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## Teaching and Educational Commentary

# A Commentary on Extension Programming: An Overview of the Costs and Benefits of Patch-Burn Grazing Extension Program Development Through the Use of a Logic Model

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### Abstract

The Extension program discussed in this commentary was developed using a logic model to provide the missing economic analysis of patch-burn grazing in comparison to traditional rangeland management practices. It was submitted to the Graduate Student Extension Competition through the Agricultural and Applied Economics Association (AAEA) to take advantage of the opportunity to present patch-burn grazing as a potential cost-reducing and beneficial management practice to Oklahoma cow-calf producers. Delivery plans and communication methods for the program include fact sheets and budget tools, research articles, conference presentations, and workshops. The development of this Extension program centered around the economics of patch-burn grazing is supplemental to ongoing research by the Prairie Project. The Prairie Project utilizes outputs such as fact sheets, workshops, and social media to convey the benefits of patch-burn grazing, which has been shown to be effective. The opportunity to build an Extension program around research using a logic model allows young professionals to learn how to build a successful program.

## 1 Introduction

The Costs and Benefits of Patch-Burn Grazing Extension program was developed to aid cattle producers in management decisions and to provide an example of program development using a logic model. The use of a logic model ensures that the program will address a problem, identify who is affected, have clear objectives, create activities to relay information and solutions, and measure outcomes of the program. The program discussed in this commentary was centered on the economic research of patch-burn grazing that developed due to recognizing missing information in existing programs.

The overall purpose of this article is to show the benefits of using a logic model as a young professional to develop a successful Extension program around applied research. The objectives are to (1) briefly convey economic research about patch-burn grazing, (2) walk through the development process of building an Extension program using a logic model, and (3) highlighting the logic model as an effective tool for young professionals developing a career in Extension.

## 2 Summary of Patch-Burn Grazing Economic Research

Due to rapid invasion of Eastern red cedar trees, fire suppression (not burning at all) should not be a rangeland management option for cattle producers. Any form of prescribed burning is encouraged to control woody plant encroachment (WPE). By maintaining rangelands through patch-burn grazing, cow-calf producers can potentially reduce drought impacts and supplemental feed costs due to higher quality and quantity forage while also reducing WPE.

## 2.1 The Problem: Woody Plant Encroachment

WPE is taking over rangelands and reducing forage production for cattle to graze, which increases supplemental costs for producers. The rapid invasion of Eastern Red Cedar and other invasive species is a result of years of fire suppression since European settlement in the late nineteenth and early twentieth centuries (Twidwell et al. 2021). Mechanical removal of the trees is an option, but becomes expensive (Smith 2011). The most cost-effective way to control invasive species is to re-adopt the practice of prescribed fire. However, to maximize the benefits of prescribed fire, an impactful grazing management system must be initiated.

## 2.2 What Is Being Done: The Prairie Project

To encourage cattle producers to use prescribed fire to limit WPE, collaboration between three universities, University of Nebraska-Lincoln, Texas A&M University, and Oklahoma State University (OSU), was established to create what is known as *The Prairie Project*.<sup>1</sup> This project consists of research, Extension, and teaching faculty that promote the rangeland management strategy of incorporating an interaction between fire and grazing on livestock operations known as pyric-herbivory. Pyric-herbivory, more commonly known as patch-burn grazing, is implemented by dividing a pasture into sections with one to two sections being burned annually rather than the traditional approach of burning the entire pasture every three years. This heterogenous pattern improves rangeland productivity by creating a natural rotational grazing environment for cattle to have improved forage quality in burned areas and stockpiled quantity in unburned areas to mitigate drought impacts.

