

The Kansas Flint Hills has long been a transient stocker cattle grazing destination known for high-quality forage and gains on yearling cattle. Historically, the area has been a reliable source of summer grazing; there have been few years when livestock had to be removed from pasture due to lack of forage.

Traditionally, stocker cattle were placed in the pastures at spring greenup and removed in early fall when weight gains had declined to less than 1 pound per head per day. Stockers that remained past late September or early October began to lose weight.

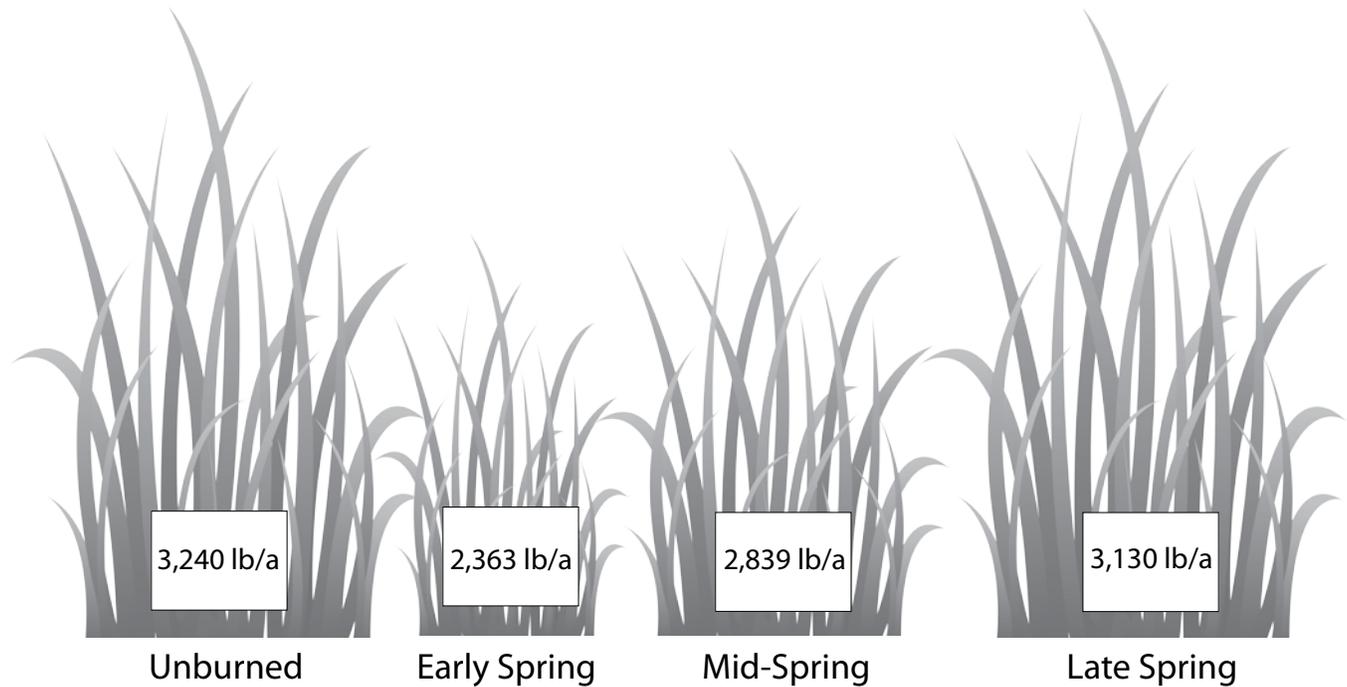
Stocking rates for cattle weighing 500 to 550 pounds average 4 acres per animal from mid- to late April until late September or early October. Adjustments for different weight animals and grassland productivities are made to ensure sufficient per-animal gains to produce optimal

profitability. Each stocker must gain enough to pay both per-animal and per-acre costs. Higher stocking rates produce a greater gain per acre; however, these higher rates reduce net profits and cause a steady decline in grassland productivity, further reducing profitability.

