Economic Impact of the Missouri Grazing Schools

November 2018

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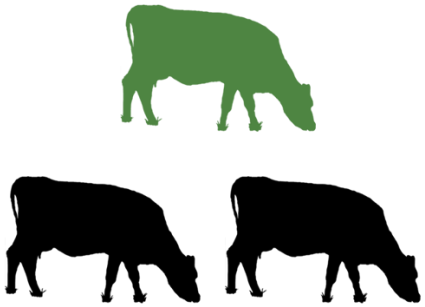
Missouri's Grazing Schools

18,300 participants attended Missouri Grazing Schools since 1990



About **1 in 3** Missouri beef farms practice rotational grazing

Annual Economic Impact of Management Intensive Grazing

Economic output added to Missouri's economy

Total **jobs** supported in Missouri

Additional **net returns** per acre for producers

Missouri's 7.1 million acres of permanent pasture provide feed for the state's 1.9 million cows. Pasture yield and quality, in turn, drive the productivity of Missouri's beef industry. Over the past 30 years, public agencies in Missouri have devoted extensive effort toward educating and incentivizing more than 18,300 producers to adopt improved grazing management practices. This report details those historical grazing educational efforts, and estimates those efforts raise the economic output of Missouri's beef industry by more than $125 million every year.

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Economic Impact of the Missouri Grazing Schools

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Management-intensive grazing (MiG) is "a goal-driven approach to grassland management and utilization" (Gerrish, 2004). MiG is defined in the literature as a "flexible approach to rotational grazing management whereby animal nutrient demand through the grazing season is balanced with forage supply, and available forage is allocated based on animal requirements" (Martz, et al., 1999). This systems approach to grazing management also includes optimization of forage yield, quality and persistence; protection and enhancement of the natural resource base; and integration of knowledge and technology to develop a viable livestock operation (Gerrish and Roberts, 1999).

Assisting Missouri cattle producers to learn better grazing techniques has a rich history in the state. In the early 1980's, pioneering grazing research conducted at the University of Missouri (MU) Forage Systems Research Center in Linneus, Missouri attracted nationwide attention. In 1990, MU joined with the USDA Natural Resource Conservation Service (NRCS) to create a three-day school at this research center. In 1992, the Missouri Soil and Water Districts Commission approved a pilot cost-share program to encourage MiG in three Missouri counties. This Missouri Department of Natural Resources Soil and Water Conservation Program (DNR SWCP) pilot program was so successful it went statewide in 1996. Attendance at a grazing school was required to be eligible for cost-share for grazing system practices.

Regional grazing schools were established in Missouri in 1995 and since then have been taught by MU Extension and NRCS. Over time, the schools have attracted more partners, such as the Missouri Department of Conservation (MDC), Missouri Forage and Grassland Council (MFGC) and Missouri Department of Agriculture. These partners have contributed research, cost share incentives and educational outreach to promote the adoption of MiG in Missouri.

The number of locations has grown over time. By 2018, grazing schools were being offered in 33 locations across Missouri. The impact of the grazing schools reaches beyond Missouri, as several other states have established grazing schools based on the MU Forage Systems Research Center program.

Outreach and teaching efforts over time have focused on two to three day grazing schools. Since 1990, 18,300 participants have attended the Missouri Grazing Schools, hosted at either Linneus or other regions throughout the state of Missouri. These schools typically have presentations covering soils, plant growth and development, livestock nutrition, animal behavior, grazing economics, water availability, fencing and design and layout for MiG. Much of the educational curriculum originates from the *Missouri Grazing Manual*, which was published in 1999 by MU Extension and developed by university and state/federal agency partners (Gerrish and Roberts, 1999).

Financial Assistance and Adoption Rates

State and federal governments have invested in financial and technical assistance programs to support the adoption of improved grazing management practices in Missouri.

Missouri DNR SWCP provides cost-share programs for soil and water conservation practices related to grazing management, which are funded from a portion of the parks, soils and water sales tax. These programs provides financial incentives to landowners for up to 75 percent of the estimated cost of implementing a practice. The SWCDs provide technical support with the design, implementation and maintenance of practices. Exhibit 1 details these Missouri DNR SWCP cost-share practices related to grazing management. Practices (DSP) must conform to related NRCS standards and specifications and attendance of the operator at a grazing school is required to participate.

