



# The Lincoln National Forest and the Economic Stability of South Central New Mexico



# The Lincoln National Forest and the Economic Stability of South Central New Mexico

---

Roy D. Seawolf, Nicholas K. Ashcroft Jr., John M. Fowler<sup>1</sup>

## ABSTRACT

The Lincoln National Forest is the epi-center of economic activity and an indispensable component of the regional economy of south central New Mexico, specifically the counties of Chaves, Eddy, Lincoln and Otero. Were the Lincoln National Forest to be closed to consumptive economic activity, as has been recommended by numerous articles and media broadcasts, how would this affect the regional economy and New Mexico as a whole?

It is apparent that the forest economy is shifting from agrarian to service orientation in much the same way as the rest of the western United States. The shift is away from consumptive uses such as mining, logging, and livestock production toward non-consumptive uses such as dispersed recreation.

If indeed the economy is shifting from traditional revenue generation to revenue generation through dispersed recreation, will this transition result in a stronger economy for south central New Mexico, or will it be detrimental to the economic well-being of those who live in this rural area?

The economy of the Lincoln National Forest was analyzed, and essential data were identified that allow quantification of the strengths, weaknesses, and uncertainties of each industry competing for land in the Lincoln National Forest; namely livestock grazing, logging, and dispersed recreation. Data to compare and contrast each industry as to viability and sustainability were quantified. From here the economic stability

of each industry was analyzed according to the following criteria:

- What factors affect the growth of the industry?
- How does the industry respond to negative internal and external economic shocks?

It was concluded that dispersed recreation, logging, and livestock grazing can and should co-exist and should not have to compete for consideration within the Lincoln National Forest.

The forest genre attracts many diverse and useful economic activities. Basic economic theory dictates that scarce resources should be used to their best advantage. This report concludes that resources within the Lincoln National Forest are used best by managing livestock grazing, logging, and dispersed recreation in a manner that will facilitate and support their continued and long-term harmonious co-existence.

## INTRODUCTION

During the administration of Abraham Lincoln, the Homestead Act was hailed as an innovative and effective way to develop western wilderness areas. Many homesteaders during this time found their way to the region that was to become the Lincoln

---

<sup>1</sup>Sr. Economic/Legal Research Specialist (rseawolf@nmsu.edu); Range Economist; and Professor, respectively; all of the Department of Agricultural Economics and Agricultural Business, New Mexico State University, Las Cruces.

National Forest, setting the stage for the communities of Mayhill, Russia, Cloudcroft, and Ruidoso, among others.

Homesteaders already established in the areas that would someday comprise the Lincoln National Forest used its renewable resources as a critical source of fence posts, firewood, and lumber. As time passed, laws were enacted that established the National Forest System and granted the Forest Service the power to control forest lands.

The Forest Service was established in the Department of Agriculture in 1905 and the Forest Reserves were moved from the Department of the Interior to the Department of Agriculture in that same year. In 1907 the former "Forest Reserves" were renamed the now common "National Forests."

The Lincoln National Forest was once part of five other national forests and was officially established on July 26, 1902 with offices in Capitan, New Mexico. The land area at that time included only the White and Capitan Mountains. Presidential proclamations were signed in 1905, 1906, 1907, 1910, and 1919 adding additional lands to the Lincoln National Forest.

In the latter part of the nineteenth century and into the twentieth century, lumber production and livestock grazing became the two principal industries in what is now the Lincoln National Forest. Generations of Americans raised families and earned their living on the ranches, sawmills and timber stands throughout the forest. Today, the Lincoln Forest has expanded its economy to include auto touring, biking, cultural and historic sites, camping, educational programs, fishing, hiking, horseback riding, hunting, off-highway vehicles, picnicking, winter sports, vacationing and wildlife viewing, to name only a few of the recreational and educational resources available (Baker, 1988).

## **METHODOLOGY**

### **Recreation survey**

A survey was conducted in the Lincoln Forest during the spring, summer and fall

of 2004 to provide insight into county-specific dispersed recreational activity. This survey was designed to provide data in the appropriate units for an Input/Output (I/O) analysis. The primary goal of the survey was to determine the dollar value of a single recreational visitor day in the Lincoln National Forest.

In order to determine the value per day of recreation, we needed to know how many people were in each visiting group, including both adults and children. Also included were simple questions about residency and willingness to return to the same geographic area in the future. Each respondent was asked what proportion of their expenditure occurred within the debarkation county and what proportion at the final destination where the primary activity took place. Specifically, respondents were asked how much money was spent on fuel, lodging, dining, groceries, entertainment, recreational purchases, rental equipment, and recreational fees during the entire recreation trip.

The number of recreation visitor days was also accounted for in each survey. A recreation visitor day (RVD) consists of at least one hour of use by one or more individuals and is calculated using the following formulas:

- 1:  $\# \text{ Individuals} \times \# \text{ Days recreating} = \# \text{ RVDs}$
- 2:  $\text{RVD per activity} / \text{Total visitor days for county} = \text{Activity weight}$
- 3:  $\text{Activity weight} \times \text{Total expenditures for activity} = \text{Weighted RVD expenditure}$
- 4:  $\text{Weighted RVD expenditure per activity summed} = \text{Expenditure across all activities}$

### **Livestock grazing**

The United States Forest Service keeps detailed records of all animals grazed on the Lincoln National Forest from 1905 to present on card files in the USFS district office in Alamogordo, New Mexico. As part of the research for this report, these records were copied onto individual sheets and the data was manually entered into Excel, where