### Range Burning

Early in the grazing history of the Flint Hills, producers learned that stockers gained more weight when grazing on pastures that had been burned than when grazing on unburned pastures.

Research at Kansas State University in the early 20th century (1919 to 1921) compared the effects of burned versus unburned rangeland on forage production, plant composition, and soil temperature. Later studies focused on when to burn to get the best forage production (Figure 1) and best maintain the plant composition.



**Figure 1.** Effect of time of burning on herbage yield (pounds per acre) of summer-grazed, Flint Hills bluestem rangeland: Early spring – 6 weeks before growth of warm-season grasses; Mid-spring – 3 weeks before growth of warm-season grasses; Late spring – beginning of growth of warm-season grasses.



*Stocker grazing studies take place at the Rannells Flint Hills Prairie Preserve.*

Grazing trials also determined the optimal time to burn for best livestock gains. The results of those studies showed burning bluestem range at the beginning of growth of the native, warm-season, tallgrass species gave the best herbage production, maintained a grass-dominated stand, prevented or reduced woody species invasion, and resulted in the highest livestock gains.

The increased stocker gains only occurred the season the pasture was burned and did not carry-over to the subsequent years if the pasture was not burned each season.

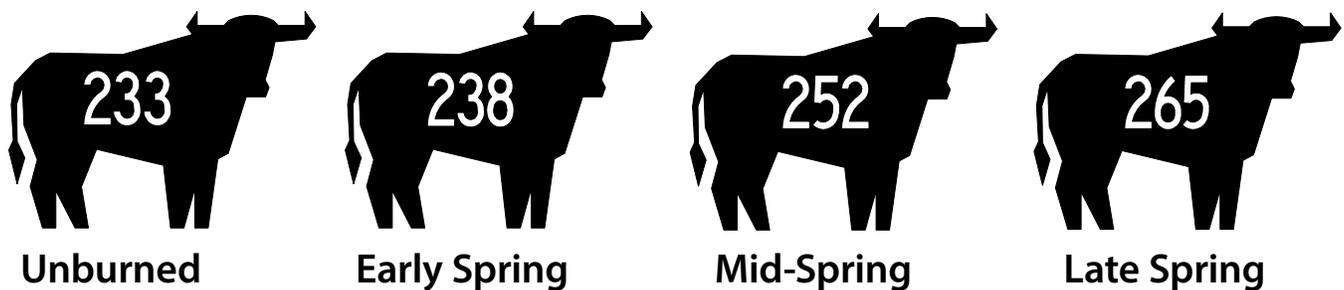
Stockers on late-spring burned bluestem range gained 32 pounds more per animal (Figure 2) on burned range than on unburned (50-year average). Fortunately, results showed the increased gain from burning in the first half of the growing season, which makes this practice compatible with grazing systems with only early-season use. When grazing stockers in the Kansas

Flint Hills, the pasture should be burned annually at the beginning of growth of the dominant warm-season perennial grasses.

### Grazing Systems

A grazing system for stocker cattle on Kansas Flint Hills range should produce the most economically efficient conversion of the forage to a saleable product on a sustained basis with maintenance of the grassland system. A grazing system is a management practice that controls the placement of animals over time and location. Strategies include varying grazing season, species and proportion of animals, grazing distribution, and frequency of use. Too often, the term “grazing system” has implied rotation of animals from pasture to pasture within the growing season. In the Flint Hills, the most economically efficient, sustainable grazing system is continuous grazing.

In a continuous grazing system, stockers remain on the same pasture for the entire grazing period. The length of time varies depending on the grazing scheme chosen. Grazing animals for the entire growing season from the beginning of growth following burning is known as season-long stocking (SLS). Season-long stocking was the primary grazing system for stockers in the Flint Hills until the mid-1970s. K-State researchers developed a grazing system to take advantage of the early-summer, high-quality forage by stocking at twice the normal season-long stocking rate for the first half of the growing season with no grazing during the last half. This grazing system is called intensive early stocking (IES).



