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ECONOMIC IMPACT OF BRUSH ENCROACHMENT IN TEXAS

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INTRODUCTION

Range livestock is important to the economy of the state of Texas. Over 4.2 billion lbs. of beef were produced in Texas with a value of over \$1.2 billion in 1971, which was the greatest for any of the 50 states [17]. Sheep and lamb production in Texas for 1971 exceeded 200 million lbs. and was valued at \$43.4 million which was the highest of all 50 states [17]. Cash receipts from cattle, calves, sheep, and lambs marketed in Texas in 1971 were estimated at \$1.6 billion [17].

Texas' production of range livestock is limited by the availability of rangeland. In 1967, over 53 percent of the land area in Texas was classified as rangeland [22, p. 20]. Undesirable woody plants which compete with favorable grasses for moisture and sunlight have infested 82 percent of the grasslands in the state [11]. It has been estimated that less than 25 percent of the grasslands have as much as half the desirable forage plants that once existed and 30 to 35 percent have less than one-fourth of the original plants remaining [11].

One of the effects of the restricted number of livestock marketed in the state is a reduced income to ranchers. In a 28-county Rolling Plains area, incomes of ranchers were estimated to have been reduced by \$26.2 million annually [4, p. 136]. Restriction of the number of range livestock has reduced the purchases of inputs. The decreased demand for range livestock inputs has resulted in reduced incomes for the suppliers of these inputs. Brush infestation has ultimately affected many of the sectors in the economy of Texas as various sectors have reduced purchases of inputs after realizing decreased demands for their products.

Major problems of mesquite encroachment are evidenced in 130 contiguous counties in western

portions of Texas. Climate in the area varies widely. Average annual precipitation (east to west) ranged from approximately 37 inches to 12 inches [13].

Some \$1.7 billion worth of agricultural products were sold in the area in 1971 [14]. Cash receipts from farm marketing of livestock and livestock products accounted for \$1.1 billion or 65.5 percent of all farm marketings [17]. Significant growth has been experienced in the feedlot cattle sector since the early 1960's. Over 3.2 million head of cattle were sold from area feedlots with an estimated value of \$706.6 million in 1971 [1, 9, 14]. Sales of crops represented approximately 34.5 percent of the total farm marketings.

BENEFITS AND COSTS FOR BRUSH CONTROL

Techniques are available that can be used to control mesquite. However, the responsiveness in herbage production has not been determined to the extent that a long-term economically feasible control program can be recommended.

A recent study of some ranches in West Texas indicated that the decrease in acres required per animal unit after brush removal with four common types of treatments ranged from 5.0 to 9.4 acres [12]. Data were based on files in the Great Plains Conservation Program that was administered by the Soil Conservation Service as well as data that were collected from ranches.

Results of an economic analysis of brush control in West Texas indicated that if the treatment cost exceeded \$10 per acre for a high level of infestation (removing 50 to 75 percent of brush), it would not be economically feasible without assistance from non-ranch sources [4]. Generally, results of economic studies regarding feasibility of brush control have concluded that available treatments are marginal.

That is, although the brush can be removed, resulting in increased capacity, net benefits in terms of profit are low.

Alternative uses of rangeland are limited. With marginal investments by the public sector, significant economic impacts may be realized. However, this project should be evaluated with other priorities and associated benefits for investment by the public sector.

The purpose of this study was to estimate the economic impact of mesquite infestation on the economy of the state of Texas. An interindustry model was used to determine the economic effects of mesquite encroachment on Texas rangelands. The reduction in output of the range livestock sector was used to estimate the economic effects on other sectors in the economy.

HISTORICAL PERSPECTIVE OF INTERINDUSTRY ANALYSIS

Interindustry analysis was developed in the early 1930's by Wassily W. Leontief. Leontief determined a national model of the United States which estimated national input patterns [5]. Models of regional economies in the United States have been developed from Leontief's national model. However, regional input patterns may be different than national patterns.