Exhibit 1. Missouri DNR SWCP Cost-Share Practices Related to Grazing Management

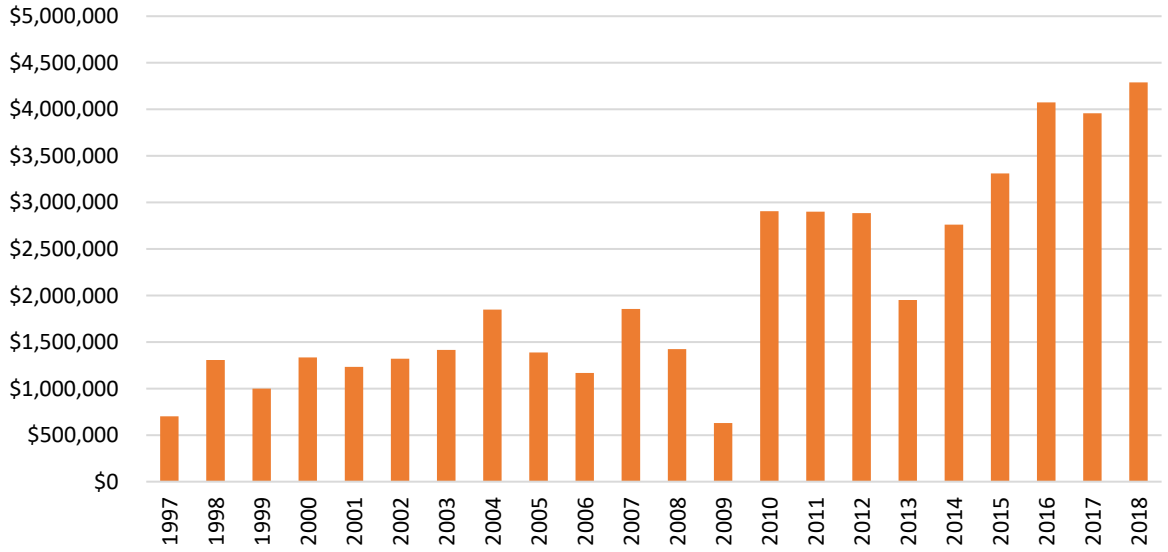
Practice Code	Conservation Practice	Description
DSP 03	Planned Grazing Systems Practice	Demonstrate the best use of soil and water through the use of rotational grazing
DSP 33	Planned Grazing Systems Practice with a Pond	Demonstrate the best use of soil and water through the use of rotational grazing that includes a pond as the water source
DSP 333	Planned Grazing Systems Practice with a Well	Demonstrate the best use of soil and water through the use of rotational grazing that includes a well as the water source
MDSP 02	Modified Permanent Vegetative Cover Enhancement	Improve the vegetative cover on pastures by introducing legumes into the grass base using no-till technology for up to 160 acres
DSP 0.2	Permanent Vegetative Cover Enhancement	Improve the vegetative cover on pastures by introducing legumes into the grass base using no-till technology.
DSP 3.1	Grazing System Water Development	Develop water sources (ponds, springs or wells) for livestock watering.
DSP 3.2	Grazing System Water Distribution	Develop water distribution, including pipeline and watering tanks, for grazing areas.
DSP 3.3	Grazing System Fence	A planned rotational grazing system allows time for vegetation to rest and recover before being grazed again. Fencing is used to allow livestock access to a small area to be grazed.
DSP 3.4	Grazing System Lime	Manage the pH of soil for optimum fertility.
DSP 3.5	Grazing System Seed	Interseed legumes in an established grass pasture grazing system to improve plant health and diversity and protect soil from erosion.

Source: Missouri Department of Natural Resources (2018)

Exhibit 2 demonstrates the usage of the conservation practices related to grazing management in Missouri from 1997 to 2018 (state fiscal years). During this time span, a total of $45.67 million in cost-share was reimbursed to Missouri producers. The past three fiscal years have been the highest in the history of the SWCP with approximately $4 million paid per year. The DSP 3.2 (Grazing System Water Distribution) is the most highly funded over the years reported in Exhibit 2, accounting for 27.4 percent of the grazing management cost-share practices. The next highest funded practices were DSP 03 (Planned Grazing Systems Practice) and DSP 3.3 (Grazing System Fence), with approximately 25.8 and 17.5 percent of cost-share payments respectively.

Initially when the grazing system practice was developed, the entire system needed to be completed in one year. The participation in the program sharply increased in 2010 because the Soil and Water Districts Commission changed policies to establish practices based on the segments of a grazing system, i.e. fence, water development, water distribution, lime and seed. The practice policy changes allows a grazing system to be implemented over a three year period which at that time must meet NRCS standards and specifications. The three period gives flexibility to the producer to spread resources over multiple years as they complete a system.

Exhibit 2. Missouri DNR Grazing Management Cost-Share Paid, By Year



Source: Missouri Department of Natural Resources (2018)

The USDA NRCS has various conservation practices and incentive programs related to grazing management. Exhibit 3 shows these practices and a description of what each practice entails. For the most part, they are offered annually through the Environmental Quality Incentives Program (EQIP) and provide cost-share payments based on units related to the practice (each, per foot, per acre, etc.).

