



**ENDANGERED SPECIES
LISTINGS
AND
STATE
ECONOMIC PERFORMANCE**

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by
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INTRODUCTION

For most Americans mention of the Endangered Species Act conjures up images of a triumphant Spotted Owl perched atop an enormous Douglas Fir, while below a group of unemployed loggers idly drink beer and pitch stones. The Endangered Species Act, some argue, is impeding American economic growth and prosperity – “trashing the economy”. Indeed, anecdotes abound of butterflies halting shopping mall projects, mosses scuttling highway extensions, and fish blocking resort development.

With the number of listed endangered species presently hovering around 800 and thousands of candidate listings waiting in the wings it is certainly prudent to question whether we can pay the alleged price for protecting endangered plants and animals in the manner presently defined by the Endangered Species Act. And it is in this context that a number of amendments to the Endangered Species Act have been proposed, all aspiring to balance the needs of biodiversity against those of the economy.

In order to assess the potential economic value of these proposed amendments we need to have some sense of the actual economic impact of endangered species listings. To what degree do such listings depress economic growth and development? Those who favor giving economic interests more weight in the endangered species process are convinced that the negative economic effects of endangered species listings are readily observable and substantial. This should be easy to verify, and if true would prove valuable in estimating the economic return from an “economically balanced” Endangered Species Act.

Accordingly, this paper estimates the impact of endangered species listings on state economic development for the period 1975-1990, the entire lifetime of the Endangered Species Act for which complete data are available. The data show that endangered species listings have not depressed state economic development activity as measured by growth in construction employment and gross state product. These findings hold even after taking into account state area, population, population density, size of economy, structure of economy, population growth, and time. In fact a state by state comparative analysis across three consecutive five year periods reveals the

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converse to be true: higher numbers of listed endangered species are associated with higher rates of economic growth and corresponding population pressures.

ESTIMATING THE ECONOMIC IMPACT OF ENDANGERED SPECIES LISTINGS AT THE STATE LEVEL

Before launching into any form of statistical estimation it is useful to examine visually the basic trends in the two key variables -- rates of economic development and endangered species "burden"-- to see how they move in time. This study uses two standard indicators of state economic performance that reflect development activity: growth in construction employment and growth in gross state product.² The choice of construction employment is obvious. If the weight of endangered species listings is systematically hindering development activity, for example forcing delays and cancellation of public works projects and spawning permit denials for residential and commercial construction, then construction employment opportunities should be limited if not actually depressed.

Endangered species burden is measured in terms of the number of listings per state – a relative measure of endangered species burden. In fact the political debate over the Endangered Species Act is itself waged in terms of the number of listings, current and prospective. Opponents worry that the impending avalanche of listings will shut down important segments of the U.S. economy, especially the natural resource sectors. A larger number of individual species listed, they argue, means a larger amount of land likely to be affected. It also implies a larger assortment of restrictions put in place, all else being equal. Therefore, Alabama with 61 listed species in 1990 would in theory labor under more onerous burdens than neighboring Georgia with 31 listed species. And both would be worse off than Louisiana with just 19 listed species.³

If the impact of the Endangered Species Act is really as pervasive and perverting as the anecdotal evidence implies then the overall economic climate

² Data were obtained from the U.S. Department of Commerce and Department of Labor.

³ Of course the number of listed species is not a perfect measure. Some listed species range over very small habitats. Habitat for the Tecopa Pupfish was under an acre. Others, such as grizzly bears require hundreds of thousands of acres. Thus, two states with a single listing each may experience very different impacts.

Then too many listed species have overlapping territories. For example, the area designated as habitat for the California Gnatcatcher contains some 37 other endangered species. Thus, it is likely that the cumulative impact of these 38 listings may be substantially less than the sum of their parts. It would be desirable, therefore, to use this alternative measure of species burden. Unfortunately, data are not yet available to allow us to measure endangered species "burden" directly by land restrictions.

in states with high numbers of endangered species listings should suffer in a measurable way.⁴ This negative effect should ripple back through state economies and be detectable in changes in the gross state product. For example, traditional assumptions about multiplier effects assert that every timber job lost in Oregon causes three additional jobs in services, retailing, etc. to disappear.

Construction Employment Growth: FIGURE 1 consists of three graphs representing the periods 1975-1980, 1980-1985, and 1985-1990. Forty-eight states, omitting Alaska and Hawaii, are plotted according to (the vertical axis) their average annual growth in construction employment during the five year period and (the horizontal axis) their corresponding number of listed endangered species as of the *beginning* of that period.⁵ In other words, each graph is a snapshot in time comparing the states in terms of the number of listed endangered species and subsequent economic performance for the five year period. The line running through the graph attempts to trace the general trend using simple regression.

None of the patterns in any of the time periods support the assertion that endangered species protection results in measurable reductions in state economic performance. In fact there seems to be a modest *increasing* (positive) trend during the first two periods in construction employment growth as the number of listed species rises, and no trend in the last period. If endangered species listings are "trashing" state economies there is no sign of that impact on construction employment.

