Historical Economic Performance of Oregon and Western Counties Associated with Roadless and Wilderness Areas

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Executive Summary

The purpose of this study is to help improve understanding of the relationship between economic growth and protection of roadless lands. This was accomplished using historical data regarding the economic experience of individual western and Oregon counties. By looking to the past to see how county economies were affected by the creation of wilderness areas, we gain a better understanding of how future roadless designations might affect Oregon counties. Similarly, by investigating the relationship between protected areas (wilderness, national parks and national monuments) and local economies, we can find whether limiting extractive activities on public lands limits county-level economic growth.

The issues that were examined and the major results are as follows:

In Oregon, the relationship between the environment and the economy is changing. Industries that extract raw materials are stagnating, while industries that benefit from the presence of environmental amenities are growing rapidly.

In regards to the declining influence of extractive industries on economic growth:

1) Extractive industries (including logging and mining) play an increasingly small role in job creation in Oregon. Between 1969 and 1997, the overall Oregon economy created jobs more than two times faster than the state's extractive industries.

2) Extractive industries play an increasingly small role in income generation. In fact, in 1997 Oregon's extractive industries actually generated $503,938 dollars *less* than they did in 1969 (based on inflation-adjusted dollars). During the same period inflation-adjusted total personal income for the entire state increased by $44.5 billion (see page 16).

3) Not surprisingly, the percentage of total income generated by extractive industries in Oregon is steadily declining and is now less than half of the 1969 level – from 13.5 percent in 1969 to 5.1 percent in 1997 (see page 16).

4) For most of the nine examined counties, the percentage of total county income and employment generated by extractive industries is steadily declining:

	Income:		Employment	
	1969	*1997*	*1969*	*1997*
Josephine	17.5%	4.8%	24.3%	15.4%
Jackson	19.1%	8.2%	20.1%	13.1%
Lane	20.6%	6.9%	25.2%	15.1%
Deschutes	15.9%	3.8%	21.1%	11.8%
Grant	39.2%	13.5%	25.0%	15.2%
Umatilla	19.4%	7.8%	16.6%	16.7%
Union	28.1%	9.8%	18.2%	14.6%
Wallowa	28.8%	9.5%	11.0%	13.7%
Douglas	36.0%	16.1%	35.9%	22.1%

Many economic sectors benefit from the presence of environmental amenities and protected areas. These sectors, such as tourism and retirement, are increasingly important sources of economic growth:

5) Economic sectors associated with tourism are increasingly important sources of income in Oregon. Between 1969 and 1997 the amount of income, in inflation-adjusted dollars, generated by hotels and other lodging places grew by 120%, income generated by drinking and eating places (restaurants, bars, etc.) grew by 151%, and income generated by amusement and recreation services grew by 459%. (In contrast, inflation-adjusted income generated by the manufacture of lumber and wood products actually declined 15% during the same period) (see page 16).

6) Retirees are also attracted to areas with recreational opportunities and natural amenities. In Oregon, the amount of government payments to retirees, in inflation-adjusted dollars, grew 296% between 1969 and 1997. Additionally, in 1997, retirement payments were 1.7 times greater than *all* of the income generated by logging, mining, and agriculture combined (see page 16).

7) For all nine examined counties, the percentage of total county income (inflation-adjusted) generated by economic activity often associated with natural amenities (retirement payments, dividends, rents, etc.; see page 8) has steadily increased:

	1969	*1997*
Josephine	28.1%	39.9%
Jackson	23.7%	33.5%
Lane	19.1%	29.4%
Deschutes	22.4%	32.3%
Grant	17.5%	31.9%
Umatilla	18.3%	25.7%
Union	19.9%	29.1%
Wallowa	21.8%	36.1%
Douglas	17.6%	32.0%

If economic sectors benefiting from environmental amenities are more important sources of economic growth than extractive industries, then the presence of roadless areas and wilderness, national parks and national monuments should not harm local economies. In fact, in the eleven western states including Oregon, the presence of protected lands (wilderness, national parks, and national monuments) and roadless areas is associated with income and employment growth:

8) In western counties during the period 1969 – 1997, the amount of *protected lands* within 50 miles of a county's center is positively correlated with employment growth ($r = 0.184$, $N = 409$ western counties, $p = 0.000$) and with income growth ($r = 0.133$, $N = 409$ western counties, $p = 0.000$).

9) In western counties during the period 1969 – 1997, the amount of Forest Service *roadless areas* within 50 miles of a county's center is positively and significantly correlated with employment growth ($r = 0.208$, $N = 409$, $p = 0.000$) and with income growth ($r = 0.171$, $N = 409$, $p = 0.000$).

10) Many argue that protecting lands from extractive activities is especially harmful to rural communities. However, when only rural western counties are studied, the relationship between economic growth and protected and Forest Service roadless areas is even stronger. In rural counties during the period 1969-1997, the amount of *protected lands* within 50 miles of a county's center is positively and significantly correlated with employment growth ($r = 0.332$, $N = 113$ rural counties, $p = 0.000$) and with income growth ($r = 0.327$, $N = 113$, $p = 0.000$). Similarly, the amount of Forest Service *roadless areas* within 50 miles of a county's center is positively and significantly correlated with employment growth ($r = 0.306$, $N = 113$, $p = 0.000$) and with income growth ($r = 0.341$, $N = 113$, $p = 0.000$). This means counties with, or near, protected lands are more likely to experience stronger economic growth.

Counties with the highest proportion of land in protected areas (wilderness, national parks, and national monuments) are growing the fastest:

11) Employment in non-metropolitan counties with more than 10% *protected areas* grew more than 1.85 times faster than the average non-metropolitan county. Employment in non-metropolitan counties with more than 10% Forest Service *roadless areas* grew more than 1.43 times faster than the average non-metropolitan county (see Table 3, p.24).

12) Income in non-metropolitan counties with more than 10% *protected areas* grew more than 1.4 times faster than the average non-metropolitan county. Income in non-metropolitan counties with more than 10% Forest Service *roadless areas* grew 1.25 times faster than the average non-metropolitan county (see Table 3, p.24).

Two statistical tests (stepwise regression analysis and K-means cluster analysis) indicate that protecting lands from extractive activities does not result in slower income and employment growth:

13) Regression analysis indicates that counties with relatively attractive environments are more likely to have relatively high rates of income growth (see page 19).

14) Regression analysis also indicates that counties with relatively attractive environments and counties with higher percentages of land devoted to wilderness, national parks, and national monuments are more likely to have relatively high rates of employment growth (see page 19).

15) The cluster analysis test indicates that the presence of Forest Service roadless or protected areas is *not* correlated with slower income or employment growth in any of the county clusters. This means that the statistical test could not find any indication that roadless or protected areas have caused county economies to grow slower. Instead, there is evidence that for some county types the presence of roadless areas is correlated with income and employment growth (see page 21).

Introduction

Problem and Objectives:

A familiar version of the "jobs versus the environment" argument asserts that efforts to protect public lands by limiting logging, mining, grazing and roadbuilding harm local economies. When extractive activities are limited, potentially productive natural resources are locked up and both employment and income growth are thought to suffer as a result.

Others claim that the presence of protected areas such as wilderness, national parks, national monuments and roadless areas is an economic asset that gives some communities an advantage in attracting tourists, retirees, and small business owners. Because of this, protected areas act as a catalyst in the transformation of stagnating extractive economies into diversified, relatively competitive amenity economies. In other words, "Our natural landscapes no longer generate new jobs and incomes primarily by being warehouses from which loggers, farmers, fishermen, and miners extract commercial products. In today's world, these landscapes often may generate more new jobs and income by providing the natural resource amenities--water and air quality, recreational opportunities, scenic beauty and the fish and wildlife--that make the. . . [area] an attractive place to live, work, and do business" (Power 1995, ii).

This research explores the "jobs vs. the environment" argument by studying the relationship between protected areas and economic growth. An analysis of detailed county-level data on the sources of income and employment growth, and on the location and extent of roadless and protected areas indicates that environmental protection does not come at the expense of either income or employment growth in Oregon or in the western United States.

