# CINTRAFOR

**Special Paper 35**

# LEWIS COUNTY ECONOMIC ASSESSMENT

**Report Prepared for**
**Lewis County Natural Resources Advisory Committee**

**June 2000**

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## LEWIS COUNTY ECONOMIC ASSESSMENT

**By**

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## EXECUTIVE SUMMARY

### Lewis County Economic Assessment

Lewis County, historically a resource-based economy, is struggling to maintain past levels of resource-based employment and net earnings in light of increasingly stringent environmental regulations and changing demographics. A growing tourism and retail trade sector has offset some of the regulatory impacts on these resource based sectors and has allowed the economy as a whole to continue to grow. However, retail trade revenues are low profit margin, and regionally centered along Interstate 5 (I-5), the cross-state transportation artery. The future of the resource-based industries [forestry, mining, and agriculture] is still critically important to the County's economy.

The goal of this analysis was to better understand the role of the natural resource-based industries on the region's economy, recognizing that over the last decade the changing regulatory framework has had a major impact on the sector and will continue to be a dominant force in the future. The objectives included determining the impacts of natural resource revenues on Lewis County's economic stability, defining the contribution of Lewis County's natural resource sector relative to the burgeoning tourism industry, and determining the socioeconomic impacts of the decline of natural resource revenues in Lewis County.

Historical data was collected for forestry, agriculture, mining, and retail trade including tourism. An analysis of employment, net earnings, tax revenues, and production (where applicable) has been conducted for each of these four sectors. Additionally, for each of these sectors, intra-county, adjacent county, and state economic comparisons have been provided. Overcall, with 73% of the land base in forestland and regulatory changes that have substantially impacted the acceptable management alternatives over the last decade, a more detailed analysis of future trends has been provided for the forest sector than other sectors. These results have been integrated to assess how Lewis County's natural resource based business fits into the total economic outlook for the county.

Since the majority of the natural resource revenues in Lewis County are generated from the forest sector, a range of future alternatives was developed for the forest sector. The impacts of the costs and revenues associated with current and potential future forest practice regulations on the forest industry have been analyzed using a model to simulate the impact of various regulations and forest management alternatives. A number of economic and environmental measures were analyzed.

### Forest Sector Projections

Both economic and habitat measures were linked to a forest harvest model to characterize changing futures under different regulatory and management strategies. Harvest flows and Net Present Value (NPV) for each landowner group, employment and taxes along with several environmental measures such as late seral forest structures, were simulated for a range of regulatory and management alternatives:

- Base Case: Pre-1990 harvest practices
- Case 2: New minimum regulations
- Case 5: Expected practices
- Case 6: Wider Riparian Buffers
- Case 3: Biodiversity Management State and Private
- Case 4: Biodiversity Management all Owners

### Timber Harvest

Changes in harvest regulations have resulted in significant declines in timber harvest levels from the pre-1990 levels across all ownership types. Since the existing harvest restrictions on federal lands in Lewis County have been so severe, the advent of more stringent harvest regulations in the future will have virtually no impact on harvest flows for federal lands. Furthermore, future harvest restrictions on state lands will not likely decrease the harvest flows significantly since the implementation of the Department of Natural Resources Habitat Conservation Plan (DNR

HCP) has already substantially reduced state harvest flows from the pre-1990 levels. Even so, the existing regulations on state forest land in Lewis County have not reduced harvest levels as significantly as for the rest of the state, since the density of critical habitat is lower than many other areas in the state.

Of greater importance, private forestland managers must begin to implement new riparian management regulations to protect salmon habitat, which will have a more substantive impact than earlier regulatory changes. While the riparian management zones make up about 18% of the land base, the recent state Forest and Fish Agreement allows some management within this zone. Given the Northwest Forest Plan (NFP) on Federal acres, the DNR HCP on state lands and the Fish Agreement and owl circle protection on private lands, harvest levels are likely to decline further over the next several decades to about 350 mmbf—down from 750 mmbf prior to 1990 and 450 mmbf for much of the most recent decade. However, with the increased management intensity that has been practiced on most non-federal lands over the last several decades, harvest levels should then increase for several decades, rising to over 500 mmbf before leveling off. There is little expectation of increasing harvests on federal lands even though more active management alternatives do exist that could restore late seral forest functionality for critical habitat more rapidly. More active management alternatives to restore habitat could support harvest levels of 450 mmbf, while also more rapidly restoring old forest habitat conditions.

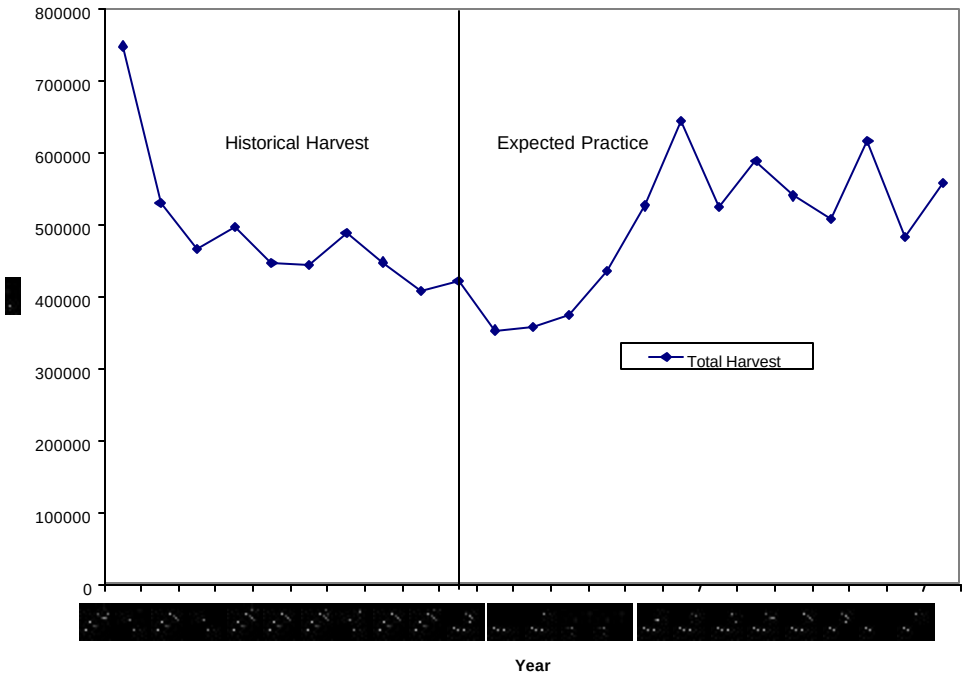


**Figure I: Historical Harvest vs. Expected Practice**

The anticipated reduction in harvest over the next two decades might suggest a conclusion that there is no need for new manufacturing capacity. However, the statewide capacity to process high quality, mid-sized logs is very limited, with no functional capacity in the Lewis County region. The trend of sawmill closures that began in the early 1980's has lead to a poor redistribution of the remaining infrastructure. High-quality logs are being trucked to Oregon mills at significant cost and market disadvantage to Washington growers, given the lack of local bidders.