Gross State Product Growth: The next set of graphs arrayed in FIGURE 2 examine the trend for growth in gross state product as a function of endangered species listings. Here again the pattern predicted by critics of the Endangered Species Act fails to appear. There is no trend of declining economic performance as species listings increase. Instead all three periods

⁴ State by state annual data for endangered species listings were obtained from the U.S. Fish & Wildlife Service.

⁵ Both Alaska and Hawaii sit as distant outliers in these graphs – that is, they fall outside the pattern set by the other states. Indeed it is quite common to exclude these states from cross-sectional analyses because of their atypical characteristics. In the context of this study there are strong substantive reasons to explain their "outlier" status. In Alaska's case its extraordinarily low population density, large wilderness areas, and natural resource (oil)economy separate it from the other states. Hawaii's island bio-geography and island economy uniquely distinguish it from the states of the continental U.S..

The statistical analyses for this study were run including and excluding Alaska and Hawaii. There were virtually no substantive differences in the results, albeit for larger standard errors around coefficients and statistics. Thus, only the results excluding these two states are reported.

show a modest increasing rate of gross state product growth associated with increasing numbers of species listings.

Simple Bivariate Associations

The patterns in the graphs are indeed suggestive, but do they hold up to more serious scrutiny? Or, is it possible that that *apparent* positive relationship could arise from chance occurrence? Using simple bivariate regressions we can test if the visual impressions from the graphs of a positive association could stand on their own as being statistically significant, or whether they just might be random fluctuations that give the appearance of a systematic relationship.⁶

Beginning with a simple bivariate regression is justified in this case by the fact that those who argue that the Endangered Species Act is trashing the economy are quite vocal in their view that the effects are clear and obvious. Certainly their anecdotes make it seem so. Therefore we should be able to detect the harmful economic effects of endangered species listings without more complex econometric or statistical controls.

Construction Employment Growth: The bivariate regression results for construction employment growth are shown in TABLE 1. What do we find? Look at the row corresponding to the predictor variable: **NUMBER of ENDANGERED SPECIES**. Each column corresponds to a given period and the first

TABLE 1: Regression Analysis of the Impact of Endangered Species Listings on Construction Employment Growth

<i>PREDICTOR</i>	<i>PERIOD</i>		
	<i>1975-1980</i>	<i>1980-1985</i>	<i>1985-1990</i>
NUMBER of ENDANGERED SPECIES	0.370*** (3.760)	0.082 (1.325)	0.004 (0.070)
<i>N</i>	48	48	48
<i>R-SQR</i>	0.24	0.04	0.00
<i>Adj. R-SQR</i>	0.22	0.01	0.00

* $p < 0.05$ ** $p < 0.01$ *** $p < 0.001$

number in the cell is the regression coefficient. It measures the change in construction employment growth as a function of change in the number of

⁶ The regression model used was:

$$\text{Construction Employment. Growth}_{(t,t+5)} = \text{constant} + \text{SPECIES}_{(t)}$$

listed species. For 1975-1980 it appears that when you compare states each additional listed species is associated with an increase of 0.37% in construction employment growth.

The number in parentheses directly below the regression coefficient is the t-statistic testing the statistical significance of the regression coefficient. An asterisk (*) indicates that based on the t-statistic there is less than a 5% chance that the coefficient is actually "0" or negative. That is, the coefficient is significant at the 5% level. A double asterisk indicates statistical significance at or below 0.01; a triple asterisk indicates statistical significance at or below 0.001. The choice of a threshold for statistical significance depends on your attitude toward risk. In general, probability values of 0.05 or 0.01 are considered to be appropriate dividing lines., indicating that for the purposes of analysis it is reasonable to assume that a systematic relationship does exist between the variables.

The lower section of the table reports some basic information about the regression. The most important number is the *Adjusted R-SQR*, which measures the relative amount of variation in the economic indicator that is accounted for by endangered species listings. A small adjusted R-SQR – say below 10% – says that the relationship is basically uninteresting because the vast amount of variation in the economic indicator is not explained.

Looking at TABLE 1 we see that the coefficients for all three time periods are positive, but only the 1975-1980 data produce a statistically significant coefficient. The simple regression for 1975-1980 seems to account for about a quarter of the variation in state construction employment growth (Adj. R-SQR). Given the null results for 1980-1985 and 1985-1990 (statistically insignificant coefficients and zero adjusted R-SQR) we can safely conclude that there is no clear or obvious systematic bivariate relationship between endangered species listings and development growth as measured by construction employment growth. This is not what opponents of the Endangered Species Act expect to see.

Gross State Product Growth: TABLE 2 looks at the relationship between endangered species listing and growth in gross state product. Once again the simple bivariate regression coefficients for **NUMBER of ENDANGERED SPECIES** are positive. While the 1975-1980 coefficient is statistically significant the others are not. We might be better off ignoring the positive trends seen in the graphs. Nevertheless these results strongly contradict the argument that endangered species listings impede state economic growth and development.

Confounding Influences

Of course all this begs the question: What happens when you take into account some of the obvious characteristic differences among the states?