Specifically, this study focused on three objectives:

> Objective 1: "What are the historical contributions of the extractive sector to county economies compared to amenity-driven economic sectors?"
>
> Objective 2: "Given the experience of similar counties across the West, is the presence of protected and roadless areas likely to create economic opportunities for Oregon counties?"

Objective 3: “Does the presence of wilderness and roadless areas come at the expense of local jobs and income?

Literature Review:

Many counties in the rural West are undergoing a fundamental economic transformation. Extractive industries (mining, logging, ranching, farming) are in decline, while the service sector has grown dramatically (Power 1991, Rasker 1993, Rasker 1994, Power 1996). In counties where the shift to services is most advanced, the relationship between the environment and local economic security has fundamentally changed. Economic security no longer depends on exporting raw materials. Instead, the presence of natural amenities --pristine mountains, clean air, wildlife, and scenic vistas--stimulates employment and income growth by attracting tourists, small business owners, and retirees. Because of this, previous research (Rasker 1993, 1994,1995; Power 1991, Power 1995; Rudzitis 1993) suggests that natural amenities are an increasingly important component of economic development in rural regions of the western United States, and are likely to be associated with relatively diversified economies, rapidly growing service sectors, and demographic change.

Several recent surveys support the view that environmental amenities and recreational opportunities play an important role in attracting and retaining firms and migrants:

Johnson and Rasker (1993) surveyed 500 randomly sampled businesses owners (473 responded) located within the Greater Yellowstone Ecosystem to determine the overall factors influencing the location decisions of the region's firms. Their sample included firms in all economic sectors, with the number of firms surveyed in each sector roughly proportional to the overall population of firms. The survey found that the most important factors in attracting (and keeping) businesses were: scenic beauty, a quality environment, recreational opportunities, the rural setting, and the fact that it was a good place to raise a family. Owners were much less likely to have been drawn to the region because of traditional business concerns, including overall tax structure, the cost of doing business, the availability of capital and labor, the transportation infrastructure, and proximity to a university. Even though 66% of the business owners felt their business would be more profitable in an urban area, when asked the question: "All things considered, would you choose to locate a business here again?" 86% said yes (Johnson and Rasker, 1993). These responses clearly indicate that factors other than simple profit maximization motivate business location decisions.

In a study focusing on the forces attracting migrants to Western counties containing wilderness areas, Rudzitis and Johansen (1989) found similar results. When asked how important a county's attributes were in convincing recent in-migrants (those moving to the county in the last 10 years) to move there, the most important factors were scenery (83%), outdoor recreation (79%), and environmental quality (78%). The least important attributes were social services (11%), cost of living (18%), and quality of schools (21%). Sixty percent said that the presence of wilderness areas was an important factor in

influencing their move, and 81% felt wilderness areas were important to their county (Rudzitis and Johansen 1989).

Other research has shown that local economies are not harmed by wilderness designation. Duffy-Deno (1998) studied the impact of a subset of federally designated wilderness areas on county growth in eight western states and found "no statistical evidence of a negative relationship between federal wilderness and county level employment, suggesting that wilderness designation may cause, on average, little aggregate economic harm to county economies" (Duffy-Deno 1998, :133).

Research Overview:

The objectives of this study were examined using historical data regarding the economic develop experienced by individual western and Oregon counties. By looking to the past to see how county economies were affected by the creation of wilderness areas, we gain a better understanding of how future roadless designations might affect Oregon counties. Similarly, by investigating the relationship between protected areas (wilderness, national parks and national monuments) and local economies, we can find whether limiting extractive activities on public lands limits county-level employment and income growth.

The first objective was investigated in Task 1. This task examines changes in the relationship between local economies and natural resources by quantifying the shift from extractive industries to economic sectors that benefit from the growth of tourism, retirement, and small businesses.

Objective 2 was investigated under Task 2. This task is based on a regression analysis and backed with a cluster analysis approach. The regression effort examined which variables (i.e. population, amount of protected lands nearby, weather, proximity to airports and interstates, etc.) have the most significant positive or negative effects on county income and employment change. Clusters analysis assigns counties to groups on the basis of common traits. Such traits include the levels of income and employment provided by specific industries, proximity to major metropolitan areas, and population size. The end result is that counties are assigned to relatively homogenous groups (i.e. farming counties, urban counties, and retirement/resort counties). Using this approach, it is possible to compare how Oregon counties have developed in the presence of roadless areas compared to similar counties across the West not in the presence of such areas.

Objective 3 is divided into several components within Task 3. Overall, this task cannot show if wilderness *causes* an increase or decrease in growth, only if the presence of wilderness is *correlated* or associated with healthier or weaker economies. It may not be the roadless or wilderness designation itself that causes economic growth, as such designations are only a paper transaction. Instead, the presence of amenities such as scenery, recreational opportunities, and knowing these amenities are protected, may be enough to attract tourists and retirees, and to encourage businesses to relocate nearby thus strengthening and diversifying local economies.

Task 3 was divided into two parts. The first part examines whether employment and income growth vary between counties with roadless and protected areas and counties without such lands. It also explores whether counties with relatively high percentages of wilderness do better or worse than counties with smaller percentages of wilderness. The second part of this task investigated if a significant positive or negative statistical relationship exists between the presence of environmental amenities and economic growth (employment and income).

The remainder of this text describes the data sources and analytical steps taken, and presents the results in text and graphic form.

Data Sources, Background and Methodology

Data Sources

To provide for consistent analyses for all counties, uniform county data sources were required. Recognizing the need to compare Oregon counties to counties in 11 western states, data sets covering all western states were needed. Therefore, the following data sets were used in this study:

1) Personal Income and Employment Data: To track long term changes in local economies, county income and employment data were needed. The data were obtained by industry sector for all counties in the United States from the *Regional Economic Information System (REIS) (1969-1997 CD-ROM*, U.S. Department of Commerce, Economic and Statistics Administration, Bureau of Economic Analysis (http://www.bea.doc.gov/bea/uguide.htm). The Bureau of Economic Analysis (BEA) describes the database: "The REIS contains annual estimates—for counties, metropolitan areas, BEA economic areas, state metropolitan and non-metropolitan portions, states, regions, and the United States—of personal income by major source; per capita personal income; earnings by two-digit Standard Industrial Classification (SIC) industry; full- and part-time employment by one-digit SIC industry; regional economic profiles; transfer payments by major program; and farm income and expenses."

2) Data on the Location and Size of Federally Managed Lands (including wilderness areas): Data on the size, location and other characteristics of National Forest inventoried roadless areas were obtained from the U.S. Forest Service (http://roadless.fs.fed.us/data/gis/coverages.shtml). This information was assembled by the USDA Forest Service Roadless Project EIS Team who collected information from all USDA Forest Service Regions regarding inventoried roadless areas. The information was provided by each forest to the regions, and then forwarded from the regions to the Washington Office who posted it on the internet after a quality control check was performed. This database contains inventoried roadless areas in both National Forests and National Grasslands and was used to identify the locations and size of USDA roadless areas.

3) *Managed Areas Database (MAD),* Remote Sensing Research Unit (RSRU), University of California Santa Barbara. R. Gavin McGhie, (www.ncgia.ucsb.edu/rsru/mad/mad.html). As printed on the RSRU web site, this database "provides accurate, up-to-date information on the spatial location and aerial extent of currently managed and protected areas. MAD is a comprehensive GIS database for the conterminous United States which includes all types of managed areas. Examples include National and State Parks and Forests, Wilderness Areas, Indian and Military

Reservations, and National Wildlife Refuges. Researchers at the Remote Sensing Research Unit have compiled this database by integrating a number of data sources diverse in scale and map projection. The database has been compiled as a 1:2,000,000 scale product, and both the precision and accuracy of the database are in accord with that scale… MAD includes information on the level of protection each management designation provides, data sources used for compilation, place names of these managed areas, and a number of additional attributes." These data were used to create databases and GIS map layers reporting the location, extent and features associated with wilderness areas managed by individual states. It also contained information on the year Oregon wilderness areas were designated.

4) U.S. Geological Survey, Linear Federal Land Features of the United States, Reston, Virginia 1999 (http://www-atlas.usgs.gov/fedlandsm.html). These data were used to create databases and GIS map layers detailing the location, extent and features associated with wilderness areas, national parks, and national monuments.