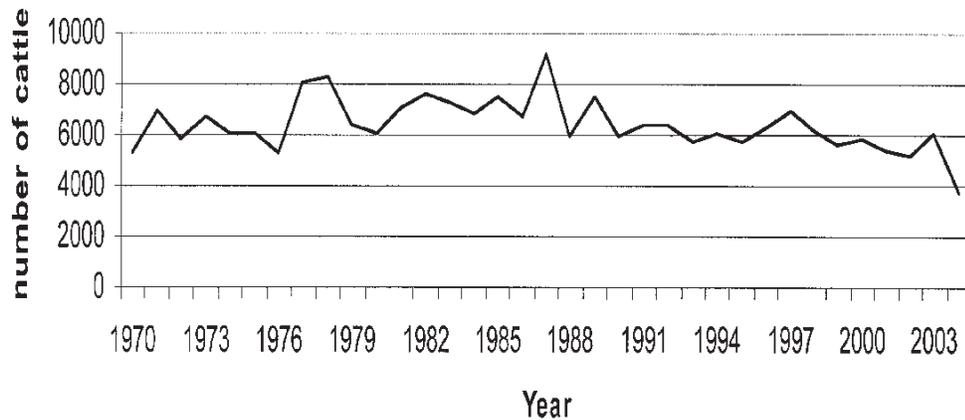


Figure 1. Livestock on LNF allotments (1970 to 2004)

it was quantified and categorized in order to establish the number of livestock that were grazed on all allotments in the Lincoln National Forest from 1970 to 2004, which is the time period under study (Figure 1).

#### Logging data

Logging data were obtained from United States Forest Service records compiled by the Cooperative Extension Service at New Mexico State University. This data set spans from 1900 to 2004 and was invaluable in establishing accurate timber harvest numbers in the Lincoln National Forest.

#### IMPLAN Protocol

IMPLAN is a micro-computer-based, Input-Output modeling program. With IMPLAN, one can estimate I/O affect for any economic need, up to 528 sectors for any region consisting of one or more counties. IMPLAN includes procedures for generating multipliers and estimating impacts by applying final demand changes to the modeled economy.

The primary database for the construction of the initial I/O models in this study was New Mexico county-specific IMPLAN data. For the four-county-specific data, the baseline matrices were constructed from 2001 databases. This aggregation reduced the dimensionality of the analysis to manageable levels and enabled the sectors that were affected by direct impacts to be analyzed.

#### Data collection

Data from the extractive industries during the study period 1970 to 2004 were quantified and adjusted for inflation; an annual gross contribution was then calculated. This particular time span was used because it reflected significant changes as far as annual revenue to the economy was concerned. Livestock grazing and logging were considered to be traditional in so far as they were the original contributors to the economy. Mining was not included in the study since it never was a major contributor and today is virtually non-existent commercially in the region.

Next, recreation-related revenue generation and the cumulative impact of the decreasing/increasing revenue base was calculated. Using USFS visitor use monitoring survey data, combined with the present recreational survey results, economic data were identified and quantified.

#### Livestock grazing regression

For the category *livestock grazing* this study hypothesized that the authorized number of livestock grazing on pasture in the Lincoln National Forest was a function of the following factors: previous year rainfall, fuel price, population, livestock grazing in feed yards, and livestock prices. In this model, two independent variables, specifically the periods before and after protected-activity centers (PACs) were in place, are qualitative or categorical in nature. By definition, PACs

are areas within the forest where no activity that would disturb the breeding or nesting habits of the Mexican spotted owl is allowed; this includes grazing activities. This type of independent variable must be modeled through dummy variables. A set of dummy variables was created for each categorical independent variable  $X$  in the model, where the number of dummy variables in the set equals the number of categories in which that independent variable is classified. The event for this regression is categorized through the use of a dummy variable; either 0, reflecting pre-protected area designation (*pre-pac*: protected before 1988), or 1 reflecting post-protected activity centers (*post-pac*: protected beginning after 1988).

### **Logging regression**

The hypothesis for the logging industry was that MBF of lumber harvested was a function of previous year lumber prices nationally, the total number of Lincoln National Forest fires for the year, total acres burned in the Lincoln National Forest, and housing starts nationally.

This study hypothesized that PACs for the Mexican spotted owl were decreasing logging activity in the Lincoln national forest due to limitations imposed on land use. Between 250 and 600 acres of land around where a Mexican spotted owl is found are effectively removed from production in order to provide the optimum environment for breeding pairs. This practice began in 1988 and continues to the present. When a Mexican spotted owl is found, a perimeter around the nest is delineated and entry into that area is prohibited for any reason other than monitoring of the bird or birds in question. As in the above regression for grazing activity, the dummy variables pre-pac and post-pac were utilized.

### **Dispersed recreation regression**

Time series data with respect to dispersed recreation were virtually non-existent for the purposes of this study. The United States Forest Service does not keep records of visitors to the forest area except on a sporadic basis. The current cross-sectional NMSU study was formatted for regression analysis to represent the Lincoln National Forest and to

explore influences on dispersed recreation.

The analysis begins by identifying revenue generating entities, first those within consumptive industries and then those related to recreational activities, arranged chronologically based on their introduction into the Lincoln National Forest. This study hypothesized that dispersed recreation, livestock grazing and logging are compatible revenue generating venues, not complete substitutes for each other in the Lincoln National Forest economy, and therefore should be viewed in that context.