## 2.3 The Missing Link: Economic Research

Although research emphasizes the benefits of patch-burn grazing, cattle producers are still skeptical of adopting the practice (Adhikari et al. 2023). There is also little economic information to support cost-effectiveness of the practice. One method of providing additional support is to provide a cost-benefit analysis of implementing and utilizing patch-burn grazing. Building a cost-benefit analysis for patch-burning involved estimating the costs of burning for both patch-burning and traditional burning (burn entire pasture every three years) using 2021 survey response data from the Natural Resource Ecology and Management Department at OSU. The main costs associated with both burn strategies include firebreak construction, fuel, and labor. After calculating these costs based on the survey responses, results convey that it costs approximately \$2.77 more per acre to implement patch-burning (\$4.58 per acre) in the first year compared to traditional burning (\$1.81 per acre). However, it is anticipated that labor and fuel costs will decrease in years two and three by roughly 28.5 percent once firebreaks are initially constructed. Costs will vary across operations, but results provide a baseline estimate. After three years (full burn rotation), the cost to use patch-burning decreases to an average of \$2.40 more per acre per year compared to traditional burning (Table 1).

**Table 1: Comparison of Three-Year Total Investment Costs for Burning 150 Acres Using Patch-Burning and Traditional Burning**

Category	Investment Cost
Patch-Burning	\$677.67
Traditional Burning	\$317.14
Difference in Investment Cost	\$360.53
Average Per Acre Cost Difference	\$2.40

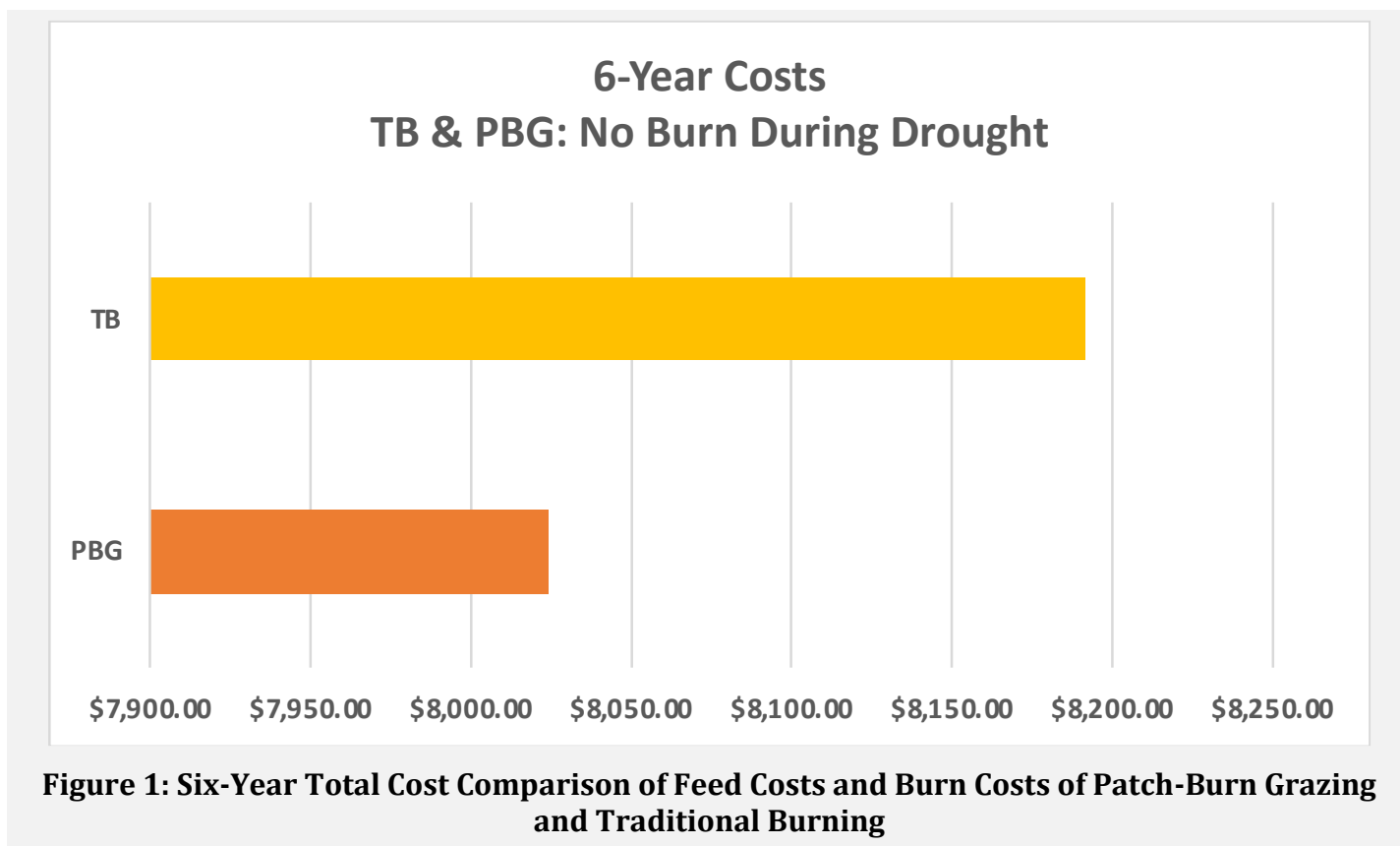
<sup>1</sup> See <https://www.theprairieproject.org/>.