5) The year some wilderness areas were designated is missing in the MAD dataset. This information was obtained from *The Wilderness Information Network* (www.wilderness.net).

6) *1989 ERS County Typology Codes*. Economic Research Service, U. S. Department of Agriculture. (http://www.ers.usda.gov/epubs/other/typolog/). This data set contains Beale Codes which classify counties on the basis of their population size and on their location relative to metropolitan counties.

Table 1: Beale Code Details

Code:	Description:
METROPOLITAN COUNTIES:	
0	Central counties of metropolitan areas of 1 million population or more
1	Fringe counties of metropolitan areas of 1 million population or more
2	Counties in metropolitan areas of 250,000 - 1,000,000 population
3	3 Counties in metropolitan areas of less than 250,000 population
NONMETROPOLITAN COUNTIES	
4	Urban population of 20,000 or more, adjacent to a metropolitan area
5	Urban population of 20,000 or more, not adjacent to a metropolitan area
6	Urban population of 2,500-19,999, adjacent to a metropolitan area
7	Urban population of 2,500-19,999, not adjacent to a metropolitan area
8	Completely rural (no places with a population of 2,500+) adjacent to a metropolitan area
9	Completely rural (no places with a population of 2,500 or more) not adjacent to a metropolitan area.

The ERS County Typology Codes also classifies non-metro counties on the basis of their economic types (farming dependent, mining dependent, manufacturing dependent, government dependent, services dependent, and nonspecialized) and based on policy types (retirement-destination, Federal lands, persistent poverty, commuting and transfers-dependent).

7) To create county and state base maps, data were obtained from *ESRI Data & Maps 1998 CD-ROM #2 and CD-ROM #3 (*Environmental Systems Research Institute, Inc., Redlands, California. www.esri.com). These databases also contain information on the location and extent of interstate highways, airports, urban areas and county level demographic information. This information was utilized in conjunction with the other data sources listed above using ArcView to conduct the analyses reported here.

8) To support the regression analysis, information on the level of amenities associated with each county was obtained from David A. McGranahan's *Natural Amenities Drive Rural Population Change*. Food and Rural Economics Division, Economic Research Service, U.S. Department of Agriculture. Agricultural Economic Report No. 781, 1999. This paper assigns an amenity value to counties on the basis of their environmental amenities using the following variables: January temperature, number of sunny days in January, July temperature, July humidity, water area, and topography; http://www.econ.ag.gov/epubs/pdf/aer781/index.htm.

Secondary Data:

Much of the data necessary to complete this study were not readily available from primary sources. Therefore, variables such as the percent of land in each county that is wilderness were calculated using the data sources described earlier in combination with a Geographical Information System (GIS).

For example, to calculate the percent of land in each county that is wilderness, the GIS was used to process the Managed Areas Database and create a map layer containing only wilderness areas. This map layer can be thought of as a digital map of wilderness connected to a data table with information about each individual wilderness area. After the wilderness map layer was created, it was overlaid on a map layer of western counties. As a result, information on the location and size of both wilderness and counties could be analyzed, resulting in a map layer containing information regarding the percent of land in each county that is wilderness.

Similarly, to calculate the amount of wilderness within 50 miles of a county, several new map layers were created. The western county map layer was used to create a map layer consisting of the centroid (the exact geographic center) of each western county. Next, a map layer consisting of 50-mile buffers around each of the centroids was created. The 50-mile buffer map layer was then overlaid on the wilderness map layer. The result was a map displaying information on the amount of wilderness within 50 miles of each county centroid.

Extractive and Amenity Sector Data:

As the income and employment data source used in this study was generated to support all U.S. industries, it was not received already organized into categories convenient for this specific study. Data were required on the relative economic benefits of extractive industries and amenity-driven industries. These data were obtained by combining economic sectors provided in the REIS data as described below to best track the performance of economies dependent on protected areas and/or extractive industries.

Extractive Sector Data:

The method used to quantify employment data for the extractive sector was derived from previous work by Rasker (1992) and Power (1991). Borrowing from Ray Rasker (1992): "Following Rasker (1991) and Power (1991), mining, manufacturing, and agriculture are defined here collectively as *extractive* industries. This includes renewable industries, such as farming, cattle grazing, and forestry, as well as nonrenewable mining industries. The mining sector includes hardrock mining and oil and gas extraction. The manufacturing sector includes lumber and wood products manufacturing… Due to the way the data are made available, it is not possible to disaggregate, over time, the lumber and wood products manufacturing from the broader category of manufacturing." Based on the historical acceptance of this method, the same industry sectors were combined in this study to measure changes in the extractive industry. Data on these industry sectors are provided by the REIS database.

Because data on income sources are more detailed, it was possible to combine the following sectors to calculate income created by extractive economies: agricultural services/foresty/fisheries, farm earnings, mining, lumber and wood products, and paper and allied products.

Amenity-Driven Sector Data:

Identifying Amenity-Driven Income: The presence of wilderness and roadless areas help generate growth through their related natural amenities such as attractive scenery, recreational opportunities, the presence of wildlife, clean air and water, and other traits closely associated with wilderness areas. These amenities attract tourists, retirees, recreationists, and entrepreneurs who desire to visit or relocate near such areas knowing the amenities are protected and will remain available into the future. Rasker (1992) demonstrated that traditional extractive economies in the West are increasingly diversified. One of the largest sources of income growth is from non-labor income, consisting of retirement payments and dividends, interest and rent (known as DIRE). Non-labor income may be brought in by people attracted by the areas natural amenities. In fact, even in many counties traditionally focused on extractive activities, the amount of non-labor income has grown larger than the income generated by all extractive industries combined. These sources of income result in growth in many other standard economic

sectors such as services, retail, wholesale, construction, etc. Thus, the presence of amenities enhances the growth and health of the entire economy. Non-labor income is sometimes referred to as *unearned income*.

There are other sources of income from amenity-related activities such as lodging, entertainment, restaurants, etc. However, we did not include these sectors when calculating the amount of amenity driven income at the county level, as data on these sectors are often suppressed for privacy concerns. Because of this, county-level income data on amenity-driven income reported herein should be considered conservative. We measure these other income sources at the state level.

Employment from Amenity-Driven Economic Activities: Amenity-based activities typically drive parts of the service economy. Amenity-based growth results in more dollars being spent locally by new businesses, tourists and residents thus creating new jobs in the service sector. The service sector is reported in the REIS database and includes sub-sectors such as hotels, repair and support services, amusements and recreation, restaurants and many others. In addition, many of the businesses attracted to amenity-rich areas fall within the service sector such as advertising firms, computers and information technologies, research, etc. All together, these new firms stimulate new economic growth in the service sector. Thus, employment changes based on growth in amenity-based activities are best measured by tracking growth in the service sector. However, data on these sub-sectors of the service economy are not available or are suppressed by the REIS database to protect the privacy of individual businesses. Therefore, job growth in amenity-related businesses could not be measured in this study.

Study Area

This study focuses on the actual economic experience of nine Oregon counties:

Josephine	*Jackson*	*Lane*
Deschutes	*Grant*	*Umatilla*
Union	*Wallowa*	*Douglas*

These counties were chosen as they represent different areas of the State and also represent various levels of economic health and vitality.

Tasks two and three look at the relationship between economic growth and environmental amenities in 11 western states:

Arizona	California	Colorado
Idaho	Montana	Nevada
New Mexico	Oregon	Utah
Washington	Wyoming	

Midwestern, Southern and Eastern states were not included in the study area as federal lands in these regions comprise a much smaller percentage of land than in the west.

All but 4 of the 414 western counties were used in this study. Two counties were split in half during the 1969-1997 study period (Yuma, Arizona and Valencia, New Mexico) and

were excluded from the study, along with the new counties (La Paz Arizona and Cibola New Mexico) created from them. The data from the two old counties could not be accurately separated into the four new counties thus rendering them unusable.

Time Period

This study focuses on economic development during the period 1969-1997, the longest period possible given the availability of REIS data on the sources of income and employment growth. Data from this time period were used for all three tasks.