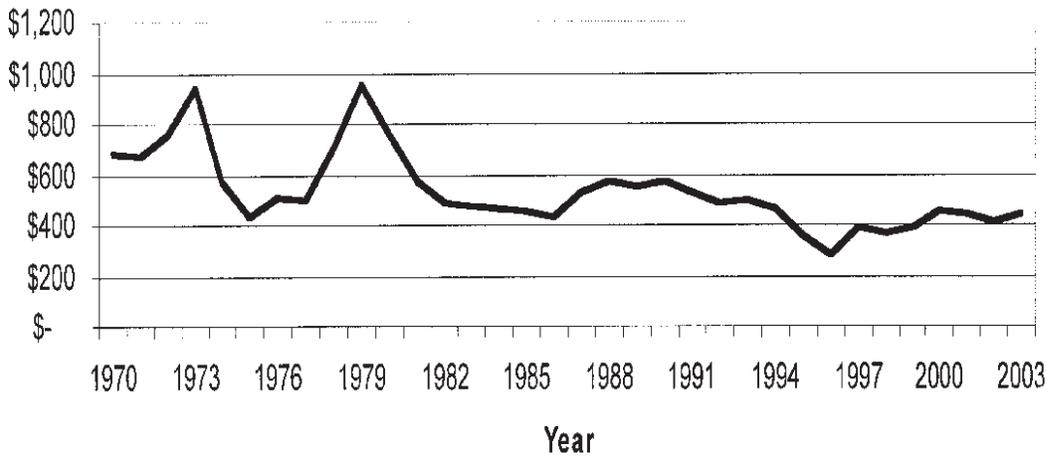
Recreation excursions to specific locations, such as skiing, horse racing, gambling, and other tourist trades, were not considered in this study because they do not utilize forested lands as do livestock grazing, logging and dispersed recreation. The goal is to identify and then quantify the strengths and weaknesses of all three sectors and the challenges they face.

## **ANALYSIS OF ECONOMIC SECTORS**

### **Livestock grazing**

By 1870 there were an estimated 158,000 head of livestock grazing New Mexican ranges, by 1880 there were 545,000, and by 1886 more than a million. The rangelands were changing as a result of the introduction of livestock grazing into New Mexico, including into the Lincoln Forest. By 1880 overgrazing was causing range depletion statewide, and it was clear that a new method of utilizing all grazing lands, including forest lands, was imperative.

The grazing control system placed in operation by the Forest Service in 1905 was a great improvement over the free grazing concept, which was officially put to an end in that year in the interest of sustainable usage of forest resources. The new system required users to pay a fee for each animal grazed for a specific unit of time. The fundamental features of this original system have remained virtually unchanged up to the present, although there have been changes in detail and in the method of calculating grazing fees. The Animal Unit Month (AUM), the amount of forage needed to feed a thousand-pound cow or its equivalent for one month,



**Figure 2. Calf prices (1970 to 2003)**

is the unit generally used to represent grazing capacity. One horse is the equivalent of 1.25 cows and five head of sheep the equivalent of one cow with respect to calculating forage consumption and grazing fees. In the Lincoln Forest a permit is required in order to graze livestock, and the number of livestock allowed to graze is regulated by the United States Forest Service (Dana et al, 1980).

The number of livestock grazed in the Lincoln National Forest has by and large been constant; historically this has been shown to provide a consistent, stable source of revenue to the regional economy. From 1970 to the late 1990s livestock grazing numbers averaged 6,223 head (74,676 AUMs) annually, dispersed among numerous allotments throughout the forest (Figure 1); the average calf price from 1970 to 2003 was \$530 per head (Figure 2).

To provide an accurate estimate of the contribution that livestock grazing provides this regional economy, the average price per calf during the period under study was multiplied by the average number of livestock grazing on pasture. We find that 6,223 head at \$530 each is approximately \$3.3 million per year from 1970 to 1990. We estimate this to be the annual gross contribution of livestock grazing to the regional economy from 1970 to 1990. From

**Table 1: IMPLAN results (livestock grazing)**

Direct Impact	Indirect Impact	Induced Impact	Total Impact
\$3,300,000	\$1,791,873	\$1,349,666	\$6,441,539

here we are able to use IMPLAN to calculate the direct, indirect, and induced economic impacts of this contribution and estimate a benefit of over 6.4 million dollars per year (Table 1).

This implies that for every dollar derived by livestock grazing and spent within this economy, approximately two dollars of benefit is realized. At this point it is imperative that we achieve better understanding of the factors that impact livestock grazing so that future shocks to this revenue-generating sector can be anticipated and then possibly mitigated.

To analyze potential factors affecting this regional economy we use econometrics, specifically regression analysis, to arrive at a plausible statistical conclusion. In the following regression the dependent variable is the number of livestock grazing on the Lincoln National Forest allotments. Several independent variables were considered in the stepwise regression, which resulted in the selection of seven for inclusion in the

**Table 2. Livestock regression**

SSE	23153048	Obs.	35		
MSE	661516	RMSE	813.33613		
Durbin-Watson	2.0645	Tot R-sq.	0.8363		
Log Likelihood	-282.41461	adj. R-sq	0.7957		
SBC	611.04875	AIC	590.82922		
Normality Test	2.0238	Pr>Chisq	0.5994		

Variable	DF	Variable estimate	Standard error	t value	pr>t
Intercept	1	414583	233841	1.77	0.0762
Rainfall	1	80.0734	539776	2.57	0.05
Fuel price	1	3.6293	5.3608	0.68	0.4984
Population	1	0.2751	0.343	0.8	0.4225
Livestock on feed	1	-0.0128	0.0071	-0.78	0.5754
Livestock price	1	-18.5656	40.3536	-0.46	0.6449
Pre-pac	1	-1.0325	0.0021	-0.27	0.7756
Post-pac	1	-43.0325	10.0235	-2.25	0.03

final model. Although this is the best model according to repeated trials, it still only accounts for approximately 80 percent of the variation in livestock grazing numbers on the Lincoln National Forest: the adjusted  $R^2$  is 0.7957. The predictors chosen for analysis were year, rainfall, fuel price, population, livestock on feed, cattle price, pre-pac and post-pac. The regression coefficients range from -523.0325 to 80.0734 in magnitude.