Quantifying the benefits of patch-burning, high quality forages, and drought impact mitigation, was the second objective of the research. Feed costs were estimated utilizing results that saw a 40 percent reduction in supplemental feed requirements for cows on patch-burned pastures compared to cows on traditionally burned pastures (Limb et al. 2011). Combining these results with 2021 feed cost estimates,<sup>2</sup> patch-burn grazing has the potential to save cattle producers \$20 per head in supplemental feed costs each year, dependent on the area not experiencing a drought. In the event of a drought (represented in year four for this research), stockpiled forages in unburned areas become the main benefit. It is estimated that if patch-burn grazing is utilized before and after a drought while not burning a patch during a drought, total supplemental feed and burn costs are lower after six years (two full-burn rotations for both practices; Figure 1). The long-term economic benefits potentially justify the higher implementation costs, especially in drought years.<sup>3</sup>

This economic research for patch-burn grazing is focused on serving cattle producers in Oklahoma since the data used to conduct the research was collected and analyzed at OSU. However, the results and development of the Extension program can be used to develop similar estimations and programs across the Great Plains region.

### 3 Extension Program Development

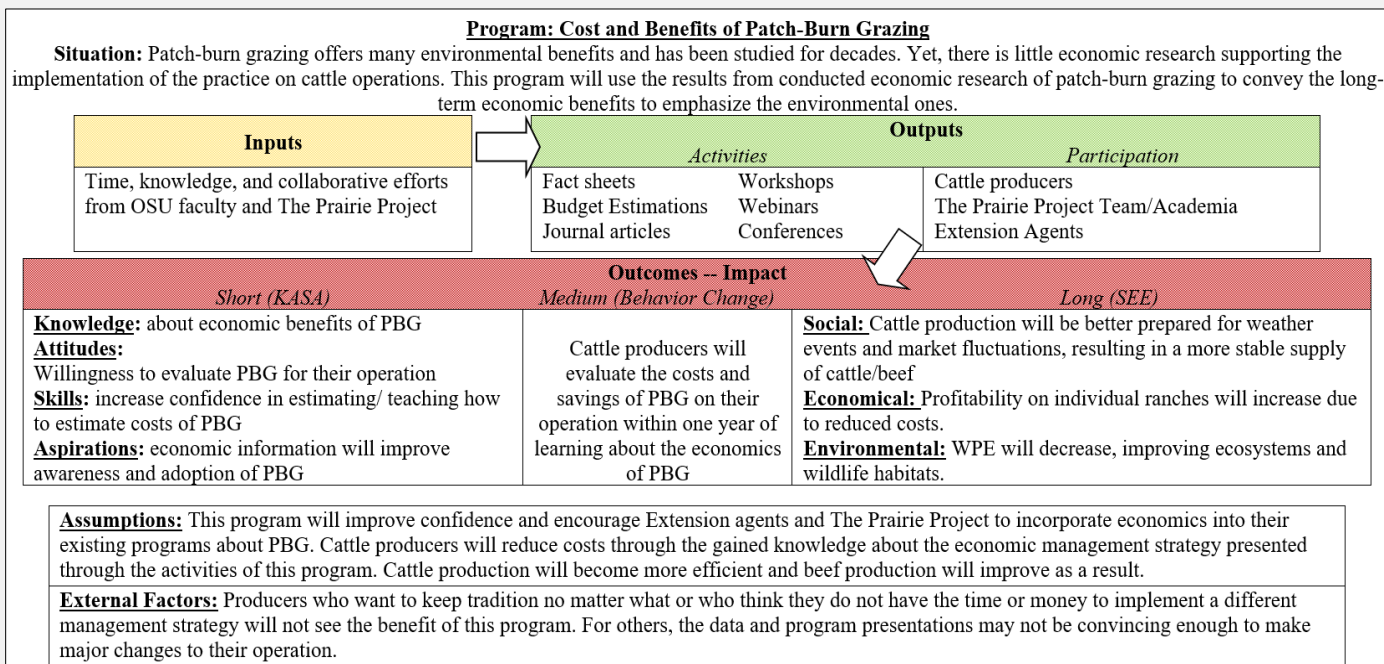
An Extension program was developed using a logic model to present the results of the economic patch-burn grazing research in the AAEA Graduate Student Extension Competition. The use of the logic model is beneficial in learning how to follow a step-by-step process of creating a successful outlet for applied research. The logic model in Figure 2 served as an outline of how to effectively convey the economic research of patch-burn grazing (Israel 2021).