Management efforts to produce larger trees for salmon and owl habitat will exacerbate this problem in the future. While there will be a strong demand for new capacity as the harvest volume begins to grow rapidly in about 20 years, there should be a current opportunity to process larger higher quality logs in the Lewis County region.

**Net Present Value of Forestland**

The Lewis County Forest Sector has been hit hard by the post-1990 harvest regulations. The model results indicate that expected forest practices would generate an all-owner NPV of $3.1 billion, 40% less than with pre-1990 conditions. The majority of this decline has occurred on public lands. The non-federal NPV is projected to decline by 27% from pre-1990 rates. Scenarios responding to wider no-management buffers along streams resulted in NPV losses of 55% compared to the pre-1990 conditions. The environmental regulations have placed 9% of Non-Industrial Private Forest (NIPF) land, 11% of forest industry land, and 37% of state land into reserves resulting in respective NPV reductions of $110 million, $380 million, and $310 million. The regulations have essentially eliminated timber production on all federal acres with an estimated NPV loss of $1.27 billion.

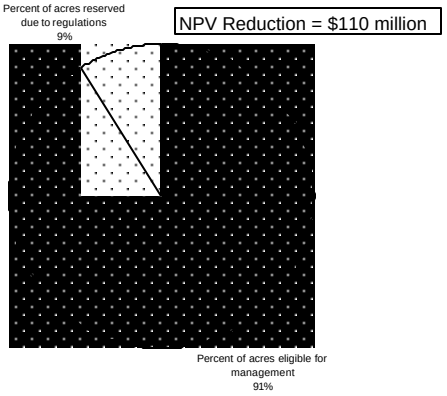


**Figure II: NIPF Timber Land and NPV Reduction due to Regulations**

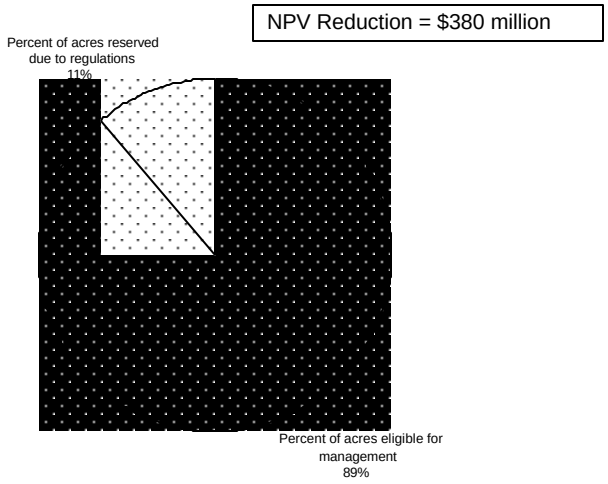


**Figure III: Forest Industry Timberland and NPV Reduction due to Regulations**

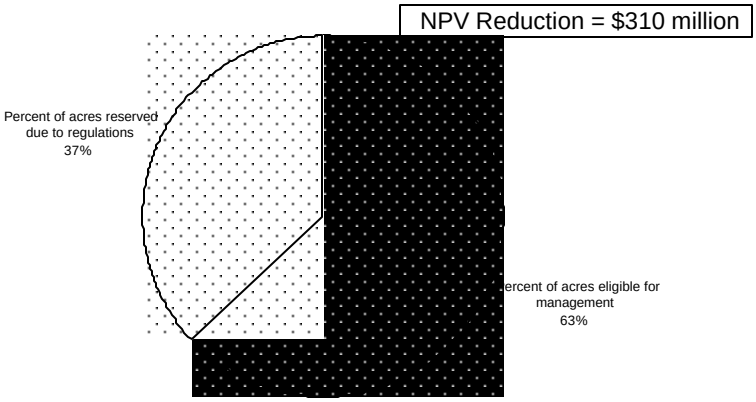


**Figure IV: State Timberland and NPV Reduction due to Regulations**

**Wood Products vs. Retail Trade Employment**

Forest sector employment in Lewis County has dropped steadily over the last 30 years. Fortunately, the employment growth rate in the retail trade sector exceeds the rate of employment loss in the forest trade sector. Projecting these historical trends out 20 years reveals an even wider gap with a net employment gain of over 3000 job opportunities. It is likely that this burgeoning retail trade sector has contributed to forest sector employees moving out of the forest industry. Additionally, some of the forest sector employment declines can be attributed to forest sector efficiency gains. To the degree that the forest sector has become more capital-intensive in the pursuit of lowering costs to remain competitive, some of the non-forest-sector jobs may be new service-related jobs serving the forest sector indirectly rather than directly, making these direct-employment sector measurements somewhat suspect. Economic models generally show a ratio of four indirect jobs for each direct forest sector worker at the

state level with about half of those in rural communities and perhaps only 1/4$^{th}$ within the county. While the indirect job support from wood products activities are therefore more than twice as large as shown, the trends are unchanged.

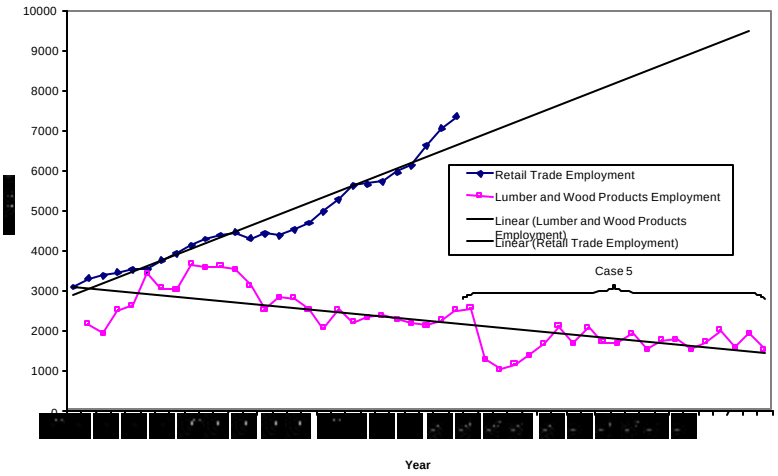


**Figure V: Retail Trade vs. Lumber and Wood Product Employment**

**Tax Receipts from Economic Activity Associated with Timber Harvests**

Harvest levels within Lewis County produce larger employment gains outside of the county, rather than within the county. Half of the forest sector employment is in non-rural locations. With disproportionately less pulp and paper activity and secondary manufacturing in the county, many adjacent counties benefit from the harvest levels in Lewis County. When all of the statewide activities are included, state tax receipts are quite substantial. Even under the most likely harvest projection, statewide tax receipts exceed $100 million. Forest sector excise tax revenues decline with the projected declines in harvest to about $7 million. The average annual tax receipts are projected to decline 30% from the Base Case under the existing regulations and potentially as much as 45% if harsher regulations are imposed.

