What's The Trend?

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Range trend can be useful in tracking the rate of change in rangeland condition, but it doesn't always give the full picture.

Range trend is commonly defined as the direction and rate of change in rangeland condition. It is considered the most important indicator of management effectiveness by many, if not most, range professionals.

However, there is a lack of critical analyses of the uses and problems associated with range trend. Our objective is to discuss the role of trend in assessment of range management effectiveness, with a focus on problems associated with measuring and interpreting trend.

Historically, shifts in relative plant composition usually measured by cover or weight have been considered the primary basis for trend (Dyksterhuis 1949). If the proportions of primary forage species increase relative to non-forage species, the trend is considered upward while the reverse is a downward trend. In some cases changes in the status of one or two decreaser grasses have been used as indicators of broader vegetation compositional shifts or trend (Fig. 1). Procedures developed by E. J. Dyksterhuis in the late 1940's have long been used to characterize rangeland ecological condition by the USDA-Natural Resources Conservation Service (NRCS) and other government agencies.

Under the Dyksterhuis system, condition scores represent the amount of climax or original vegetation remaining on the site. Categories of early seral, mid seral, late seral, and climax correspond to 0–25%, 26–50%, 51–75%, and 76–100% remaining original vegetation. Until recently qualitative terms of poor, fair, good, and excellent were used in describing these categories to ranchers by the NRCS. Financial returns from livestock production and forage production are generally well associated with ecological condition on native grasslands and semidesert areas.

Generally, a change in ecological condition score of 5% or more is considered to indicate an upward or downward trend. Otherwise range condition is considered to be stable. The application of the Dyksterhuis condition/trend approach is discussed in considerable detail by Dyksterhuis (1949), Bonham (1989), USDA-NRCS (1997), and Holechek et al. (2001).

Although the Dyksterhuis model is still widely used for characterizing ecological condition and trend, it has limitations that are now fairly well recognized by most range professionals. **For example, the exact climax vegetation for most range sites is more an abstraction than a reality.** On annual grasslands, seeded pastures, and many woodland range types, the best forage species are not necessarily associated with high ecological condition scores. Generally the Dyksterhuis approach is best suited to native perennial grasslands and semidesert areas. The Dyksterhuis system better reflects range values for cattle grazing than for sheep, wildlife, or certain other uses.

Dissatisfaction with the Dyksterhuis approach has lead to various alternative procedures both past and present. Unfortunately they also have important limitations. Various methods are available to characterize successional shifts in vegetation composition. However, they convey little direct knowledge to ranchers about whether grazing values are improving or declining on their lands.

The primary problem with forage productivity is that large annual fluctuations typically occur among years due to the vagaries of weather. Even heavily grazed areas generally show forage production increases during wet years and conservatively or lightly grazed areas can show large declines in

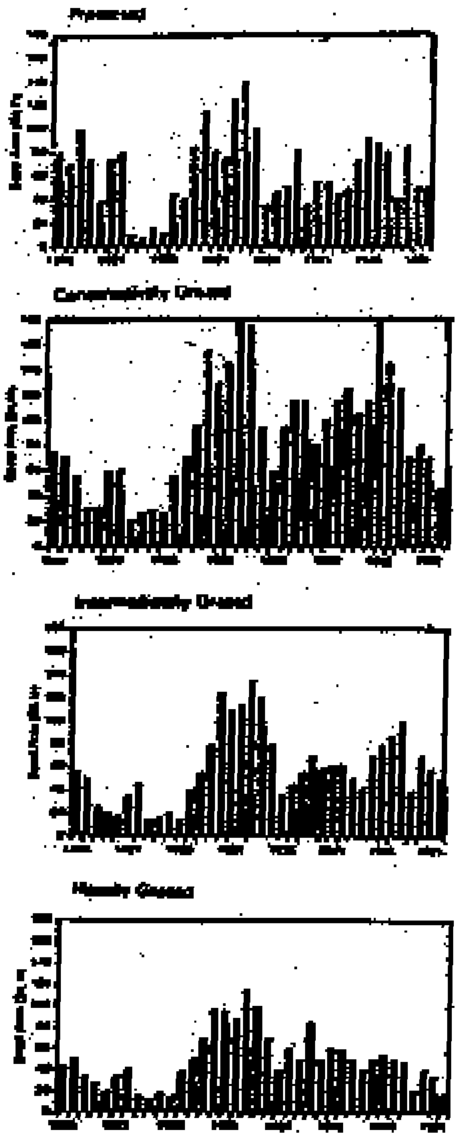

Fig. 1. *Basal area of black grama on areas protected from grazing and at three intensities of grazing on the Jornada Experimental Range in south-central New Mexico, 1916–1953 (from Paulsen and Ares 1962). Range trend reflected by black grama basal area was upward on all areas in wet periods and downward in dry periods. Conservatively grazed areas had more black grama over time than protected or heavily grazed areas. All areas had less black grama in 1952 than 1916 due to severe drought in the 1949–1952 period. This study shows the difficulty of interpreting trend without additional information on rainfall, grazing intensity, and exclosures.*

dry years. Therefore, forage production trend can be misleading as to management effectiveness on a short-term (3–5 years) basis and sometimes even over long periods.