TABLE 2: Regression Analysis of the Impact of Endangered Species Listings on Gross State Product Growth

<i>PREDICTOR</i>	<i>PERIOD</i>		
	<i>1975-1980</i>	<i>1980-1985</i>	<i>1985-1990</i>
NUMBER of ENDANGERED SPECIES	0.17** (3.04)	0.04 (1.55)	0.02 (1.30)
<i>N</i>	48	48	48
<i>R-SQR</i>	0.17	0.05	0.03
<i>Adj. R-SQR</i>	0.15	0.03	0.01

* $p < 0.05$ ** $p < 0.01$ *** $p < 0.001$

Perhaps the opponents of endangered species protection are fundamentally correct – endangered species protection does hinder economic growth – but their rhetoric exaggerates the case. Could the effect be more subtle than they believe? Controlling for certain state characteristics, therefore, might reveal the negative economic effects they predict. While a more subtle negative effect might not be as politically compelling it would still be important for public policy-making.

For example, many western states have fairly large territorial areas, relatively small populations, and have economies that depend to a substantial degree on natural resource industries: forestry, oil and coal extraction, mining, etc. Large area and low population implies fewer occasions where human activities and wildlife activities collide, suggesting lower numbers of species listings. At the same time these states may be more likely to have poorly performing economies because natural resource commodity markets have been skittish for the past two decades. Consequently, an analysis of the relationship between endangered species listings and economic performance that includes these states may be biased if it ignored these confounding correlations.

Likewise we could speculate that states with larger economies might tend to have more listed endangered species because they have larger populations and enjoy more aggressive land development, making encroachments into critical habitats more likely. "Big economy" states may also have stronger economic engines to drive stronger growth. Ignoring state differences in economic size could mask a fundamentally negative relationship between endangered species listings and economic growth. Therefore, we should reanalyze the data using statistical controls to adjust for characteristic differences among the states that are likely to be related to both the relative number of endangered species listings and economic performance.

TABLE 3 presents the results for a multiple regression that examines how growth in construction employment varies with the number of species

TABLE 3: Multiple Regression Analysis of the Impact of Endangered Species Listings on Construction Employment Growth

<i>PREDICTOR</i>	<i>PERIOD</i>		
	<i>1975-1980</i>	<i>1980-1985</i>	<i>1985-1990</i>
NUMBER of ENDANGERED SPECIES	0.407*** (3.718)	0.164* (2.599)	0.019 (0.325)
Land Area	0.315 (0.639)	-0.777 (-1.139)	0.933 (1.222)
Size of Economy	-1.003* (-2.241)	-0.378 (-0.575)	-0.394 (-0.523)
Percent Extractive Industry	0.677 (0.695)	-3.400** (-2.770)	-4.740** (-3.237)
	<i>N</i>	48	48
	<i>R-SQR</i>	0.36	0.33
	<i>Adj. R-SQR</i>	0.30	0.28

* $p < 0.05$ ** $p < 0.01$ *** $p < 0.001$

listings after taking into account some key differences among the states in the form of the nuisance variables: area, economy size (gross state product), and extractive industry dependency (percent of gross state product derived from extractive industries).⁷

Comparing the coefficients and probabilities for **NUMBER OF ENDANGERED SPECIES** between TABLE 1 and TABLE 3 we see that the strength of the positive relationship between construction employment growth and species listings *increases* after taking the nuisance variables into account. Moreover the 1980-1985 series crosses the 0.05 threshold of statistical significance. Clearly there is something interesting here.

⁷ Area, gross state product, and percent of industry in extractive industry are used in the estimating equation in log form. Log form is used to remove the confounding effects of non-linear relationships among the variables and heteroscedasticity in the residuals. It also turns out that these are log-normal variables. Population is excluded from the analysis because it is so highly correlated with size of economy (0.985). Economy size is an effective surrogate. Substitution produces the same results. Population density is implicit in the analysis using the log forms of area and population. Percent of urban population was also tried in early analyses but dropped when it failed to show any effect.

In particular the declining magnitude and statistical significance of the coefficients linking **NUMBER OF ENDANGERED SPECIES** and construction employment growth over consecutive periods suggest that the positive association dissipates over time. In contrast the negative relationship between construction employment growth and extractive industry grew stronger over time. This is consistent with the fact that states with large energy producing sectors enjoyed good economic times the 1970s as a result of oil price shocks. This produced an expanding construction market (notice the positive, though statistically insignificant coefficient for **PERCENT EXTRACTIVE INDUSTRY**). The economic fortunes of these states changed in the 1980s and that is reflected in the negative coefficients for 1980-1985 and 1985-1990.

Regardless of what one thinks of this persistent counter-intuitive positive to null association between species listings and construction employment growth, state experiences during the period 1975-1990 do not conform to the notion that the Endangered Species Act has hurt economic performance, even after controlling for the nuisance variables.

Gross State Product Growth: TABLE 4 reexamines the relationship between gross state product growth and species listings with controls for state characteristics. Here again the relationship between species listings and gross state product growth is marginally stronger (compare with TABLE 2) -- the coefficients are larger and the associated significance levels get smaller -- when characteristic differences among the states are "controlled."