**Environmental Restoration of Late Seral Structures for Protected Habitats**

As a consequence of commercial management, mainly, the decline in old forest conditions was the motivation for more restrictive regulations to protect endangered species. Each regulatory change in regulations to date has resulted in more forestland placed in reserves and less available for harvest. The natural aging of these reserves should eventually restore the amount of old forest habitat. The simulations show this natural aging process to be both slow and costly. Active management treatments can restore late seral habitat conditions more quickly. For current management and regulations, the projection increases late seral levels from a current 10% of the landscape to 15% by age 55 and 24% by age 105. More active management alternatives raised the level of late seral habitat to 20% by age 55 and 25% by age 105 with substantially reduced revenue and employment losses. Of these alternatives, Riparian Management Zones (RMZs) have become most important with the listing of salmon and show even greater restoration potential. Active management simulations to restore late seral conditions in the riparian areas resulted in more than doubling the late seral forest structures by age 55.

**Cost of Late Seral Habitat Restoration**

The simulation of current regulatory and management practices demonstrates very high economic losses per acre of improvement in late seral stand structures, almost $13,000 per late seral acre by age 55 in comparison to pre-1990 conditions. Active management alternatives cut that cost in half. While these costs are still very high, the potential

gains from implementing active management, such as within a Habitat Conservation Plan (HCP) where it can be used for restoration, are very large.

**Tourism and Retail Trade**

During the last 10 years specifically, tourist activities, especially along the I-5 corridor, have grown more rapidly in Lewis County than for Washington State as a whole. This growth in tourism and retail trade, in conjunction with a decline in forest sector production, indicates economic factors supporting tourism and retail trade far outweigh the same factors in the forest sector. It should be noted here that many of the indirect jobs supported by the forest sector are included in retail trade data, not forest sector data. It should also be noted that the overall number of the jobs for Lewis County might have declined, had it not been for growth in other sectors.

**Mining and Agriculture**

Both mining and agriculture have experienced declines not unlike the forest sector. Mining had experienced a long period of growth prior to 1990. Mining represents only a small share of jobs and is particularly dependent upon one coal facility. Activity therefore remains very dependent upon the competitiveness and environmental compliance of the one mine and utility plant. Agriculture employment has remained stable for the last 10 years although as much as 30% below the levels of the 1980's. The general weakness of these two sectors as well as the forest sector makes the growth in total county employment, retail trade and tourism, that much more astounding. The indirect job losses linked to the decline in these sectors would clearly have reduced levels of retail trade if they had not been offset by the higher growth of other contributors to retail trade such as tourism.

**TABLE OF CONTENTS**

**Page**

**LIST OF FIGURES**

## LIST OF TABLES

**Page**

## I. INTRODUCTION: LEWIS COUNTY OVERVIEW

Lewis County, historically a resource-based economy, is struggling to maintain past levels of resource-based employment and net earnings in light of increasingly stringent environmental regulations and changing demographics. In Lewis County, 73% of the land base is occupied by timber resource, where the majority of the regulatory impacts have been levied. Additionally, recent demographic shifts have led to a sluggish agriculture and mining sectors. A growing tourism sector has offset some of the regulatory impacts on these resource-based sectors and has allowed the economy as a whole to continue to grow. This rise in tourism is exhibited by the growth in various sectors of retail trade. However, unlike resource-based dollars, retail trade revenues exhibit a narrow profit margin not well distributed across the county and are also, to a large extent, dependent upon basic producing sectors. It is clear that the resource-based industries [forestry, mining, and agriculture] still drive the county's economy.

The Lewis County population growth rate has fallen off the state trend starting in the mid-1980's. This disparity in the county growth rate (in comparison to the state growth rate) can be attributed to the rise in service-based industry in more high-populated areas of the state. This has created both an influx of new people into the State and a greater flow of people out of Lewis County. It also corresponds to the period of time when forest product markets became much weaker with the end of the post World War II (WWII) baby boomers forming households and an international recession.

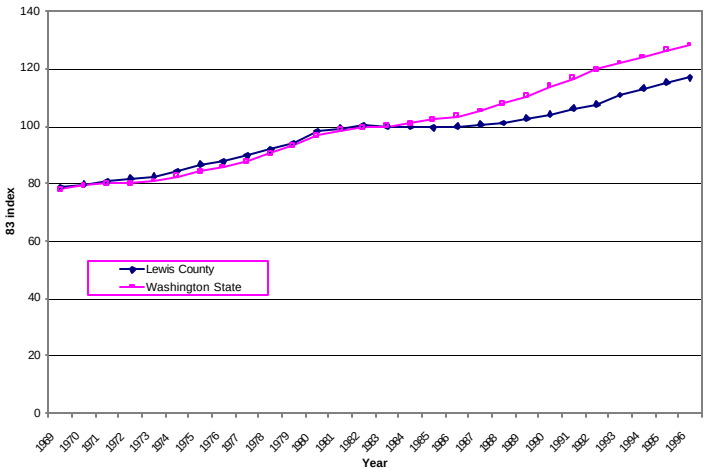


**Figure I.1: Lewis County vs. Washington State Population Comparison**

*Source*: REIS, 1996

Not surprisingly the decline in the Lewis County population growth rate relative to the state is accompanied by similar relative declines in Lewis County's personal income and employment numbers. The comparatively high wages earned in service-based industries have led to this growing personal income disparity between Lewis County and Washington State.

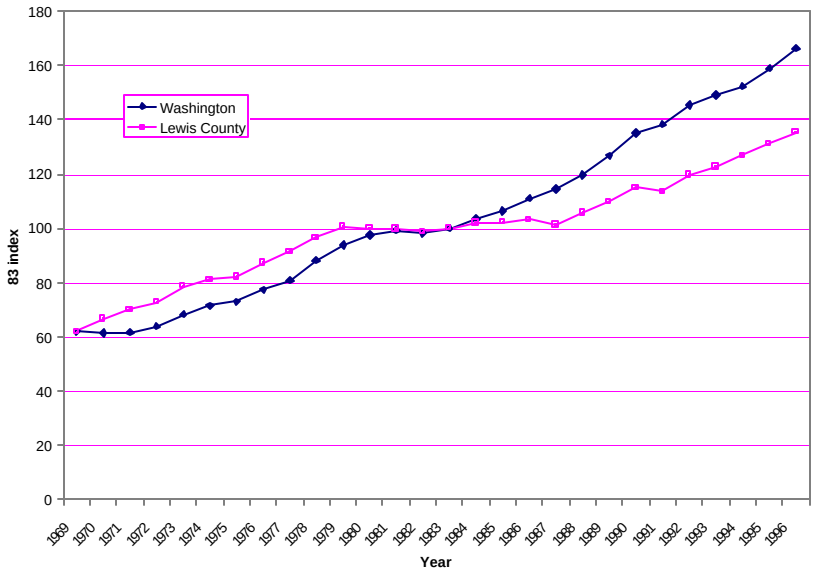


**Figure I.2: Lewis County vs. Washington State Personal Income Comparison**
*Source*: REIS, 1996

The difference between employment growth rates in Lewis County and the rest of the state is further emphasized when compared to King County. Explosive service-based growth in King County has led to this growing employment disparity.