**Figure 1: Six-Year Total Cost Comparison of Feed Costs and Burn Costs of Patch-Burn Grazing and Traditional Burning**

<sup>2</sup> See <https://extension.okstate.edu/fact-sheets/supplementing-beef-cows.html>.

<sup>3</sup> See <https://extension.okstate.edu/fact-sheets/implementation-costs-and-benefits-of-patch-burning.html>.



**Figure 2: Logic Model of the Cost and Benefits of Patch-Burn Grazing Extension Program (Modified Wisconsin Model)**

### 3.1 Situation: The Challenge and Opportunity

The first step in building a program is recognizing the need for the program and how to go about meeting that need. For the Extension program discussed in this commentary, the situation is that there is little economic research supporting the implementation of patch-burn grazing. This challenge presents an opportunity to estimate implementation costs for cattle producers, while also emphasizing and quantifying the environmental benefits of patch-burn grazing.

### 3.2 Inputs and Outputs: Activities and Participation

Step two is identifying the inputs needed for the program to be successful. This involves any effort, time, and money spent on development. The inputs of this program included time to develop activities and resources such as online webinars, conference presentations, and literary materials. Online webinars and presentations highlight only the economic information, while the economic literary materials such as fact sheets with budget estimations, research articles,<sup>4</sup> and newsletters<sup>5</sup> can be added to existing workshops and field days as handouts. Funding from a USDA-NIFA AFRI grant and collaborative efforts between researchers and Extension faculty at OSU and The Prairie Project were also inputs of this program.

Step three goes hand in hand with developing activities because the outlets developed are based on how your target audience best receives information. This Extension program is designed to reach a wide range of audience members that includes cattle producers, Extension agents, The Prairie Project team, and fellow professionals in academia. Therefore, a wide range of resources and activities were developed.

<sup>4</sup> See <https://bit.ly/patchburn-potentialcostsaver>.

<sup>5</sup> See <https://bit.ly/patchburn-mastercattleman>.

### **3.3 Outcomes: Short-Term Impacts**

Step four involved measuring the effectiveness of the program through short-, medium-, and long-term impacts (Israel 2001). Short-term impacts involve seeing change in the areas of knowledge, attitudes, skills, and aspirations. The short-term goal is to get the audience thinking about how they can apply what they learned. The short-term goals of this program are to increase awareness of patch-burn grazing by increasing knowledge about the economic benefits, improving confidence about how to estimate the costs, and willingness to evaluate the use of patch-burn grazing for specific cattle operations.

