MARITIME PASTURE MANUAL

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NOVA SCOTIA
Agriculture

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The New Brunswick Agricultural Council
Le Conseil Agricole du Nouveau-Brunswick
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Hants County Federation of Agriculture | Hants County Soil and Crop Improvement Association

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Nova Scotia's Adaptation Council

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INTRODUCTION AND ACKNOWLEDGEMENTS

Forages constitute the single largest agricultural land use in the Maritimes. In Nova Scotia and New Brunswick the amount of land devoted to pasture is second only to the amount of land used for cropping hay. Pasture is the fourth largest agricultural land use after hay, potatoes and barley in Prince Edward Island. The combined area in pasture for the three Maritime Provinces exceeds 340, 000 acres.

Most pasture in Atlantic Canada is not intensively managed. Stocking rates of one cow calf pair per 3 to 4 acres is common. The potential for increased animal productivity through intensive pasture management in Atlantic Canada is huge. On farm studies have shown that when native pastures are well managed and intensively grazed that stocking rates of 1.0 acre per cow calf pair or 4-5 ewes per acre are very achievable. Farms practicing such intensive management grazing have reported producing over 600 lbs of beef per acre and over 200 lbs of lamb per acre: three times the productivity expected under a more traditional continuous grazing system.

The purpose of this project was to produce a comprehensive but practical pasture management manual for the three Maritime Provinces. The information and recommendations in the manual have been shown to be effective tools in this region for improving both animal and pasture productivity. The manual is written from the prospective that if you improve the productivity and health of the pasture then animal productivity will improve. The manual covers a broad range of information including grazing management systems, pasture fertility, fencing, drought management, riparian management, as well as methods for extending the grazing season.

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As mentioned, pasture is a greatly underutilized resource in Atlantic Canada. A century ago there were 10 times the number of cattle in the Maritime Provinces then there is today. The relatively low cost and higher production efficiencies associated with an intensive management grazing system makes it a key to the success of the beef and sheep industries. It is hoped that this manual will be an effective tool to help producers make greater use of their pastures.

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CHAPTER 1 ~ PLANT GROWTH

INTRODUCTION

It is important to consider the requirements of both plants and animals when developing a grazing system. While livestock have a direct impact and ultimate control of the crop being grown, “ruminant livestock producers” are, in fact, “forage farmers”; the livestock are simply a means of marketing the grass. If the livestock are simply a means of marketing the grass, it is imperative that the forage be managed for maximum productivity.

To maximize pasture yields and reduce the potential for losses from animal impacts, a grazing plan must be developed that meets the specific requirements of the plants in the sward. This does not mean that any one type of grazing system is the correct one; rather, it means that depending on the type of plant species in the sward, as well as the class and type of livestock grazing the pasture, certain grazing systems are more effective than others at maximizing yields and reducing wastage (Emmick and Fox 1993).

In deciding on which grazing system to implement on your farm (Chapter 2), it is important to understand basic forage growth dynamics. How a plant grows and the effect of grazing on plant growth will determine overall pasture productivity and quality. This chapter will provide an overview of grass and legume growth characteristics and benefits, and the consequences of poor and good grazing management.

GRASS GROWTH CHARACTERISTICS

Basic Grass Physiology

The growth of forage grasses and legumes is dependent on photosynthesis. Simply explained, the process of photosynthesis coverts the energy of sunlight into carbohydrates. In order for photosynthesis to occur, plants must have light, water and carbon dioxide. The water is absorbed through the plant roots and root hairs and carried to the leaves. The leaves trap light and absorb carbon dioxide from the air and move it to the cells containing chlorophyll (a green pigment). Photosynthesis occurs in two stages. In the first stage, the pigment chlorophyll captures the energy of light and uses it to make high energy molecules. The second phase uses the energy captured in Phase I to combine hydrogen with carbon dioxide to make simple carbohydrates. The carbohydrates are stored and used by the plant for energy to grow. The plant also stores carbohydrates to help it live through times of stress (drought) and/or initiate growth after defoliations or winter.