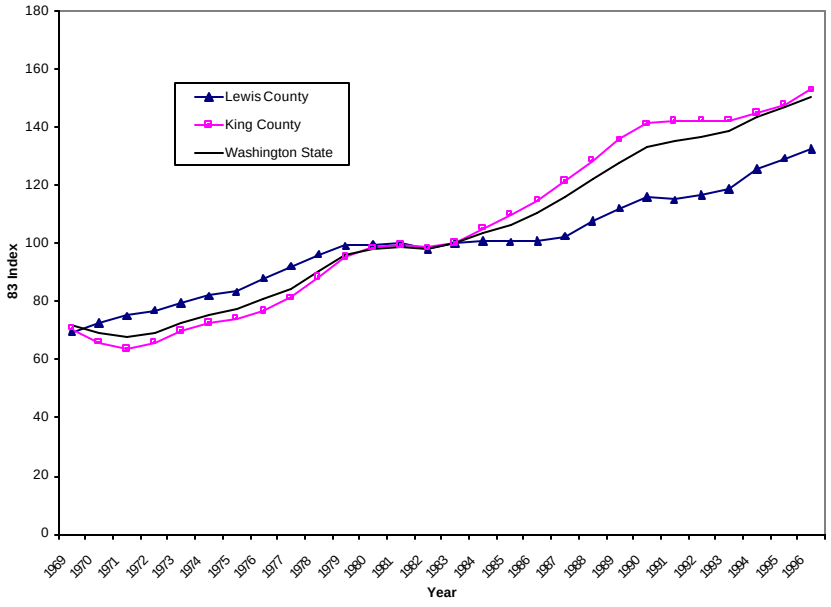


**Figure I.3: Lewis County vs. King County and Washington State Total Employment**
*Source*: REIS, 1996

The composition of the employment in Lewis County has undergone substantial changes over the last thirty years. In Figure I.4, the transition away from basic (employment-generating) trade sectors and into retail trade (non-manufacturing) sectors is clearly evident, particularly in the mid-1980's. One exception is with the agriculture, forestry, fishing and other employment sector, which has continued to rise at a greater rate than that of retail trade. However, the total number of employees in this sector is insignificant when compared to the other sectors. Possible explanations for this transition are discussed in the respective sections. Please note that the vertical axis in Figure I.4 is an index relative to 1983 and not an absolute value. Consequently, growth trends can be compared to 1983, only.

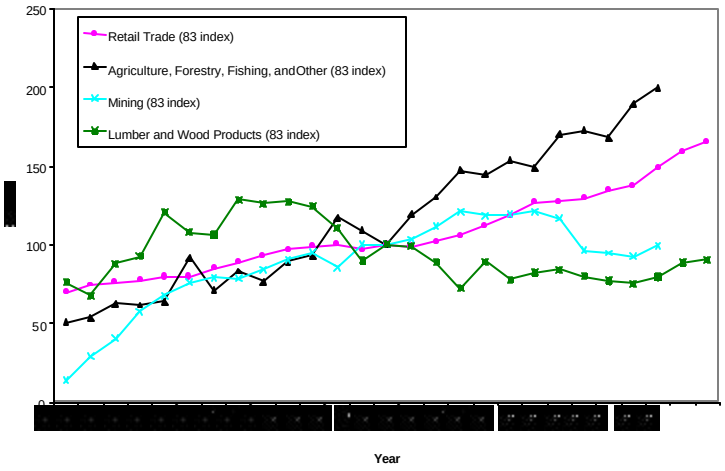


**Figure I.4: Lewis County Employment Sector Comparison**
*Source*: REIS, 1996

Tax revenues are an essential part of maintaining the economic well being of the County. In 1997, the majority of taxable retail sales were generated from wholesaling, transportation, communications & utilities, and retail trade. However, the distribution of taxable retail sales has changed dramatically over the past 15 years. The greatest changes occurred with manufacturing, retail trade and transportation communication & utilities. The share of taxable retail sales generated from manufacturing has declined 3% during this time period, while the share of retail trade and transportation, communication & utilities has increased 6% and 11% respectively.

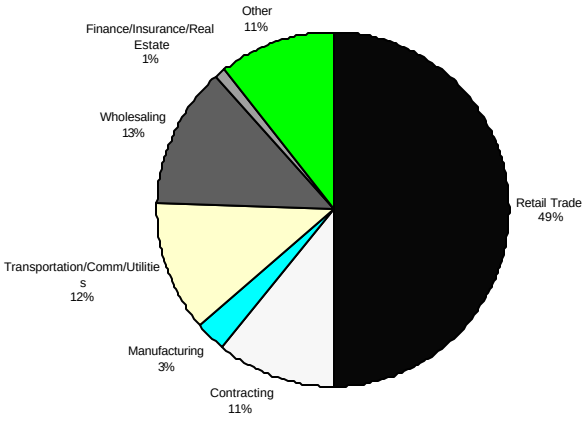


**Figure I.5: 1997 Lewis County Taxable Retail Sales**

*Source*: CINTRAFOR, 1999

**Table I.1: Percent of Total Retail Tax Revenue for Lewis County**

| Net Earnings Category | 1981 | 1997 | %Change |
|---|---|---|---|
| Retail Trade | 44% | 50% | 6% |
| Business Services | 0.7% | 2.4% | 1.7% |
| Contracting | 10.4% | 10.8% | 0.41% |
| Manufacturing | 5.7% | 2.8% | -2.9% |
| Transportation/Comm/Utilities | 0.7% | 11.8% | 11.1% |
| Wholesaling | 13.0% | 12.7% | -0.3% |
| Finance/Insurance/Real Estate | 0.3% | 1.3% | 1.0% |
| Other | 25.2% | 8.2% | -17% |

1997 Total = $737 million
1981 Total = $668 million (1997 $)
1981 Total = $668 million (1997 $)
1981 Total = $668 million (1997 $)

*Source*: CINTRAFOR, 1999

The changing tax base reflects the growing retail trade sector in Lewis County, and the decline in timber tax revenues for Lewis County is representative of the declining resource-based industries. Timber revenues (including timber taxes, federal in-lieu of tax payments and County trust lands) dropped from $28 million in 1995 to $22 million in 1998, a 20% decrease. Most of the decline occurred on private and forest service lands. Although a significant quantity of revenue is generated from timber, most activity is not retail so it is less than 3% of the total retail sales revenue generated for Lewis County.