Indeed, all three time periods now show a statistically significant relationship between species listings and growth in gross state product. As we saw for construction employment, this relationship appears to have been strongest during the earlier period. Similarly, the negative relationship between

TABLE 4: Multiple Regression Analysis of the Impact of Endangered Species Listings on Gross State Product Growth

<i>PREDICTOR</i>	<i>PERIOD</i>			
	<i>1975-1980</i>	<i>1980-1985</i>	<i>1985-1990</i>	
NUMBER of ENDANGERED SPECIES	0.21*** (4.05)	0.07** (3.19)	0.07*** (5.05)	
Land Area	0.35 (1.51)	-0.32 (-1.30)	-0.27 (-1.49)	
Size of Economy	-0.96*** (-4.58)	-0.28 (-1.19)	-0.59** (-3.29)	
Percent Extractive Industry	0.19 (0.42)	-1.24** (-2.75)	-2.28*** (-6.56)	
	<i>N</i>	48	48	48
	<i>R-SQR</i>	0.50	0.36	0.67
	<i>Adj. R-SQR</i>	0.45	0.30	0.63

* $p < 0.05$ ** $p < 0.01$ *** $p < 0.001$

extractive industry dependence and economic performance grows over time.

Anecdotes notwithstanding, the data compel us to reject the argument that higher numbers of endangered species listings are associated with poorer economic performance.

ANALYZING A MORE SUBTLE FORM OF NEGATIVE ECONOMIC IMPACT FROM ENDANGERED SPECIES LISTINGS

Perhaps it is true, as the above results suggest, that states with higher numbers of listed species also tend to have stronger economies. Nevertheless, species listings could still exert a more subtle drag effect – a sort of negative feedback – that gradually and incrementally retards the rate of growth of state economies. You could argue that, regardless of what did happen in the 1970s and 1980s, states with higher numbers of species listings might have *further* economically outpaced the other states had they not had higher species listings.

The effect would be evident by comparing each state's growth rate in a given period against its prior and subsequent economic performance. If larger numbers of species listings decelerate economic growth, then when comparing

the periods 1975-1980, 1980-1985, and 1985-1990 states with cumulatively higher numbers of species listings would show a tendency toward slower growth in subsequent periods relative to states with fewer listings.

This hypothesis is tested in TABLE 5 for growth in Gross State Product.⁸ As the first row shows the coefficients are positive, not negative as Endangered Species Act detractors would expect. As states accumulate species listings their economic growth rates do not decelerate; in fact they seem to accelerate. The best predictor of a slowing economy is dependence on extractive industries.

TABLE 6 performs the same analysis for growth in construction employment and produces fundamentally the same results. The accumulation of endangered species listings over time is not associated with decelerating growth rates in construction employment. There is either a slight positive association or no association at all.

The data fail to find any basis for presuming that states that accumulated higher numbers of listed species over time would have enjoyed even stronger growth had the Endangered Species Act not been implemented.

⁸ Defining "Diff" as the difference in economic indicator growth rates between two consecutive five year periods, then the equation is:

$$\text{Diff}_{(p,p-5)} = \text{constant} + \text{Species}_{(p)} + \text{Nuisance Variables}_{(p)} + \text{Error}.$$

TABLE 5: Multiple Regression Analysis of Impact of Accumulated Endangered Species Listings on Inter-Period Changes in Gross State Product Growth Rates

<i>PREDICTOR</i>	<i>PERIOD</i>	
	<i>1980-1985</i>	<i>1985-1990</i>
	<i>vs.</i> <i>1975-1980</i>	<i>vs.</i> <i>1980-1985</i>
TOTAL NUMBER of LISTED SPECIES	4.586** (3.306)	2.005 (1.682)
Land Area	-0.455 (-1.176)	0.004 (0.013)
Size of Economy	-0.147 (-0.374)	-0.343 (-1.068)
Percent Extractive Industry	-1.173 (-1.685)	-1.912** (-3.033)
	<i>N</i> 48	48
	<i>R-SQR</i> 0.28	0.24
	<i>Adj. R-SQR</i> 0.22	0.16
	* <i>p</i> <0.05 ** <i>p</i> <0.01 *** <i>p</i> <0.001	

TABLE 6: Multiple Regression Analysis of Impact of Accumulated Endangered Species Listings on Inter-Period Changes in Construction Employment Growth Rates

<i>PREDICTOR</i>	<i>PERIOD</i>	
	<i>1980-1985</i>	<i>1985-1990</i>
	<i>vs.</i> <i>1975-1980</i>	<i>vs.</i> <i>1980-1985</i>
TOTAL NUMBER of LISTED SPECIES	8.487* (2.640)	-0.422 (-0.114)
Land Area	-1.192 (-1.329)	1.505 (1.474)
Size of Economy	0.051 (0.057)	-0.044 (-0.044)
Percent Extractive Industry	-2.163 (-1.340)	-3.443 (-1.765)
	<i>N</i> 48	48
	<i>R-SQR</i> 0.24	0.09
	<i>Adj. R-SQR</i> 0.17	0.01
	* <i>p</i> <0.05 ** <i>p</i> <0.01 *** <i>p</i> <0.001	

ESTIMATING THE IMPACT OF ECONOMIC GROWTH ON ENDANGERED SPECIES LISTINGS AT THE STATE LEVEL

Of course the above results do not mean that we can stimulate state economic growth by intentionally increasing the number of listed endangered species. Then how can we explain these paradoxical results? *Reverse cause and effect*: strong economic growth is an engine for increases in species listings and subsequent economic growth. Therefore, the data series produce correlations between species listings and subsequent economic growth even though the causal relationship runs the other way.