Interindustry studies for nine regions as well as for the state of Texas were completed in 1972 from survey information. In the regional study for the Texas High Plains, Osborn and McCray estimated direct, indirect, and "stemming-from" effects from irrigation for the Texas High Plains economy [8].

PROCEDURE

Estimation of the total economic effects of brush encroachment on the economy of Texas required several steps in the procedure. Herbage production that was displaced by mesquite encroachment on the rangeland was estimated. Production of herbage was converted to costs and revenues for production of beef from cow-producing units (CPU). Costs for CPU were delineated into the economic sectors in the interindustry model. Total economic effects on the economic sectors were estimated for the State of Texas with the interindustry relationships.

Herbage yields for livestock production were estimated for above-average, average, and below-average situations for each of the 11 resource areas in the 130-county study area. Herbage yields were available for above-average and below-average amounts of rainfall by range site in each resource area [18, 19, 20, 21]. Estimates of acreages in each range

site per resource area were determined from soil surveys of sample counties in seven of the resource areas for determining herbage yields. For the other four resource areas, range site composition and productivity of rangeland were based on data applicable to the areas, since soil surveys were not available.

Mesquite infestation data for Texas are available by acres with the associated levels of canopy cover which is classified as low (0 to 10 percent), medium (10 to 20 percent), and high (20 to 100 percent) [21]. Although it is recognized that brush encroachment on rangeland reduces the production of desirable herbage, a functional relationship between mesquite infestation and herbage production has not been scientifically determined for the study area. A study for another area was completed such that herbage yields could be estimated for the canopy covers [16]. It was estimated that herbage yields declined by 12, 36, and 86.5 percent, respectively, for low, medium, and high canopy covers in low rainfall areas [4].

It was assumed that 30 percent of the brush-infested acres was required for wildlife and browse [10, p. 20]. In addition, it was assumed that 50 percent of the annual herbage production would not be utilized in order to sustain rangeland productivity [3, 4, p. 69]. Herbage available for annual utilization was expressed in terms of megacalories of digestible energy. Requirements of megacalories of digestible energy for annual maintenance of a CPU as recommended by the National Research Council was used [4, 6]. Herbage available for annual utilization and megacalories of digestible energy for annual maintenance of a CPU were used to estimate the number of CPU that could be associated with the encroachment of brush.

Total output was estimated for 1967, above-average, average, and below-average levels of herbage production. Estimated costs for the CPU that would utilize the herbage were delineated into 52 processing economic sectors. It was assumed that production of calves from this herbage would be used to decrease imports of feedlots into the 130-county study area. That is, the direct requirement for imports by feedlots in the final payments section was decreased. In addition, direct requirements by feedlots from range livestock in the study area increased. The Leontief matrix was inverted to determine final demand and output multipliers for the four herbage situations.

