



Grazing Invasive Annual Grasses: The Green and Brown Guide





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Brenda Smith, Roger Sheley, and Tony Svejcar



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What is the “Green and Brown” Strategy for Managing Annual Grasses?

Managing annual grass infestations can be **difficult and very expensive. It’s a regular** occurrence that that an expensive treatment is applied and no reduction in annual grass invasion occurs. Using livestock grazing can be an excellent way to manage annual grasses and actually provide some direct benefits in animal production.

Grazing management can be complicated with very sophisticated grazing system designs, but in this document we discuss a simple method for managing livestock to control annual grasses while allowing perennial grasses to re-occupy the sites and generating more animal **production. It’s called “Green and Brown”** grazing to manage annual grasses: graze when invasive annual grasses are green and desired

species are brown. This strategy is also known as time-controlled, short-duration, high-intensity grazing.

Annual grasses are most palatable and nutritious when they are green. They are also most susceptible to damage by grazing while green. Perennial grasses are less palatable and more grazing-tolerant when they are brown because they are dormant. This creates a natural opportunity to graze when annual grasses are green and perennial grasses are brown. Once the perennial grasses initiate any growth, the animals must be moved to another pasture until the new growth becomes at least **10” tall. Over time, desired perennial grasses** will increase and annual grass abundance will decrease.



Grazing management to control annual grasses can be as simple as green and brown: grazing when invasive annuals are green and when perennials are brown.

The Need for the “Green and Brown” Strategy for Grazing Invasive Annual Grasses

Invasion of rangeland by annual grasses has become one of the most serious and catastrophic land management problems in the western United States. Millions of acres of rangeland are dominated by invasive annual grasses. Annual grasses displace desired plants and create monocultures that do not provide adequate plant cover for the entire year.

Degraded ecosystems and the associated loss of vegetation lower wildlife quality and reduce forage production for livestock. Water cycling and nutrient cycling can be severely inhibited when these species are present, which continues the downward spiral of rangelands.

Monocultures of annual grasses also increase the frequency of fires which severely limits the **land’s usefulness and ability to provide goods and services to society.**

Livestock grazing is quite possibly one of the most useful tools to keep rangelands in good condition and maintain optimum production. Rangelands are diverse with native species having multiple life strategies that survive and flourish in these areas. Grazing management of these weeds is the only management option that has the potential to make money; all others are expensive and rarely work. The **“Green and Brown” strategy can be a useful concept to guide your grazing program.**



Annual grasses like medusahead degrade ecosystems in a number of ways, including degradation in water cycling, erosion and nutrient cycling, an increase in frequency of fire, and significant **reduction of quality forage for wildlife and livestock and the land’s overall usefulness.**

Why Use Livestock to Manage Invasive Annual Grasses?

Managing weeds can be expensive. Run through the list of what you can use to combat invasive plants and everything on the list, including bio-control, fire, herbicide and seeding, requires an outlay of money and involves the possibility of unexpected risks. For those who have livestock and annual grasses co-dominating with some desired perennial **grasses, “Green and Brown” could 1) control** the annual grasses, 2) help restore the desired perennial plants, and 3) help you make money.

There are numerous scientific studies documenting that proper grazing with livestock can be used to facilitate the resistance to invasion as well as the recovery of rangeland. The potential of grazing is exciting and promising because no other vegetation management tool has the prospect to make money while improving rangeland. Grazing has been shown to alter species composition from less desirable species to desired species, increase the productivity of selected plant species, increase the nutritive quality of the forage and increase the diversity of habitat.

The focus of this guideline is to help managers understand what constitutes proper grazing **using the “Green and Brown” grazing strategy** for managing invasive annual grasses in situations where annual grasses co-dominate. Ultimately, using livestock to manage invasive annual grasses will have positive effects on the landscape and help managers achieve their economic goals.

Management Tools can include these listed below and can have significant costs.



How Can this Guideline Benefit You?

This guideline was designed to provide land managers and ranchers with direct, helpful information on how to best use livestock for managing invasive annual grasses, such as cheatgrass, medusahead and ventenata. In many cases, livestock may be the best tool to manage annual grasses and the goal of this guide is to provide the ecological basis for using livestock to manage invasive grasses and examples of how to use livestock to manage rangelands.

Whether you are faced with the threat of invasion by annual grasses, have areas where annual grasses have invaded but desired species are still present, or maybe you are

challenged with areas where annual grass monocultures require the site be revegetated or restored, grazing should be a part of your management program. This guide is designed with land managers in mind.

What can be the direct benefits of using this guideline?

- 1) Understanding of the value of grazing as a management tool,
- 2) Find out how grazing fits into the ecologically-based invasive plant management (EBIPM) system, and
- 3) Knowledge of the science behind the **“Green and Brown” grazing strategy.**



The **“Green and Brown” strategy** and EBIPM both take aim at utilizing grazing to stress the undesired plants, such as cheatgrass, medusahead and ventenata (from left to right above) which can help give perennials a competitive edge in growth, seed development, and performance.



Strategic grazing, such as the “Green and Brown” strategy, can provide an energy-efficient, low-cost and effective method of managing invasive annual grasses and other invasive plants.

When this grazing strategy can be implemented to manage invasive annual grass infestations, it can heal the land, recover the ecology of the diverse systems and see productivity return in an economical way.

There are many general discussions about grazing and weeds, but there is no concise, detailed information specifically on grazing annual grass infestations. We developed this guideline based on exploiting the differences in

phenology between annual and perennial grasses and to provide land managers with an up-to-date and simple strategy for using grazing to manage land where annual grasses are co-dominant with desired perennial grasses.

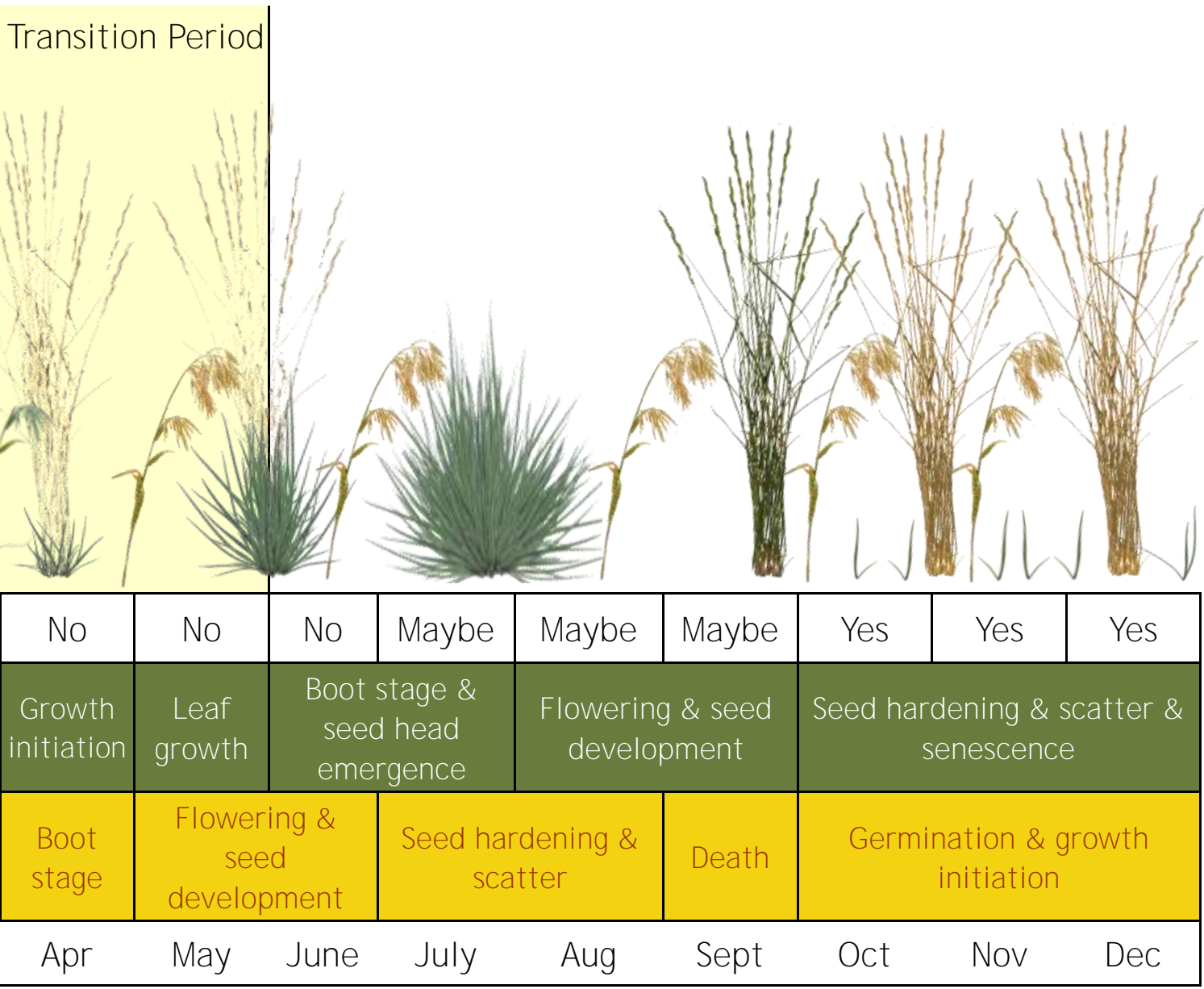
“GREEN AND BROWN”