**Figure 2.** *Effect of time of burning on steer gain (pounds per steer) from May 1 to October 1 on summer-grazed Flint Hills bluestem rangeland: Early spring – 6 weeks before growth of warm-season grasses. Mid-Spring – 3 weeks before growth of warm-season grasses. Late Spring – Beginning of growth of warm-season grasses.*

As the grazing season progresses, ungrazed plants mature and forage quality declines reducing livestock gains. Grazing animals compensate by grazing on regrowth of previously grazed plants. Grazing systems that move animals from one grazed area to an area not previously grazed during the same season result in lower stocker gains, since animals will be grazing mature, low-quality forage. Gains may be reduced as much as 30 to 40 pounds per animal.

Systems that move cattle from one area to another appear to increase herbage growth and tempt the producer to increase the stocking rate. In reality, there is no increased herbage growth from those systems. Less herbage is eaten due to the lower quality of the more mature forage. Due to the reduced intake, there is more herbage remaining at the end of the growing season. A decline in forage quality reduces intake because it takes more time in the rumen for microbes to break down the herbage. The rate that herbage passes through the animal determines the rate that forage can be ingested. To maintain animal performance, grazing systems that have relatively long periods of nongrazing, followed by grazing within the growing season should not be used for stockers in the Kansas Flint Hills or on any other range areas.

*Intensive early stocking.* Research on season-long stocking at K-State has shown that stockers gain the same during the first half of the grazing season on pastures stocked at light, moderate and heavy rates. That same season-long stocking research showed that two-thirds of the stocker gain occurred in the first half of the growing

**Table 1.** Gains (pounds) per steer and per acre on burned Flint Hills range for season-long stocking (4 acres per steer from late April until October 1) and intensive early stocking (2 acres per steer from late April until mid July). Steers were about 550 pounds per steer at initial stocking.

	SLS	IES
<b>Gain/Steer</b>	282	193
<b>Gain/Acre</b>	70	96
<b>Gain (lb/day)</b>	1.9	2.6

<b>IES</b>	intensive early stocking
<b>IES-B</b>	intensive early stocking, burned pasture
<b>IES-R</b>	intensive early stocking rotation
<b>LSG</b>	late-season grazing
<b>SLS</b>	season-long stocking
<b>SLS-B</b>	season-long stocking, burned pasture
<b>SLS-R</b>	season-long stocking rotation
<b>SLS-UB</b>	season-long stocking unburned pasture

season. Therefore, doubling the normal stocking rate during the first half of the growing season increases gain per acre without reducing individual animal gain (Table 1). When not grazed during the latter half of the season, sufficient leaf growth occurs to store adequate food reserves to promote vigorous growth the following season. Big bluestem and Indiangrass, co-dominants, increase in composition compared to season-long stocking under intensive early stocking. An added benefit of intensive early stocking is the continuous fuel source for burning. That results in almost the entire pasture being burned. With season-long stocking, there are many areas that do not have sufficient fuel to burn due to patchy grazing.

After intensive early stocking, stockers are usually placed directly in the feedlot in mid-July. There is a 15 percent increase in feed efficiency for these animals compared to those entering the feedlot in October following season-long stocking. It takes about 1 pound less feed per pound of gain



*Prescribed burning in the late spring optimizes stocker gains.*



*Research shows that prescribed burning is an important tool for preserving Tallgrass Prairie.*

for animals placed in the feedlot in July compared to those placed in October. That is largely attributable to cold weather at the end of the feeding period for stockers placed in the feedlot in October.

*Intensive early stocking + late-season grazing rotation (IES+LSG).* Early in the grazing season, forage quality is high and animals gain well regardless of where they graze. Late-season individual animal gain centers on the quality of the forage they consume. During the early season, cattle create grazed patches, which they return to throughout the season because forage quality is greater there due to regrowth of previously grazed plants.