Forage plant basal cover has been advocated as an alternative to forage production because it shows less short-term response to climatic problems. However, long term studies show even this trend indicator tends to increase in wet cycles and decrease in dry cycles regardless of grazing management (Paulsen and Ares 1962) (Fig 1). Like production, the basal cover increases are greater in wet years and the decreases lower in dry years under light to moderate than heavy grazing.

Another problem with basal cover of forage species is that increases do not always indicate improved rangeland health or productivity. On shortgrass rangelands in the central Great Plains, increases in cover of blue grama and other shortgrasses have been associated with decreased total forage production, lower soil water infiltration, and increased erosion. Conversely, on these same rangelands increases in mid grasses such as dropseeds, wheatgrasses, needlegrasses, and bluestems have sometimes resulted in less total perennial grass basal cover but higher forage productivity and soil stability.

Problems With Interpreting Trend

We have encountered several important problems in interpreting trend. The first of these problems is that vegetation composition on heavily grazed, degraded rangelands can be stable because desirable plants have been completely eliminated. This applies to large areas of Bureau of Land Management rangelands near Las Cruces, New Mexico placed in the custodial category.

If livestock grazing pressure is removed from these lands, increases in perennial grasses will occur in some situations. Ungrazed annual forbs and grasses help promote soil stability and improve wildlife habitat value. Lack of a downward trend should not be used as an excuse to continue destructive grazing practices.

Some long term studies on shortgrass prairie and salt desert rangelands have shown little change in vegetation composition under heavy, moderate, and light grazing intensities. However, forage production has been substantially higher under light and moderate than heavy grazing. This also applies to mountain grasslands and meadows dominated by muttongrass and Kentucky bluegrass.

As an example, on the Desert Range Station in central Utah general trend in relative species composition based on plant cover has not been well related to grazing pressure (Norton 1978). On the other hand, yields of valuable forage

The USDA-Bureau of Land Management pasture in the background in south-central New Mexico is in stable ecological condition because nearly all palatable forage grasses have been eliminated by heavy livestock grazing. Livestock grazing continues on this alotment even though annual grasses and forbs provide nearly all the grazable forage. The ungrazed area in the foreground provides a seed source that could result in range improvement if livestock grazing was discontinued.

The heavily grazed shortgrass (blue grama) pasture on the right in central New Mexico has been in a stable mid-seral ecological condition for several years. Cover of blue grama has actually in - creased over the past 10 years while forage productivity has declined. Total forage production in 1999 (a wet year) was 150 lbs/acre. Adjacent moderate grazed pastures that have nearly the same ecological score and vegetation composition produced 300 to 400 lbs/acre of forage in 1999.

species such as winterfat and bud sage have been cut in half by long term (28 years) heavy grazing (Holmgren and Hutchings 1972).

The winterfat/bluegrama rangelands in north-central New Mexico shown in the photo on page 7 had similar relative plant composition based on basal cover and similar ecological condition scores. However, the long term ungrazed area had higher ground cover and four fold more forage production. Klipple and Bement (1961) noted that forage production was much more impacted by grazing pressure than was vegetation composition on shortgrass prairie in Colorado. We have observed this same phenomena on several blue grama rangelands in New Mexico .

In some cases grazing induced downward trends have initially resulted in loss of cover with no relative plant compositional shift. We have observed this situation on some desert grassland areas in New Mexico. Unless there are adjacent ungrazed or moderately grazed areas, this type of retrogression is difficult to detect. It should be noted that ecological condition scores are nearly identical for the two pastures, shown to the right, but forage productivity and ground cover are 30% higher for the left hand pasture.

Fluctuations in annual and short lived perennial plants can cause large changes in vegetation composition not well related to the health of desirable forage plants. In New Mexico broom snakeweed populations show large shifts among years due to climatic fluctuations. These shifts can greatly alter ecological condition scores and forage plant vigor even under sound grazing management. Fluctuations in cheatgrass productivity can have the same effect on sagebrush grassland ranges. Under these conditions any evaluation of trend can be misleading even when exclosures are available to separate grazing from climatic effects.

Vegetation trend is a lagging indicator of management effectiveness. By the time a downward trend is detected, long term damage to desirable forage plants may have occurred. Major shifts in vegetation composition can occur very quickly during and after extended drought.