Measuring the importance of a variable by its observed significance level (p value) provides the researcher with an opportunity to conclude which variable has a statistical effect on the dependent variable. In this scenario, a p value greater than the alpha-1 level of .05 for this study is insignificant. Rainfall and post-pac were shown to exert a significant influence ( $p < 0.5$ ) on the number of livestock grazing in the Lincoln National Forest. To focus the discussion, consider the regression results equation for predicting the number of livestock grazing on allotments in the Lincoln National Forest (Table 2).

From 1990 to 2004, the average number of livestock grazing on Lincoln forest allotments fell from an average of 6,223 to an average of 4700 head per year. Because of this decline in livestock grazing on pasture, revenue from livestock grazing fell by \$795,000 in those years. This brings the contribution from livestock grazing down from \$3,300,000 to \$2,505,000 annually (Figure 3).

At this level, IMPLAN calculates direct, indirect, and induced impacts from livestock grazing to be only \$4,670,865.

The total negative impact to the economy of the decrease in grazing revenue between 1990 and 2004 is estimated to be over \$2,450,000, a 48 percent reduction. This is a substantial decrease in benefit to those who live in the area (Table 3).

In the previous regression analysis of livestock grazing on Lincoln National Forest allotments, rainfall has been shown to have a direct impact on the number of livestock, which seems logical. Significant drought circumstances should tend to reduce overall numbers grazed on allotments for a limited time due to forage loss, but from all indications this downward spiral in livestock grazing is not wholly correlated to the rainfall patterns observed. For example, reduction in livestock grazing numbers during drought years is sensible, but this does not explain their failure to increase in wet years, all other things being equal.

Analyzing rainfall data alongside actual numbers of livestock grazing on allotments, it is clear that regular increases and decreases in the number of livestock grazed on Lincoln National Forest allotments occurred from 1970 to 1999, which coincides with rainfall patterns. However, from 2000 to the present, only decreases in livestock grazing numbers have been observed irrespective of rainfall amounts.

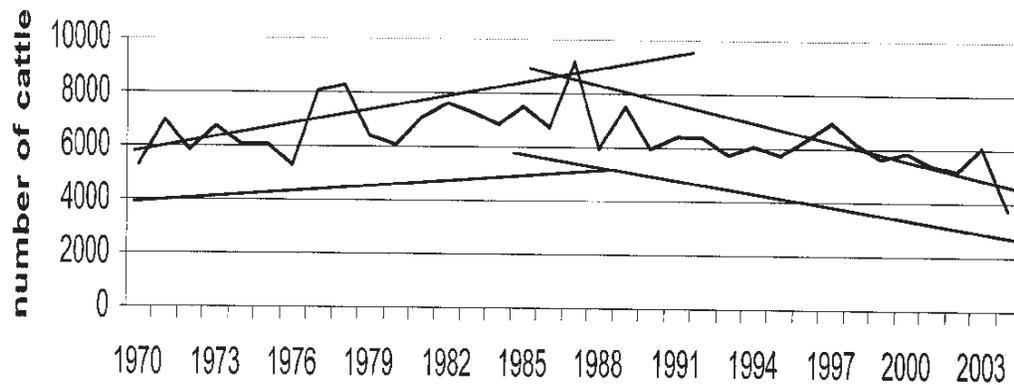


Figure 3. Cattle on LNF allotment (1970 to 2004)

Table 3. Economic impacts of grazing allotment reduction

	Direct Impact	Indirect Impact	Induced Impact	Total Impact
Livestock grazing (1970–1990)	\$3,648,104	\$1,980,890	\$1,492,037	\$7,121,031
Livestock grazing (1990–present)	\$2,392,884	\$1,299,316	\$978,665	\$4,670,865
Difference	(\$1,255,220)	(\$681,574)	(\$513,372)	(\$2,450,166)

Table 4. Rainfall and change in cattle numbers

Yr.	Rain	Difference from mean (21.7)	Hypothesized decrease	Actual #	Projected #	Actual difference
1999	16.03	-5.67	-453.6	5807	5808	-1
2000	18.21	-3.49	-279.2	5314	5983	-669
2001	19.17	-2.53	-202.4	5115	6060	-945
2002	17.9	-3.8	-304	3983	5958	-1975
2003	13.53	-8.17	-653.6	3693	5608	-2008
2004	19.03	-2.67	-213.6	3600	6048	-2448

In the following table the average number of livestock grazing on pasture was used as a baseline number (6,223 head). Average rainfall was used as the baseline measure for rain (21.7 inches). Using the regression parameter estimate for rainfall ( $\approx 80$ ), a table was constructed that reflects the actual

numbers of livestock grazing on allotments using historical averages from USFS AUM data and what they should be when rain was a factor for estimating livestock on allotment totals. The numbers mesh well during most of the time period under analysis, until 1999; then the disparity between actual livestock

**Table 5. Income demographic analysis**

	4 county	NM	US
Per capita money income	\$16,137	\$17,261	\$31,472
Median household income	\$31,315	\$34,133	\$41,000

grazing and projected livestock grazing becomes pronounced (Table 4).

It appears that up until 1999, rainfall was the major influence on the number of livestock grazing on allotments. From 2000 forward, however, other factors appear to enter in. The question then becomes: What are these factors and how can their effects be minimized or eliminated? As mentioned previously a reduction in revenue of over \$2,450,000 or 48 percent has been modeled. According to the Bureau of Economic Analysis (BEA), New Mexico ranks among the lowest in per capita and median income of any state in the United States. The four counties in our study area have per capita and median incomes below the New Mexico level (Table 5).