Wilderness areas were created in Union, Umatilla, Douglas, Grant, Lane, and Jackson counties in 1984. Because of this, we were able to study some of the economic effects of wilderness designation by calculating whether growth rates increased or decreased after the designations were made. We were unable to assess the impact of wilderness designation in Deschutes County as its wilderness areas were created before 1969. Economic data are not available for years prior to 1969. In addition, Wallowa County whose wilderness areas were created in both 1978 and 1975, and Josephine County where wilderness areas were created in both 1978 and 1984, were not examined. These multiple launch dates for wilderness areas made it impossible to measure if and when these designations began affecting income or employment growth.

Data Preparation

The first step for all three tasks was to create databases containing the sources of income and employment for all counties in the study area and not just the nine study counties. This was done by:

1) Downloading and organizing REIS data in Excel.
2) Eliminating counties located outside of the 11 western states.
3) Estimating missing/suppressed observations. This is necessary, as the BEA routinely suppresses county level data to avoid the disclosure of confidential information. To overcome missing/suppresed observations, the following two steps were taken:
   a) If a county has less than 10 jobs in an economic sector, the Bureau of Economic Analysis (the creator of the REIS data base) substitutes the letter "L" for the actual number of jobs. This is done to protect the privacy of these employers. When this was the case, "L" was replaced with "10". This will slightly overestimate the number of jobs attributed to these economic sectors, but since "L's" appear often in extractive industries, "10" was substituted to ensure the effects of this industry were not unfairly minimized.
   b) If a county has three or fewer employers in a given economic sector, the BEA suppresses that sector's employment data out of privacy concerns. When this is the case, the number of employees was estimated using the average number of employees in that sector in similar counties. "Similar counties" were identified by their Beale codes. Beale codes classify counties on the basis of their population size and on their proximity to metropolitan areas, and were obtained from the Economic Research

Service. In other words, if the number of mining jobs in a particular rural adjacent county (Beale code = 9) is suppressed, it is estimated by calculating the average number of mining jobs in all other counties with the same Beale code. Counties without any mining jobs are excluded from this calculation.

4) Finally, adjust all income data to remove the effect of inflation. Inflation adjustments were based on the Consumer Price Index (CPI-U), 1982 - 1984 = 100.

Methodology

Task 1: "What are the historical contributions of the extractive sector to county economies compared to amenity-driven economic sectors?"

This task compared the historical growth of the extractive and amenity-related sectors in nine Oregon counties plus the state as a whole. For each county, once the data were prepared for all industries from 1969 to 1997, they were assembled into EXCEL spreadsheets. We then combined the appropriate industrial sectors to represent the extractive and amenity-related sectors. From these spreadsheets we assembled data and created graphics showing inflation-adjusted income and employment growth by sector. Counties containing Forest Service roadless and/or protected areas in Oregon were examined to see if economic growth differed from counties without such areas. These results can be found in Appendix A and B.

Once all graphs were created, each county's results were analyzed to:

- Compare the county's development path before and after wilderness designation,
- Determine if the pace of economic growth decelerates or accelerates after wilderness designation, and
- Determine if the county's economy diversifies into other industrial sectors. That is, does the county's dependence on other industries relative to extractive industries increase or decrease after wilderness lands were designated?

Task 2: Do Counties Benefit From the Presence of Forest Service Roadless Areas?

Regression Analysis:

Regression analysis was the primary method used to study the relationship between the presence of wilderness and economic development. This involved the multiple regression of the association between employment growth and demographic, economic and environmental variables. A second regression of the association between income growth and the same independent variables was also undertaken.

Specifically, stepwise multiple regressions were used to determine the significance and relative importance of environmental amenities in influencing economic growth at the county level. Stepwise multiple regressions isolate the independent variables that have

critical causal effects. In other words, in this type of regression only the most important independent variables are retained in the regression model.

The dependent variable used in the first regression (EMP69-97) is employment growth during the period 1969 to 1997 in nonmetropolitan counties. The dependent variable used in the second regression (INC69-97) is income growth during the period 1969 to 1997 in nonmetropolitan counties. Metropolitan counties were then excluded from these study areas because the debate over public lands generally does not focus on land in metro counties. Similarly, extractive sectors in metro counties are relatively small, and these counties' economic performance is largely decoupled from the nature and quality of the natural resource base. The independent variables include the county's proximity to airports and interstates, the types and volumes of public lands within the county, population and demographics, etc. The 18 independent variables and their data sources are listed in Appendix C.

The method for selecting variables in the stepwise procedure is based on the following criteria: Probability of F to enter ≤ 0.05, Probability of F to remove ≥ 0.10.

Appendix D presents the results of the employment and income regressions. Implications and interpretations are presented in the Results section.

K-Means Cluster Analysis:

The results of the regression approach were further tested based on an analytical process known as K-Means Cluster Analysis. This process was used to sort counties in the 11 western states into groups, or clusters, on the basis of demographic characteristics as well as sources of income growth and employment growth. The objective of cluster analysis is to group counties together that share common traits and characteristics.

Cluster analysis was used to identify relatively homogeneous subgroups of western counties based on selected variables. The variables used in this study include components of employment growth and income growth (i.e. the percent of county income created by the mining sector), population size, total personal income, population density, population growth rates, and data from the Economic Research Service's U.S. County Economic Typology.

The K-Means Cluster Analysis algorithm was used to sort the 414 western counties into 10 like clusters. This step groups counties into clusters in which the degree of association is strong between members of the same cluster and weak between members of different clusters. All counties were classified into the following 10 clusters. Counties are assigned to clusters based on the industry upon which each largely depends:

1. Farming economies
2. Service economies
3. Retirement/Tourism economies
4. Manufacturing/Lumber economies

5. Government economies (aid to families with dependent children, welfare, government jobs, etc.)
6. Suburban counties
7. Mining/Federal Land economies
8. Urban Counties
9. Poverty/Government economies
10. Low income/Agricultural Services, Farming, Forestry economies

The cluster analysis reviews an established set of variables to determine strength of association when deciding which cluster to assign each county. These variables are listed in Appendix E. For reference, the cluster in which each Oregon county was listed is presented in Appendix F.

Once the clusters were created, the Oregon counties in our study area were compared to similar western counties to identify differences in income and employment growth between counties that were economically and structurally similar except for differences in the amount of protected and Forest Service roadless areas.

Task 3: "Does the presence of wilderness and Forest Service roadless lands come at the expense of local jobs and income?"

This task was divided into two parts. The first part examines if employment and income growth varies between counties with Forest Service roadless and protected areas and counties without such lands. The second part of this task investigated if a significant statistical relationship exists between the presence of environmental amenities and economic growth (employment and income).

Task 3, Part One:

Using GIS, the first step was to create map layers containing information on the location and extent of wilderness areas within county boundaries and within 50 miles of each county's center. The second step was to create map layers containing information on income and employment growth. The map layers created include:

- % of county land that contains Forest Service roadless areas
- % of county land that is wilderness
- % of county land that is either Forest Service roadless areas or wilderness, national parks and national monuments
- Square miles of Forest Service roadless areas within 50 miles of county centroid
- Square miles of wilderness, national parks and national monuments within 50 miles of county centroid
- Square miles of land that is either Forest Service roadless areas or wilderness, national parks and national monuments within 50 miles of county centroid
- Income growth in western counties 1969 – 1997
- Income growth in western counties 1990 – 1997
- Employment growth in western counties 1969 – 1997

- Employment growth in western counties 1990 – 1997
- Metropolitan counties (Beale codes 0-3)
- Nonmetropolitan counties (Beale codes 4-9)
- Rural counties (Beale Codes 8-9)

Next, the GIS was used to calculate both income and employment growth rates for counties with varying amounts of wilderness, national parks, national monuments, and Forest Service roadless areas.

Task 3, Part Two:

The second part of this task quantified the relationship between economic growth and environmental amenities. This was accomplished using Pearson's product moment correlation coefficient. Pearson's product moment correlation is a widely used index to measure the association, or correlation, between two variables. When variables are positively correlated (i.e. a person's height and weight) an increase in one is associated with an increase in another. When variables are negatively correlated (i.e. number of cigarettes smoked and life expectancy), an increase in one is associated with a decrease in the other. In this case, the amount of environmental amenities within 50 miles of a county's center was compared to rates of economic growth (income and employment growth) to determine if there is a significant relationship between the two.