As a plant matures, it increases in less digestible fiber components and nutrient concentrations decline in part due to mobilization of chemical constituents and storage of those constituents in storage organs (stem bases and rhizomes primarily), which are necessary for regrowth after

defoliation or frost. On those patches created by stockers in the early season, regrowth produces new young leaves that have higher nutritional quality than ungrazed plants. Therefore, the proportion of the animal's diet derived from regrowth in the latter half of the growing season will influence their late-season gain.

<b>IES</b>	intensive early stocking
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<b>LSG</b>	late-season grazing
<b>SLS</b>	season-long stocking
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<b>SLS-R</b>	season-long stocking rotation
<b>SLS-UB</b>	season-long stocking unburned pasture

To test that concept, a 3-year rotation of season-long stocking (SLS), IES, and IES with late season grazing (IES+LSG) (Figure 3) was tested. Under IES+LSG, stockers are grazed at twice the SLS rate during the first half of the growing season and half those animals are removed with the other half remaining on the pasture until early October. To sustain herbage productivity of the pastures that were stocked IES+LSG, researchers tested a 3-year rotation of SLS, IES, and IES+LSG (Figure 3) so that the reduction in plant vigor under the high stocking rate of the IES+LSG treatment could be mitigated by 2 years of stocking at the normal grazing rates for SLS and IES.

On Kansas Flint Hills range, research shows that preconditioning forage on an area by grazing at a high stocking density (two times the normal

season-long rate) in the early season followed by a lower stocking density (normal season-long rate) in late season (IES+LSG-Oct.) resulted in an increased season-long individual steer gain even though the stocking rate for the season was greater than the traditional rate (SLS) (Table 2). Earlier research showed that exceeding the moderate rate of about 4 acres per steer reduces season-long gains. Increased regrowth availability in the late season resulted in a 10- to 12-pound greater individual animal gain for animals that grazed the entire grazing season even though stocking rate was higher than the optimal rate. Gains for steers removed in mid-July showed gains similar to those achieved for traditional IES. Data suggest that bluestem range could recover herbage productive capacity by grazing at the normal SLS rate for a season following the IES+LSG treatment.

**Figure 3.** Grazing scheme for two cycles of a 3-year rotation which includes season-long stocking (SLS), intensive early stocking + late-season grazing, and intensive early stocking (IES) applied sequentially.

Year	Pasture 1	Pasture 2	Pasture 3
1	IES+LSG	IES	SLS
2	IES	SLS	IES+LSG
3	SLS	IES+LSG	IES
4	IES+LSG	IES	SLS
5	IES	SLS	IES+LSG
6	SLS	IES+LSG	IES

**Table 2.** Steer gains for a 3-year rotation of season-long stocking (SLS), intensive early stocking, and intensive early stocking plus late-season grazing (IES+LSG). For SLS, steers (~550 lbs.) were stocked at 4 acres per steer from late April until October 1. For IES, steers (~550 lbs.) were stocked at 2 acres per steer from late April until mid July. For IES+LSG, steers (~550 lbs.) were stocked at 2 acres per steer from late April until mid July and half the steers were removed and the remaining steers grazed at 4 acres per steer until October 1. SLS-R and IES-R are the rotation systems. (9-year average).

	SLS	SLS-R	IES	IES-R	IES+LSG- JULY	IES+LSG- OCT.	SYSTEM
<b>Gain/Steer</b>	282	284	188	193	201	293	
<b>Gain/Acre</b>	70	71	94	96	50	73	110

A subsequent 10-year study confirmed that a 2-year rotation of IES+LSG followed by SLS (Figure 4) maintained both animal and forage production (Table 3). Concurrently, a 2-year rotation of IES+LSG and IES (Figure 5), which also maintained both animal and forage production (Table 4), was also tested.