To the United States as a whole, \$2.4 million in reduced benefits is insignificant; however, it represents the per capita income of 148 individuals who live in this rural economy.

### Logging

An ingenious rail system was devised to bring cut timber down from the higher elevations of the Sacramento Mountains. Using small locomotives and trestle bridges, a precious cargo was delivered to the lower elevations to await transformation into lumber and other valuable commodities. A distinguished group of investors that included Charles B. Eddy built the El Paso and North-Eastern railroad in 1886 to run from El Paso north to Alamogordo, finally connecting with larger railroad companies to get their product to market. Over the years more sophisticated methods of transportation were introduced, which made the logging industry much safer. By the 1950s, logging trucks were in common use, and the rail method of delivering timber to Alamogordo and beyond was becoming a thing of the past (Baker, 1988).

In the Lincoln Forest, the average annual revenue generated from logging activities

**Table 6. IMPLAN summary (Logging 1970-1990)**

Direct Impact	Indirect Impact	Induced Impact	Total Impact
\$11,000,000	\$3,649,186	\$2,409,651	\$17,058,836

from 1970 to 1989 was approximately \$11,000,000 per year with a high year of almost \$24,000,000 in 1972 (Figure 4).

Analyzing this average of \$11,000,000 using IMPLAN, the total direct, indirect, and induced impacts to the regional economy from the logging industry were calculated to be \$17,058,836 per year in real dollars up until 1990 (Table 6).

An initial change in aggregate demand can have a greater final impact on equilibrium regional income. This is known as the multiplier effect and it comes about because injections of demand into the circular flow of income stimulate further rounds of spending. The multiplier, of approximately 1.5 in this case, can represent a significant boon to a rural economy, supplying jobs, income, and added benefits to residents engaged directly in the industry and also providing indirect economic benefit to support businesses in the area.

It was hypothesized that previous year's lumber prices, total acres burned the previous year, total fires the previous year, housing starts the previous year, as well as pre-pac and post-pac, were factors that potentially could affect the harvest of timber in the Lincoln National Forest (Table 7).

With p values of 0.0060, 0.0434 and 0.0500 respectively, previous year lumber price, total acres burned the previous year, pre-pac and post-pac are statistically significant and therefore should have an influence on logging in the Lincoln National Forest. The problem, however, is that the first two parameter estimates are too small to sufficiently explain the degree of logging reduction observed from 1990 to 1999. With the addition of the dummy variable post-pac, however, we can conclude that indeed, beginning in 1988, PACs have steadily decreased logging in the Lincoln National Forest.

In the Lincoln National Forest from 1990 to 1999 logging revenues decreased

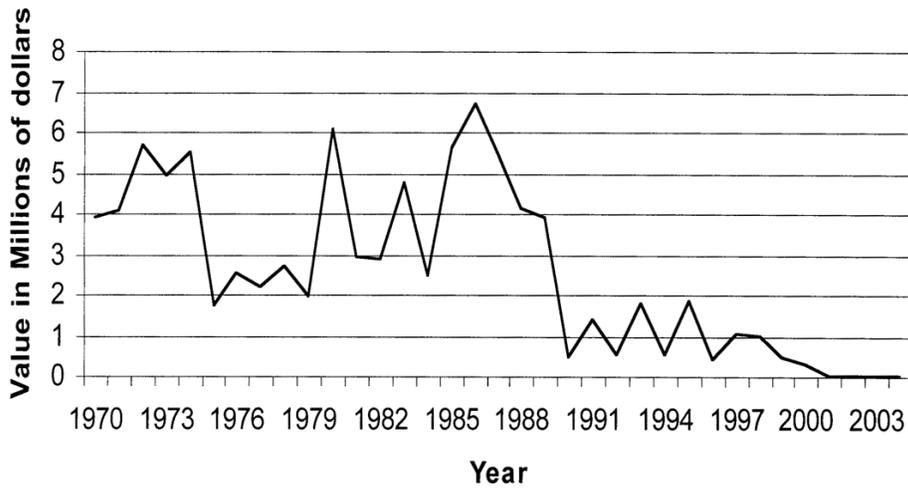


Figure 4. Timber revenue (1970 to 2004)

Table 7. Logging regression

SSE	17.9950458	Obs.	30
MSE	0.59983	RMSE	0.77449
Durbin-Watson	2.2257	Tot R-sq.	0.8911
Log Likelihood	-282.41461	adj. R-sq	0.8139
SBC	93.8186326	AIC	86.0418923
Normality Test	1.9259	Pr>Chisq	0.5153

Variable	DF	Estimate	Standard error	t value	pr>t
Intercept	1	7.7104	1.5265	5.05	<.0001
Prev. Yr. lumber price	1	0.00303	0.001026	2.96	<.0001
Tot. fires	1	0.003033	0.3350	1.76	0.0892
Total acres burned	1	-0.1653	0.0784	-2.11	0.0434
Housing starts	1	0.000175	0.000354	0.49	0.6257
Pre-pac	1	0.000123	0.00002	.023	0.7852
Post-pac	1	-395.0235	83.2565	-2.25	0.0300

Table 8. IMPLAN: Economic Effect of Logging

	DirectImpact	Indirect Impact	InducedImpact	Total Impact
Logging 1970–1989	\$11,000,000	3,649,186	\$2,409,651	\$17,058,836
Logging 1990–1999	\$1,500,000	\$497,616	\$328,589	\$2,326,205
Difference	(\$9,500,000)	(\$3,151,570)	(\$2,081,062)	(\$14,732,631)

**Table 9. Dispersed Recreation Survey Expenditure Report**

Category	Amount
Total spent	\$82,951
\$ per visit	\$ 71.14
% spent in area	25%
% spent out area	75%
Avg \$ per RVD in area	\$17.79
Avg \$ per RVD out of area	\$53.36
Avg \$per RVD/3 in area	\$5.93

86 percent to approximately \$1,500,000 per year. Today only a small amount of logging takes place within the forest with the exception of on the Mescalero Indian Reservation. IMPLAN calculates the impact to the four county economies as a loss of \$14,732,631 in benefit to the region (Table 8).