GRAZING STRATEGY FOR INVASIVE ANNUAL GRASSES

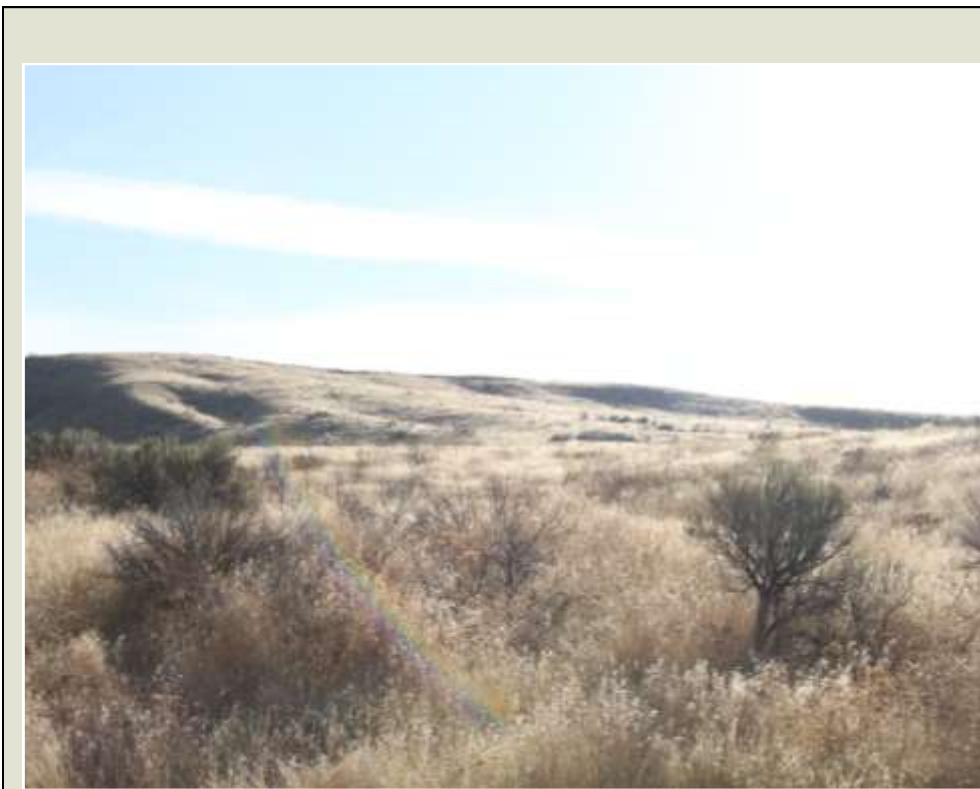
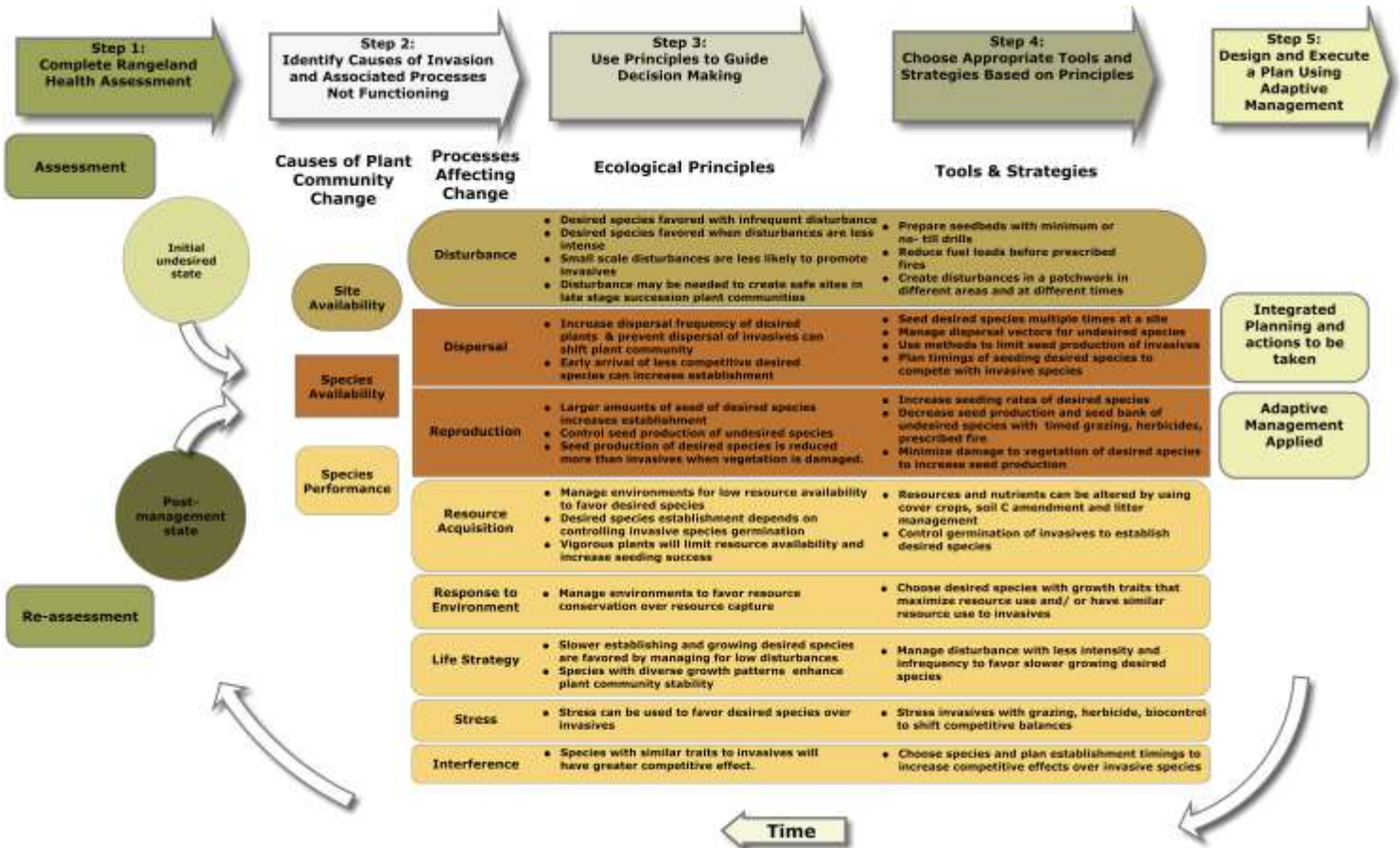


Grazing Period	Yes	Yes	Yes	Yes	Yes	Maybe
Perennial Grasses	Senescence		Dormancy			
Annual Grasses	Germination		Growth initiation			Leaf growth
Month	Oct	Nov	Dec	Jan	Feb	Mar

Use this chart to help you manage invasive annual grasses such as medusahead and cheatgrass. In the table below, grazing periods are imposed based on the actual plant growth stage for both desired perennial grasses and annual grasses. The calendar months are only to be used as a general reference, **always graze by plant growth stage paying close attention to early green-up of perennials**. This also illustrates the critical transition period for removing livestock.