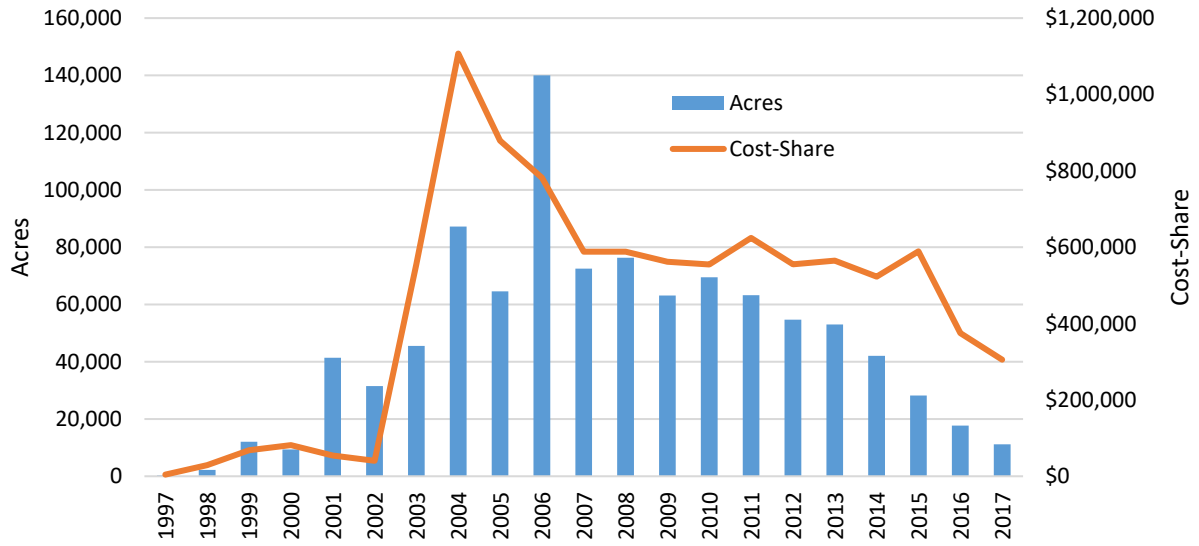
Exhibit 3. Primary USDA NRCS Conservation Practices Related to Grazing Implementation

Practice Code	Conservation Practice	Description
110	Grazing Management Plan	Written plan.
314	Brush Management	The management or removal of woody plants including those that are invasive and noxious.
382	Fence	A constructed barrier to animals or people.
472	Access Control	The temporary or permanent exclusion of animals, people, vehicles, and equipment from an area.
511	Forage Harvest Management	The timely cutting and removal of forages from the field as hay, green-chop or ensilage.
512	Forage and Biomass Planting	Establishing adapted and/or compatible species, varieties, or cultivars of herbaceous species suitable for pasture, hay, or biomass production.
516	Livestock Pipeline	A pipeline and appurtenances installed to convey water for livestock or wildlife.
528	Prescribed Grazing	Managing the harvest of vegetation with grazing and/or browsing animals.
561	Heavy Use Area Protection	Stabilize a ground surface that is frequently and intensively used by people, animals, or vehicles.
614	Watering Facility	Providing drinking water to livestock or wildlife.

Source: USDA Natural Resource Conservation Service (2018a)

To give a sense of cost-share impact, Exhibit 4 details the usage of the NRCS practices related to prescribed/planned grazing from 1997 to 2017 (based on federal fiscal years). Prescribed grazing conservation practice standard (Code 528) has many options available to producers based on the grazing intensity, density of grazing and deferment of animals during parts of the year. Based on FY2018 Missouri policy, establishment payment rates are paid on a per acre basis and typically range from $21.81 to $63.82 (except biological control with grazing animals at $638.79 per acre). Higher payment rates are available for historically underserved producers (beginning farmers, socially disadvantaged, tribes, veterans, etc.). Over this 21-year period, 985,379 acres were enrolled in the prescribed grazing NRCS conservation practice and a total of $9,340,255 in cost-share was provided to Missouri producers. The peak in enrollment was 2006 with 139,980 acres and the peak cost-share paid was $1,107,160 paid in 2004. In recent years, usage of this conservation practice has declined.

