory agency to better align management goals.

When to Monitor

Timing of monitoring can have profound impacts on the collected data. Estimating annual forage availability is best done at the end of the growing season. Depending on the targeted vegetation this may be in the late spring, summer, or fall. No matter the timing, measurements should occur annually during the same time frame for repeatability and to develop trends over time.

What to Monitor

Precipitation: Rangeland pastures are often in remote areas, lacking a weather station. Precipitation records can be inaccurate if off-site weather stations are used, thus it is important to record weather events on the monitoring site. A rain gauge should be placed at the monitoring site that would allow for regular access and record keeping. If the area is large, multiple gauges should be placed.

Vegetation: Several ways to measure vegetation exist. One way is to measure vegetation production or biomass. This consists of taking a subsampled area, within a designated area of known size (i.e., square feet or square meters), cutting all vegetation within the square, drying, and then weighing. With the size of the square known, biomass can be calculated and expressed as pounds per acre. However, vegetation composition is highly variable on rangelands and not all vegetation is equally useful as a forage. Taking multiple biomass samples will help account for variations in production across the landscape. Additionally, clipped samples can be separated into vegetation classes (i.e., grasses, broadleaves or forbs, and woody vegetation) to estimate available biomass by forage class (relative biomass).

Another way to measure vegetation is through density counts. Plant density is the number of individual plants per area. Similar to biomass, the area sampled needs to be known for calculations, multiple measurement areas will help to account for variability, and separating counted plants into species can help to identify preferred forages or sensitive species. Distinguishing between individual plants can be difficult when they are rhizomatous or stoloniferous as one root system can produce several upright plants. An extensive time commitment should be accounted for when doing density counts.

Vegetation cover can be categorized into canopy, foliar, basal, and ground cover. Canopy cover estimates the circumference of ground surface area the plant covers, whereas foliar cover takes into consideration the same surface area and includes gaps as well as overlap in leaf area. These two types of cover are generally reserved for trees, shrubs, and broad leaves or forbs as they have a larger leaf surface area. Basal cover measures vegetation at junction of the soil and plant and is often used to assess grasses. Ground cover incorporates basal cover with the addition of soil characteristics such as litter, rocks, and bare ground. This method allows for assessment of a sites erosion potential. As soil and ground characteristics increase, site stability decreases (i.e., increased erosion potential).

Vegetation composition is calculated rather than directly sampling the vegetation and is one of the main methods to assess rangeland conditions. It is the relative proportion of a plant species in relation to the rest of the plant community. As described previously, composition can be expressed in a variety of terms such as relative biomass, relative density, or relative cover.

Frequency is the probability of whether a plant species is present or absent within a particular area. The probability is assessed based on the occurrence of a certain species within specified area. This can be done

along a transect (line frequency), a single quadrant marked at designated intervals, or a physical grid within the quadrant (quadrant frequency). Presence or absence can then be calculated as the percent probability of occurrence. For instance, if a quadrant with twenty five internal areas is used and twenty of those have a certain species present, the probability of the plant occurring on the landscape is approximated 80 percent. It is one of the easiest methods to assess rangeland vegetation conditions and trends as it only focuses on targeted species. However, as species diversity increases, it becomes difficult to assess vegetation conditions as not all species are assessed. In addition, when a grass is encountered, the leaves can be extended upwards and measured for a stubble height assessment. More time consuming methods, such as biomass, cover, and density, may provide more meaningful information.

Soil: Ground cover was previously discussed and helps assess erosion potential. Soil moisture is critical for plant growth and can be assessed through a soil pit. A soil pit is simply a hole dug approximately twelve inches deep and moisture is recorded as dry, moist, or wet. Soil organic matter is becoming an increasingly important aspect of rangeland health. Micro-organisms use vegetation, breaking it down into soil organic matter, stabilizing the soil, increasing nutrient cycling and water holding capacity. Quantified data can be obtained by sending soil samples to a laboratory. However, qualitative estimates may be sufficient depending on management objectives.

Animals: Although animals are not the primary target in monitoring rangeland conditions, they do play an integral role in soil, water, and vegetation management. Thus, records should be kept of livestock numbers, days grazing, and distribution, as well as wildlife numbers and occurrences. Wildlife are often scarce and hard to count. The fecal pellet count method is one way to estimate relative animal visitation to a site. This can be done by noting the type and counting each occurrence while taking vegetation samples. Another method is to use game cameras that can survey the landscape from a strategic spot and count wildlife numbers and frequency of visitation.

How to Monitor

The key to monitoring is to have objective, repeatable and quantitative measurements, which can be accomplished through establishing transects. A transect is one way to do this and is a line between two points where measurements can be taken at designated intervals. There are some monitoring methods that do not require transects but are qualitative (i.e., photo points and ocular estimates). Qualitative methods are useful when they support quantifiable data rather than alone.

Photo Points: Photographs give a point in time visual record of range conditions and supports quantitative measurements for that period of time. Upon site selection, a marker should be used to be able to repeat the photograph annually. Additionally, photos can be taken multiple times yearly, but it is advised to compare the same annual point in time. When repeated annual photos are taken, the original photo should be in hand for duplication. Two photos should be taken per site. A landscape-level photo gives a panoramic estimate of the area condition. This photo should include some permanent identifiable feature of the landscape (i.e., hill, drainage, or rock outcrop). A sign that can easily be seen in the photo should be used with key information such as pasture name, date, photo point number, and other pertinent information. The second photo should be a ground-level photo near the marker point that represents ground-level characteristics. A scale ruler should be used to quantitatively determine the size aspects of the photo. A two meter carpenter ruler bent in half at a right angle is recommended.

Ocular estimation: Ranchers often use this method and take mental notes for management decisions. It is critical to quantify these observations. An observer can use an approximated area to gauge vegetation types, frequency of occurrence, and amounts of vegetation, then make a record. Even though this can be subjective

and highly variable, particularly if different observers are used, it can still be helpful with additional quantified data.

Quantifiable methods: The point method consists of using a sharpened rod or pin to assess plant and soil characteristics. Variations of the point method exist such as a laser, cross-hair, step- and drop-point. The two latter methods require a transect and are a variation of the line method. The step-point transect was developed as a rapid, accurate, and objective method of determining vegetation composition (Evans and Love 1957). This method involves selecting a bearing and recording it for repeatability, then using the toe of one boot as the point of observation or "hit". Boot tip size and shape vary depending on observer and therefore marking the boot tip is recommended so that the same point is used. Unlike step-point, drop-point requires a measuring tape and a pin to take observations at designated intervals along the tape. This method is more time consuming but is more precise than step-point. Using either method allows for the measurement of cover, stubble heights, and line frequency. A square, grid, or hoop can also be used at designated intervals to obtain available biomass, density counts, and quadrant frequencies.

References:

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