The EBIPM model To learn more about the EBIPM process and how to implement more effective management for invasive species, additional guidelines are available at www.ebipm.org.



By understanding the how the 3 causes of succession create changes in plant communities,

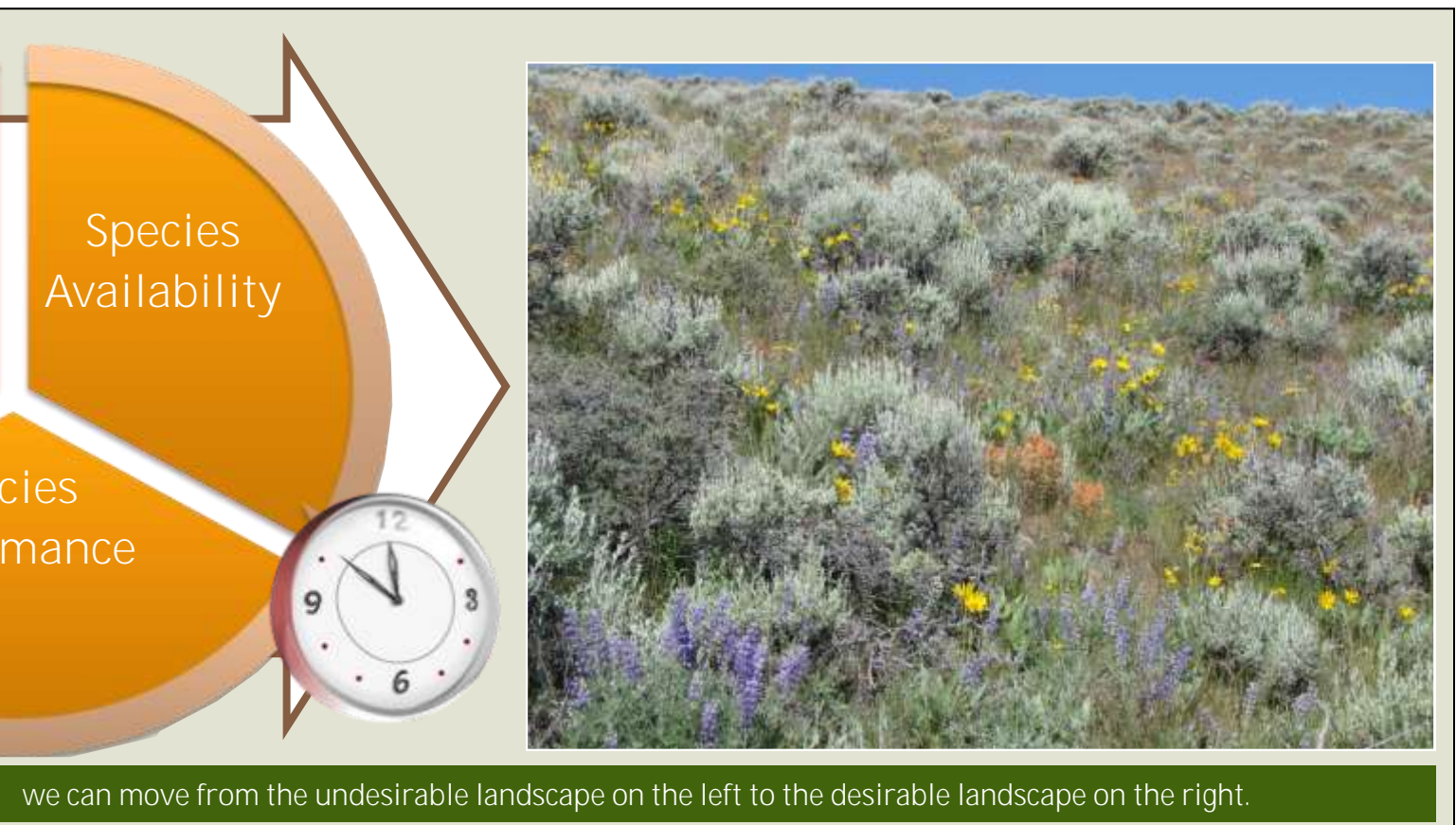
The Link Between EBIPM and the “Green and Brown” Grazing Strategy

EBIPM is a step-by-step decision framework developed for land managers to address the underlying cause of invasion, rather than simply controlling invasive weeds. Grazing is linked to EBIPM in step 4 (EBIPM model on the previous page) when land managers are making decisions on the strategies and tools to implement to effectively manage invasive annual grasses.

The underpinnings of the EBIPM framework are rooted in understanding the ecology of plant community change or succession. The three main causes of succession are **site availability**, **species availability** and **species performance**. These three causes help explain how plant communities change in response to influences or disturbances.

Instead of seeing invasive plants as the problem, the EBIPM model helps guide managers to identify and repair the ecological processes that are not functioning. A shift in thinking occurs when the presence of weeds is recognized as a symptom of this ecological breakdown. EBIPM can help managers determine the true cause or causes of invasive grass infestations. Use of the EBIPM framework is a dynamic planning process to account for the ecological complexity of the system.

Grazing is one tool that can be part of an integrated management plan using the EBIPM framework. When considering the ecological processes affected by grazing, land managers **can use the “Green and Brown” strategy** to create available sites for desired species,



reduce seed production, and control or prevent annual grasses. Within the context of an EBIPM program, managed grazing using the “Green and Brown” strategy is primarily designed to

alter relative species performance, but managers using grazing can also influence species availability and even site availability in creating different disturbances.

The Dynamics of Grass Growth and the Response to Grazing

Grazing is considered a natural process in grasslands. As a result of the process of grazing, livestock remove litter, recycle nutrients, stimulate tillering of perennial plants, and reduce seedbanks of competitive annual plants.

There are two fundamental differences in life strategies between annual versus perennial grasses that allow land managers to exploit them using grazing and these differences form **the basis for the “Green and Brown” strategy.**

The first difference is annual grasses have a growth period different than many native perennial grasses and many non-native

perennial grasses as well. Annual grasses such as cheatgrass and medusahead germinate in the late-fall, winter or early-spring. Germination is prompted by precipitation occurring when temperatures are high enough for biological activity. Even when they germinate in the spring it is usually very early, prior to the time when most perennial grasses come out of winter dormancy and begin to grow.

This difference makes invasive annual grasses temporarily more preferred and selected by livestock and sets up an opportunity to develop a grazing strategy that exploits this difference.

It’s called “Green and Brown”. When invasive



The photo above was taken in eastern Oregon in mid-March and illustrates the capacity of cheatgrass to germinate and begin growth initiation earlier than perennials.

grasses are green, it indicates they are actively growing, very palatable, highly nutritious, and will be preferentially selected by livestock. Grazing at this time reduces the competitive ability and seed production of annual grasses. On the other hand, perennial grasses senesced or not growing, are of low nutritive value during much of the period that annual grasses are green and growing (See “Green and Brown table on pages 6-7). In addition, senesced perennial grasses are very tolerant to grazing when they are brown.