Results and Discussion

Task 1: "What are the historical contributions of the extractive sector to county economies compared to amenity-driven economic sectors?"

1a - Extractive industries play an increasingly small role in job creation in Oregon. The total number of jobs in Oregon grew more than 10 times faster than jobs in extractive industries. See Figure 1 in Appendix A.

1b - Extractive industries play an increasingly small role in income generation. In fact, in inflation-adjusted dollars, in 1997 Oregon's extractive industries actually generated $503,938 dollars *less* than they did in 1969 (based on 1997 dollars), while during the same period inflation-adjusted total personal income for the entire state increased by $44.5 billion. See Figure 2 in Appendix A.

1c - Not surprisingly, the percentage of Oregon's total income generated by extractive industries is steadily declining and is now less than half of the 1969 level – from 13.5 percent in 1969 to 5.1 percent in 1997. Figure 3 in Appendix A.

1d - For most of the nine examined counties, the percentage of total county income and employment generated by extractive industries is steadily declining:

	Employment		Extraction	
	1969	*1997*	*1969*	*1997*
Josephine	17.5%	4.8%	24.3%	15.4%
Jackson	19.1%	8.2%	20.1%	13.1%
Lane	20.6%	6.9%	25.2%	15.1%
Deschutes	15.9%	3.8%	21.1%	11.8%
Grant	39.2%	13.5%	25.0%	15.2%
Umatilla	19.4%	7.8%	16.6%	16.7%
Union	28.1%	9.8%	18.2%	14.6%
Wallowa	28.8%	9.5%	11.1%	13.7%
Douglas	36.0%	16.1%	35.9%	22.1%

1e - Economic sectors associated with tourism are increasingly important sources of income in Oregon. Between 1969 and 1997 the amount of income, in inflation-adjusted dollars, generated by hotels and other lodging places grew by 120%, income generated by drinking and eating places grew by 151%, and income generated by amusement and recreation services grew by 459%. (In contrast, inflation-adjusted income generated by the manufacture of lumber and wood products actually declined 15% during the same period)

1f - Retirees are also attracted to areas with recreational opportunities and natural amenities. The amount of government payments to retirees, in inflation-adjusted dollars, grew 296% between 1969 and 1997. Additionally, in 1997, retirement payments were 1.7 times greater than *all* of the income generated by logging, mining, and agriculture combined

1g - Amenity-related economic sectors play an increasingly larger role in income generation. In fact, in inflation-adjusted dollars, in 1997 income from dividends, interest, rental earnings and retirement payments alone in Oregon were $14.6 billion *greater* than they were in 1969 (adjusted to 1997 dollars) – an increase of 219.3 percent. See Appendix B.

1h - Not surprisingly, the percentage of Oregon's total income generated by sectors associated with the state's natural amenities has increased from 20.1 percent in 1969 to 27.5 percent in 1997.

1i - For all nine examined counties, the percentage of total county income generated by economic activity often associated with natural amenities has steadily increased:

	1969	*1997*
Josephine	28.1%	39.9%
Jackson	23.7%	33.5%
Lane	19.1%	29.4%
Deschutes	22.4%	32.3%
Grant	17.5%	31.9%
Umatilla	18.3%	25.7%
Union	19.9%	29.1%
Wallowa	21.8%	36.1%
Douglas	17.6%	32.0%

Why The Shift Away From Extraction?

Economies in the rural west have historically been dominated by a single extractive industry (Deavers and Brown, 1985), and employment in primary industries is notoriously cyclical, seasonal, and vulnerable to mechanization (Lyson and Falk 1993). In counties where primary industries continue to dominate, this dependence can lead to job loss, economic stagnation, and slow or negative population growth (Lichter, Johnston, and McLaughlin 1994).

Although extractive industries fueled economic growth in the west between the 19th and mid 20th century, their economic influence has declined. There are four main reasons for this assertion:

First, the costs associated with extractive industries generally increase over time at any given location (Freudenburg 1992, Freudenburg and Gramling 1994, Humphrey 1995). This is because the resources that are most profitable and

accessible are harvested/mined first. Additionally, workforces tend to organize and press for higher wages over time.

Second, global prices for commodities tend to remain stable or decline over time. This is the result of competition from third-world producers and technological improvements that decrease extraction costs and permit access to previously inaccessible deposits (Freudenburg 1992).

Third, economic growth is less dependent on natural resources. Many of the most rapidly growing sectors (computer software and financial services for example) use minimal amounts of raw materials (Freudenburg 1992). Even within the industrial economy itself, increased manufacturing efficiency has reduced the link between employment and production (Rasker, 1994). Similarly, manufacturers reduce their consumption of raw materials as they become more efficient (less waste, recycling, etc.) (Humphrey 1995).

Fourth, in some areas, extractive industries have been the victims of their own success, as resource exhaustion and unsustainable land-use practices eventually create unemployment in resource dependent communities (Deavers and Brown 1985).

What Is Replacing Extraction?

Despite the misfortunes of extraction industries, a number of counties in the rural west are experiencing rapid economic growth. This apparent contradiction indicates that a fundamental change in the economy has taken place. Many rural areas are successfully navigating away from dependence on a few natural-resource industries to having a modern, diversified, service-oriented economy. An increasing number of researchers (including the 68 endorsing Power et al. 1995) feel that the West's economic future lies not in extractive industries, but in industries that benefit from the presence of environmental amenities.

A positive trend has existed for jobs and income associated with the amenities provided by wilderness and Forest Service roadless areas. The presence of roadless lands is associated with economic growth. The natural amenities associated with such lands (scenery, recreational opportunities, the presence of wildlife, clean air and water, etc.) draw tourists, retirees, recreationists, and entrepreneurs who are attracted by the quality of life. With these people come new sources of income, which then creates new jobs in the area. Protecting such lands assures people the amenities they seek are protected and will remain thus encouraging them to invest in moving their homes and businesses to the area. The major economic contributions made by these people to county economies are typically in the form of income received from sources outside of the county (i.e. social security, military pensions, dividends, interest, and rents).

From 1969 to 1997, employment related to the extraction sector has risen only 53.9 percent while real income (inflation-adjusted) has actually fallen 11.3 percent. Inflation-adjusted personal income for all of Oregon increased 134.2 percent during this period.

The transition from extractive economies can be clearly seen in the figures presented in Appendix B. For example, Appendix B shows the transition from extraction toward unearned income in Douglas County, Oregon. It shows that, in inflation-adjusted dollars, extractive industries have declined since 1969 and were eclipsed by steadily growing unearned (amenity-related) income in 1980. When these two lines cross in 1980, the economy can no longer be said to be an extractive economy. This is an important change. Jobs in extractive industries were long thought to be the foundation of rural economies. Yet in Douglas county in 1980, all of these sectors together contributed less income to county residents than money earned by passively collecting social security and pensions, interest from bank accounts, dividends from investments, checks from renters, and royalties from patents. These new sources of income are then spent locally stimulating jobs in all varieties of industries and services.

Figure 4 in Appendix A presents the trends in jobs and income for all major industries for the state economy as a whole. This charts show that growth in services, which includes many of the effects of amenity-related services, surpasses all other income sources.

Task 2: "Given the experience of similar counties across the west, is the presence of wilderness likely to create economic opportunities for Oregon counties?"

2a - Regression analysis indicates that counties with relatively attractive environments are more likely to have relatively high rates of income growth.

2b - Regression analysis also indicates that counties with relatively attractive environments and counties with higher percentages of land devoted to wilderness, national parks, and national monuments are more likely to have relatively high rates of employment growth.

2c - Cluster analysis was used to group western counties into 10 clusters, or county types. Once similar counties were grouped together, we could measure differences in economic growth between counties that were similar except with some containing roadless areas and others without. The differences were measured using Pearson's correlation coefficients. This analysis revealed that there was *not* a statistically significant relationship between Forest Service roadless areas and slower employment or income growth for any of the 10 county types. Nor was there a statistically significant relationship between protected areas and slower income or employment growth for any of the 10 county types.