This reduction in revenue and economic activity in the region represents the income of 930 individuals in the economic study area.

**Dispersed recreation**

The transcontinental railroads not only opened the Southwest for economic development and settlement but also expanded the client base for tourism. In the late part of the nineteenth century, hundreds of tourists visited New Mexico, especially its Indian pueblos.

New developments in marketing and advertising were a lucrative means whereby rail and hospitality companies could promote the American Southwest as the perfect vacation destination. This financial incentive formed an interaction between rail and hospitality companies—which then formed partnerships with Native Americans—that endured for more than three-quarters of a century. In spite of the significant expenditure of advertising money, however, only the most easily accessible destinations attracted a significant number of visits. Before 1940 services and facilities were virtually non-existent due to the effect that supply and demand had on the construction of basic amenities (USDA Forest Service Report, 1980).

Much has changed today. With the shift from rail travel to travel in personal vehicles,

**Table 10. IMPLAN Summary (Dispersed Recreation)**

Direct Impact	Indirect Impact	Induced Impact	Total Impact
\$4,359,955	\$3,362,878	\$608,798	\$8,331,681

access to even the most remote recreational areas has become relatively inexpensive and convenient. In 2004 it was estimated that in the Lincoln National Forest alone 735,237 people visited for purpose of dispersed recreation (Kocis et al., 2004). The 2004 NMSU study of dispersed recreation<sup>2</sup> revealed that dispersed recreation in and of itself generated approximately \$17.79 per RVD.

The National Visitor Use Monitoring Study (NVUM) conducted by the USFS in 2004 calculated an RVD as 8 hours (Kocis et al., 2004). Our study calculates an RVD as 24 hours. In order to accurately depict dispersed recreation expenditures in the study area using the USFS visitor numbers, we divided our daily, in-area expenditures by three. This, in essence, put our data and the USFS data on the same page in portraying the amount of money that was spent on a daily basis for dispersed recreation. In other words, according to the 2001 and 2004 studies, average daily expenditures for dispersed recreation in the forest area were \$17.79 based on a 24-hour RVD and \$5.93 based on the forest service RVD of 8 hours (Table 9).

Calculating the value of dispersed recreation in the Lincoln National Forest using the *in area* calculations, we find that recreation in the Lincoln National Forest contributes approximately 4.36 million annually to the economy of south central New Mexico. This number was derived from the NVUM visitor calculations of 735,237 visitors per year multiplied by the revised RVD estimate (\$5.93).

IMPLAN calculates the direct, indirect and induced impacts to the economy from dispersed recreation to be \$8,331,681 annually in economic benefit to the four county economies. As illustrated below, the total impact from dispersed recreation is substantial (Table 10).

<sup>2</sup>Recreation to non-specific destinations (i.e., camp grounds, hiking trails, hunting excursions, picnic areas).

**Table 11. Dispersed recreation regression results**

SSE	3.65167827	Obs.	197		
MSE	0.01854	RMSE	0.13615		
Durbin-Watson	1.8707	Tot R-sq.	0.8233		
Regress r sq	0.9181	adj. R-sq	0.8100		
SBC	-204.5246	AIC	-227.75144		
Normality Test	56.8864	Pr>Chisq	<.0001		

Variable	DF	Estimate	Standard error	t value	pr>t
Intercept	1	-0.0204	0.0328	-0.62	0.5356
Rentals	1	0.5828	0.0255	22.83	<.0001
Expenses/RVD	1	0.003033	0.3350	-21.03	<.0001
Total Budget	1	-0.1653	0.0784	25.21	<.0001
Income	1	0.000175	0.000354	-22.61	<.0001
CPI	1	0.000123	0.00002	-1.24	0.2151

Regression analysis reveals numerous interesting elasticities with respect to dispersed recreation. Elasticity is a measure of responsiveness; the responsiveness of behavior, measured by variable Z, to a change in environment, variable Y, is the change in Z observed in response to a change in Y. Specifically, this approximation is common: Elasticity = (percentage change in Z) / (percentage change in Y)

The smaller the percentage change in Y used, the better the measure is and the closer it is to the intended theoretically perfect measure.

The significant variables under consideration at the 95 percent confidence interval are: rentals of recreation equipment, expenses per recreation visitor day, total budget for a given trip, and personal income of the dispersed recreationist. Those with a value of .05 or less are considered significant (Table 11).

In this particular regression model a data transformation was performed, that is, the natural log was taken for both the dependent and independent variables. There are many reasons to use a log transformation of data as part of a regression analysis.

- To achieve linearity.
- To achieve homogeneity of variance, that is, constant variance about the regression equation.
- To achieve normality or, at least, symmetry about the regression equation.
- To allow  $\beta_j$  hat, which is an estimation of the true population under study, to directly measure the elasticity of RVDs with respect

to  $X_j$ ; the most important reason in this instance.

For the purposes of this study, we are interested in the percentage change of the dependent variable *Total recreation visitor days* when the predictors change by ten percent.