FINDINGS

Potential rangeland productivity in the

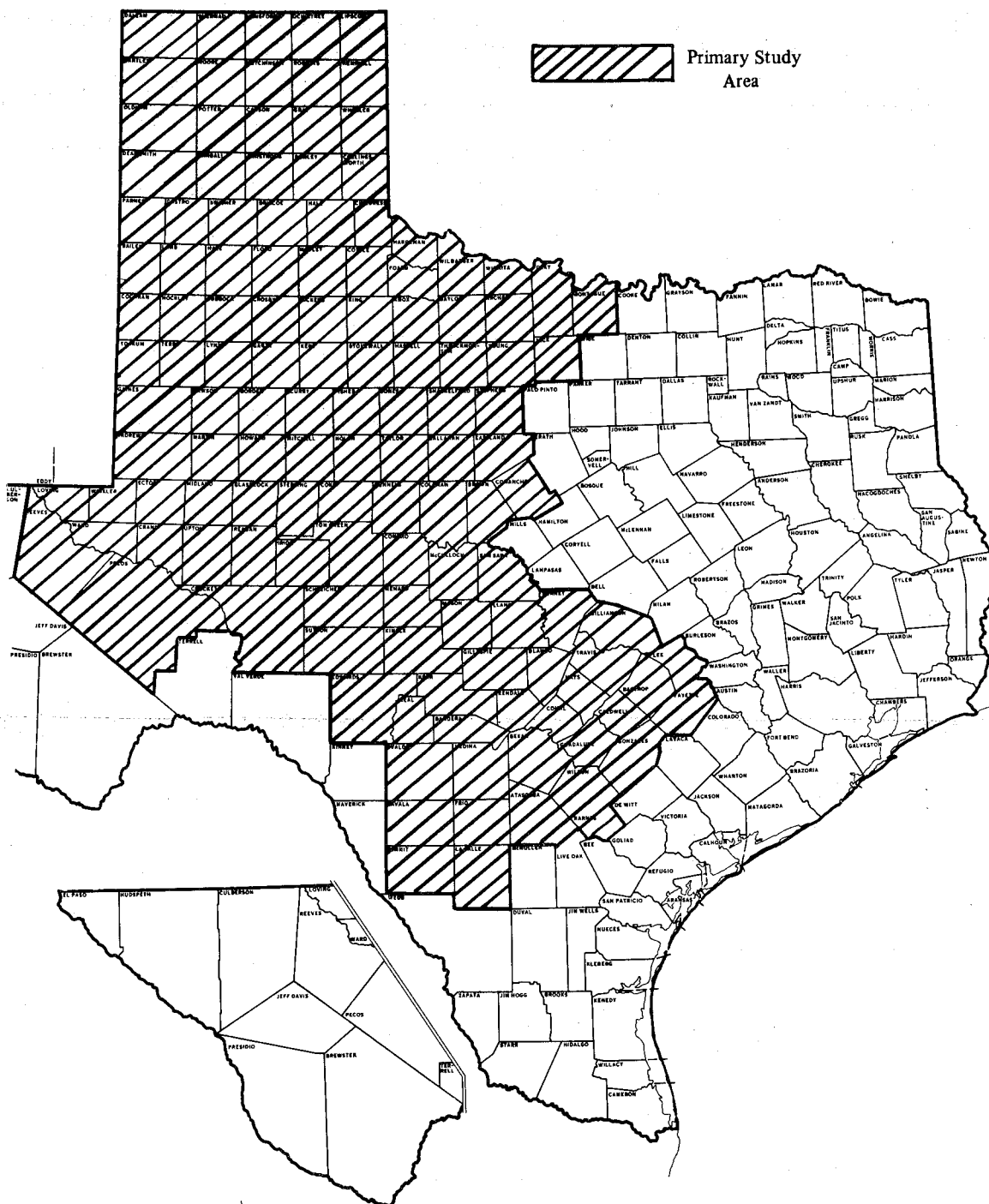


Figure 1. AREA WITH SIGNIFICANT ENCROACHMENT FROM MESQUITE

130-county area was estimated to be reduced by encroachment of mesquite by an equivalent of 11,562,273 acres of non-infested rangeland. This acreage of rangeland was estimated to support 1,374,528 CPU in an average year (Table 1). Annual loss of marketable calf production was an estimated 470.1 million lbs. (approximately 1,045,000 calves at

450 lbs. each).