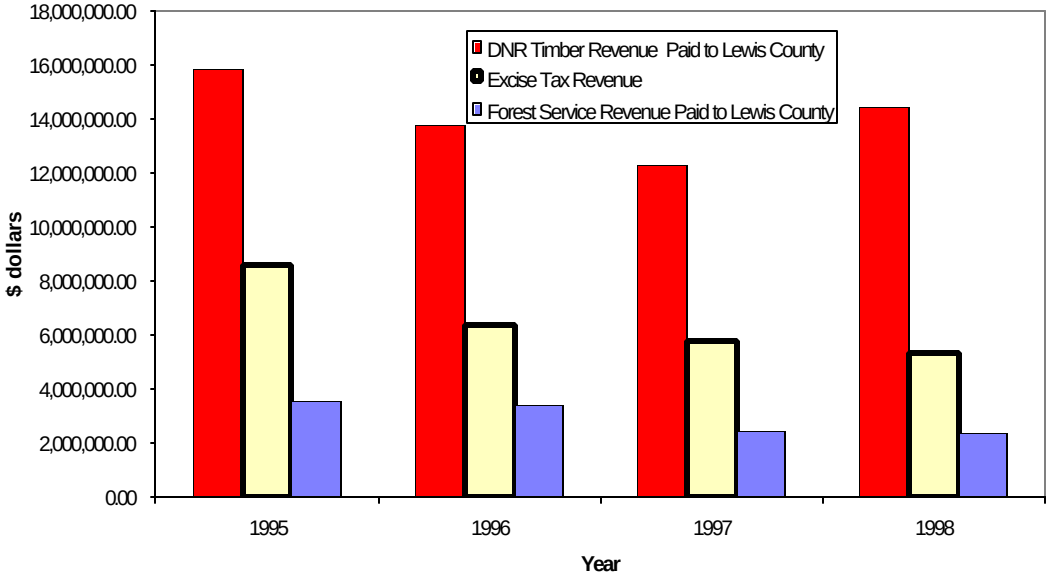


**Figure I.6: Lewis County Timber Revenues**

*Source*: CINTRAFOR, 1999

The annual growth rate for taxable retail sales for all industries in Lewis County over the last 30 years has been 0.7%. This trend would yield $800 million in taxable retail sales if projected out to the year 2004.

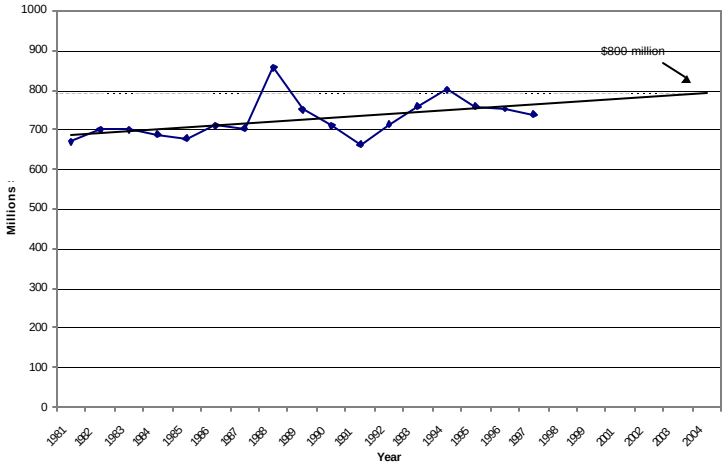


**Figure I.7: Lewis County Taxable Retail Sales for All Industries**

*Source*: CINTRAFOR, 1999

Much of the tax revenue generated in Lewis County is concentrated along the I-5 corridor, primarily in the cities of Centralia and Chehalis. The level of visitors passing through the corridor has increased which, in turn, resulted in a corresponding increase in the level of tax revenues generated in this area. Additionally, a greater percentage of the retail trade and service-based industry is located along the corridor. The greater corridor activity combined with a greater concentration of service-based industry located in this area has significantly reduced the share of county tax revenue generated from manufacturing over the last 15 years.

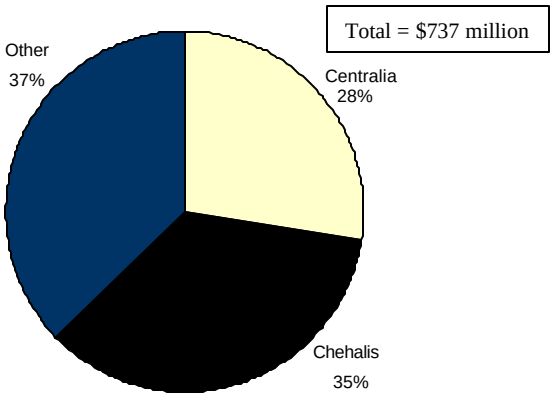


**Figure I.8: 1997 Total Tax Revenue by Area**
*Source*: CINTRAFOR, 1999

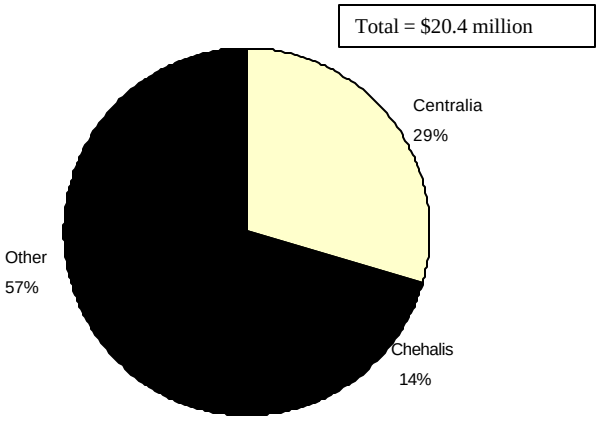


**Figure I.9: 1997 Manufacturing Tax Revenues**
*Source*: CINTRAFOR, 1999

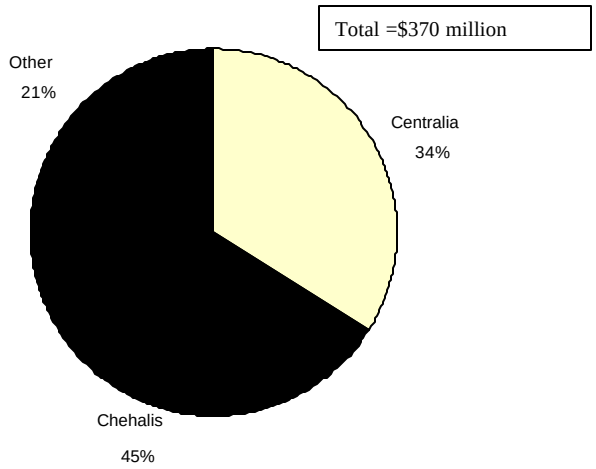


**Figure I.10: 1997 Retail Trade Tax Revenues**
*Source*: CINTRAFOR, 1999

An examination of net earnings, defined as the total employee income, for Lewis County compared to Washington State indicates that a greater percentage of net earnings in Lewis County is generated from agriculture and mining than the rest of the State. However, Washington State generates a greater percentage of its total net earnings from construction and other manufacturing industries. This is not surprising given the high population growth rate for the rest of Washington State.