2d - When a statistically significant relationship was found between Forest Service roadless areas and employment growth, the relationship was positive. This was the case for Grant, Union, and Wallowa counties. All belong to cluster 10 (counties defined by agricultural services, forestry, relatively low income and federal lands). Within this county cluster, the correlation between percent of county land consisting of Forest

Service roadless areas and employment growth between 1969 and 1997 was positive and significant (r =0.210; P= 0.050, 1-tailed; N=63).

2e - When a statistically significant relationship was found between protected areas and income growth, the relationship was also positive. This was the case for Douglas county, a member of cluster 4 (counties defined by lumber, manufacturing (including wood products), and ASFF (agricultural services, farming and forestry)). Within this county cluster, the correlation between percent of county land consisting of protected areas and income growth between 1969 and 1997 was positive and significant (r =0.490; P=0.050, 1-tailed; N=20).

Task 2, Part One: Regression Analysis:

Results of the Employment Regression

Of the 18 independent variables tested (each is listed in Appendix C), the stepwise regression procedure only identified and ranked six variables as having significant effect on county employment. The six, in declining order of importance, are:

1 population growth
2 percent of population over 65
3 environmental amenities
4 the presence of airports
5 the percent of county land that is wilderness, national parks and/or national monuments, and
6 population demographics.

This means that the presence of wilderness, national parks and national monuments is an important predictor of employment growth, and (because the Beta weight of the wilderness variable is positive) an increase in the percent of land managed as wilderness, national parks and national monuments predicts more rapid employment growth. In addition, the *environmental amenities* variable was chosen by the stepwise regression meaning the quality of the local environment (temperature, number sunny days, topography, etc.) impacts economic growth.

The fact that both attractive environments and the presence of wilderness, national parks and monuments have a positive effect on employment growth indicates that environmental protection and economic security are linked, and that the transition from extractive economies to amenity economies favors regions that have (and protect) high-quality environments. In other words, a *jobs and the environment* argument is more persuasive than a *jobs vs. the environment* argument.

Results of the Income Regression

Of the 18 independent variables tested in the stepwise regression procedure (see Appendix C), only five were identified as having significant effect on county income. They are, in declining order of importance:

1 population growth

2 percent of population over 65
3 percent of total employment in extractive industries
4 percentage of population by race, and
5 environmental amenities.

Again, the presence of environmental amenities was selected by the stepwise procedure, suggesting that the presence of an attractive environment plays an significant role in local economic security.

It is also important to note that the independent variable reporting the percentage of a county's income generated by extractive industries (*P-extract*) was also selected by the stepwise procedure. It suggests that counties that have not diversified their economies by moving away from a reliance on extractive industries are more likely to suffer from relatively slow income growth as the beta for *P-extract* was negative. This reports a negative relationship between extraction and overall income.

Task 2, Part Two: Cluster Analysis Highlights:

There was no indication that the presence of Forest Service roadless areas or the presence of wilderness, national parks and national monuments was correlated with slower income growth or with slower employment growth in any of the county clusters during the study period (1969 – 1997). At a minimum, this supports Duffy-Deno's claim (1998) that "there is no statistical evidence of a negative relationship between federal wilderness and county-level employment (suggesting that) wilderness designation may cause, on aggregate, little economic harm to county economies."

Grant, Union and Wallowa counties are members of cluster 10, which is dominated by agricultural services/forestry/fisheries, relatively low income and federal lands. Within cluster 10, the relationship between percent of county land consisting of Forest Service roadless areas and employment growth was positively and statistically significant ($r = 0.210$; $P = 0.050$, 1-tailed; $N=63$).

Douglas county is a member of cluster 4, which is dominated by lumber, manufacturing, and Agricultural services/fishing/forestry. Within this cluster, the relationship between percent of county land consisting of protected areas and income growth was also positive and highly significant ($r =0.490$; $P = 0.050$, 1-tailed; $N=20$).

With cluster analysis, it is difficult to find statistically significant correlations between the presence of amenities and economic growth. One possible reason is that when similar counties are grouped into clusters, there is less variation in economic growth rates within county clusters than within the study region as a whole. Another is that the number of observations within county clusters is smaller than the number of observations within the region as a whole thus making it tougher to develop reliable conclusions.

Task 3: "Does the presence of wilderness and Forest Service roadless lands come at the expense of local jobs and income?"

In this task, income and employment growth rates for counties containing, or located close to, roadless and protected areas were compared to counties without such lands.

3a - The presence of protected areas (wilderness, National Parks and National Monuments) and Forest Service roadless areas does not limit economic growth in western states. On the contrary, as Table 2 shows, the presence of both protected areas (wilderness, national parks and national monuments) and Forest Service roadless areas is associated with stronger income and employment growth.

3b - Even though employment and income in metro counties grew relatively rapidly during the study period, nonmetropolitan counties containing Forest Service roadless and/or protected areas grew *faster* than the average western county (see Table 3).

3c - There is a statistically significant, positive relationship between economic growth and the presence of environmental amenities. The presence of Forest Service roadless areas, wilderness, national parks and national monuments is positively associated with income and job growth. This holds true for both the 1969-1997 study period and for the period from 1990-1997 (see Appendix G for statistical output).

3d - Despite the fact that rural economies are generally thought to be the most dependent on extractive industries, the relationship between protected areas and economic growth is stronger in rural counties. For example, the Pearson's correlation coefficient for the relationship between protected areas and income growth for all 409 western counties (including urban areas) is 0.133, while the correlation between protected areas and income growth in the 113 rural counties is 0.360 (see the statistical output in Appendix G).

These results indicate that the jobs vs. the environment argument is seriously flawed: environmental regulations limiting extractive activities in wilderness, national parks and national monuments do not seem to limit either income or employment growth in surrounding counties. As Task One demonstrated, extractive activities are increasingly less likely to form the base of local economies. These results support the argument that the counties most able to adapt to the loss of extractive activities are typically those that have environmental amenities that attract tourists, retirees, business owners and other new sources of income and employment. Protection of natural amenities versus exploitation is associated with growing, more diverse county economies.

Task 3, Part One:

This task looks at the differences in employment growth rates between counties containing protected areas and counties with multiple use federal lands. Additionally, this task explores whether counties with relatively high percentages of wilderness do better or worse than counties with smaller percentages of wilderness.

Are Extractive Industries Benign?

Some may argue that roadless areas and protected lands are not necessary, that extractive activities such as logging and mining on federal lands do not make an area less desirable to retirees, tourists and small business owners. As the results of the regression analysis on income indicates, this is probably not the case.

Table 2 indicates that protecting federal lands from extractive activities can benefit local economies. Counties containing only multiple use federal lands (federal lands other than wilderness, national parks and national monuments) experience slower income and employment growth than counties containing protected lands. The highest rates of income and employment growth are found in counties that actually contain a higher proportion of protected lands (wilderness, national parks, national monuments) than multiple use lands.

Table 2: Employment and Income Growth Rates for Western U.S. Counties Based on the Types of Federal Lands Contained in Each:

Counties Containing:	Number of Counties:	Employment Growth 1969-1997:	Income Growth 1969-1997:
No federal lands	13	63.5%	755.9%
Any federal lands[1]	401	142.7%	992.5%
Federal multiple use lands only[2]	172	115.6%	864.5%
Federal multiple use lands and protected lands[3]	230	163.3%	1,089.7%
More protected lands than multiple use lands[4]	13	197.3%	1,109.2%
Federal protected lands Only[5]	0	--	--

[1] Includes all federally managed lands including military lands.
[2] Includes only counties with federal lands but no wilderness, national parks or national monuments.
[3] These include counties with some federal lands open to multiple uses and some protected federal lands (wilderness, national parks, national monuments).
[4] These are counties where a majority of federal lands are protected (wilderness areas, national parks and monuments).
[5] There are no counties in the western U.S. with only federal lands that are entirely protected (wilderness, national parks, national monuments)

Counties with the highest proportion of land in protected areas (wilderness, national parks, and national monuments) are growing the fastest:

Tables 4 and 5 provide additional evidence for the assertion that "Our natural landscapes no longer generate new jobs and incomes primarily by being warehouses from which loggers, farmers, fishermen, and miners extract commercial products. In today's world, these landscapes often may generate more new jobs and income by providing the natural resource amenities--water and air quality, recreational opportunities, scenic beauty and the fish and wildlife--that make the. . . [area] an attractive place to live, work, and do business" (Power 1995, ii).