The second fundamental life strategy difference between annual and perennial grass species is annual grasses start from seed every year. If land managers can reduce seed production through grazing, it can be very effective in long-term control of **annual grasses. Animals' grazing** tendencies play perfectly into this as well because they typically remove the top portion of the plant first.

If the soil remains moist into early summer, light grazing can in fact stimulate more seed production in annual grasses more than no grazing. To be successful in managing invasive annual grasses, grazing should be of high intensity and short-duration. The advantage of high-intensity and short-duration grazing is the negative impact on weeds and grazing recovery periods for desired species can be planned which ensures the range is grazed more efficiently.



Cheatgrass and other annual plants start from seed every year so reducing the number of seeds, through grazing or any other means, will reduce the number of plants that can grow in the future.

In order for the “Green and Brown” strategy to work well, there are three major considerations:

1. **Stocking rates must be high** enough to heavily graze the annual grasses.
2. Animals must be removed **prior to growth by desired perennial plants**, which occur mid-spring.
3. Grazing annual grasses be a part of a **long-term approach to managing** invasive annual grasses. Once animals are removed, annual grasses rapidly **return. The message here is that grazing isn't a one time prescription** to managing invasive annual grasses.

Meeting Land Use Objectives with the “Green and Brown” Grazing Strategy

Managers often take into account a number of land use objectives including improving production, wildlife habitat or ecological functioning and increasing biodiversity of the area when planning management. Typically, a management plan where invasive annual grasses are present would be considered a success when the abundance of weedy grasses

is lower and dominance by perennial desired species is greater. This change in ecosystems would meet most reasonable land management objectives. Grazing can be considered a gradual method of vegetation change and managers should be patient so long as vegetation is moving in a favorable direction.

Ecological Principles Associated with the “Green and Brown” Grazing Strategy

An ecological principle can best be described as a scientifically-based rule of thumb. Principles indicate a relative magnitude and direction of change that a management strategy, such as the “Green and Brown” will have on invasive and desired plants. When a land manager knows the ecological implications of the strategies and how to use them, they can choose grazing programs aimed at achieving these ecological targets. In using the “Green and Brown” strategy to manage

invasive annual grasses, we are manipulating plant “species performance” to shift the competitive advantage to desired species. There are two basic principles of the “Green and Brown” grazing strategy for invasive annual grasses:

- 1) Keep annual grasses from flowering
- 2) Keep perennial desired species strong and healthy



Management plans that look to increase abundance of desired perennial species and decrease invasive annual grasses would typically be considered a success.

Principle 1: Keep Annual Grasses from Flowering

Think of the ability of cheatgrass seeds to get in clothing; plants have the capacity to produce astonishing amounts of seed even under adverse conditions and stress. Plants have been documented growing from hundreds to thousands of plants/sq. foot and each seed head can produce up to 20 seeds which quickly escalates seed production.

Annual grasses must produce seeds to survive. To be successful in managing annual grasses, one objective is to keep annual grasses from reaching this stage. Seed set is the only way an annual can be successful from one season to the next and reducing species availability lowers the odds of seeds being dispersed or finding a suitable site to germinate and grow.

Most annual grass seeds live for only a few years in the soil, by reducing the number of seeds produced, plants are not able to reproduce and eventually, with a decreasing seed bank, the population will begin dying out. Even partial reduction in seed production because of grazing can be helpful.



Principle 2: Keep Perennial Desired Species Strong and Healthy

When annual grass seeds disperse where perennial desired species are growing vigorously, the annual grasses are generally unable to establish. The ecological fundamental for this principle is to create opportunities in managing the land to shift the competitive advantage to the perennial desired species. For example, continuous grazing on perennial plants will weaken the root system as the plant sacrifices roots to regenerate top growth for photosynthesis. Fewer roots of desired grasses allow excess water and nutrients to be taken up by annual grasses.

Opportunities exist with grazing livestock to affect the ecological processes such as **resource acquisition, plants' response to the environment, stress and interference from other plants** which are all linked to species performance. If the desired plants can be protected from herbivory at critical periods of plant growth, they will be stronger and healthier to compete against invasive plants.

As land managers realize they have the ability to use strategies and tools to not only negatively impact the invasive annual grasses but also to positively impact the desired **perennial plants, they'll progress toward more productive and diverse plant communities.**



Six Factors Affecting the “Green and Brown” Grazing Strategy for Invasive Annual Grasses

The “Green and Brown” grazing strategy has a scientific basis and using this strategy is about manipulating species to alter the competitive balance where desired species can gain a competitive advantage over undesired species.

As land managers look to create a desired landscape using livestock, control over timing, intensity and frequency all impact whether a grazing treatment is successful. Additionally, stocking rate, palatability, and class of livestock are also important in understanding the underlying basis of the “Green and Brown” grazing strategy. In the following section we detail the specific roles of these factors in the “Green and Brown” grazing strategy.

1) Timing: Plan grazing by plant state, not dates

2) Intensity: Increased intensity for increased removal of biomass

3) Frequency: Protect those you care about

4) Preference and Palatability: If it is green they will eat it.

5) Stocking Rate: Pack ‘em in to take out the annual grasses

6) Class of Livestock: Use what you have available to graze



The “Green and Brown” grazing strategy is focused on stressing invasive annual grasses through the strategic use of intensity, frequency and stocking rates so that livestock graze at a time when the undesired species are palatable and even preferred over the dormant perennial grasses.

1) Timing: Plan grazing by plant state, not dates

Timing, in the context of grazing, is when in the **plant's life cycle the animals remove biomass.**

This is not calendar time, but the stage of growth when the plant is grazed. Timing is an aspect of grazing management tied closely to palatability, since it varies with the phenological development or life stage of plants. The phenology worksheet in the appendix of this guideline (pages 34-35) to help you monitor the growth stage of plants to determine optimal grazing periods to stress invasive and undesired species while allowing desired perennial grasses to grow undisturbed.

What typically happens as a plant matures is the percentage of stems increases, creating a

higher percentage of fiber and a decrease in the percentage of protein. Digestibility then decreases and the plants become less palatable. When plants are less digestible, the **forage consumed passes through the animal's gut more slowly.** With a high lignin content and poor digestibility of a low-quality grass, a cow can only eat half as much and receives only a quarter of the nutrition of a higher quality feed.

This knowledge makes a clear case for grazing when annual grasses are green and desired perennial grasses are brown. The critical period when animals must be removed is when desired species start to grow in the spring.



The critical timing for high-intensity grazing of invasive annual grasses may vary from year to year so it's important to plan grazing based on the state of the perennials in the system rather than simply planning based on the month or time of year.

2) Intensity: Increased intensity for increased removal of biomass

In grazing management, intensity is described as the degree of plant biomass removed by an animal at any one time or the amount of forage utilized. Grazing intensity has been considered to be the most critical of management factors because high intensity grazing damages the eaten plants (undesirable or desirable plants).

The intensity at which a rangeland is grazed is a major factor affecting vegetation change. Light grazing may not alter species composition because intensity is insufficient to alter plant growth and subsequent competitive interactions. Managers recognize that a plant or range can be intensively grazed without being overgrazed. If an area is grazed under

high intensity, there will be a greater rate of forage utilization and, in the short-term, forage quality is improved because low quality forage is removed. This is a key factor when grazing invasive annual grasses. When managing to reduce medusahead or cheatgrass under the **“Green and Brown” strategy**, high intensity grazing when the annual grasses, cheatgrass and medusahead, are green and the desired perennials are brown (dormant) is an important goal.

One way to measure intensity of grazing is utilization and a simple way to measure utilization is through the use of cages in the grazing area during the grazing event.