However, when the plant is frequently defoliated by grazing, or regrowth is limited by long periods of stress such as drought, sugar reserves become limited as the plant does not have the leaf area required to photosynthesize at full potential. To further complicate the situation, when the top growth is limited by frequent grazing or by environmental stress, the roots begin to die off and recede reducing the amount of water and soil nutrients taken up to support plant growth. Poor grazing management compounds the effects of environmental stresses. While environmental stresses cannot be controlled, a good grazing regime can help maintain healthy, vigorous pastures.

Seasonal Growth Curve

Initial spring growth of cool-season forages is supported from carbohydrate (sugar) reserves from the previous growing season. The buds produce new shoots and leaves which start to photosynthesize sunlight to promote stronger growth. The rate of plant growth in the spring is generally twice the rate of summer growth with a moderate increase in the fall. Kunelius and Goit (1982) recorded pasture growth at 100 kg DM/Ha/day when growth peaks in May-June, but dropping to 40 kg DM/Ha/day in July-August. This was followed by an increase to 55 kg DM/Ha/day in September-October (Figure 1.1). The flush of growth in the spring is related to the development of flower and seed production. Knowledge of this natural cycle is key to the implementation of a good grazing management system.

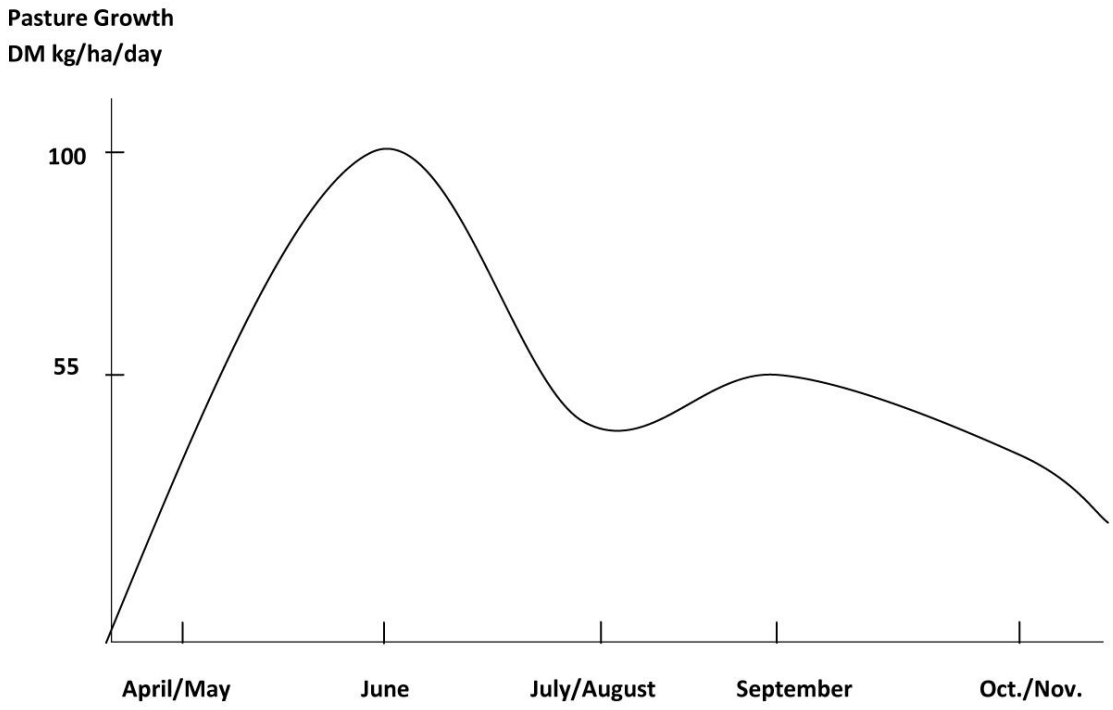
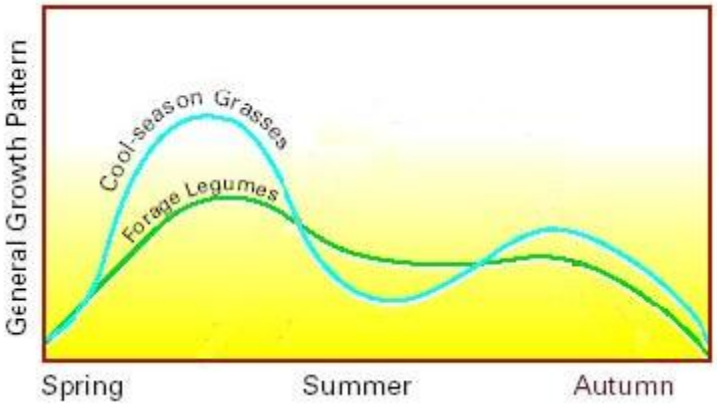