The appropriate step is to reverse the causal direction in the analysis and reexamine the data predicting endangered species listings based on *prior* economic performance. The analysis here is conceptually straightforward. The pace of economic growth for each state during a given period is measured and then we ask how it is related to the *subsequent* rate of endangered species listings in that state. For instance, did states with higher rates of growth in gross state product between 1975-1980 experience larger increases in endangered species listings in subsequent years?

While this is a simple question conceptually some analytic gymnastics are required to answer it. First, case studies show that pressures on a given species develop slowly and are often unrecognized for a considerable period of time. The development activity that poses a threat to either the creature or its habitat may persist for many years before the threat is recognized. Second, studies of the listings process itself show that there is a substantial delay between the time authorities become aware that an animal or plant may be in danger and its eventual placement on the endangered species list. Indeed, many species in trouble never make it to the list at all. Several dozen have disappeared while in the waiting queue. Thus, we cannot not expect an instantaneous cause and effect.

Moderating that delay, however, are the efforts by U.S. Fish & Wildlife and many national and local environmental organizations supporting enforcement of and compliance with the Endangered Species Act, as well as the activities of local (NIMBY) interests wishing to block specific projects. Whatever the latter's motivation they nonetheless help to identify potential candidates for listing prior to development work. In short, there may be some lag between economic growth (cause) and consequent listing of species (effect) but it should not be extreme.

The multiple regression analysis in TABLE 7 attempts to predict the pace and distribution of new endangered species listings based on economic growth

rates.⁹ It assumes a two-year delay between economic “cause” and species listing “effect”. Economic activities between 1980 and 1985 are presumed to affect species listing rates between 1982 to 1987. Other lag values (0 to 5 years) do not substantially alter the results either way. For this analysis both indicators of economic development, the five-year average annual growth in gross state product and the five-year average annual growth in construction employment, appear as independent variables in the model together.

The results in TABLE 7 support our suspicions about the real links between state economic performance and endangered species listings. Gross state product growth is systematically and *positively* associated with subsequent growth in the number of listed species, after controlling for state

TABLE 7: Multiple Regression Analysis of the Impact of Development Pace on Endangered Species Listings

<i>PREDICTOR</i>	<i>PERIOD</i>		
	<i>1975-1980</i>	<i>1980-1985</i>	<i>1985-1990</i>
Gross State Product Growth	0.21** (3.35)	0.14** (2.83)	0.10** (2.71)
Construction Employment Growth	-0.03 (-1.15)	-0.01 (-0.30)	-0.004 (-0.386)
Land Area	-0.12 (-1.84)	0.13* (2.39)	-0.003 (-0.075)
Size of Economy	0.26*** (-4.04)	0.07 (1.46)	0.230*** (5.130)
Percent Extractive Industry	0.03 (0.26)	0.18 (1.82)	0.172 (1.458)
	<i>N</i>	48	48
	<i>R-SQR</i>	0.37	0.43
	<i>Adj. R-SQR</i>	0.29	0.37

* $p < 0.05$ ** $p < 0.01$ *** $p < 0.001$

area, size of economy and extractive industry dependence. In contrast, growth in construction employment does not seem important when the other variables are considered. Its coefficients, while uniformly negative, are for all intents and

⁹ The equation is:

$$\text{New Listings}_{t+2,t+7} = \text{constant} + \text{Gross State Product Growth}_{t,t+5} + \text{Construction Employment Growth}_{t,t+5} + \text{Nuisance Variables} + \text{Error}.$$

The nuisance variables are in log form, as is the dependent variable: new listings. Analysis shows these are all log-normal variables.

purposes “0”, as indicated by their small values and failure to attain statistical significance. While at first glance this result might seem odd, it actually makes good sense. A zero coefficient means that when you hold growth in gross state product constant (as well as the other predictor variables) changes in growth in construction employment do not affect endangered species listings. This is entirely reasonable since growth in construction employment a direct result of an expanding economy. Therefore "controlling" the latter has the effect of controlling the former, and so no independent effect is registered.¹⁰

The table also shows that states with larger economies also tend to have larger numbers of listed species. This may be partially the result of greater economic dynamism: big economies expand more. It may also be related to the fact that big economies have big populations, implying significant population pressures on wildlife habits.

We can carry this exploration one step further if we consider the link between economic performance, development, and population trends. As noted earlier state population was not explicitly used in the analysis because it was effectively captured by several of the other variables.¹¹ But, as shown in TABLE 8 when change in state population (population growth) during periods is added to the equation, then growth in gross state product no longer has a statistically significant effect. This occurs because of the dynamic interaction among these two variables, with gross state product growth acting as a partial surrogate for population growth when the latter is not in the equation explicitly. People are attracted to states with expanding economies, and an influx of new workers and consumers further stimulates development and economic growth.¹² Therefore when both gross state product growth and population growth are included together in the analysis the former effect is nullified.