On experimental pastures on the Chihuahuan Desert Rangeland Research Center we found perennial grass mortality was more than doubled on heavily grazed compared to conservatively grazed areas during the mid-1990's drought. Although downward trends occurred on all pastures and exclosures, high grass plant mortality (black grama, mesa dropseed) on the heavily grazed pastures had severely impaired their recovery compared to exclosures and conservatively grazed areas.

Vegetation trend provides little information on how well vegetation residues meet soil, watershed, livestock, wildlife, and esthetic needs throughout the year. Amount of ungrazed standing and decaying vegetation biomass are closely related to water infiltration, soil erosion, and forage plant health. It's been our experience that the amount of standing biomass, ground cover, and number of fecal patties have much more impact on

On some areas initial retrogression from overgrazing results in a loss of cover of desirable grasses with no real change in relative vegetation composition (pasture on right). This type of ret - rogression is very difficult to detect with most measures of trend. However, the fence line (moder - ately grazed area on left) graphically shows retrogression is occurring. These rangelands are in south central New Mexico.

society's opinion of a grazing practice than changes in plant species composition. Heitschmidt and Walker (1996) made this same observation.

Uses and Misuses of Trend

Although difficult to interpret, we do believe range trend can be a useful measure of long term range management effectiveness if precipitation patterns are carefully documented and exclosures are used to separate grazing from climatic effects. However, it is not a panacea and should never be used as a single indicator.

It provides critical insight through time on how desirable plant species are responding to management and climate. However, downward trends in dry periods and upward trends in wet periods tell little about range management effectiveness unless compared to ungrazed or lightly grazed areas. Exclosures for such comparisons have been lacking on most public land allotments and on privately owned rangelands.

Obtaining useful information from exclosures can be a big problem. Exclosures can be costly to install and maintain and they remove land from the forage base. Exclosures should generally be 0.75 to one mile from water and at least 5 acres in size. Excessively small exclosures can attract rabbits and rodents that differentially impact vegetation relative to grazed areas or much larger areas ungrazed by livestock.

In our opinion, range trend has limited value in stocking rate/grazing capacity decisions on public lands. It tells nothing about current or future forage supplies or forage demand by wildlife and insects. What happened in the previous 10 years may have small or no relevance to what will happen in the next 10 years because of climatic uncertainty.

Heavy reliance on trend can result in managers ignoring seasonal and yearly changes in forage conditions. Rather than applying adaptive approaches, managers have too often used trend to justify prescriptions that lead to disaster in dry years. In our opinion, effective range management is a dynamic process that depends on quickly responding to ever changing financial, biological, climatic, and political conditions.

Another problem is that rangeland condition on public lands has been often evaluated at intervals of 10 years or more. Our research on long term monitoring sites in southern New Mexico shows condition scores can show considerable annual variation (Table 1). An average of three consecutive years is needed for reliable characterization.

Constantly attempting to keep animal numbers in balance with forage resources is the primary key to range management success. While this will not insure an upward trend, various long term grazing studies reviewed by Vallentine (1990), Heady and Child (1994), and Holechek et al. (2001) show this is the surest way to maintain and improve multiple use values, livestock productivity, and rangeland health.

Table 1. Examples of annual fluctuations in rangeland ecological condition scores on 4 pastures on the Chihuahuan Desert Rangeland Research Center in south-central New Mexico.

	Pasture #[1]			
Year	14	15	1	4
	- - % Remaining Climax Vegetation - -			
1995	72	66	49	67
1996	86	83	66	65
1997	69	70	58	73

[1]Range condition scores are based on percent by weight composition of ungrazed standing crop at the end of the growing season (October). Ten evenly spaced key areas with two 100 yard permanent transects within each pasture were used for monitoring.

Arguments against depending heavily on annual forage production and grazing intensity surveys as basis for management have often focused on their cost and lack of reliability. While we acknowledge these can be important problems, we have previously demonstrated this also applies to range condition/trend analyses.

Ideally, range managers should use a combination of information on forage production, grazing intensity, range condition, range trend, livestock numbers grazed, wildlife populations, and monthly precipitation data in their management decisions as discussed by Holechek et al. (2001). Unfortunately, this is seldom possible due to limitations of money, labor, time, and technology. In the future we believe public land ranchers will have to do more monitoring themselves or hire range consultants. Understanding the uses and limitations of different range surveys is a critical part of designing an effective monitoring program.

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Photo ID for page 10. These two winterfat/blue grama pastures in north-central New Mexico have similar ecological condition scores and relative plant composition. However, the long-term ungrazed pasture on the right has several fold higher ground cover and forage production levels than the heavily grazed pastures on the left. This type of retrogression is not well detected by most measures of trend.

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