Grazing intensity should be focused on removing as much biomass from invasive annual grasses as possible before perennials begin growth initiation in the spring.

3) Frequency: Protect those you care about

Probably the most straightforward of all grazing considerations, frequency refers to how often **grazing is repeated, and in the “Green and Brown” strategy this has implications** specifically for desired species. Species that are grazed less frequently display greater leaf areas and attain a competitive advantage. Frequency has everything to do with the amount of time a desired plant has to recover. If desired plants are re-grazed as they are trying to re-grow, this will compromise the vigor of the plants.

However, recognizing how frequent grazing sacrifices the resources in a plant can be used to the great advantage of a manager dealing **with invasive annual grasses. In a “Green and Brown” strategy, grazing should occur** continuously when the invasive species are green. As soon as the desired species show green growth, the animals should be removed until most of the growth has occurred (for most species approximately 10 inches in height) to keep them strong and competitive. After this time the plants can be grazed under low frequency.



Allowing desired perennial grasses to rest and re-grow will give them a competitive advantage.

4) Preference and Palatability: If it is green, they will eat it

Preference and palatability are not unrelated but do have two completely different meanings **when considering the “Green and Brown”** strategy to manage invasive species.

A plant that is edible refers to palatability and palatability can change within any given plant as a result of a number of factors. A plant might be palatable in certain life stages and become unpalatable as the plant matures as in the case of medusahead. When someone says **cattle won't graze medusahead, this merely means** they put the animals in the infestation when the plants were brown and the desired species were green.

Preference then is when, presented with two palatable choices, an animal will prefer one over the other. While young and actively

growing, medusahead may be palatable but it generally is not preferred. A number of characteristics also affect preference. Among these factors, preference can be learned from cow to calf. But preference also is affected by season and life stage of plants as well as plant condition in relation to climatic stresses.

Toxicity aside, most classes of livestock will eat anything under given circumstances, the main circumstance being if they are hungry enough. Waiting until an animal is hungry enough, **however, usually doesn't meet production** goals.

Particularly important is realizing that palatability varies depending on a plant **species' life stage. This is especially true for** both medusahead and even cheatgrass.



Research has shown preference can be learned from cow to calf, and cows that eat medusahead and cheatgrass can teach their calves to eat less palatable grasses.

Annual grasses such as cheatgrass and medusahead can provide a palatable and even nutritious source of feed for cattle during the early spring months before the seed hardens.

The “Green and Brown” grazing strategy focuses grazing on invasive species to stress their growth, giving desired perennials a chance to gain a competitive advantage.

Cheatgrass especially, is quite palatable before seed set. In early spring, cheatgrass is palatable and high in nutritional value before the seed hardens. Repeated intensive grazing (2-3 times) during early growth **can reduce that year’s**

seed crop, as well as standing biomass. Alternatively, late fall or winter grazing of cheatgrass-dominated areas can be achieved by complementing grazing with protein supplement for livestock. After the unpalatable seeds have all dropped, cheatgrass is a suitable source of energy, but low in protein.

Medusahead is less palatable and generally for a shorter time frame but for both species, palatability sharply declines upon seed set and



senescence. However, recognizing that animals find new shoots more palatable than older growth and they will return to a plant that was recently grazed, has significant implications **when setting up the “Green and Brown” grazing** strategy to negatively impact these species. Land managers should recognize that it is within their control to manipulate the behavior of the animals to cause them to concentrate grazing on the invasive species.

5) Stocking Rate: Pack 'em in to take out the annual grasses

Stocking rate is closely linked to carrying capacity, as the carrying capacity is the stocking rate at which animal performance can be achieved while maintaining the resource base – grass. Carrying capacity can be described as how much grass is available. Stocking rate is the feed demand. For land managers dealing with a heavy infestation or monoculture of invasive annual grasses, the goal may not be to maintain the integrity of the resource. Under the “Green and Brown” strategy, the goal is to negatively impact the invasive species as much as possible, while achieving a high stocking rate during active growth of the invasive annual grasses is required to create the level of grazing intensity needed to impact the annual grasses. At high

stocking rates, animals are unable to avoid grazing less desirable species. By concentrating animals or setting up intensively-grazed areas with high animal numbers (high intensity, short duration grazing) cheatgrass and medusahead can be dramatically suppressed.



High intensity, short duration grazing can have a dramatic impact on invasive annual grasses.

6) Class of Livestock: Use what you have available to graze

When implementing a “Green and Brown” grazing strategy, any class of livestock can be useful in managing invasive annual grass. However, recognizing the inherent differences among classes of livestock will be useful as the invasive annual grasses begin to decrease and more desirable vegetation emerges. Cattle are grazers which mean their foraging behavior consists of taking large bites for quantity rather than quality of forage. This pattern of foraging differs from sheep and goats that are considered browsers. As compared to goats or sheep for example, cattle have higher dry matter requirements, lower nutrient

requirements and larger rumen volume/body ratios. The pattern of foraging that is typical for cattle make them very useful for grazing invasive annual grasses; however sheep have shown to effectively graze medusahead.



Cattle generally graze for quantity while goats and sheep tend to “browse” for quality.

“Green and Brown” Grazing and How it Affects the 3 Causes of Succession

	Site Availability	Species Availability	Species Performance
Timing		Early removal of undesired species will decrease seed production Avoid late grazing until after seed production of desired species	Annuals grow early; initiate grazing early to stress invasives.
Intensity			High intensity grazing creates high stress on annuals. Short duration minimizes stress to desired perennials.
Frequency		Infrequent grazing will increase the seed supply of desired species.	Invasive species grazed again before recovering will be severely stressed.
Palatability and Preference			Grazing when invasives are most palatable will stress those species.
Stocking Rate	Closely herded animals will create herd effect and trampling to increase sites if reseeding desired species is part of the plan.	High stocking rates will assure animals don't skip over less palatable invasives to keep seed production down.	Even distribution will enhance uniform grazing that will keep desired species healthy
Class of livestock			Cattle find medusahead and cheatgrass more palatable in the tillering stage.

Linking Management Goals with the “Green and Brown” Grazing Strategy

Land management goals vary based on the specific conditions of the ranch or management focus or the agency in charge of the land. Land management goals are related to the desired uses of the land and the goods and services the land is capable of producing. However, there are generalized ecological goals that fit any land management unit with respect to invasive plants.

In situations where there are no annual grasses, but the likelihood of invasion in the near future is moderate or high, protecting the uninfested land is the key management goal.

In areas, where the land has scattered patches and occasional large areas of annual grasses, but at least 10 to 15% of the original pre-invasion desired vegetation still exists, the management goal is to control the annual grasses to allow the desired species to regain dominance again.

In areas where annual grasses dominate as a complete monoculture, and less than 10% desired species exists, the goal of management is to control annual grasses and re-establish desired vegetation.

In this section we offer how the “Green and Brown” grazing strategy can help land managers meet these management goals.



Scenario #1: Management Goal - Preventing Annual Grass Invasion Using “Green and Brown”

In this scenario where no invasive species are present; the entire emphasis of a “Green and Brown” strategy is to keep the desired perennials growing vigorously. The most effective method for using livestock to manage areas that are not infested is by grazing desired perennial species in a manner that allows them to fully recover the lost biomass by the time they are grazed the next year. Grazing when the perennials are brown, cattle will still receive adequate nutrition yet the grasses will not be overgrazed since they are not actively growing. In a landscape where preventing infestations of annual grasses is the objective, a grazing plan where the animals remove standing litter will keep the perennials’ growth robust. Standing

litter impedes vegetation growth within the plant and provides fuels for very hot and harmful fires. In a prevention program, all efforts should be made toward a grazing plan that keeps the perennials in good condition and with adequate energy stores throughout the year.