The Adjusted R-SQR values shown in TABLE 6 caution that we should not, however, push this argument too far. Only about 40% of the variation in new listings is accounted for the by the two statistically significant predictor variables: population change and size of economy. Thus most of the explanation for differences in species listings among the states continues to elude us. Studies by other researchers point to a host of bureaucratic,

¹⁰ The correlation between gross state product growth and construction employment growth is 0.82, 0.83, and 0.56, respectively for the three periods. The constraining effect on construction employment growth when gross state product growth is held constant is clearly seen in partial regression plots.

¹¹ In fact colinearity was so severe that it prevented model estimation.

¹² The correlation between population growth and growth in gross state product is 0.91, 0.45, and 0.78 for each of the three periods, respectively.

TABLE 8: Multiple Regression Analysis of the Impact of Development Pace on Endangered Species Listings

<i>PREDICTOR</i>	<i>PERIOD</i>			
	<i>1975-1980</i>	<i>1980-1985</i>	<i>1985-1990</i>	
Gross State Product Growth	0.054 (0.679)	0.067 (1.247)	0.085 (1.252)	
Construction Employment Growth	-0.048 (-1.692)	-0.01 (-0.658)	-0.003 (-0.240)	
Land Area	-0.163* (-2.577)	0.070 (1.254)	-0.0.12 (-0.200)	
Size of Economy	0.278** (-4.627)	0.089 (1.963)	0.228*** (4.978)	
Percent Extractive Industry	-0.017 (-0.143)	0.038 (0.334)	0.170 (1.427)	
Change in Population	0.342** (2.936)	0.176* (2.339)	0.018 (0.266)	
	<i>N</i>	48	48	48
	<i>R-SQR</i>	0.48	0.50	0.47
	<i>Adj. R-SQR</i>	0.40	0.43	0.39

* $p < 0.05$ ** $p < 0.01$ *** $p < 0.001$

organizational, ecological, political, and economic influences that may account for much of the missing variation.¹³

CONCLUDING OBSERVATIONS

The one and a half decades of state data examined in this paper strongly contradict the assertion that the Endangered Species Act has had harmful effects on state economies. Protections offered to threatened animals and plants do not impose a measurable economic burden on development activity at the state level. In fact the evidence points to the converse. The combination of robust development and population migration accelerates the rate of endangered species listings.

This relationship is clearly seen in FIGURE 3 which places each state in a three dimensional space. The floor of the graph is defined by the two growth

¹³ See, for example: Stephen L. Yaffe (1982) *Prohibitive Policy: Implementing the Federal Endangered Species Act* (Cambridge, MA: MIT Press); Richard J. Tobin (1990) *The Expendable Future: Politics and the Protection of Biological Diversity* (Durham, N.C.: Duke University Press); and United States General Accounting Office (1993) *Endangered Species: Factors Associated with Delayed Listing Decisions* (GAO/RECD-93-152).

indicators: growth in gross state product and construction employment growth over the entire period 1975-1990. The vertical axis corresponds to the total number of listed species in 1992, allowing for lags in the listings process. Each state is represented by a "hat pin" whose vertical height corresponds to total number of listed species. The long upward slope of the hat pins that ascends toward the top rear corner of the graph clearly suggests that endangered species listings are a consequence of strong economic performance over the 15 year period.

We must now return to the source of this inquiry and reconcile these findings with the anecdotes that find their way to the media. How can it be, given the well-publicized horror stories, that the Endangered Species Act does not leave a trace on state economies? The answer is simple: the economic effects of endangered species listings are so highly localized, of such small scale, and short duration that they do not substantially affect state economic performance in the aggregate. They are lost in the noise of background economic fluctuations. A rare toad may indeed impede construction of an ocean resort or golf course but such events do not ripple back through state economies.

Although detractors of the Endangered Species Act often describe it as blind to the needs of people and the economy, every government and academic examination of the endangered species process has reached the opposite conclusion: political, economic, and social considerations permeate the listings process.¹⁴ In fact, for every tale about a project, business, or property owner allegedly harmed by efforts to protect some plant or animal species there are over one-thousand stories of virtual "non-interference." In reviewing the record of 18,211 endangered species consultations by the Fish and Wildlife Service/National Marine Fisheries covering the period 1987-1991 the General Accounting Office found that only 11% (2050) resulted in the issuance of formal biological opinions.¹⁵ The other 89% were handled informally -- that is to say the projects proceeded on schedule and without interference. Of the 2050 formal opinions issued a mere 181 -- less than 10% -- concluded that the proposed projects were likely to pose a threat to an endangered plant or animal. And most of these 181 projects were completed, albeit with some modification in design and construction. In short, more than 99% of the projects reviewed under the Endangered Species Act eventually proceeded unhindered or with marginal additional time and economic costs. Given the political and economic screening that occurs in listings cases it is not surprising that no measurable negative economic effects are detectable.

¹⁴See the previous footnote.

¹⁵ United States General Accounting Office (1992) *Endangered Species Act: Types and Numbers of Implementing Actions* (GAO/RECD-92-131BR).