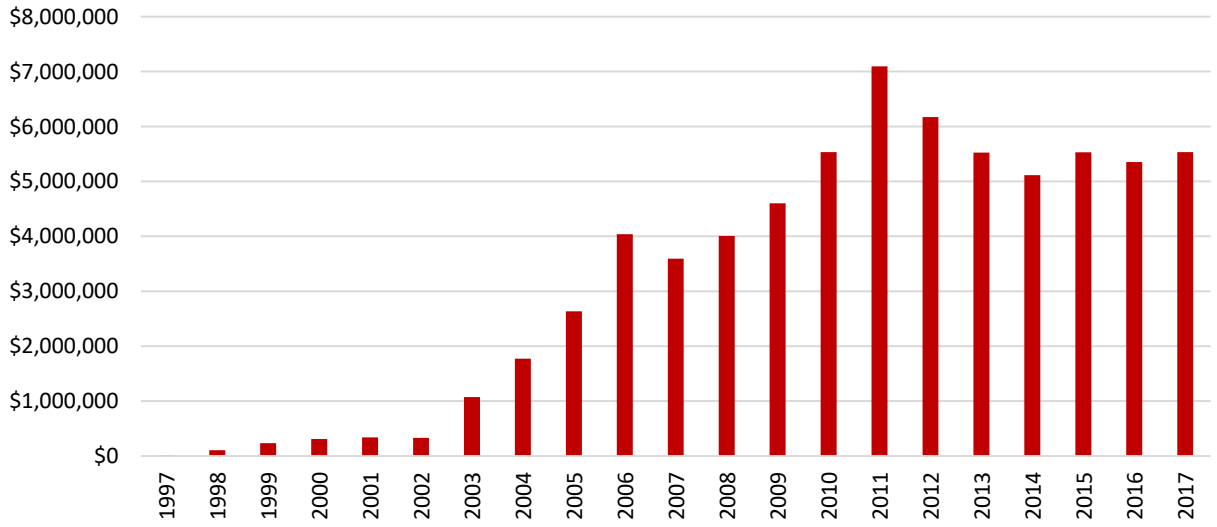
Exhibit 4. USDA-NRCS Prescribed/Planned Grazing Practice Adoption in Missouri



Notes: Data includes NRCS Practice Standards 528 and 762 (interim practice code). Data for years 1997 to 2003 may not be complete.
Source: USDA Natural Resource Conservation Service (2018a)

Exhibit 5 shows the cost-share dollars paid across all USDA-NRCS conservation practices related to grazing implementations. From 1997 to 2017, a total of $68,913,201 was paid to Missouri producers who adopted these various conservation practices. Over the past five years, approximately $5.4 million per year has been expended from these programs. Note that some practice standards have merged into other related practice standards over this time series.

Exhibit 5. USDA NRCS Grazing Implementation Cost-Share Paid in Missouri by Year



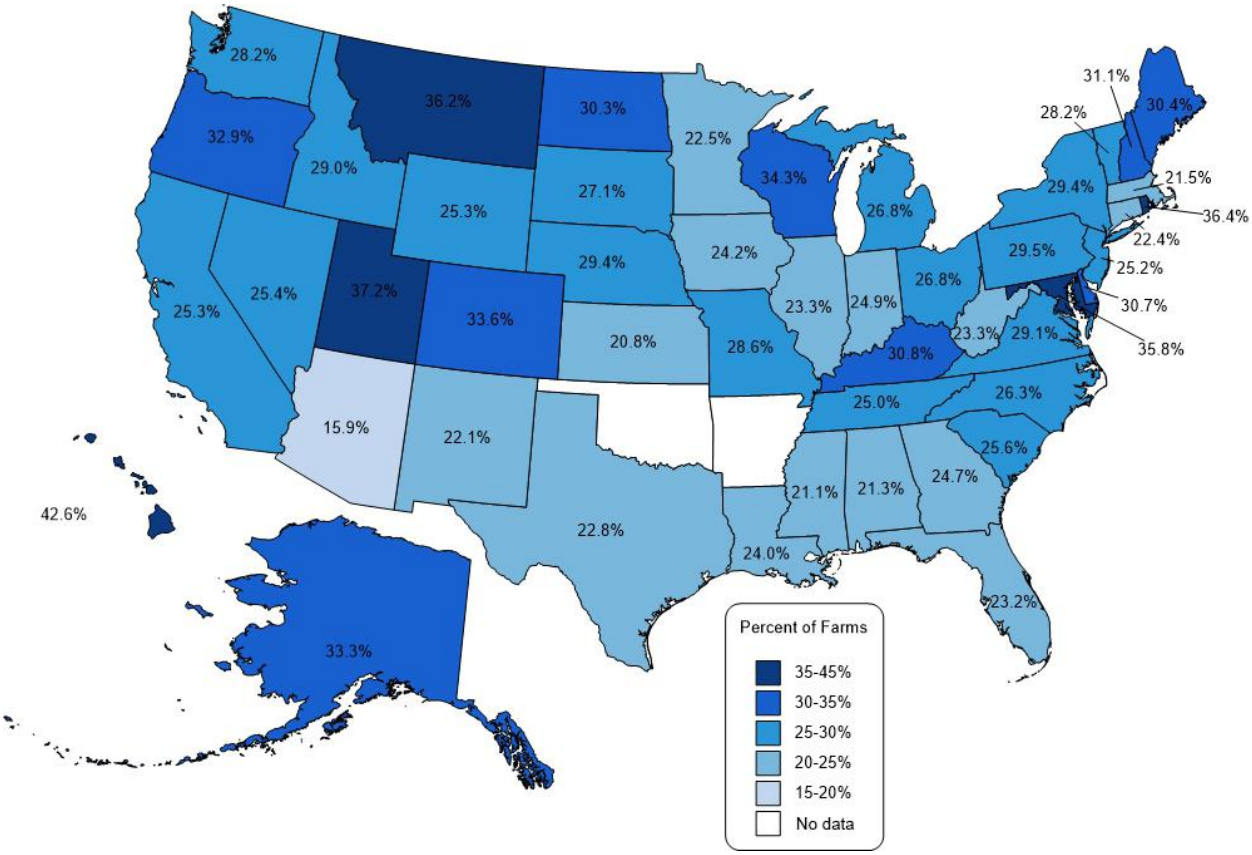
Notes: Historical data includes NRCS Practice Standards 110, 314, 382, 472, 511, 512, 516, 528, 561, 614 and 762. Data for years 1997 to 2003 may not be complete
Source: USDA Natural Resource Conservation Service (2018a)