A. Timing of grazing:

Under the “Green and Brown” strategy, grazing when the perennials have matured or are brown does not greatly affect energy stores in the plant. However, this rule of thumb is dependent on available soil moisture as the plants will require ample moisture to re-grow

after grazing. If soil moisture is limiting during the growing season and the plants are severely grazed, the amount of leaf area and corresponding root mass present will not be sufficient for the plant to adequately restore energy supplies. Low energy reserves will weaken the plants’ ability to tolerate cold winter temperatures. Calendar-year timing to graze the



Timing grazing of desired perennial grasses so livestock remove standing litter from previous years’ growth will help perennials to grow more robust in the coming years and decreases the load of fine, dry fuel which will decrease frequency and intensity of wildfires.

perennials when they are brown usually begins occurring by mid-summer when soil moisture becomes limiting and after the grasses set seed. Plants can be grazed into the fall but if plants are closely cropped in the late fall, the buds lose the insulation from the winter cold.

B. Intensity of grazing:

To prevent infestations of annual grasses, the **“Green and Brown” strategy is designed to keep** desirable species healthy and producing seed. If livestock are deferred from grazing until the perennial growth reaches about 10 inches in height, this will help to insure vigor for adequate specie performance of perennial plants. Often seed set occurs by this growth stage and a seed bank is available of desired species in case a natural disturbance occurs out of a **manager’s control (i.e. fire)**. Less-intense grazing is generally called for in this management scenario. Taking 50% of the biomass in a uniform pattern by having animals distributed evenly is a desired goal. In this way perennials have enough leaf area remaining to re-grow, but enough older leaf mass will be removed to keep the growing points from being shaded out.

C. Frequency of grazing:

When the goal is to prevent infestations of invasive annual grasses, desirable plants are best grazed less frequently. The focus in this management situation is really about the time between grazing or the recovery period. If **plants are grazed under the “Green and Brown”** grazing strategy, plants will have adequate recovery periods between grazing and they benefit by completing their life cycle. Adequate seed production will keep a desirable seed bank in place and continue regeneration of these species. When available sites are filled with vigorous desired species, the probability of **invasive species’ seeds being able to find a home to germinate and reproduce** is greatly reduced.



A grazing plan that combines strategic timing, intensity, and frequency of grazing can help a manager toward fulfilling a number of goals especially when preventing an area from the infestation of invasive annual grasses and other undesired species.

Scenario #2: Management Goal - Managing for Annual Grass Control Using “Green and Brown”

This management scenario will likely be the most time-intensive of the three scenarios as well as requiring the greatest flexibility when presented with different climatic conditions. Generally these are areas with annual grass infestations but desired species are still present. In using a “Green and Brown” grazing strategy, grazing treatments must shift as much competitive advantage to the desired perennial species as possible. This is best accomplished by intensively grazing invasives when they are green and removing the livestock when green-up occurs of the desired perennials.

It is valuable to know about the life history of the competing species – annuals vs. perennials

– under this management situation. In areas where annual grasses are to be controlled, livestock must be allowed to graze during the brief periods where the annual grasses are growing while the associated desired species remain dormant.

A. Timing of grazing:

Early grazing is recommended in this management scenario. This would be as soon as the invasive species are showing grazable growth; when green, the annuals have adequate protein requirements. At this time, **the perennials will still be dormant and won't as** likely be selected by cattle. This usually occurs



sometime in the fall, around November, and again in the spring after snow melts to as late as April in some cases, but is highly dependent on climatic conditions. Plants must be grazed as heavily as possible without creating significant soil disturbances for at least three consecutive years and probably indefinitely. Grazing can occur again later in the summer after desired species have completed growth for the year. Under a

The focus for grazing management in an area with annual grasses invading with desired species still present would be to graze intensively when annual grasses are green and remove animals while perennials are in periods of growth and development.

fall grazing, the dried annual grasses and desired plants provide adequate energy requirements but are low in protein. Grazing during this time may require protein supplementation particularly for pregnant cows.

B. Intensity of grazing:

In situations where a manager has a mix of desired species growing well but an infestation of invasive annual grasses competing for resources, high intensity grazing will be necessary for at least two reasons. The first is because the annuals are growing quickly and the second is the window for grazing is short. If the annual grasses are going to be significantly impacted, intensive grazing will be required. While the desired grasses are actively growing, **under the “Green and Brown” strategy, grazing** would be deferred; once they are dormant, grazing intensity would be moderate where the animals are not removing excessive amounts of biomass (50%) from the desired species.

C. Frequency of grazing:

Where invasive annual grasses are present, as long as the perennial species are dormant, managers want to plan for continuous, high-intensity grazing for the narrow window when the invasives are green and growing but the desired species are still dormant. This is where flexibility in managing livestock becomes so **critical. Depending on the season’s growing** condition, a manager may need to add livestock to get an area grazed adequately in a short time frame to effectively impact the invasive grasses. Once the desired species begin greening up, grazing would be curtailed until these species go dormant late into the summer. There is no prescription for the frequency of grazing except conscientious monitoring and the ability to adapt to changing conditions.



The ability to adapt from year to year is essential because timing for intense grazing of invasive annual grasses can only be stated generally in terms of season or month; variations include temperature, precipitation, and climate changes from one year to the next.

Scenario #3: Management Goal - Landscape Restoration Using “Green and Brown”

In restoration programs, the “Green and Brown” grazing strategy can be used to reduce the amount of annual grasses by repeated grazing, both in the fall and early spring. Grazing invasive annual grass monocultures does not have to be limited to the time when desired species are dormant because they are not present in the system. This will require at least three years of intense grazing of invasive grasses, during which time the seed bank should be depleted enough to minimize annual grass competition to newly reseeded plants once revegetation occurs. After the area is seeded, grazing management should follow the procedures described previously for controlling invasive grasses.

A. Timing of grazing:

When the goal is to restore land to desirable species, it is crucial to reduce the seedbank of the undesirable species. Since no desirable species are available in this management scenario, the timing of grazing and subsequent recovery periods is not a critical component of the “Green and Brown” strategy initially. The strategy here is to reduce seed production as much as possible, beginning when early spring growth is occurring as soon as livestock can start grazing and having the animals return frequently as growth accelerates. Keeping up with the fast growth when water and temperatures are favorable is one of the



biggest obstacles when annual grasses are growing in monoculture. If the animals need to be held in these areas with supplemental feed into the non-growing season, it will not negatively affect the landscape. **Livestock won't preferentially** graze mature and less-palatable annual grasses that have set seed and this will create a situation where the animals trail through these areas and they collect seeds to disperse to other areas and grazing intensity becomes a key.

In situations where annual grasses have created a monoculture, it can take at least three years of grazing to deplete the seedbank enough to the point that the annuals lose their competitive edge and desired perennials can be established.

B. Intensity of grazing:

With a “Green and Brown” grazing strategy for restoration, it will be critical to graze areas at high intensity during the rapid period of growth of annual grasses. This can present a challenge to livestock producers. Combining herds is often the only way to graze large tracts of rangeland and stocker herds are usually the most flexible when setting out to graze with high intensity.

High intensity grazing will assuredly be the most efficient way to evenly graze as many plants as possible, thereby preventing seed production of as many plants as possible. Remember, in this management scenario livestock are being used as a tool in the restoration plan not as the most desirable situation for livestock to increase gain.

C. Frequency of grazing:

Annual grasses use their energy to grow quickly and produce high amounts of seed. When considering this aspect of the life history, grazing should be as frequent as possible.

Under the “Green and Brown” grazing strategy, if the annual grasses are actively growing in the spring, managers will want to return to livestock to grazing before the plants have recovered sufficiently to begin putting up seed heads. As the season progresses, an annual grass will not even grow leaf blades and any remaining shoots will try to develop seed heads. Keep in mind that seed production will probably not be completely eliminated. As the annual species are increasingly stressed either from grazing or reduced precipitation they transfer any energy into reproductive plant parts and produce seeds. Seed production will be greatly reduced and this is your primary goal.

