Range Plant Growth and Development

Green plants are the foundation of all life. Understanding how they grow and how grazing management affects growth is basic to range management. Grazing can hurt or help plants, depending upon when it occurs and to what extent. Knowing how various species function permits more than just improved grazing management. As an example, weedy species can be controlled by planning certain activities in accord with their most susceptible periods of growth.

Photosynthesis is the process by which the plant produces its own energy or food from the sun's energy by combining water, carbon dioxide, and plant nutrients in the presence of chlorophyll contained in the green leaf. A large number of factors affect the rate at which this process occurs; on range or pasture the most effective factor man can control is the time and level of leaf removal. The amount of energy produced relates to the amount of effective leaf area (number, size, and activity of green leaves).

Energy or plant food is also consumed by the process of respiration. This process continues as long as the plant lives. Perennials undergo dormancy periods of varying length each year. Throughout these dormant periods, plants remain alive through respiring some of their stored energy.

Except for evergreens, perennial plants must send up new leaves and start their growth cycle anew each year. In doing so, they depend on stored energy. Perennial grasses and forbs store energy in roots and crowns. Shrubs store it in roots, crowns, and twigs (buds). Old leaves of grasses and forbs are no longer living after growth ceases each year. Their removal then will not affect the level of stored energy since that energy was translocated from leaves to the storage sites earlier in the season. As a survival mechanism, plants have the ability to store excess energy, but this ability varies greatly among species. By the same token, perennial plants may not produce as much energy under some conditions, such as grazing or drought, as would be desirable for normal functioning, yet they do not necessarily die immediately. Thus, understanding the survival abilities of plants on your ranges has much to do with perpetuating their productivity.

The amount of new spring growth and its vigor depends on the level of energy stored the previous season. Roots begin growth before leaves, in some cases several weeks before. The general pattern of energy or carbohydrate decline or depletion is fairly similar among species but the pattern of storage is not. As much as 75 percent of the entire supply of stored energy may be needed for a plant to make as little as 10 percent of the next season's growth. So, energy or food reserves of perennial plants will be at their seasonal lows soon after early spring growth starts. The plant must get the opportunity to grow on past these early stages and start to restore or put back energy that it used. Most perennial grasses are still storing energy up to the time of seed maturity. In some species, such as bluebunch wheatgrass, at least one-half of the season's growth must be made before the energy level at the beginning of the season is reached. In other species, such as squirreltail, that level is reached by about the fourth leaf stage (Figures 1 and 2).

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Energy is needed at all times, but there are three especially critical periods in the life cycle. First is early spring when new growth is initiated. Energy is drawn out of storage. Next is the period of active reproduction from flower stalk to seed when energy comes from upper leaves currently producing it. Last is when fall regrowth occurs. Energy comes from storage here, too. In addition, plants need energy to replace grazed leaves and to withstand drought conditions. One of the reasons for range deterioration in the turn-of-the-century era was lack of knowledge and understanding.
about these processes by the livestock owner and operator.

Annual plants produce energy, of course, but their survival mechanism is their seed. Poor growing conditions, especially when combined with close grazing, cause the plant to have less active photosynthetic leaf surface resulting in slower growth and less viable seed produced. Perennials can survive quite well without producing viable seed although the level of seed production is a useful indicator of plant health. However, don't expect seed to be produced in the dry years.

Managed spring grazing and grazing after maturity do not greatly affect energy storage and seem not to be injurious to plants. Studies show that root growth is slowed and may be stopped by the level of removal of the tops. But, when less than 50 percent is removed from most species at this time, little to no effect takes place. If spring grazing is only for a short time period and is stopped while enough soil moisture remains to allow ample regrowth, the plant should restore the energy it needs. Grazing should not occur again until the plant has accumulated as much energy as it can for that season. When growing season moisture is very limited and plants are grazed severely, there will not be sufficient leaf area remaining for the plant to both extract remaining available moisture and restore its energy supplies. The size of the root system will be reduced, which will affect the ability of the plant to make normal growth the next year.

Low energy reserves, whether caused by past grazing practices or not, also weaken the plants' ability to tolerate cold winter temperature. The concentration of the cell sap is raised, which lowers the freezing point. Low food reserves result in reduced root growth and decreased drought resistance. In essence, a continuously closely grazed plant cannot supply its own needs and is being starved by lack of an active recharging mechanism.

Plants make their growth from buds, which contain meristematic or new-growth-generating cells. Susceptibility to grazing varies a great deal from plant group to group and, of course, from species to species. Buds of forbs and shrubs occur on branches and twigs. Whenever buds or growing points are removed before potential full growth is made, the plant's growth for the season may be impaired. If grazing can be rotated so bud removal would occur, followed by relief from grazing, new growth from lateral buds may keep up production. Depending on the species, the ratio of reproductive to vegetative or leafy twigs or stems will be different. This can affect the forage quality.

Grasses are uniquely suited to be grazed because the growing point is protected inside the plant for most of the growing season (Figure 3). Each stem or culm has a growing point which develops either more nodes and leaves or seed heads. Grass leaves have several parts. The blade originates from a node, which is where the cells divide and become larger. The sheath extends and pushes the leaf out of the tube. Once the leaf has emerged and unrolled or unfolded, its growth is complete.

Grasses are of two common growth forms—stemmed and stemless. Stemmed grasses tend to have a high percentage of reproductive to vegetative stems (Figure 4). Some stemless species also have a high reproductive-vegetative ratio, but sev-
eral, such as the bluegrasses and grama grasses, have a high ratio of vegetative-to-reproductive stems. Stemmed grasses tend to be more robust and productive. They also are more numerous in the cool season growing conditions. Some species have the ability to grow more or less prostrate and can escape grazing that way. Management to incorporate this knowledge will allow you to capitalize on each plant species' desirable and less desirable points.

Stemless grasses are less susceptible to grazing than are stemmed grasses. Their growing points are at or below ground level for most of the growing season and their leaves are pushed up through the tube from below ground. The nodes are close together; only in the later part of the growing period do the upper internodes elongate so a mature grass appears with mostly basal leaves and relatively few seed stalks. In stemmed grasses, the early leaves up through 4 or 5 are pushed up as with stemless. Then, the internodes start to elongate and soon the growing point is lifted, whether it produces seed or not.

If the growing point is removed, there will be no more growth on that stem. That cannot happen for the stemless ones because the growing point is too low to be grazed. For the stemmed group, all new growth will have to come from inactive buds at the base of the grass. If sufficient soil moisture exists, such buds may develop, but in most years there is not enough soil moisture left for very much regrowth. If grazing can be managed intensively enough, this factor can be capitalized upon, e.g., crested wheatgrass may be grazed heavily enough so its growing point will be removed. After this time, most new growth will be vegetative.

By knowing your major grasses and how they grow, you will be able to set the most advantageous time to graze each area. You will also be able to predict the level of use the plants will tolerate and still produce well.