Practice Adoption Rates

USDA conducts a Census of Agriculture every five years. The most recently reported census occurred in 2012. One question asked in its survey was about whether a farming operation "practices rotational or management-intensive grazing" any time during the survey year.

The beef industry adoption of rotational or management-intensive grazing is represented in Exhibit 6. Missouri had 40,724 farms that were in beef cattle production and 11,633 were identified to practice rotational or intensive grazing (28.6 percent).

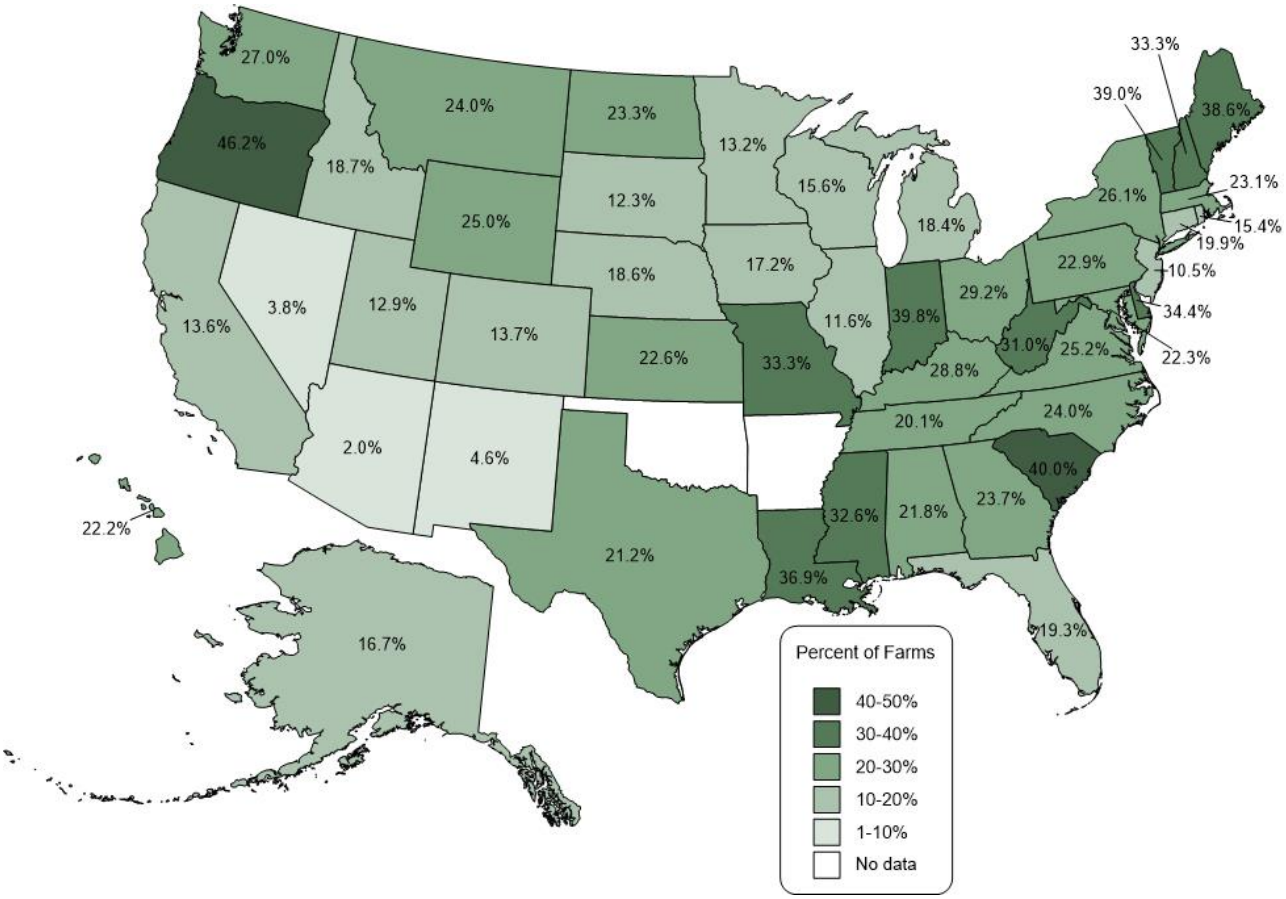
Exhibit 6. Percent of Beef Farms that Practice Rotational or Management Intensive Grazing, By State, 2012