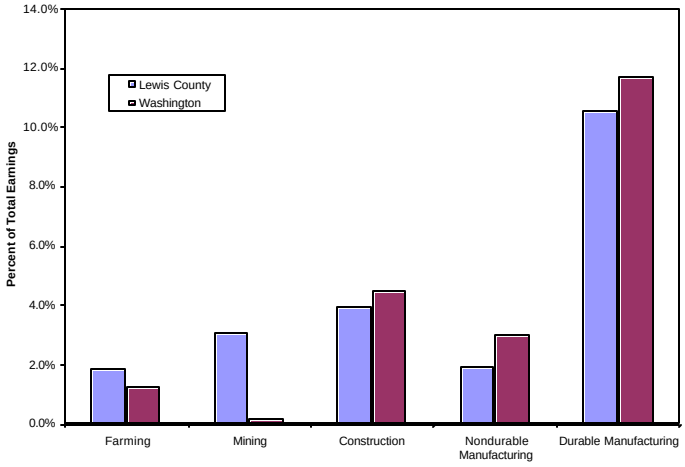


**Figure I.11: 1997 Lewis County Goods-Producing Industries Share of Net Earnings**
*Source*: CINTRAFOR, 1999

With respect to the service-producing industries, Lewis County generates a smaller percentage of its total net earnings in comparison to Washington State in almost all sub-categories, which should be expected given Lewis County's resource-based economy. However, one exception in which Lewis County generates a greater percentage of its total net earnings than Washington is with retail trade. This is a reflection of the large amount of income that is generated along the I-5 corridor as a result of the abundance of visitors that pass through the County.

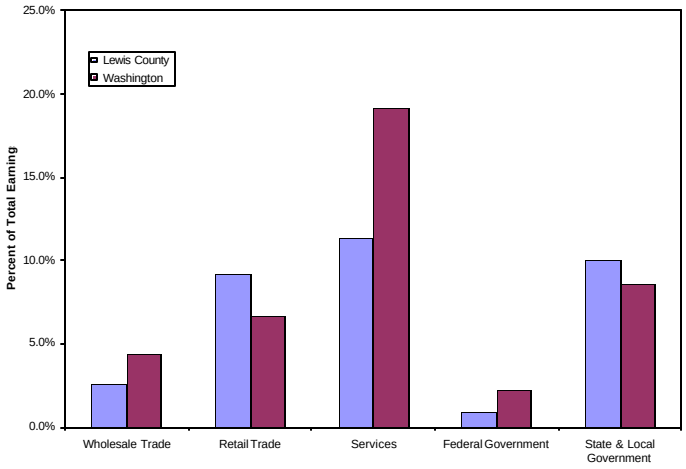


**Figure III.12: 1997 Lewis County Service-Producing Industries Share of Net Earnings**

*Source*: CINTRAFOR, 1999

Over the past 15 years, the composition of net earnings generated within Lewis County has undergone some major changes. Most notably, the resource-based industries all generated a smaller percentage of the County's total net earnings in 1996 than in 1980. Net eamings generated from mining, agriculture, and lumber and wood products decreased 1.2%, 0.6%, and 6.7% respectively.

**Table I.2: Lewis County Net Earnings Historical Comparison**

| Net Earnings | 1980 | 1996 | %Change |
|---|---|---|---|
| Construction | 3.0% | 5.4% | 2.4% |
| Farm Earnings | 2.5% | 1.9% | -0.6% |
| Mining | 4.3% | 3.1% | -1.2% |
| Lumber and Wood Products | 15.7% | 9.0% | -6.7% |
| Retail Trade | 8.5% | 9.2% | 0.7% |

*Source*: CINTRAFOR, 1999

Although the population in Lewis County fell off the growth rate for Washington State, the home prices have been increasing at a rapid rate. From 1990 to 1995 home prices surged at a 1% per month increase. Since 1995, home prices have risen as much as 30%. The rate of growth in home prices has however been lower in Centralia than the growth rate for the rural west, the rural east and greater Chehalis. This may be due to the greater concern of flooding that is experienced in Centralia, with most recent losses occurring in 1996.

**Table I.3: Lewis County Home Prices**

| AREA (average single family used home under 5 acres) | 1995 (1st Quarter) | 1999 (1st Quarter) | % Change |
|---|---|---|---|
| Greater Centralia | $76,600 | $82,900 | 7.6% |
| Greater Chehalis | $80,000 | $109,000 | 26.6% |
| Rural West | $67,000 | $96,000 | 30.2% |
| Rural East | $57,000 | $81,000 | 29.6% |

*All figures in nominal dollars

*Source*: Lewis County Assessor's Office, 1999

In addition to the four natural resource sectors discussed in this report, it should be noted that revenue is also generated from the three dams along the Cowlitz River. Two of the dams are owned by Tacoma Public Utilities, which is considered a municipal entity so they are exempt from paying taxes. However, in lieu of taxes, Tacoma Power pays approximately $650,000 a year back to Lewis County for use of the roads and other county facilities that are associated with the operation of the dams (Tacoma Power, 1999).

## II. FOREST SECTOR OVERVIEW

The forest sector in Lewis County has long been a central part of the county economy, and with the dominant share of the acreage in forests, it will remain that way. The Lewis County Overall Economic Development plan states this intention in "Goal III" which reads, "to develop the primary renewable resources of the County in order to provide a growing and permanent economic base." The large role that the forest sector plays in the county is a direct result of the composition of the land. Lewis County ranks 6th in land area of the 39 Washington counties and 73% of that land area is timberland. The labor and proprietor income generated by exports from logging camps & contractors and sawmills & planing mills which utilize that timberland account for approximately 36% of county income (County Portraits of Washington State, 1997).

The majority of the forestland area is owned by the private forest industry. However, most of the net volume of growing stock and the net volume of sawtimber is located on national forest lands in the Gifford Pinchot National GPNAF (USDA Timber Resource Statistics for Western Washington, 1992). Even though much of the federal timber is mature (contributing to their larger volume), most of it has been restricted from harvesting by the National Forest Plan (NFP) in order to protect and restore late seral forest structures as a strategy to protect the Northern Spotted Owl, which is listed as an endangered species.