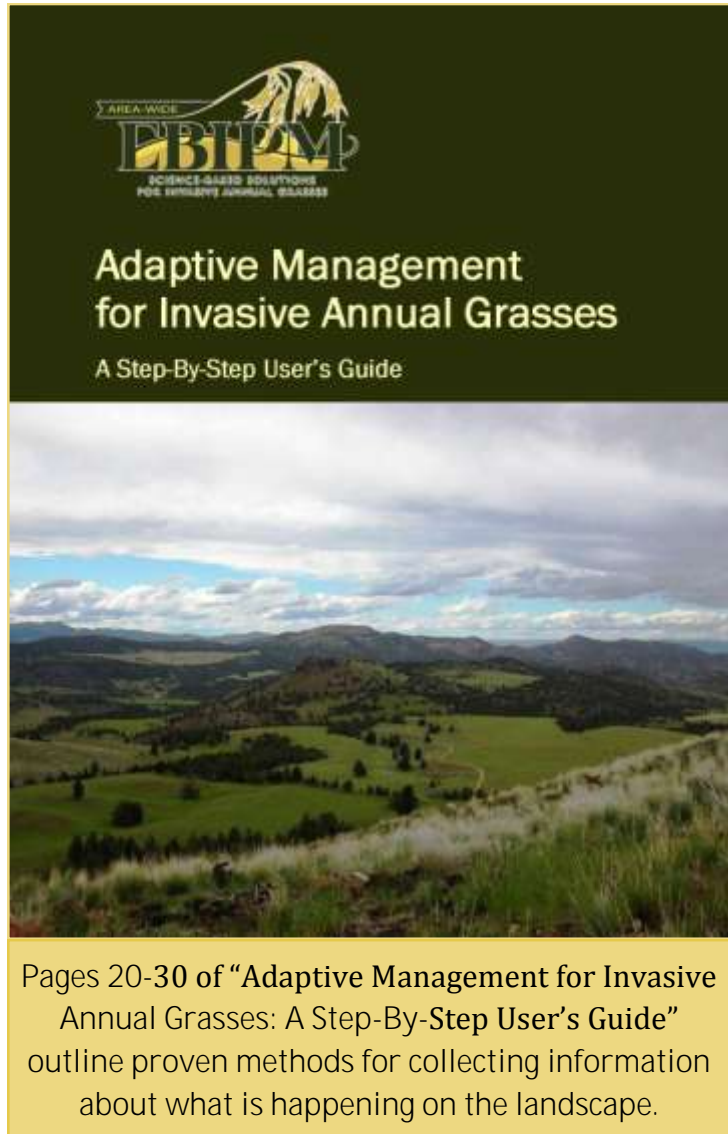


Implementing the “Green and Brown” strategy will not likely eliminate seed production of the invasive annual grasses, but with careful timing, intensity, and frequency of grazing, the annuals’ seed production can be reduced enough to give desired species a competitive edge.

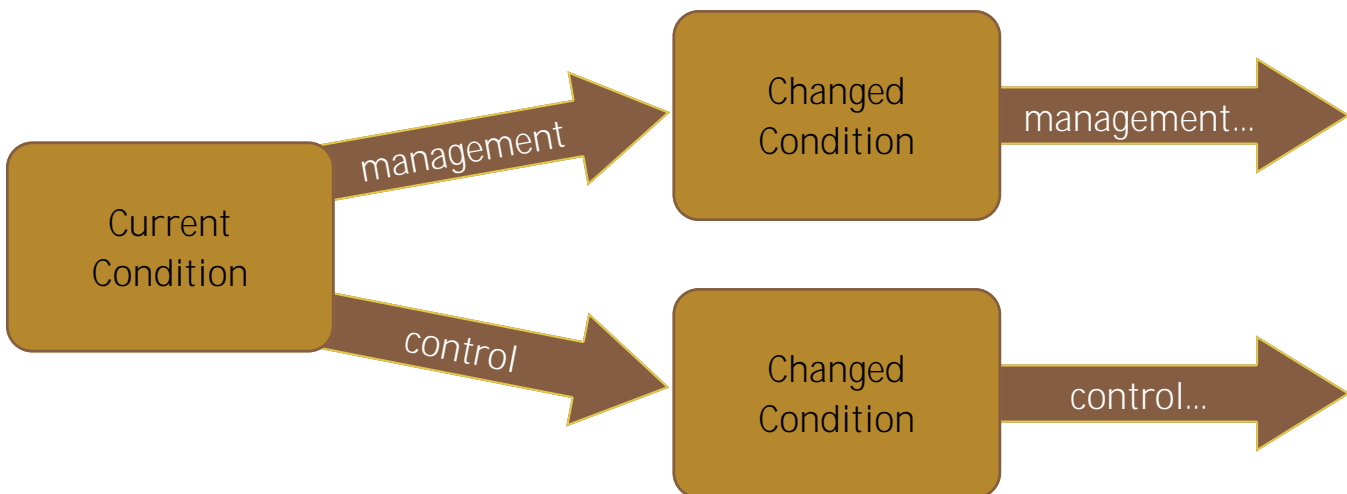
Setting up a “Green and Brown” Grazing Plan

Most managers realize how critical it is to have a good plan in place. Since managers have no control over the amount or occurrence of precipitation, it is important to be conservative in planning. Developing a method where information can be collected about what is happening on the landscape will be an important step in setting up an effective ‘Green and Brown’ grazing strategy. We suggest using a monitoring system for data collection outlined in the adaptive management guide available at www.ebipm.org.

If you already have a monitoring system in place, just setting up a control (this can be as simple as setting up small non-grazed enclosures) and replicating the data collection, is one of the best ways to determine if the management plan and treatments are the reason for the good condition of the rangeland or if changes are just occurring by coincidence.



Pages 20-30 of “Adaptive Management for Invasive Annual Grasses: A Step-By-Step User’s Guide” outline proven methods for collecting information about what is happening on the landscape.



Fencing and Water Movement with a “Green and Brown” Grazing Strategy

Regardless of the goal a manager has set for the land, a “Green and Brown” grazing strategy for annual grass management will require a more intensive management style. Intensive management calls for managers paying close attention to sometimes subtle changes in vegetation characteristics in response to grazing. One way to record these changes is to establish utilization cages for comparison between grazed and un-grazed areas. The ability to be ready to move livestock in just a few days’ time is important in this strategy. In addition, intensive management may require large numbers of animals concentrated in a sub-portion of the management unit for a short

time. Animal distribution can be altered by moving water points, feed or mineral supplements and salt blocks have been shown to change distribution of cattle as well.

The bottom line is that to see success using animals for invasive grass management takes commitment and dedication to grazing. By making it your objective to control invasive annual grass infestations, it can be economical and satisfying to see a grazing plan implemented. In our appendix we have provided resources for detailed ideas about fencing requirements and water development that might fit your needs on open rangeland.



Large management units and scattered watering points on western rangelands make it challenging to manage livestock for annual grass management. Rancher’s ingenuity and careful planning are all part of the process. For more ideas see our “resources section.”