Source: USDA National Agricultural Statistics Service (2014)

Exhibit 7 details rotational or management intensive grazing adoption rates by U.S. state for the dairy industry. In 2012, Missouri had a total of 1,153 dairy farms and 384 listed this grazing practice for their farm (33.3 percent).

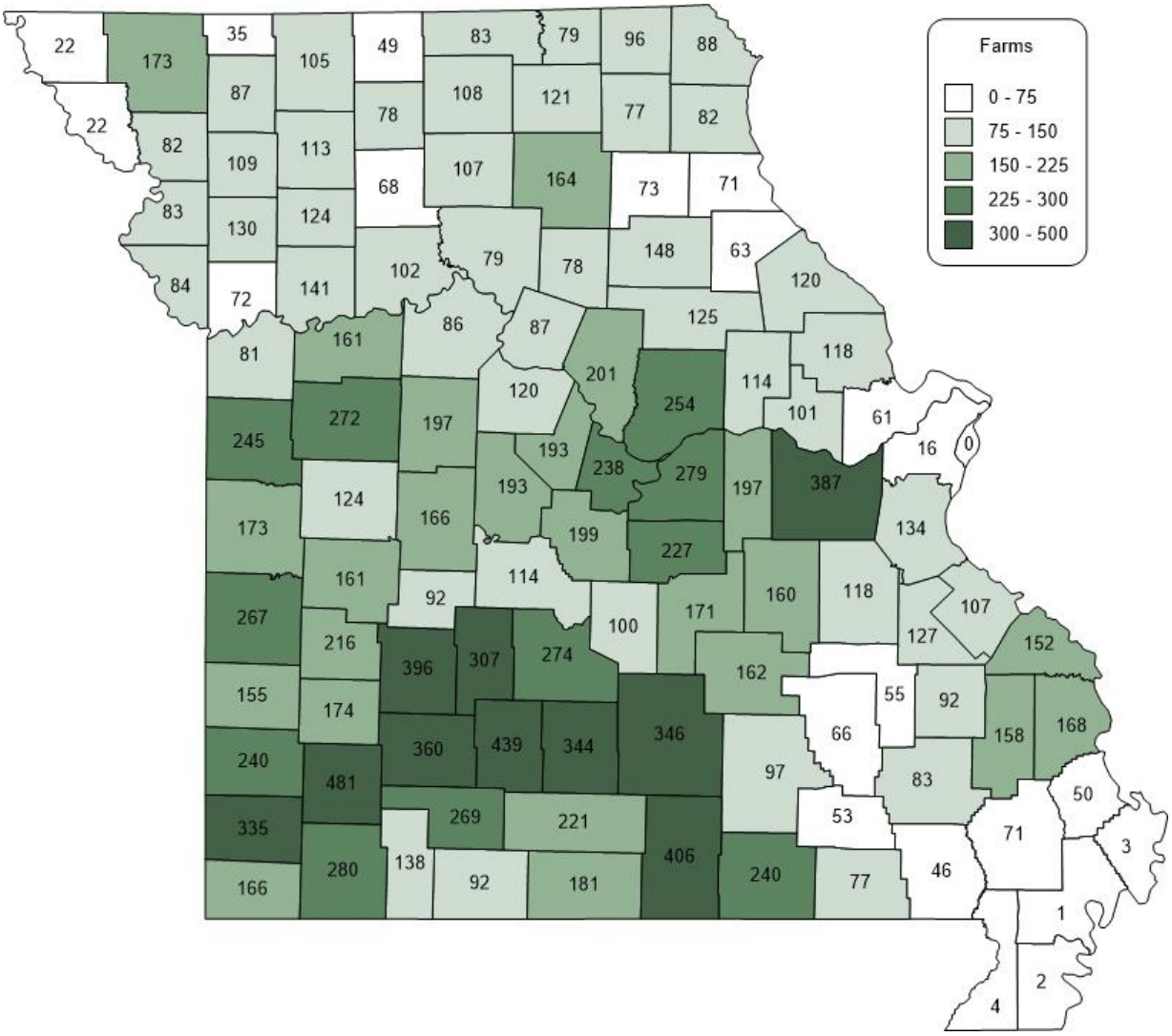
Exhibit 7. Percent of Dairy Farms that Practice Rotational or Management Intensive Grazing, By State, 2012