Figure 1.1 Seasonal pattern of DM accumulation over the growing season

While total seasonal DM accumulation varies by month and year due to precipitation and temperature, the growth pattern is predictable from year to year. Knowing this pattern is valuable when determining the total number of paddocks required for the season (this is discussed in more detail in Chapter 2). The high amount of growth in the spring can sustain livestock on fewer paddocks than late summer, so planning for shortages later in the summer is crucial. In fact, cool season grasses can develop so rapidly in the spring that grazing alone may not keep up with DM accumulation. Therefore, it may be desirable to determine which pastures are easily harvested mechanically and manage the excess forage growth through harvesting for hay or silage. It may also become necessary to clip pastures at various times over the season, depending on climate conditions and animal requirements.

Grass versus Legume Growth Pattern

Grasses and legumes differ in their growth pattern over the grazing season (Figure 5.1). Cool season grasses, such as tall fescue and timothy, tend to have high productivity in spring to early summer and then drop in productivity as the season progresses. These grasses usually become more productive again by early fall once moisture returns. In contrast, legumes tend to have a more evenly distributed seasonal yield because they maintain their productivity better through the drier summer period. Of course, some grasses and legumes can withstand drought better than others and the growth pattern of certain varieties within species may differ, so this will affect the pasture yield distribution. Therefore, choosing the correct species for a pasture mixture can have a significant effect on seasonal yield.



CHECK Figure 1.2 Typical growth pattern of different pasture species over the growing season Source: http://www.extension.iastate.edu/Publication/PM1791.pdf

Balancing Yield and Quality

When plants begin to grow in the spring, the initial growth (vegetative stage) is leafy and has a higher percent protein and digestibility. As the plant continues to develop and grow taller, the upper leaves will start to shade the lower leaves, resulting in an accumulation of dead or dying leaves at the lower part of the plant. As the plant matures, producing reproductive structures, its growth rate slows down and the leaves and stem decrease in quality. In general terms, the amount of indigestible fibre increases with maturity. This increase in indigestible fibre is accompanied by a decrease in digestible energy (DE). It follows then, that the DE available to the animal is high when the plant is young and immature but declines as the plant ages and accumulates DM. A similar decline in crude protein occurs with plant maturity.

In order to optimize the grazing potential of a pasture, it is important to factor in the yield and the rate of recovery, as well as determine the point where both yield and quality are balanced. This will provide the highest yield of quality forage (Bartholomew 2004). See Figure 1.3.