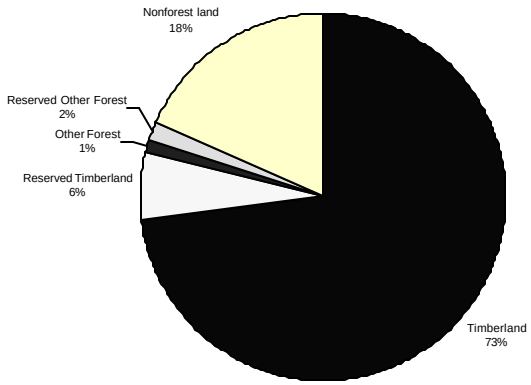


**Figure II.1: Lewis County Land Types**

*Source*: USDA Timber Resource Statistics for Western Washington, 1992

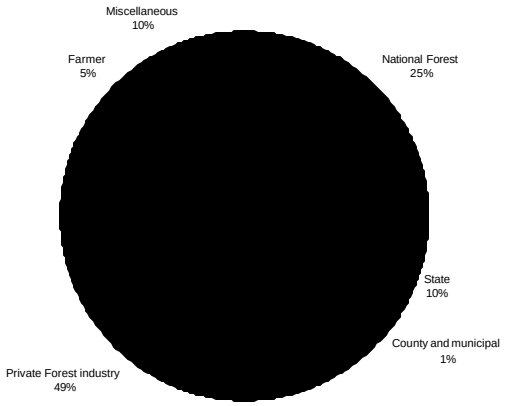


**Figure II.2: Lewis County Forest Land Area**

(Total = 1,131 thousand acres)

*Source*: USDA Timber Resource Statistics for Western Washington, 1992

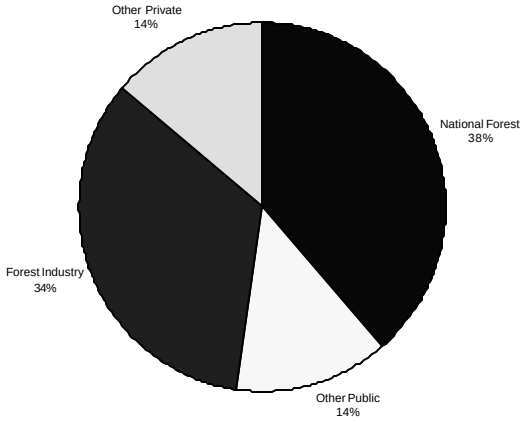


**Figure II.3: Net Volume of Growing Stock**

(Total = 4,634 million cubic feet)

*Source*: USDA Timber Resource Statistics for Western Washington, 1992

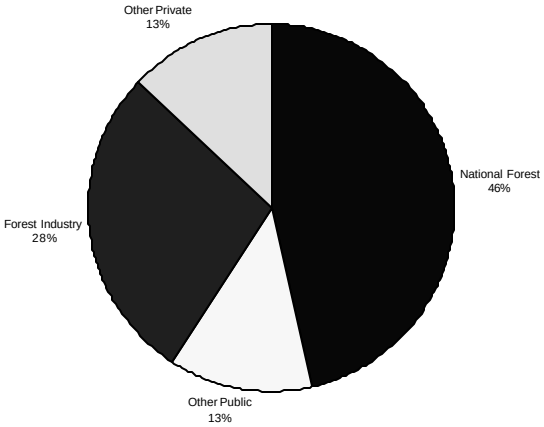


**Figure II.4: Net Volume of Sawtimber**

(Total = 19,411 million board feet)

*Source*: USDA Timber Resource Statistics for Western Washington, 1992

Although the majority of the growing stock is located on Forest Service lands, only 15% (245,000 acres) of their forestland is currently available for management. Additionally, the forest service is having a difficult time meeting even their reduced harvest goals given the complexities of the restrictions and planning requirements under the Northwest Forest Plan. Therefore, the national forests constitute 36% of Lewis County's total growing stock, but a very small portion of the actual harvest.

The forest sector in Lewis County has been significantly impacted by environmental regulations, most notably the policies restricting harvest on state and federal lands to protect the Northern Spotted Owl and Marbled Murrelet. These restrictions have resulted in steady declines in harvest levels since the mid-1980's (Figure II.5). The 413 mmbf harvest from all owners in 1996 is more than 40% below the over 700 mmbf harvest per year experienced for the decade of the 1970's. During this same period, increased harvest volumes have been experienced on private lands due to the high prices resulting from reduced harvests on federal lands and perhaps the concern over future harvest restrictions. The recently negotiated riparian regulations outlined in the Washington State Forest and Fish Agreement will have a substantial impact on private owners. It has also been estimated that 56 square miles of non-industrial private forestland will be converted to non-forest uses each year (DNR, 1998). The overall declining harvest trend for Lewis County is not significantly different than the trend for Washington State (see Figure II.6).