Source: USDA National Agricultural Statistics Service (2014)

When considering all livestock operations, the USDA reported in 2012 that Missouri had a total of 16,882 farms that practiced rotational or management intensive grazing. Missouri ranks number two in the U.S. behind Texas (41,401 farms) and followed by Kentucky (14,652 farms) and Tennessee (11,766 farms). The distribution of Missouri farms that practice rotational or management intensive grazing can be found in Exhibit 8. The top five counties that have adopted this grazing practice include Lawrence (481 farms), Webster (439 farms), Howell (406 farms), Polk (396 farms) and Franklin (387 farms).

Exhibit 8. Livestock Farms Practicing Rotational or Management Intensive Grazing in Missouri, By County, 2012



Source: USDA National Agricultural Statistics Service (2014)

Farm Level Effects

First and foremost, MiG is a way to increase output (gains) from a fixed amount of land. This gain is accomplished via increased forage production and utilization, higher stocking rates, often better animal performance and using stockpiling to extend the grazing season. Sollenberger et al. (2012) conducted a refereed literature review of rotational and continuous stocking in livestock production. In the report, the authors concluded with sufficient evidence that the advantage in rotational stocking for forage response ranged from 9 to 68 percent, with an average of 30 percent. This improvement is based on either a greater accumulate rate or improved utilization in rotational stocked pastures.

MiG can also cut input costs such as feed, hay, fertilizer and weed control. Soil fertility should improve over time in an MiG system with improved manure distribution and result in less fertilizer purchases. Chemical usage for weed and insect control should decrease with intensive management of pastures. Livestock will perform more of the forage harvest themselves. They also increase utilization, which results from intensified grazing pressure followed by rest periods. Deferred grazing or stockpiling offers an opportunity to extend the grazing season and as a result, less hay feeding is needed. Additionally, farmers have reported that cattle are easier to handle as they are trained to move throughout the grazing system.

Negative aspects of MiG include adding capital costs and complexity to the livestock enterprise. The farm will require more fencing and watering systems, which add capital costs to the operation. Labor is needed on a regular schedule to move animals from paddock to paddock and to operate the overall system. Management is needed at a higher level for making stocking and pasture decisions over the course of the year. Additionally, more financial investment in animals could be needed for an MiG system if stocking rates were increased. The potential positive and negative farm level effects of MiG are summarized in Exhibit 9.

Exhibit 9. Potential Farm Level Effects from Management Intensive Grazing Adoption

Positive Effects	Negative Effects
1. Increased forage utilization 2. Extended grazing season 3. Reduce feed costs 4. Higher forage quality 5. Potentially greater average daily gains (ADG) 6. May decrease fertilizer costs 7. May decrease weed control costs 8. Easier cattle handling 9. May increase stocking rates	1. More fencing cost 2. More watering system cost 3. Additional labor and management needed 4. Increased animal investment per acre

In 2018 the report authors completed an analysis to quantify the economics of improved grazing management. A spreadsheet tool developed by the USDA National Resource Conservation Service (2018b) was used to simulate the changes from an existing grazing system to improved grazing management system for a beef cow-calf operation. A 110-acre baseline farm was used in this analysis to portray a typical Missouri cow-calf operation size. This farm size was selected based upon averages reported for Missouri in the USDA Census of Agriculture data (2012) on acreage and farms in permanent pasture (USDA National Agricultural Statistics Service, 2014).

The NRCS partial budget spreadsheet tool allows users to estimate the impact of moving from an existing pasture system to an improved pasture management system with medium or high levels of management intensity. Exhibit 10 details the key pasture management parameters used for each scenario. Those producers adopting MiG and moving from low intensity management of cattle on pasture to a high level of pasture management, are estimated to achieve pasture utilization rates of 50 percent and harvested pasture yields of 7,800 lbs. per acre per year which results in stocking rates of 2.6 acres per cow. Those producers adopting MiG and moving from low intensity management of cattle on pasture to a medium level of pasture management are estimated to achieve pasture utilization rates of 40 percent and harvested pasture yields of 7,000 lbs. per acre per year in forage yield resulting in a stocking rate of 3.6 acres per cow.