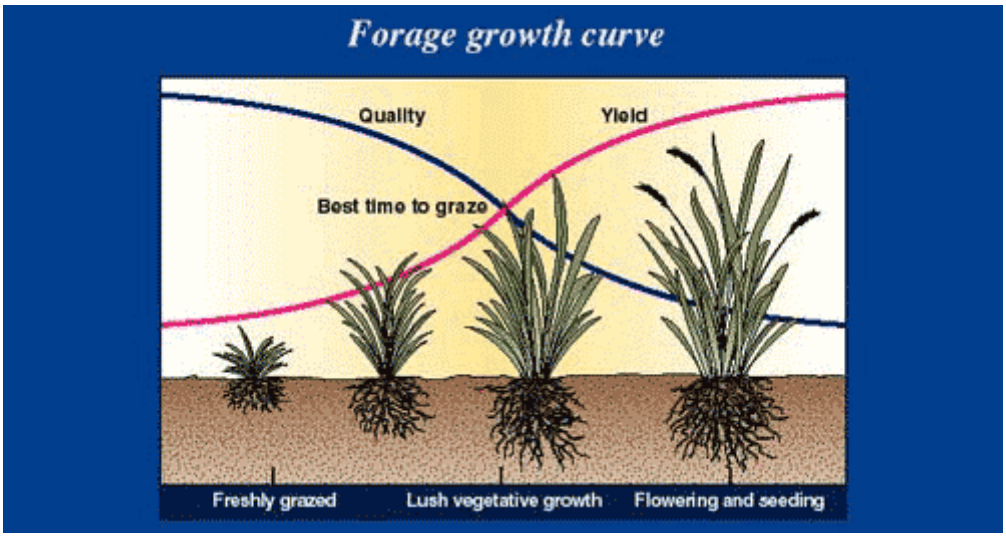


Figure 1.3 Typical Maritime forage growth curve showing the best time to graze. From:http://www.thisland.uiuc.edu/60ways/images/10b-detail.gif

Overall, it is important to monitor the growth of the pastures. Once plant growth and it's relation to plant recovery and forage quality is understood, it becomes a very effective tool for planning and managing the use of pastures. For more detail about individual species of pasture grasses and legumes and their growth patterns see Chapter 6.

GRAZING MANAGEMENT

Good grazing management is essential for successful pasture-based livestock production. Proper stocking rates and the timing and length of each grazing period are key. When pastures are managed effectively, an overall increase in production can be expected. Also, the fertility, the quality, and the longevity of the pasture can be increased. Good grazing management controls the frequency, intensity, timing, and duration of grazing so that the plants stay healthy and productive. Under a continual grazing system, pasture growth can only be managed through grazing intensity. It is not easy to maintain pasture productivity under a continuous grazing system. A more effective method of managing pasture productivity is through the use of a rotational grazing system. A rotational grazing system uses specific grazing intervals and rest periods to manage forage growth for quality and pasture performance.

The Importance of a Proper Rest Period

The rest period is the period of time given to the pasture to recuperate between successive grazings, and is the main tool to control the frequency of grazings over a season. The number of days required to rest a pasture will increase as the rate of plant growth decreases over the season. For example, in the spring, rest periods will be about half as long as in the middle of summer because forages generally grow twice as fast in the spring. The rest period should always be long enough to ensure adequate pasture regrowth (10-15 cm sward height). It should not be so long that the pasture becomes overgrown reducing forage quality and causing losses in yield by trampling and rejection. It is important to remember book values are only a guide: you cannot overemphasis the power of observation.

When to Graze

The growth of a plant goes through three phases during initial spring growth and following defoliations (Figure 1.4). In Phase I, the plant's growth rate is slow because it does not have the required leaf area to effectively harvest the sun's energy and must use its root reserves. Phase II is characterized by a high growth rate, as the number of tillers increases, producing more and more leaves to photosynthesize thereby increasing the total amount of energy available to the plant for growth. After this, the plant goes into the third or reproductive phase, in which the rate of growth has essentially stopped and the yield actually decreases somewhat. By this time, the top leaves have shaded out the lower leaves for a long enough period of time that the lower leaves die. Also, once a grass has gone into the reproductive phase, new tillers will not be produced until after harvesting or flowering.