It is not my intention to trivialize the economic or social effects at the sub-state level that may result from some individual species listing or habitat designation.¹⁶ Counties, cities, and towns are much more sensitive to single employer or single industry effects. Endangered species critical habitat listings may, under certain conditions, have demonstrable negative economic impacts at the local level. The evidence, however, remains to be collected and analyzed.¹⁷ But even conceding the possibility of systematic local effects, in terms of scale and scope they are a far cry from the national economic crisis that the Endangered Species Act's detractors depict.

Economic assistance, job training grants, and other localized programs can make a difference in such cases at modest cost. The revitalization of county economies in the Pacific Northwest following the listing of the Northern Spotted Owl is one example.¹⁸

Furthermore local economic effects must be considered in context. Hundreds of state and federal policies have far more injurious impacts on local economies than wildlife protection. For example, the recent series of military base closings have had economic effects hundreds of times greater than all the listings during the 20-year life of the Endangered Species Act. Even greater economic and social harm resulted from the ill-conceived deregulation of the savings and loan industry during the 1980s. The number of jobs lost to leveraged buy-outs in the 1980s exceeds by many times the wildest estimates of jobs lost to endangered species; and no social good was accomplished in any of these cases.

The evidence is clear: Based on the actual economic experience under the Endangered Species Act weakening the Act will not spur job creation and economic growth. It will not launch poor rural or western communities on the

¹⁶Available case studies also suggest that local communities suffer far greater economic and social harm from over-dependence on extractive industries. The boom to bust story continues to be played out in coal country, hard-rock mining communities, oil towns, and timber regions. Even the Spotted Owl case reveals that at worst the listing merely brought forward the date of collapse of segments of the Pacific Northwest timber industry. See, for example: William R. Freudenburg (1992) "Addictive Economies: Extractive Industries and Vulnerable Localities in a Changing World Economy," *Rural Sociology*, Vol. 57, No. 3, pp. 305-332.

¹⁷ One such study, by the Texas and Southwestern Cattle Raisers Association, attempted a regional analysis of this sort in which they did find endangered species listings depressed local property values. Unfortunately, several errors in their statistical methodology produced this result. When these errors were corrected the analysis produced the opposite findings: counties with endangered species listings enjoyed higher than average property value growth. See: *Comparison of Fair Market Value of Rural Land and Vacant Lots/Tracts in 33 Central Texas and Hill Country Counties 1989-1993* (October 1994) and the author's review of that report.

¹⁸ See: Jessica Maxwell (1995) "Back to the Woods," *Audubon* Vol. 97, No. 1 (January-February), pp. 88-91; Timothy Egan (1994) "Oregon, Foiling Forecasters, Thrives as IT Protects Owls" *The New York Times* (October 5), p.A1.

road to prosperity. It will not save overextended developers from bankruptcy. If "growing the economy" is the top priority of government then we should focus on policy options that can make a difference.

Figure 1: Construction Employment Growth and Species Listings

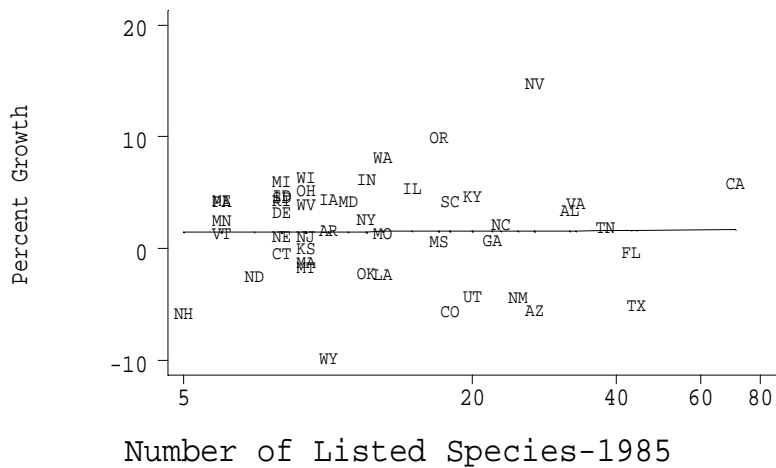
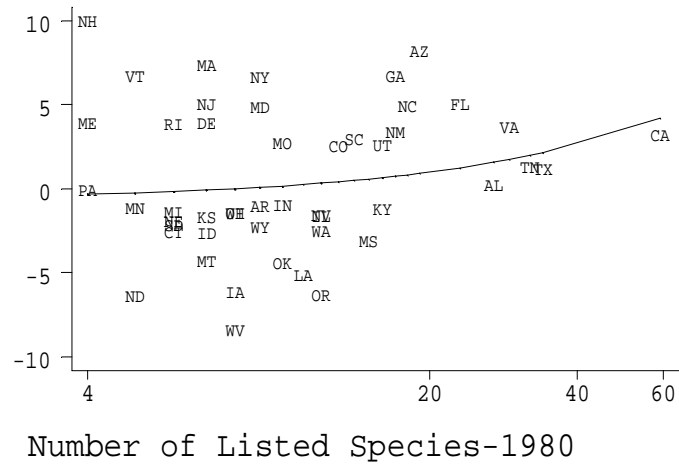
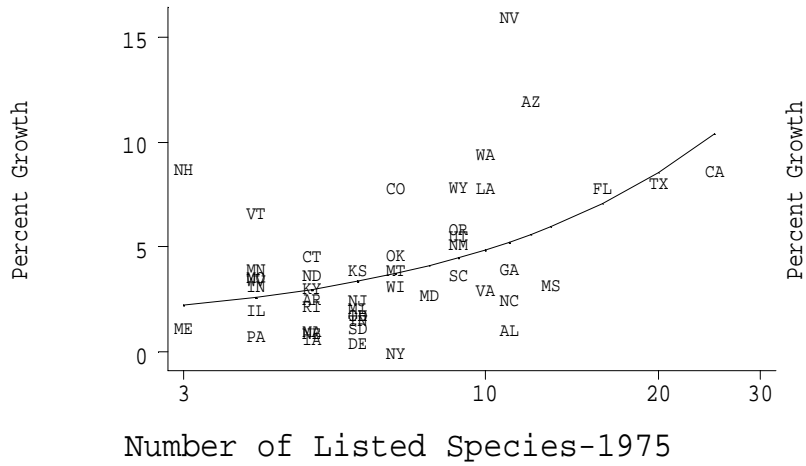