#### Summary of independent variables

- A 10 percent increase in recreational rentals increased RVDs in the Lincoln National Forest by 5.8 percent. This seems logical; renting equipment would of course induce additional recreation time, resulting in longer stays.
- A 10 percent increase in out-of-pocket expenses per RVD decreases recreational visitor days in the Lincoln National Forest by 5.7 percent. In other words, as the price of fuel, groceries, auto, or other expenses increases, fewer visits are made to the Lincoln National Forest.
- A 10 percent increase in the total budget for any given trip increases RVDs in the Lincoln National Forest by 4.9 percent. That is to say that as the budget for a particular trip increases for a given recreationist, the time spent recreating increases.
- A 10 percent increase in personal income decreases RVDs to the Lincoln National Forest by 4.5 percent. It has been shown in a study on the Snake River basin in Idaho that participation in dispersed recreation is inversely proportional to income (Normandeau, 1999). As personal income rises individuals are more inclined to use motels and to frequent other types of

**Table 12. IMPLAN analysis of impacts; dispersed recreation**

	Direct Impact	Indirect Impact	Induced Impact	Total Impact
Recreation (Before)	\$4,359,955	\$3,362,878	\$608,798	\$8,331,681
Recreation 65% less	\$1,525,984	\$1,177,024	\$213,079	\$2,916,088
Difference	(\$2,833,971)	(\$2,185,954)	(\$395,719)	(\$5,415,593)

recreational venues not requiring them to “rough it.”

Recreation-type business ventures can create economic leakages, in that many of the goods and services they require to operate optimally are imported from outside the regional economy. Typically, temporary workers are drawn to the area to fill jobs in hotels, ski resorts, etc., and many of the recreation-related establishments (restaurants, hotels, tour and travel companies) are owned by national or regional companies that export the profits (Gibson, 1993). Part of the money from tourists and seasonal residents ultimately leaves the area. In addition, the seasonality of recreation activities can create problems for local workers and businesses during off-seasons.

Dispersed recreation provides both pros and cons of economic opportunity. On one hand, many individuals seek the ambience of the forest to maintain a balance in their lives. On the other hand, it appears that whenever personal income is reduced, travel distance will inhibit dispersed recreation. That is, a family may choose to recreate near home rather than traveling to distant destinations if the family budget is reduced by any measure. This volatility in recreational dollars spent directly impacts an economy that relies on dispersed recreation as its primary economic engine.

When the overall economy of the United States is affected by higher interest rates, oil prices, or—as in past years—severe weather anomalies that affect prices of everyday goods and services, the recreation dollar shrinks immediately and directly affects those regional economies that rely upon it.

The NMSU recreation study indicates that price elasticity with respect to out-of-pocket costs for travel to dispersed recreation activities is -0.5731. In other words a 10 percent increase in travel costs would reduce

participation by 5.731 percent.

To put this into perspective: in the spring of 2004 gasoline prices in the Lincoln National Forest study area increased from an average of \$1.35 per gallon to an average of \$2.88 per gallon, or approximately 113 percent. Using the above multiplier, dispersed recreation visitor participation potentially decreased by as much as 65 percent. To further illustrate the economic instability that can result from dependence on dispersed recreation, a 65 percent reduction in revenue generated by dispersed recreation—created by increased out-of-pocket expenses—would reduce dollars available to the economy from dispersed recreation to approximately \$1,525,984 annually. This deficit affects tax base, per capita income, and other factors that define a stable economy. IMPLAN calculates the impact to the economy as a 5.4 million dollar loss of economic benefit due to an estimated 113 percent gasoline price increase. This volatility creates an element of uncertainty and doubt in an already precarious economy (Table 12).

In addition, almost 75 percent of the dollars spent on dispersed recreation were spent in the county or city of origin and not in the recreation target area (Table 13).

Another statistic that should cause concern is that the number of recreational trips demanded was lower for high-income persons. The ramification of this information is that individuals with more disposable income are less likely to use dispersed recreational facilities and thus less likely to spend that disposable income where it will benefit the dispersed recreation sector the most.

**Table 13. Dispersed recreation spending allocation**

Total Spent	\$82,951
\$ per visit	\$71.14
% spent in area	25%
% spent out of area	75%

**CONCLUSION**

The four-county economy of south central New Mexico as defined by the Lincoln National Forest is a complex and fragile entity. Per capita and median household incomes for residents of this area fall well below national and New Mexico levels. Individuals who live here live here for reasons that transcend financial considerations, entering into the realm of subjective values, which defy quantification.

Difficult as it is to measure the utility that living in this area brings, we must not lose sight of the fact that these residents still value stability, security, and employment as much as do urban dwellers who choose urban life usually for the financial benefits and conveniences that exist there.

Logging and livestock grazing have for generations provided a source of stable employment to numerous individual who in turn have kept households together, maintaining the way of life they desire.

The owners and operators within these two industry sectors know that in order to stay in business for the long haul they must adhere to conservative business practices; to do otherwise would mean an end to that sector of the economy as they know it.

Dispersed recreation is viewed by federal agencies responsible for forest management as being more in keeping with the spirit of the Multiple Use Sustained Yield Act, and therefore emphasis has been placed on developing and promoting this sector of the economy while pressure is being applied to diminish livestock grazing and logging.

This is best illustrated by the Draft 1995 Resources Planning Act (RPA). The RPA Program projected that the Forest Service’s outdoor recreation program would generate a \$111 billion annual contribution to the national Gross Domestic Product (GDP) by the year 2000. An economic analysis done in 2004 for the USDA Forest Service Strategic

**Table 14. Dispersed recreation expenditure report NMSU 2004**

Category	Amount
\$ per visit	\$ 71.14
% spent in area	25%
% spent out area	75%
Avg \$ per RVD in area	\$17.79
Avg \$ per RVD out of area	\$53.36
Avg \$ per RVD/3 in area	\$5.93

Plan for Fiscal Years 2004–2008 revised the GDP estimate from the recreation program for 2002 to \$11.2 billion. The revision constituted a 90 percent reduction from the 1995 RPA projection.