Additional Grazing Resources

Cattle Producer's Library : Grass Growth and Development Considerations for Grazing Management - Marni L. Porath and Thomas E. Bedell
<http://www.coopext.colostate.edu/lasanimas/agdocuments/grassgrowth.pdf>



The Stockman Grass Farmer "is the grazing publication of North America. Since 1947 it has been devoted solely to the art and science of making a profit from grassland agriculture."
<http://www.stockmgrassfarmer.net/>
 Toll Free: (800) 748-9808
 Email: sgf@stockmgrassfarmer.com



Targeted Grazing <http://www.cnr.uidaho.edu/rx-grazing/index.htm>



Grass the Stockman's Crop -

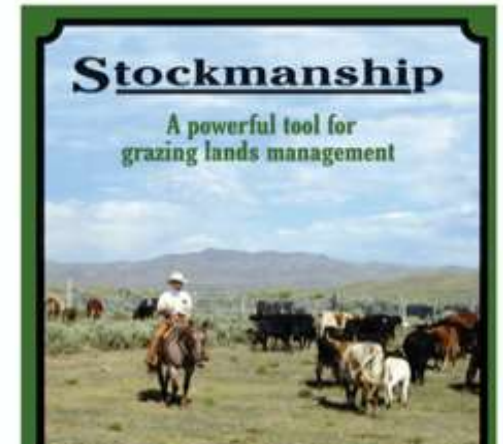
Harland Dietz

<http://www.sunshine-unlimited.com/brochure/>



Stockmanship

http://www.blm.gov/or/programs/nrst/files/Stockmanship_Book.pdf



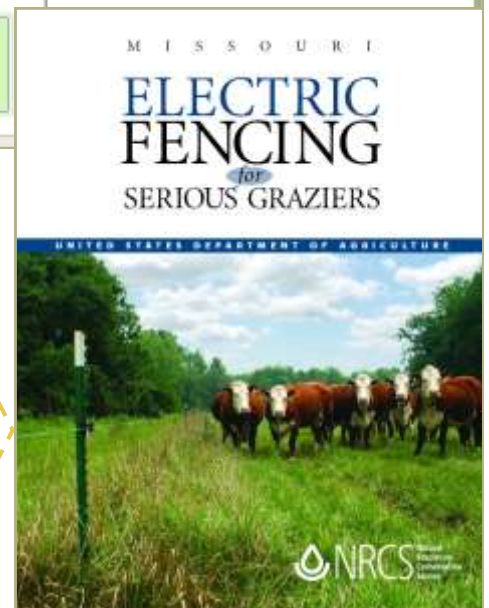
Livestock for Landscapes

<http://www.livestockforlandscapes.com/>



Electric Fencing for Serious Graziers - NRCS Publication

http://www.mo.nrcs.usda.gov/news/pubs_download/out/MO%20NRCS%20Electric%20Fencing_low.pdf



Phenology Worksheet Instructions

Use this phenology worksheet to monitor the growth stage of plants to determine optimal grazing periods to stress invasive and undesired species while allowing desired perennial grasses to grow undisturbed.

Plant growth can be monitored based on the life stages listed below. For best results, track plant growth at least twice per month. Simply find the grass plants and record the growth stage in the provided box with the corresponding number between 1-6 (use the growth stage guides below). After recording the life stage for 3-4 plants, find the average and record that in the box provided (see example below). Monitoring more than one plant and taking an average will provide better accuracy on the life stage of the plant community.

<u>Growth Stage Guides</u>		
<u>Perennial Grasses</u>	<u>Perennial Shrubs & Forbs</u>	<u>Annual Grasses</u>
1. Dormant	1. Dormant	1. Germination
2. Growth initiation	2. Leaf initiation	2. Growth initiation
3. Leaf growth	3. Reproductive shoots	3. Leaf growth
4. Boot stage & seed head emergence	4. Flowering	4. Boot stage & seed head emergence
5. Flowering & seed development	5. Seed formation & hardening	5. Flowering & seed development
6. Seed hardening & scatter & senescence	6. Seed scatter & senescence	6. Seed hardening & scatter & senescence

Sample:

Species: bluebunch wheatgrass

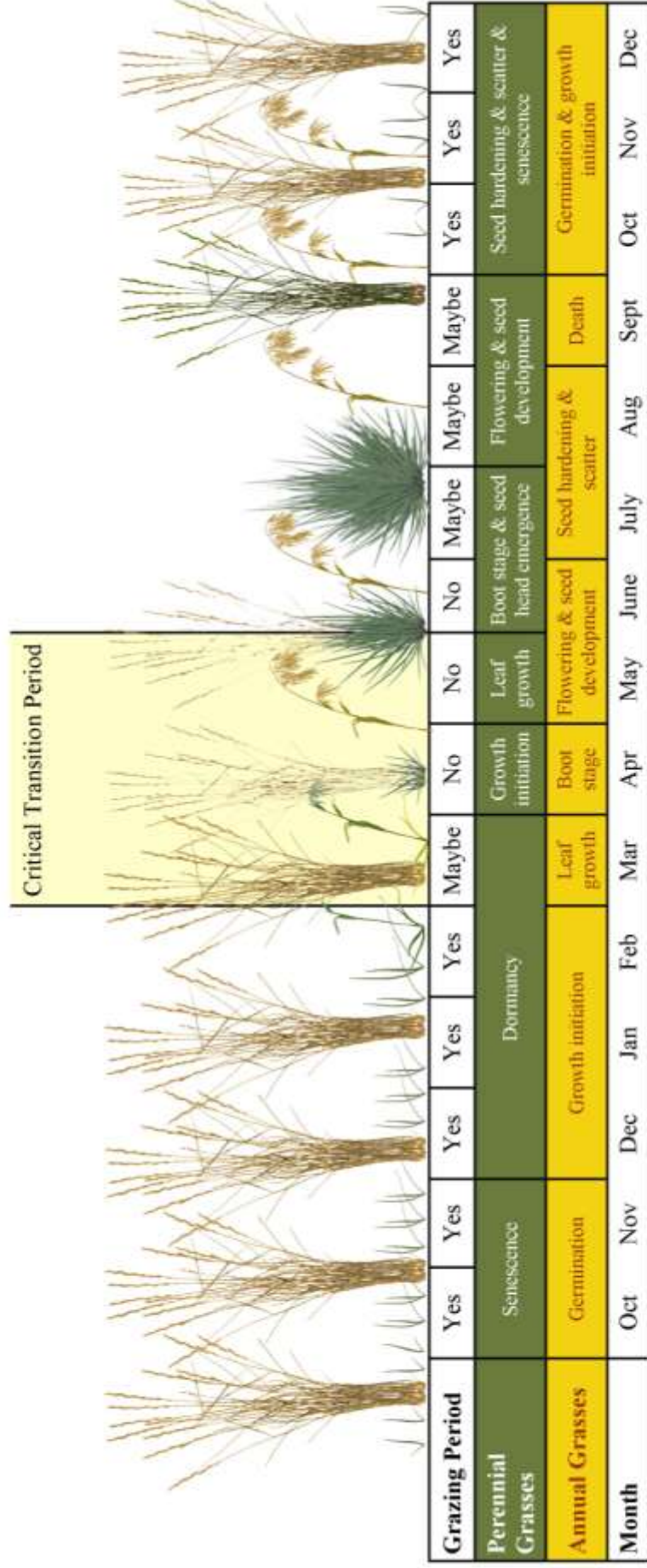
	February		March		April		May		June		July	
Date:	12	27	9	25	14	30	11	28	10	28	7	25
1	1	1	1	1	1	2	2	2	3	3	4	4
2	1	1	1	1	2	2	3	3	3	3	4	4
3	1	1	1	1	2	2	2	2	3	3	3	4
4	1	1	1	1	1	2	2	3	3	3	4	4
Avg.	1	1	1	1	1.5	2	2	2.5	3	3	4	4

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“GREEN AND BROWN”

GRAZING STRATEGY FOR INVASIVE ANNUAL GRASSES



Use this chart to help you manage invasive annual grasses such as medusahead and cheatgrass. In the table above, grazing periods are imposed based on the actual plant growth stage for both desired perennial grasses and annual grasses. The calendar months are only to be used as a general reference, always graze by plant growth stage paying close attention to early green-up of perennials. This also illustrates the critical transition period for removing livestock.