### Economics of Different Grazing Strategies

**Burning.** There is substantial opportunity to increase profitability when grazing stocker cattle in the Kansas Flint Hills. Properly timed burning is at the base of improving net profit. The cost of burning Flint Hills range is relatively low compared to the increased economic returns. Long-term research shows an increased gain of 32 pounds per steer. That translates into an increased net return of approximately \$9.30 per acre each year during the last decade (Table 5). In addition, late-spring burning reduces or prevents invasion of undesirable woody shrubs and trees, improves grazing distribution, and favors the warm-season perennial dominant tallgrasses. Annual, late-spring burning should be a part of any grazing system for stockers in the Kansas Flint Hills.

<b>IES</b>	intensive early stocking
<b>IES-B</b>	intensive early stocking, burned pasture
<b>IES-R</b>	intensive early stocking rotation
<b>LSG</b>	late-season grazing
<b>SLS</b>	season-long stocking
<b>SLS-B</b>	season-long stocking, burned pasture
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**Grazing System.** Grazing stockers using IES further increases net profit. However, for highest net return, the 2-year rotation of IES and IES+LSG should be used. The use of the 3-year rotation using SLS and IES following IES+LSG is not recommended since both animal and plant productivity are maintained under the 2-year rotations. Risk analysis indicates that the rotations that use IES+LSG reduce risk. Marketing at two different times and the increased net return from a higher stocking rate under IES+LSG buffers market fluctuations.

**Figure 4.** Grazing scheme for a 2-year rotation which includes season-long stocking (SLS) and intensive early stocking + late-season grazing applied sequentially.

Year	Pasture 1	Pasture 2
1	SLS	IES+LSG
2	IES+LSG	SLS
3	SLS	IES+LSG
4	IES+LSG	SLS

**Table 3.** Steer gains for a 2-year rotation of season-long stocking (SLS) and intensive early stocking and late-season grazing (IES+LSG). For SLS, steers (~550 lbs.) were stocked at 4 acres per steer from late April until October 1. For IES+LSG, steers (~550 lbs.) were stocked at 2 acres per steer from late April until mid July and half the steers were removed and the remaining steers grazed at 4 acres per steer until October 1 (10-year average).

	SLS	IES+LSG-JULY	IES+LSG-OCT	SYSTEM
Gain/Steer	267	190	282	
Gain/Acre	85	95	73	118

**Figure 5.** Grazing scheme for a 2-year rotation that includes intensive early stocking (IES) and intensive early stocking + late-season grazing (IES+LSG) applied sequentially.

Year	Pasture 1	Pasture 2
1	IES	IES+LSG
2	IES+LSG	IES
3	IES	IES+LSG
4	IES+LSG	SLS

**Table 4.** Steer gains for a 2-year rotation of intensive early stocking (IES) and intensive early stocking + late-season grazing (IES+LSG). For IES, steers (~550 pounds) were stocked at 2 acres per steer from late April until mid July. For IES+LSG, steers (~550 pounds) were stocked at 2 acres per steer from late April until mid July and half the steers were removed and the remaining steers grazed at 4 acres per steer until October 1. (8-year average).

	SLS	IES	IES+LSG-JULY	IES+LSG-OCT	SYSTEM
Gain/Steer	306	192	201	318	
Gain/Acre	77	96	102	80	101

**Table 5.** Average net returns for different grazing strategies in the Kansas Flint Hills using market values from 2003 through 2013. UB=unburned; B=burned; SLS=season-long stocking; IES=intensive early stocking; IES+LSG=intensive early stocking + late-season grazing. For SLS, steers (~550 lbs.) were stocked at 4 acres per steer from late April until October 1. For IES, steers (~550 lbs.) were stocked at 2 acres per steer from late April until mid July. For IES+LSG, steers (~550 lbs.) were stocked at 2 acres per steer from late April until mid July and half the steers were removed and the remaining steers grazed at 4 acres per steer until October 1. (10-year average).

	SLS-UB	SLS-B	IES-B	IES+LSG/ SLS	IES+LSG/IES
Net Return \$/Acre	\$33.98	\$43.28	\$47.70	\$59.52	\$64.77



Steers grazing on the Rannells Flint Hills Prairie Preserve.

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