Table 3 shows that counties with higher percentages of protected lands and Forest Service roadless areas tend to have relatively strong income and employment growth.

Table 3: Economic Growth Rates for Counties Containing Varying Amounts of Protected and/or Forest Service Roadless Lands:

	Growth Rate: 1969-1997:	
Type of County:	Employment	Income
All Western Counties	140%	983%
All Non-metro Counties	123%	893%
Non-metro Counties with More than 5% Protected or Roadless Areas[6]	168%	1,061%
Non-metro Counties with More than 5% Roadless Areas	169%	1,068%
Non-metro Counties w/ More than 5% Protected Areas	198%	1,188%
Non-metro Counties with More than 10% Protected or Roadless Areas	162%	1,054%
Non-metro Counties with More than 10% Roadless Areas	176%	1,115%
Non-metro Counties w/ More than 10% Protected Areas	228%	1,253%

Appendix H presents in visual form the differences in counties containing varying amounts of protected and roadless lands for 1969-1997 and for the 1990-1997 time frames. Clearly, the counties possessing protected and Forest Service roadless areas over this time frame tended to experience greater job and income growth than the typical western and non-metro county. Counties with USFS-designated roadless areas fared much better than rural counties without such lands.

Counties Containing or Located Near Protected and/or Forest Service Roadless Areas:

Counties do not have to contain protected or roadless areas to benefit from their presence. Commerce does not recognize county lines. A town located in a different county only 20 miles from a protected area may experience more benefits than a town 40 miles away but still in the same county as that protected area. Recognizing this, employment and income changes were measured for counties whose geographic centers were within 50 miles of protected and/or Forest Service roadless areas:

[6] These are counties with more than 5% of its total land area containing protected or roadless areas.

Table 5: Economic Growth Rates for Counties Containing or Located Near Varying Amounts of Protected and/or Forest Service Roadless Lands:

Type of County:	*Growth Rate: 1969-1997:* Employment	Income
All Western Counties	140%	983%
All Non-metro Counties	123%	893%
Non-metro Counties with >100 square miles of Protected and/or Roadless Areas within 50 miles[7]	148%	988%
Non-metro Counties with >100 square miles of Roadless Areas within 50 miles	150%	994%
Non-metro Counties with >100 square miles of Protected Areas within 50 miles	173%	1,083%
Non-metro Counties with >300 square miles of Protected or Roadless Areas within 50 miles	155%	1,022%
Non-metro Counties with >300 square miles of Roadless Areas within 50 miles	160%	1,031%
Non-metro Counties with >300 square miles of Protected Areas within 50 miles	194%	1,151%
Non-metro Counties with >1,000 square miles of Protected or Roadless Areas within 50 miles	181%	1,083%
Non-metro Counties with >1,000 square miles of Roadless Areas within 50 miles	209%	1,162%
Non-metro Counties with >1,000 square miles of Protected Areas within 50 miles	281%	1,284%

For counties whose centers are within 50 miles of protected areas (wilderness areas, National Parks and Monuments), employment and income growth rates were higher than for those counties only located near Forest Service roadless areas. In addition, as the amount of roadless and protected areas within 50 miles increases, so do county employment and income growth rates.

Task Three, Part Two:

In this task, the amount of environmental amenities within 50 miles of a county's center were statistically compared to each county's economic growth rates (income and employment growth) to see if they are related. This was done using Pearson's product moment correlation coefficient. The results indicate that the presence of Forest Service roadless and wilderness areas (USFS wilderness, national parks and monuments) is statistically correlated with economic growth. In addition, even though rural economies are generally thought to be the most dependent on extractive industries, the relationship between protected areas and economic growth is stronger in rural counties than in other county types. The statistical output from this analysis is presented in Appendix G.

[7] This includes all counties that have more than 100 square miles of protected lands within a 50 mile radius of its center.

This analysis shows that the presence of wilderness and Forest Service roadless areas are *associated* with economic growth. It does not prove that wilderness and roadless areas *cause* economic growth. It does, however, support the well publicized idea that in the rural west, economic security is associated with counties that no longer rely on the environment as a source of raw materials for export, but instead use the environment as a magnet to attract tourism, retirees, and small businesses (see Literature Review).

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Appendix A:

Extraction and the Oregon Economy

Appendix B:

Statewide and County Income and Employment Growth

Appendix C:

Independent Variables Used in the Regression Analysis and Their Sources

Variable	Definition	Source* (see end of table)
DEPENDENT VARIABLES:		
Inc69_97	*Total income growth during the period 1969 –1997*	*Calculated using A*
Emp69_97	*Total employment growth during the period 1969 – 1997*	*Calculated using A*
Cnty_PWR	Percent of county land area that is wilderness, national parks, national monuments and USFS roadless	Calculated using C, D, E and F
Cnty_PR	Percent of county land that is USFS roadless	Calculated using C and D
Cnty_PW	Percent of county land that is wilderness, national parks and national monuments	Calculated using C, E and F
Popgro	Population Growth 1990 to 1997	A
Trans	Year income from DIRE and transfer payments Surpasses income from extractive activities.	Calculated using A
P_Unearned	Percent of total income that is unearned (DIRE and retirement transfer payments)	Calculated using A
P_Extract	Percent of total employment in extractive industries (Farming, Mining, ASFF, and Manufacturing)	Calculated using A
Amenities	Environmental amenities	G
P_65	Percent of the population over 65 years old	Calculated using C
P_White	Percentage of population by race	Calculated using C
RD_Wbuf	Square miles of wilderness, national parks, national monuments and USFS roadless areas within 50 miles of the county centroid	Calculated using C, D, E and F0
RD_buff	Square miles of USFS roadless areas within 50 miles of the county centroid	Calculated using C and D
WPMbuff	Square miles of wilderness, national parks and national monuments within 50 miles of the county centroid	Calculated using C, E and F
Urban_ar	Square miles of land within the boundaries of urban areas within 50 miles of the county centroid	Calculated using C
Airports	Square miles of land devoted to airports within 50 miles of the county centroid	Calculated using C
Highways	Square miles of land within 5 miles of an interstate highway within 50 miles of the county centroid	Calculated using C
Pop_sqmi	The number of people per square mile in 1990	C

Pop1990 Population 1990 C

*Source Code	Source
A	U.S. Bureau of Economic Analysis, *Regional Economic Information System*, 1999
B	U.S. Bureau of the Census, *Census of Population,* 1990
C	Environmental Systems Research Institute, *ESRI Data and Maps CD ROM,* 1998
D	USDA Forest Service - Geospatial Service and Technology Center (GSTC), National Inventoried Roadless Areas, 2000; http://roadless.fs.fed.us/data/gis_data.shtml
E	Remote Sensing Research Unit, University of California Santa Barbara M*anaged Areas Database*, 1996; http://www.ncgia.ucsb.edu/rsru/mad/mad.html
F	U.S. Geological Survey, *Linear Federal Land Features of the United States*, Reston, Virginia 1999; http://www-atlas.usgs.gov/fedlandsm.html
G	David A. McGranahan, *Natural Amenities Drive Rural Population Change*. Food and Rural Economics Division, Economic Research Service, U.S. Department of Agriculture. Agricultural Economic Report No. 781, 1999. This paper assigns an amenity value to counties on the basis of their environmental amenities using the following variables: January temperature, number of sunny days in January, July temperature, July humidity, water area, and topography; http://www.econ.ag.gov/epubs/pdf/aer781/index.htm

Appendix D:

Stepwise Regression Results

Regression Output for Employment (EMP69_97)

(This model, based on the dependent variable EMP69_97, examined the variables that had a significant effect on employment trends from 1969 to 1997).