Figure 2: :Gross State Product Growth & Species Listing

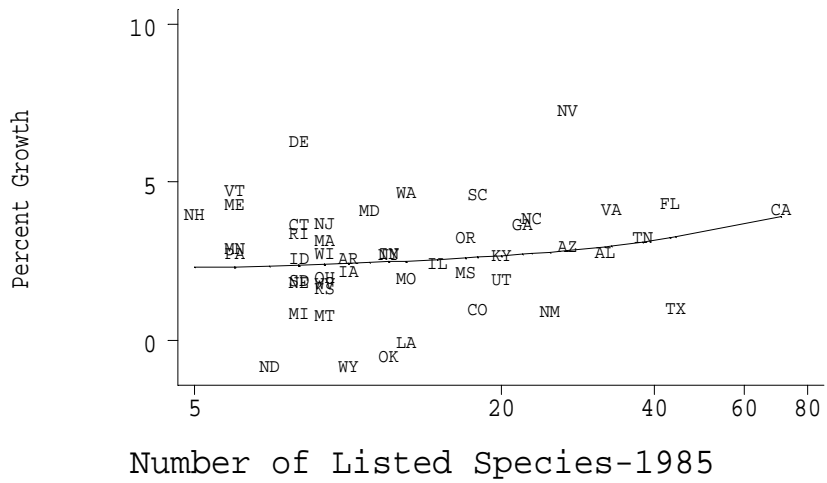
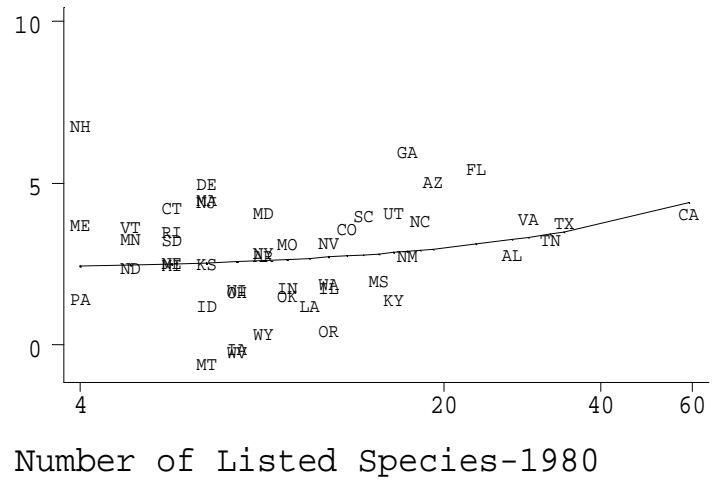
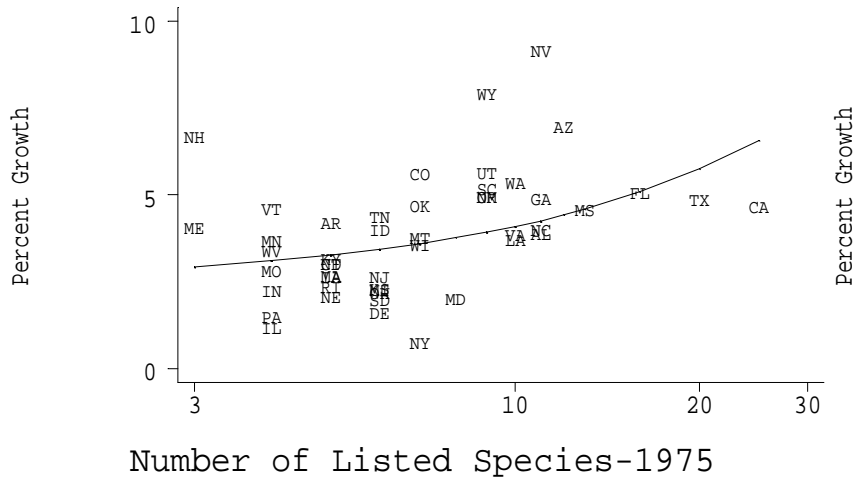


Figure 3: Species Listings & State Economic Performance 1975-1992