The NVUM survey verified that the Draft 1995 RPA Program projection of roughly 800 million visits to NFS lands for 2000 was a substantial overestimate. The NVUM survey estimated the number of total visits to all lands managed by government agencies to be approximately 205 million visits per year.

According to the USDA, GDP estimates have been lowered because of lower user spending per visit deduced from NVUM data. This corroborates our findings from the 2004 recreational study, which showed that 75 percent of funds used for dispersed recreation were spent in the city of origin not the recreation area of destination (Table 14).

The 2004 NMSU recreation study has shown that dispersed recreation responds swiftly and negatively to increases in out-of-pocket expenses. The dispersed recreation consumer sector is highly correlated with those income groups that have a lower disposable income and thus are less able to withstand price fluctuations. Further, support of dispersed recreation is ancillary to other budget demands, and as such is the first to be reduced or eliminated when a budgetary challenge arises.

The Clinton administration promoted the idea of dispersed recreation replacing consumptive forest activities based on the strength of the 1995 Draft RPA. The fact that current estimates of spending and visitor use derived from the 2004 NMSU recreational study correlate harmoniously with the results

of the revision of the economic analysis for the USDA Forest Service Strategic Plan for Fiscal Years 2004–2008 lends further credence to the conclusion that dispersed-recreation-oriented revenue generation can in no way sustain a local economy such as is found in the Lincoln National Forest.

On the other hand, logging and livestock grazing provide a steady, reliable source of employment and thus income to the regional economy. Temporary price changes minimally affect overall production because of the long-term investment involved. The level of commitment required to pursue this type of livelihood results in consistency and dedication. Dollars generated from these industries are spent locally, increasing the economic well-being of numerous other residents of the area. But for external factors beyond the control of participants in these two sectors, both logging and livestock grazing would be in full production today.

Dispersed recreation, logging and livestock grazing can co-exist and should not have to compete for consideration within the Lincoln National Forest.

Policies should be implemented that follow the Multiple Use Sustained Yield Act to protect consumptive revenue generation. Dispersed recreation should be viewed as an enhancement to the economy, not as a replacement to existing uses of forest land. This study illustrates and defines the Lincoln National Forest as a critical component of economic stability in the four counties of south-central New Mexico. The forest genre creates an ambience that attracts many diverse and useful economic activities. Basic economic theory dictates that scarce resources should be used to their best outcome. The Multiple Use Sustained Yield Act was created with this goal in mind. In the case of the Lincoln National Forest this report defines “best outcome” as managing livestock grazing, logging, and dispersed recreation in a manner that will facilitate and support a continued and long-term harmonious co-existence.

## REFERENCES

- Athearn, R.G. (1986.) *The mythic West in twentieth century America*. Lawrence: University Press of Kansas.
- Baker, R.D., Maxwell, R.S., Treat, V.H., Dethloff, H.C. (1988). *Timeless heritage: A history of the Forest Service in the Southwest*. (FS-409 Washington, DC: USDA Forest Service.
- Dana, Samuel T. and Sally K. Fairfax (1980). *Forest and range policy: Its development in the United States* (2d Ed). (p. 89). New York: McGraw-Hill.
- Gibson, H. (1993). Busy travelers: Leisure-travel patterns and meanings in later life. *World Leisure*, 44, (2), 11-20.
- Kocis, S., English, D. B. K., Zarnoch, S. J., Arnold, R., & Warren, L. (2004). National Visitor Use Monitoring Survey results, (USDA Forest Service report). Lawrence: University Press of Kansas.
- New Mexico State University Cooperative Extension Service. (2002). *Forest Service timber harvest record compilation*. New Mexico State University: Las Cruces.
- Normandeau Associates, Agricultural Enterprises, Inc., and University of Idaho. (1999). Willingness-to Pay and expenditures for general outdoor recreation in the Snake River Basin in central Idaho, Contract No. DACW68-96-D-003 Delivery Order 0010, Modification 01. The Army Corps of Engineers. Walla Walla District, Walla Walla, Washington. Retrieved September 18, 2004 from <http://www.npc.navy.mil/Officer/Pers44/CivilEngineerCorps/>
- Seawolf, R. D (2006). *The Lincoln National Forest and the economic stability of south central New Mexico*. Unpublished master's thesis, New Mexico State University Las Cruces.
- Smith, V. K. and Kaoru, Yoshiaki (1990). Signals or noise? Explaining the variation in recreation benefit estimates. *American Journal of Agricultural Economics*, 72(2): 419-433.
- Tweed, W.C & USDA Forest Service. (1980.) A history of outdoor recreation development in national forests, 1891-1942. (NAL Call No. aGV191.67.F6-T94-1978, p.29). Clemson, SC: Clemson University, Department of Parks, Recreation, and Tourism Management.
- USDA Forest Service. (1995). The Forest Service program for forest and rangeland resources draft RPA program. Washington, DC.
- USDA Forest Service (2004, revision). *An economic analysis for the USDA Forest Service Strategic Plan for Fiscal Years 2004-2008*. Retrieved February, 2003 from [http://www.fs.fed.us/recreation/GDP\\_Q&A\\_Final.pdf](http://www.fs.fed.us/recreation/GDP_Q&A_Final.pdf)

## Notes

**Notes**

Printed August 2007

---

New Mexico State University is an equal opportunity/affirmative action employer and educator.  
NMSU and the U.S. Department of Agriculture cooperating.