Model		R-Square	Adjusted R-Square	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
				B	Std. Error	Beta		
1	(Constant)	0.259	0.256	0.2	0.14		1.432	0.153
	POPGRO			7.739	0.731	0.509	10.585	0
2	(Constant)	0.337	0.333	2.204	0.351		6.277	0
	POPGRO			6.722	0.712	0.442	9.445	0
	P_65			-13.419	2.178	-0.288	-6.161	0
3	(Constant)	0.371	0.365	1.639	0.369		4.442	0
	POPGRO			5.913	0.722	0.389	8.192	0
	P_65			-12.591	2.135	-0.27	-5.897	0
	Amenities			0.172	0.042	0.193	4.12	0
4	(Constant)	0.4	0.392	1.39	0.366		3.791	0
	POPGRO			5.479	0.715	0.36	7.666	0
	P_65			-12.166	2.091	-0.261	-5.817	0
	Amenities			0.164	0.041	0.184	4.015	0
	AIRPORTS			0.114	0.029	0.174	3.926	0
5	(Constant)	0.425	0.416	1.314	0.36		3.651	0
	POPGRO			5.301	0.702	0.348	7.547	0
	P_65			-11.926	2.052	-0.256	-5.813	0
	Amenities			0.115	0.042	0.129	2.735	0.007
	AIRPORTS			0.133	0.029	0.204	4.614	0
	CNTY_PW			3.823	1.031	0.17	3.707	0
6	(Constant)	0.441	0.431	-0.612	0.728		-0.842	0.401
	POPGRO			5.035	0.699	0.331	7.204	0
	P_65			-13.912	2.129	-0.299	-6.535	0
	Amenities			0.124	0.042	0.139	2.977	0.003
	AIRPORTS			0.133	0.029	0.204	4.671	0
	CNTY_PW			3.557	1.022	0.158	3.482	0.001
	P_WHITE			2.44	0.804	0.135	3.034	0.003

Regression Output for Income (INC69_97)

(This model, based on the dependent variable INC69_97, examined the variables that had a significant effect on income trends from 1969 to 1997).

Model		R-Square	Adjusted R-Square	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
				B	Std. Error	Beta		
1	(Constant)	0.44	0.437	4.226	0.429		9.855	0
	POPGRO			35.544	2.245	0.662	15.835	0
2	(Constant)	0.5	0.497	10.47	1.076		9.731	0
	POPGRO			32.377	2.181	0.603	14.843	0
	P_65			-41.821	6.675	-0.255	-6.265	0
3	(Constant)	0.53	0.527	12.661	1.147		11.037	0
	POPGRO			29.621	2.199	0.552	13.471	0
	P_65			-36.547	6.575	-0.223	-5.558	0
	P_extract			-10.647	2.315	-0.189	-4.6	0
4	(Constant)	0.55	0.542	6.002	2.243		2.675	0.008
	POPGRO			28.485	2.188	0.531	13.021	0
	P_65			-43.254	6.755	-0.263	-6.403	0
	P_extract			-11.616	2.294	-0.206	-5.064	0
	P_WHITE			8.76	2.551	0.137	3.434	0.001
5	(Constant)	0.56	0.557	3.987	2.284		1.745	0.082
	POPGRO			27.037	2.193	0.504	12.327	0
	P_65			-42.411	6.65	-0.258	-6.378	0
	P_extract			-9.165	2.368	-0.162	-3.87	0
	P_WHITE			8.841	2.509	0.139	3.524	0
	Amenities			0.44	0.129	0.14	3.411	0.001

Appendix E:

Variables Used to Assign Counties to Clusters

The analysis used the following group of variables:

Total Personal Income
% of total income generated by farming
% of total income generated by proprietor's income
% of total income generated by agricultural services, forestry and fishing
% of total income generated by construction
% of total income generated by manufacturing
% of total income generated by transportation
% of total income generated by wholesale trade
% of total income generated by retail trade
% of total income generated by finance, insurance, and real-estate
% of total income generated by services
% of total income generated by government
Population growth 1990 – 1997
Population density
The percent of population over 65
Percentage of population by race
The percent of total jobs in Lumber and wood products
Classification by the USDA ERS as a retirement county
Classification by the USDA ERS as a federal lands county
Classification by the USDA ERS as a service county
Classification by the USDA ERS as a persistent poverty county

(Data on % of total income, % of total employment and population were standardized by converting them to z-scores)

Appendix F:

Beale Codes for Oregon Counties

County Name:	Beale Code:
Baker	7
Benton	4
Clackamas	0
Clatsop	6
Columbia	1
Coos	5
Crook	7
Curry	7
Deschutes	5
Douglas	4
Gilliam	9
Grant	9
Harney	7
Hood River	6
Jackson	3
Jefferson	7
Josephine	4
Klamath	5
Lake	7
Lane	2
Lincoln	7
Linn	4
Malheur	7
Marion	2
Morrow	9
Multnomah	0
Polk	2
Sherman	9
Tillamook	6
Umatilla	4
Union	7
Wallowa	9
Wasco	7
Washington	0
Wheeler	9
Yamhill	1

Appendix G:

Pearson's Correlation Coefficient Tests

This test is a method of determining whether or not wilderness is statistically associated with increasing income and employment.

The variables in the table below are:

WPMBUFF The number of sq. miles of wilderness, national parks and national monuments within 50 miles of county centroid

RDBUFF The number of sq. miles of Forest Service roadless areas within 50 miles of county centroid

RD_WBUF The number of sq. miles of land that is either Forest Service roadless or wilderness, national parks and national monuments within 50miles of county centroid

Study Area: All 409 western counties

Correlations

		WPMBUFF	RDBUFF	RD_WBUF
EMP69_97	Pearson Correlation	.184(**)	.208(**)	.193(**)
	Sig. (1-tailed)	.000	.000	.000
	N	409	409	409

		WPMBUFF	RDBUFF	RD_WBUF
EMP90_97	Pearson Correlation	.167(**)	.149(**)	.165(**)
	Sig. (1-tailed)	.000	.001	.000
	N	408	408	408

		WPMBUFF	RDBUFF	RD_WBUF
INC69_97	Pearson Correlation	.133(**)	.171(**)	.148(**)
	Sig. (1-tailed)	.003	.000	.001
	N	410	410	410

	WPMBUFF	RDBUFF	RD_WBUF

INC90_97	Pearson Correlation	.140(**)	.242(**)	.206(**)
	Sig. (1-tailed)	.002	.000	.000
	N	410	410	410

** Correlation is significant at the 0.01 level (1-tailed).

Study Area: Nonmetro Counties (counties with Beale codes of 4-9)

		WPMBUFF	RDBUFF	RD_WBUF
EMP69_97	Pearson Correlation	.238(**)	.272(**)	.260(**)
	Sig. (1-tailed)	.000	.000	.000
	N	322	322	322

		WPMBUFF	RDBUFF	RD_WBUF
EMP90_97	Pearson Correlation	.202(**)	.196(**)	.213(**)
	Sig. (1-tailed)	.000	.000	.000
	N	321	321	321

		WPMBUFF	RDBUFF	RD_WBUF
INC69_97	Pearson Correlation	.198(**)	.267(**)	.237(**)
	Sig. (1-tailed)	.000	.000	.000
	N	323	323	323

Correlations

		WPMBUFF	RDBUFF	RD_WBUF
INC90_97	Pearson Correlation	.186(**)	.311(**)	.273(**)
	Sig. (1-tailed)	.000	.000	.000
	N	323	323	323

** Correlation is significant at the 0.01 level (1-tailed).

Study Area: Rural Counties (counties with Beale codes 8 and 9)

Correlations

		WPMBUFF	RDBUFF	RD_WBUF
EMP69_97	Pearson Correlation	.332(**)	.306(**)	.302(**)
	Sig. (1-tailed)	.000	.000	.001
	N	113	113	113

Correlations

		WPMBUFF	RDBUFF	RD_WBUF
EMP90_97	Pearson Correlation	.275(**)	.231(**)	.244(**)
	Sig. (1-tailed)	.002	.007	.005
	N	113	113	113

Correlations

		WPMBUFF	RDBUFF	RD_WBUF
INC69_97	Pearson Correlation	.327(**)	.341(**)	.322(**)
	Sig. (1-tailed)	.000	.000	.000
	N	113	113	113

Correlations

		WPMBUFF	RDBUFF	RD_WBUF
INC90_97	Pearson Correlation	.360(**)	.403(**)	.398(**)
	Sig. (1-tailed)	.000	.000	.000
	N	113	113	113

** Correlation is significant at the 0.01 level (1-tailed).