Effects of mesquite infestation on total output of the Range Livestock Sector (RLS) were estimated by using each of the three levels of herbage production (Table 2). In a year when an average herbage yield was available, the total output for the RLS in the 130-county area was estimated to be reduced by

Table 1. ESTIMATED REDUCTIONS IN COW-PRODUCING UNITS AS WELL AS MARKETABLE POUNDS OF CALVES FROM ENCROACHMENT OF MESQUITE IN 130 COUNTIES, TEXAS

Herbage Production	Cow-producing Units	Marketable Pounds of Calves (million pounds)
Above Average	1,793,321	613.3
Average	1,374,528	470.1
Below Average	924,372	316.1

Table 2. ESTIMATED TOTAL OUTPUT FOR THE RANGE LIVESTOCK SECTOR, TEXAS

Herbage Production	Total Output (\$ Million)	Percent of 1967
1967	799.9	100.0
Above Average	986.9	123.4
Average	943.2	117.9
Below Average	896.3	112.0

Table 3. ECONOMIC ACTIVITY ASSOCIATED WITH THE RANGE LIVESTOCK SECTOR, TEXAS

Herbage Production	Output Multiplier	Economic Activity (\$ billion)	Increases in Economic Activity (\$ million)
1967	4.16	3.3	-
Above Average	4.22	4.2	832.5
Average	4.21	4.0	638.0
Below Average	4.20	3.8	429.3

\$143.3 million. Reduction in output of \$143.3 million was approximately 17.9 percent of the 1967 total output of the RLS for the state. Similarly, mesquite infestation reduced total output of the RLS an estimated \$187.0 million and \$96.4 million, respectively, when above and below-average herbage yields were evaluated.

The output multiplier for the Range Livestock Sector for 1967 was estimated to be 4.16 (Table 3).¹ For each dollar of production by the Range Livestock Sector, it was estimated that \$3.16 of additional economic transactions would be generated to support production requirements. For above-average production, the output multiplier was 4.22. The

¹This is an output multiplier. It is the sum of the interindustry coefficients for a sector divided by its intrasector interindustry coefficient [7].

output multiplier for above-average herbage production situation was greater than the 1967 situation, since it was assumed that increased production of feeder calves could be used to reduce imports by feedlots.

Total economic activity generated by the RLS was calculated by multiplying the output multiplier by its corresponding output. Economic activity generated by the RLS in 1967 was estimated to be \$3.3 billion (Table 3). That is, for the state Range Livestock Sector to produce \$799.9 million of output in 1967, \$3.3 billion of output was required from all processing sectors. Of the \$3.3 billion, \$799.9 million was direct from RLS and \$2.5 billion was indirect from supporting industries. Economic activity increased by an estimated \$638.0 million, or approximately 19 percent when total output associated with average herbage yields was evaluated with its output multiplier. Economic activity corresponding to above- and below-average RLS outputs was estimated to be \$832.5 million and \$429.3 million, respectively.

SUMMARY

Range livestock production in Texas is important to the state's economy as well as to the United States. A primary source of input in the production of range livestock is rangeland. However, encroachment of mesquite on rangeland has become a major problem. Productivity of herbage on rangeland has decreased during recent years. This fact has increased the requirement of supplemental feeding for cattle on rangeland.

Reduction in herbage by mesquite encroachment was estimated to be equivalent to from 924,000 to 1.8 million CPU in a 130-county West Texas area. An interindustry analysis was made to estimate total economic effects. Total output of range livestock could be increased from an estimated 12 to 23 percent without the incidence of mesquite. In addition, it was estimated that total economic activity in the state was decreased from \$429 million for below average herbage production to \$832 million for above average herbage production when compared to economic activity in 1967.

Adjustments are being made throughout the study area to this impact. Private investment in industry is being delayed or discontinued throughout the area. The result is a regressive attitude in the private sectors.

In the public sector, decision makers have a decreasing base on which to establish a repayment schedule for capital improvements. In many situations, declining sources for tax bases provide problems for local governments that have established debt retirement schedules. Refinancing and/or new bond issues may be required for some local governments.

Results of this analysis are limited by numerous factors. Assumptions that are required to conduct an interindustry analysis may establish some inflexible aspects in terms of constant prices and technology. Increases in beef production with a high level of brush control may have an impact on prices of beef. However, changes in beef prices could not be evaluated with the interindustry analysis.

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