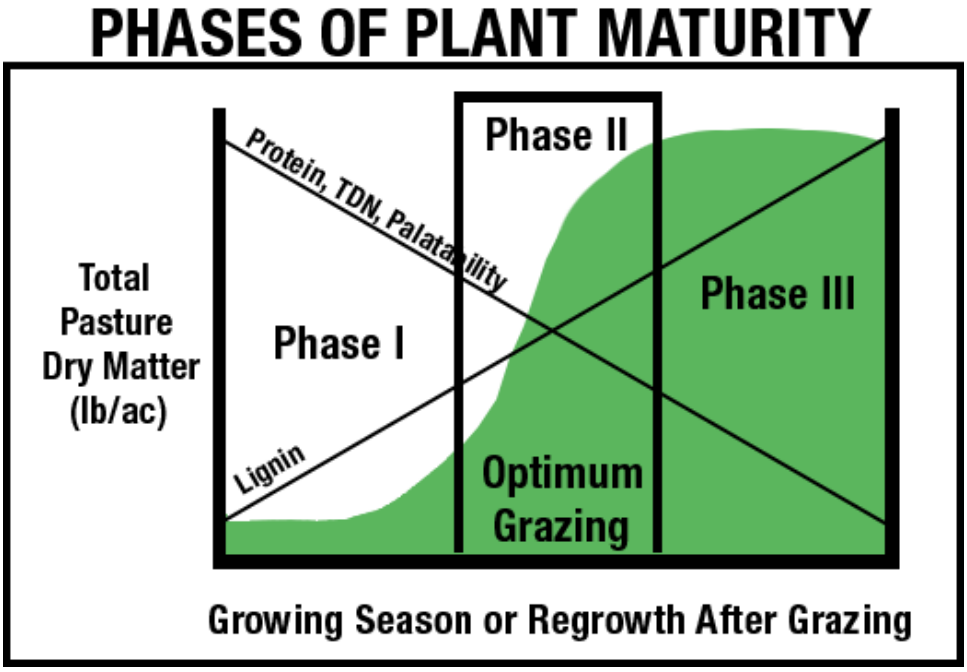


Figure 1.4 Phases of plant maturity showing the optimum time for grazing

From: http://www.noble.org/Ag/Forage/RotationalGraze/phases.gif

From Figure 1.4, it follows that the optimal time to begin grazing is near the end of Phase II when the yield is greater. It is important not to allow the sward to be grazed so short that the plant must depend on carbohydrate reserves to regrow (Phase I) instead of depending on regrowth from its leaf biomass (Phase II). In this way, the plants ability to regrow is preserved, the rest period is shorter, but more importantly, it is less stressful on the plant and it can rebound quicker.

Grazing Intensity

Grazing intensity is an expression of the number of animals grazing a defined area for a certain period of time (#cows/acre/day). Forage utilization and grazing efficiency increases as the grazing intensity increases because livestock have less chance to be selective. The ideal grazing intensity will vary depending on the type of forage species, the time of year, and the class of livestock being grazed.

Exit and Entrance Heights

The height to which a grass grows affects when the livestock must be removed from the pasture. The growing points of tall species such as timothy or smooth bromegrass are elevated and are several centimeters off the ground, so the plant material should not be grazed too short. These species are termed jointed grasses. On the other hand, non-jointed species like Kentucky bluegrass have growing points closer to the ground and can therefore withstand closer grazing. It should also be noted that all forage species handle grazing differently, no matter what their classification. Tall fescue, while being a tall grass, can handle intensive grazing better than smooth bromegrass, as it has more basal leaves.

For the first grazing in the spring:

- **Predominantly short forages** (bluegrass/redtop/white clover/fine fescue pastures): start grazing at a height of 10-12 cm (4-5 inches) and graze down to a stubble height of 4 cm (1.5 inches)
- **Predominantly tall forages** (orchardgrass, tall fescue, bromegrasses, timothy, red clover): start grazing at a height of 15-20 cm (6 inches) and graze down to a stubble height of 5 cm (2 inch)

For the remainder of the grazing season:

- **Predominantly short forages**: start grazing at a height of 10-15 cm (4-6 inches) and graze down to a stubble height of 4 cm (1.5 inches)
- **Predominantly tall forages**: start grazing at a height of 20-25 cm (8-10 inches) and graze down to a stubble height of 5-6 cm (2-2.5 inches)

Again, book values are only guidelines and in the end, a good rest period is most important in the recovery and subsequent high productivity of the pasture.

The time of year has an influence on how tall the sward should be when it is grazed. In the spring, the various pastures are usually uniform in growth so waiting for a specific, or “ideal” height to begin grazing the first pastures would result in the other paddocks becoming over-mature. This would reduce quality and risk yield losses from trampling and rejection. In the spring, it is recommended to start grazing, particularly the first paddock, at a lower initial height this will help prevent the remaining paddocks from becoming too mature.

The use of a sacrifice paddock during wet periods will help protect the other paddocks. Similarly, during periods of drought, the soil will be better protected if the livestock are removed sooner from each grazed paddock. Leaving a little more forage after grazing will help keep more moisture in the top layers of the soil and allow the plants to regrow quicker once adequate levels of moisture return. When little pasture is available, the temptation is to overgraze the paddocks, but it is better to supply the animals with stored feed and allow the pastures sufficient stubble height for faster regrowth when the moisture returns.