### **3.4. Outcomes: Medium-Term Impacts**

Medium-term impacts involve the target audience reacting and adopting change. This goal should be measurable by time and realistically achievable. The medium-term impact for this program is to see cattle producers evaluate the costs and economic benefits of patch-burn grazing for their operation and decide on whether adoption is economical within one year of learning about the economics of patch-burn grazing.

### **3.5 Outcomes: Long-Term Impacts**

Last, long-term goals are categorized by social, economical, and environmental categories. The long-term outcomes for the program discussed in this commentary include a social impact of improved cattle and beef supply, an economic impact of increased profitability on cattle operations, and an environmental impact of maintaining ecosystems and wildlife habitats. Each long-term impact would be a result of producers utilizing patch-burn grazing as a long-term investment practice on rangelands.

### **3.6 Assumptions and External Factors**

This part of the logic model is important for considering the terms of the program and recognizing circumstances that could affect the success of the program. The assumptions in this logic model are that providing economical information will enhance existing programs and increase knowledge of patch-burn grazing. Cattle producers will strive to be profit maximizing, cattle production will become more efficient, and rangelands will be restored. The external factors that could limit program outcomes include producers who prefer their traditional style of management and producers who may not be convinced by the data to make any changes.

## **4 Extension Program Structure, Outreach, and Evaluation**

Building an Extension program around applied research enhances the knowledge of the target audience. Providing economic information about the advantages of patch-burn grazing creates the opportunity for various resources to be utilized in various ways. Measurable outcomes are necessary for the program to improve and grow in the future.

### **4.1 Structure and Outreach: Stand-Alone or In Addition To**

This Extension program was developed after recognizing that economic information needed to be added to existing programs to support implementation from an economical viewpoint. An additional goal of the research was to emphasize the environmental results by quantifying them. Therefore, the economic materials and information developed can be used in existing programs as well as in a program of its own because the environmental and economic benefits go together.

Structuring the program to be utilized as a “stand-alone” program and as an “in addition to” program creates the opportunity to reach a larger audience. Some participants may only need economic information through online webinars and literary materials that assign monetary value to what they already know. Others who are new to patch-burn grazing need a more hands-on experience by attending

workshops and field days hosted by The Prairie Project, where they will see the environmental results in the field while also being presented with economic information through the form of a presentation or handout.

## 4.2 Evaluation: Measuring the Success and Effectiveness of the Program

Feedback from the target audience is vital to measuring the outcomes stated in the logic model. The audience is encouraged to provide feedback through pre- and post-surveys at in-person events and online webinars. For an audience of Extension agents, The Prairie Project Team, and academia professionals, questions will include the following, using a ten-point ranking scale with “1” being the least and “10” the greatest:

- 1) Before/After this event, how beneficial do you think knowing the economics of patch-burning grazing is for cattle producers?
- 2) Before/After this event, how confident are you in talking with producers about estimating the costs and economic benefits of patch-burn grazing?
- 3) Before/After this event, how likely are you to incorporate economics into your existing programs?

Questions for a producer audience would include the following, on the same ranking scale:

- 1) Before/After this event, rank yourself on how much you know about the costs and economic benefits of patch-burn grazing.
- 2) Before/After this event, how confident are you in estimating the costs of patch-burning on your operation?
- 3) Before/After this event, how likely are you to use patch-burn grazing on your operation?

Number of downloads, views, and engagements on social media and websites (The Prairie Project, OSU Extension, etc.) is also accounted for to measure the impact of literary materials.

## 5 Conclusion

In this article, we review the development of the Costs and Benefits of Patch-Burn Grazing Extension program that was derived from the opportunity to build a successful program using a logic model to present an economic analysis of patch-burn grazing. The logic model was a valuable tool in recognizing the challenge and opportunity among a target audience, intentionally creating activities, and setting measurable outcome goals to ensure the effectiveness of teaching the costs and economic benefits of patch-burn grazing. The flexible structure of the program allows for literary and online resources to be used in various ways to reach the entire target audience.

Target audiences of Extension programs need resources to make informed decisions. Research projects are designed to provide solutions to aid in this decision-making process. Using a logic model as a tool to bridge the gap between the target audience’s need and the research project’s design ensures the success of an Extension program.

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