Exhibit 10. Forage Yield, Utilization and Stocking Rate for Each Pasture Management Scenario

Level of Pasture Management	**Forage Yield** (lbs./acre/year)	**Utilization Rate** (%)	**Stocking Rate** (acres/cow)
Low	6,000	30%	4.8
Medium	7,000	40%	3.6
High	7,800	50%	2.6

Costs to improve grazing management from current to planned systems include infrastructure improvements for additional watering facilities, pipeline, fencing and herd expansion (cow purchase cost). For the 110-acre baseline farm, total costs were estimated at $142.10 per acre for a low to medium pasture management system (4 paddocks) and $331.39 per acre for a low to high pasture management system (8 paddocks). Investments included new cross fencing, electric fence energizer/installation, portable water tank (for high management system only) and cow herd expansion. These system investment costs were assumed to be paid 50 percent through federal or state cost-share programs and 50 percent by the cow-calf producer implementing the system.

The returns from improving grazing management on existing pasture is determined by comparing the annual net returns from the current or existing operation and the expected annual net returns from the improved grazing management operation. The difference between these two values provides the annual net returns from improving grazing management. Cow-calf production budgets were used to customize the costs and returns to each enterprise.

An investment evaluation of improved grazing management systems can be found in Exhibit 11. The grazing management improvement costs are compared to the change in annual net returns from the cow-calf operation over a specified time period. The evaluation analysis below was based on 30-year time period. A discount rate (4 percent) was used to convert the future net returns to present value for comparison with costs. The net present value is also shown in annual equivalents to demonstrate the improvement in yearly returns per acre that will be achieved given the assumptions used in the analysis. The medium and high levels of pasture management show an annual equivalent improvement per acre of $39.44 and $61.50, respectively.

Exhibit 11. Economic Evaluation for Medium and High Management Grazing Systems

Assumption	Medium Mgt.	High Mgt.
Present value costs ($/acre)	$71.05	$165.70
Present value returns (over a 30-yr period) ($/acre)	$753.03	$1,229.16
Net present value ($/acre)	$681.98	$1,063.47
Annual equivalent of net present value ($/acre)	**$39.44**	**$61.50**

Improvement in Missouri grazing management practices have influenced the productivity, profitability and sustainability of livestock producers. Examining the economic impact from grazing management adoption can provide some quantification of what the net benefit has been to the livestock industry sectors and the Missouri economy over time.

To model the Missouri impact estimate, several assumptions were made. While many livestock species may be under a rotational grazing system, Missouri has a large cow-calf sector and it is assumed that the adoption occurred solely in this sector. Net benefits in other sectors (backgrounding/stockers, dairy, etc.) would represent higher value per acre improvements, so a cow-calf assumption would provide a more conservative scenario of adding value to livestock production from intensive grazing management.

Missouri has an estimated 1,794,706 acres under a beef rotational grazing system as of January 1, 2018. This estimation is derived by using the number of Missouri beef farms with rotational grazing (USDA National Agricultural Statistics Service, 2014) and the average pasture acreage per farm in Missouri to establish a baseline of 1,279,596 acres in beef rotational grazing in 2012. The authors then extrapolated how much acreage has been adapted to intensive grazing management since 2012 by analyzing state and federal agency grazing cost-share practices adoption in Missouri (257,555 acres). It is assumed that an equivalent amount of acres were added without cost-share assistance.

Based on the net present value per acre in Exhibit 11, going from a low to medium pasture management system shows an improvement of $39.44 per acre annually and going from a low to high management system shows an improvement of $61.50 per acre annually. Exhibit 12 quantifies the annual impact to Missouri if either of these two pasture grazing management improvements were made to the total estimated acres under beef rotational grazing systems.

It is not known to what extent each improved management grazing system (medium or high level of management) has been adopted in Missouri. Note that the likely impact is somewhere in between the low to medium and low to high pasture management estimates. If you assume 50 percent of cow-calf producers are in each pasture management level (medium and high), it would suggest the impact would support 2,037 jobs, add $73.5 million in total value and $125.1 million in total output to Missouri's economy.

Exhibit 12. Impact from Improved Grazing Management Adoption to Missouri (2018)

Level of Pasture Management	Total Jobs Supported	Total Value Added	Total Output
Low to Medium	1,592	$57,421,005	$97,744,158
Low to High	2,482	$89,538,332	$152,414,458
Average	**2,037**	**$73,479,669**	**$125,079,808**

It is important to understand the metrics used to explain economic impact. Jobs data are the annual average of monthly jobs. A job can be either full-time or part-time and do not represent full-time equivalents. Output communicates the value of industry production. Value added represents the difference between industry sales (output) and the cost of the intermediate inputs used to generate those sales. Additionally, value added is considered to be an industry's contribution to gross domestic product (GDP).

Economic impact results were developed with IMPLAN software. Results above include the combined direct, indirect and induced economic effects from the grazing management adoption. Direct effects refer to the change in production from Missouri cow-calf farmers. Indirect effects accumulate when these cow-calf businesses purchase materials and services from other businesses (i.e. supply chain interactions). Induced effects accrue when businesses' employees and proprietors spend their household income within the local economy.

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