Grazing Period Length

The total length of time that livestock are in a particular section of pasture or paddock needs to be balanced with the stocking rate. Too long a period and the animals begin to graze regrowth, but too short a duration and the forage is wasted and labour may become an issue as well. The length of stay on a pasture should not exceed five – seven days in spring or 10 to 12 days in mid-summer. As the total time spent on a pasture increases, trampling and fouling increase which can actually decrease animal performance (Emmick and Fox 1993). Shorter stays on pasture will promote increased forage intake that is also higher in quality.

Table 1.1 describes the number of days that different livestock classes should stay on any one paddock.

Table 1.1 Recommended pasture residency periods for livestock

Livestock Class	**Number of Days in a Paddock**	
	Spring	**Summer**
Lactating dairy cattle	0.5 – 2 days	0.5 – 2 days
Milking sheep or goats	1 – 2	3 - 4
Growing stock (steers, heifers, lambs)	2 – 4	6 - 8
Beef cow/calf, ewe/lamb	3 – 4	7 - 10
Most adult non-lactating stock	5 - 7	10 - 12

Adapted from Emmick and Fox (1993)

Over or under-grazing are two symptoms of incorrect grazing frequency and duration, and many times show up within the same pasture. When a pasture is repeatedly overgrazed, the grass and legume species are not given an opportunity to recover sufficiently after grazing. If the plant is given little or no rest period, the plant cannot rebuild its carbohydrate reserve and will be weakened and may die. Over the long term, the pasture sward's root mass will be minimal and shallow. A similar species disappearance can happen when the pasture is undergrazed, but this is due to the shading and competition of other species, as most grazing livestock are selective grazers. The long term result in this case is a very patchy pasture, with some areas being overgrazed and others looking coarse and rank.

With poor grazing management, such as chronic over or undergrazing, pastures will begin to show a decrease in productivity. Uncontrolled, this decrease in productivity can begin an undesirable cycle that will not only result in poor livestock and pasture production but will result in a very tangible decrease in monetary return (Figure 1.5) (Thomas and Goit 1986). This cycle is referred to as "The Cycle of Poverty."

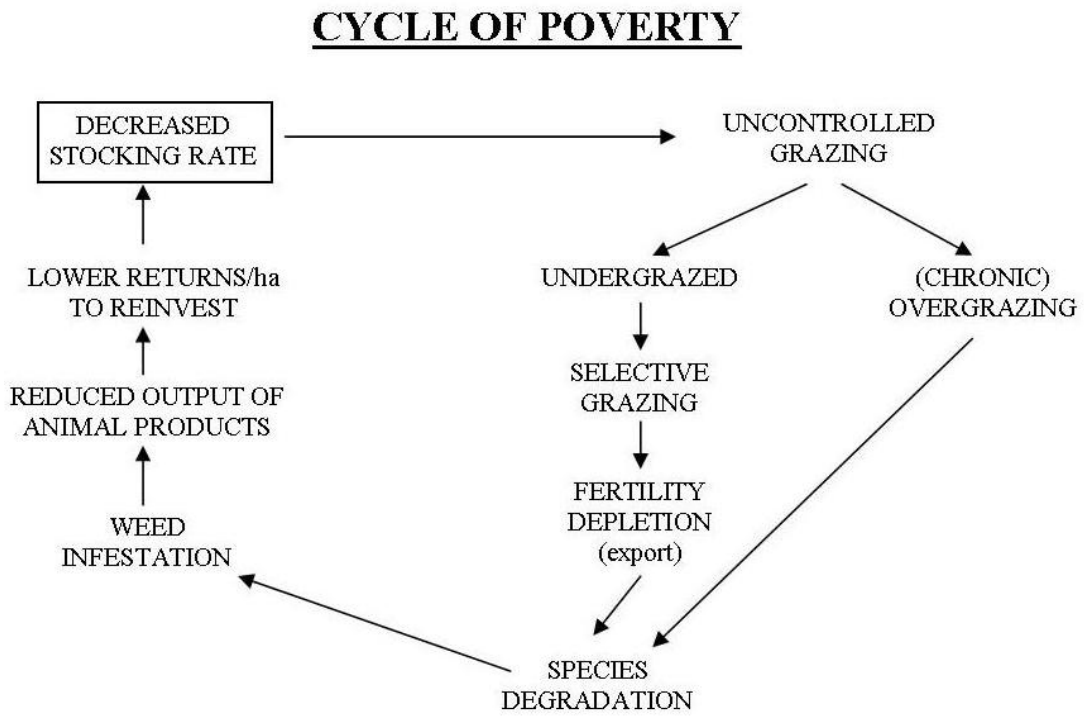


Figure 1.5 How uncontrolled grazing contributes to the "Cycle of Poverty". Adapted from Thomas and Goit 1986

Given the opportunity, livestock will only eat what is most palatable and will only use preferred areas of the pasture. As desirable forage species decline and disappear, weeds will grow in their place, either because of actual patches of bare ground or by being able to out compete the weakened plants. There is good reason to control the frequency and length of time that the livestock stay on a given pasture.

When grazing is controlled the entire system becomes healthier, known as the 'Cycle of Plenty' (Figure 1.6). Pastures under a controlled grazing system will tend to have a higher carrying capacity because they yield more and can sustain intensive grazing better. They tend to have fewer weeds because there is less grazing selectivity and the forages can easily compete for nutrients and light. Fertility levels tend to be more evenly distributed over the entire pasture, further increasing pasture productivity, and forage is given rest to adequately recover and allow the roots and leaves to regrow.

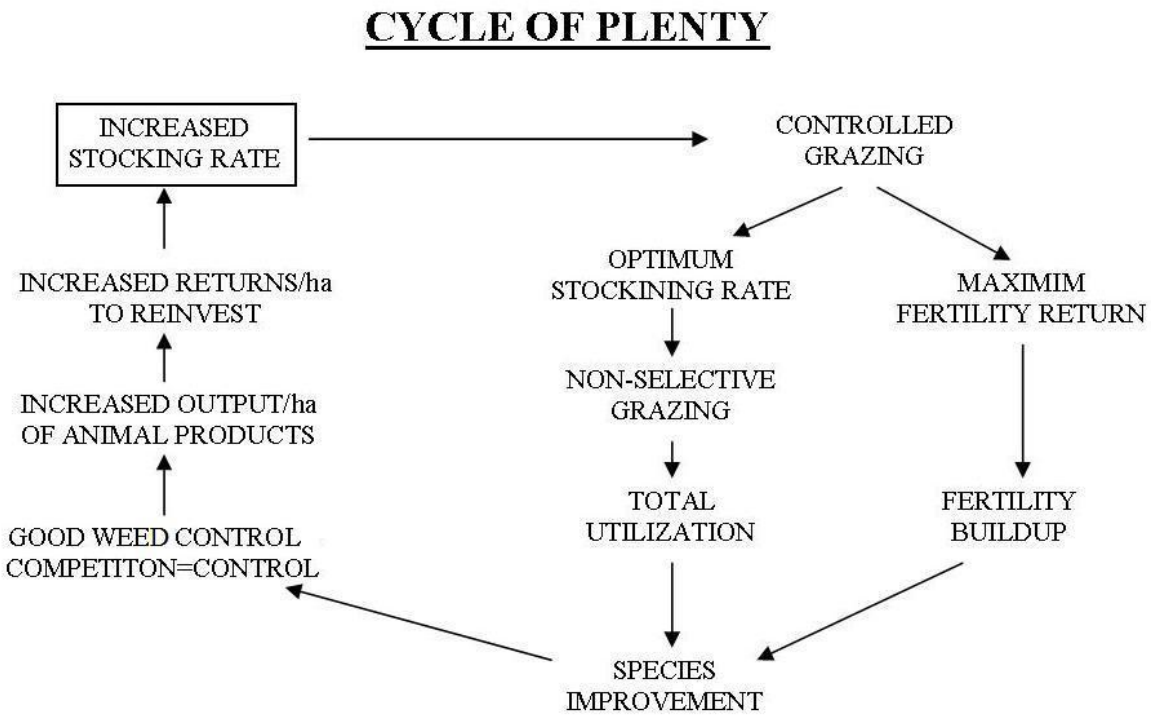


Figure 1.6 How controlled grazing contributes to the "Cycle of Plenty".

Adapted from Thomas and Goit 1986