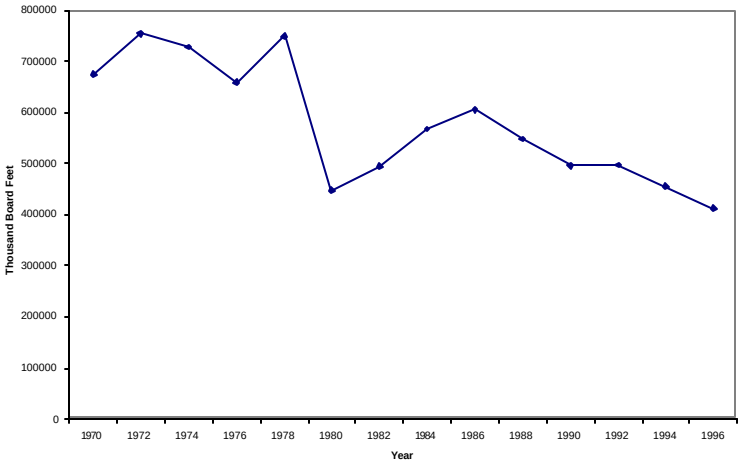


**Figure II.5: Lewis County Harvest Level**

*Source*: DNR Mill Survey, 1996


**Figure II.6: Harvest Comparison: Lewis County vs. Washington State**

*Source*: DNR Mill Survey, 1996

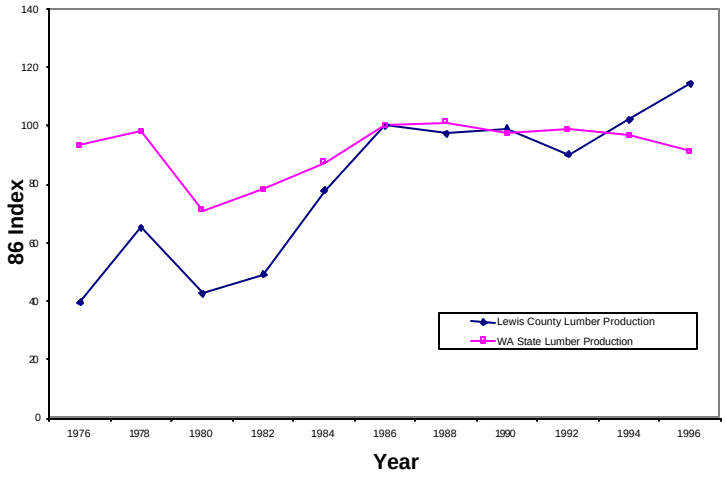


**Figure II.7: Lumber Production Comparison: Lewis County vs. Washington**
*Source*: REIS, 1996

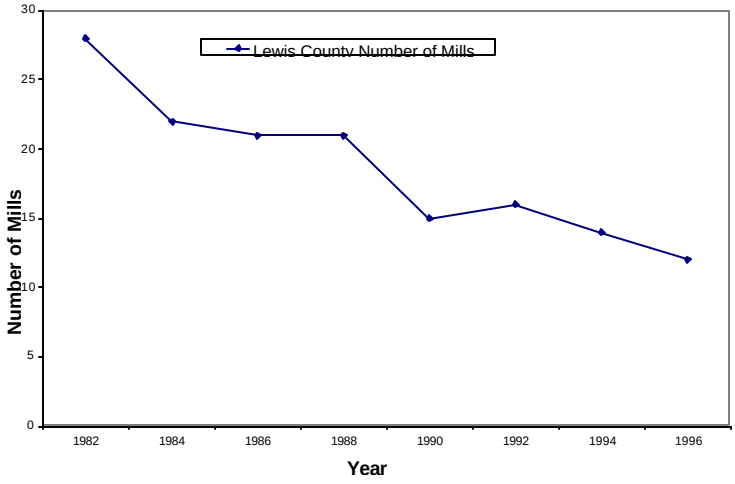


**Figure II.8: Lewis County Number of Lumber Mills**
*Source*: REIS, 1996

In spite of the harvest declines, lumber production in Lewis County has continued to increase (Figure II.7). This counter-intuitive result can be partly explained by the diversion of log exports to domestic mills. However, the number of mills in Lewis County has also declined (Figure II.8) suggesting that lumber producers have been impacted by harvest restrictions. Mills in Lewis County have also shifted from manufacturing large diameter logs to smaller ones. The increase in lumber production in Lewis County can also be related to more importation of logs into the County and from this shift to the manufacturing of smaller diameter timber. The larger mill capacity per mill should indicate increasing economies of scale and lower unit costs. Also, the fact that lumber production in Lewis County increased in spite of the harvest restrictions could be a result of the county's competitive advantage to

bid logs away from more inefficient producers. Even so, almost half of DNR timber sales statewide have been purchased by Oregon processors with much of this volume crossing Lewis County. Oregon mills may have a competitive advantage in bidding for the higher quality and larger diameter timber available in DNR timber sales given the lack of any large log processing capacity in Lewis County.

While the number of operating mills has declined substantially starting in the early 1980's, the types of mills still operating in the state are not necessarily well matched to the available timber. All but two sawmills that could process high quality mid-sized logs in the state have been shut down. With the 80-90% decline in harvest of federal timber, the available supply of these logs became insufficient as a supply source. In addition most high quality logs harvested on state and private land received higher prices in international markets and were therefore being exported. The Congressionally mandated ban on the export of the State's timber that began in the early 1990's has resulted in many state timber sales to Oregon mills with the higher quality logs being transported out of Washington State, incurring an additional transportation cost of $50-100 over local processing.

In more recent years, log exports have declined with a larger share of the private harvest being locally processed. Some increase in the capacity to process higher quality mid-sized logs would seem to be needed in the center of Southwest Washington.

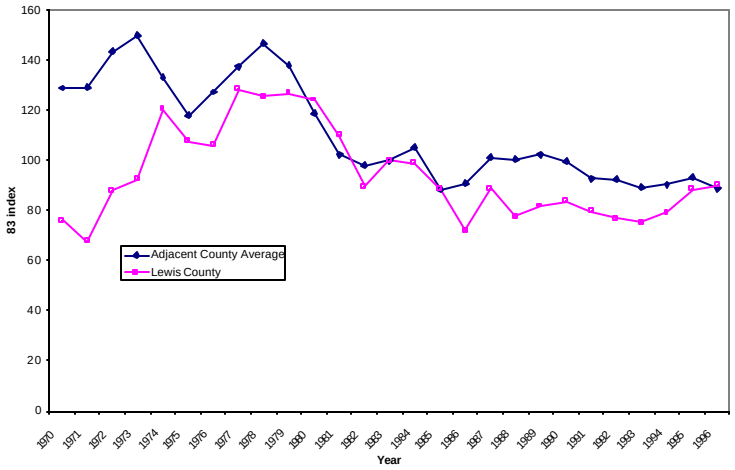


**Figure II.9: Lumber and Wood Products Employment Comparison**

*Source*: REIS, 1996

Employment in lumber and wood products dropped off 40% from the early 1980's to the early 1990's. This impact was felt in adjacent counties (Skamania, Pacific, Cowlitz, and Pierce) as well (Figure II.9). Very weak markets followed the strong markets produced by record housing levels of the1970's in the 1980's. The low productivity gains in the 1970's were followed by restructuring and high productivity gains in the early 1980's contributing to an even greater decline in employment than harvest. All regions experienced somewhat similar declines although they appeared to be somewhat later in Lewis County. Additionally, employment in Lewis County appears to be rising in recent years at a greater rate than in the adjacent counties. The increase in employment in recent years can probably be attributed to the increased lumber production and large amounts of wood coming online on private lands, which requires thinning treatments. If the data had been available for the years after 1996, falling export markets would also be a contributing factor.

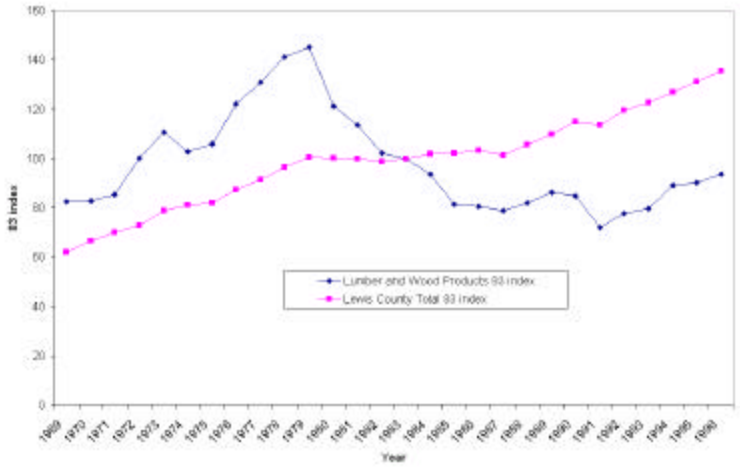


**Figure II.10: Lewis County Net Wage Earnings Comparison**
*Source*: REIS, 1996

The majority of the net wage earnings in the forest sector are generated from lumber and wood products. Lumber and wood products net earnings peaked in the late 1970's during a period of strong demand (Figure II.10). Weak international markets followed by harvest restrictions reduced lumber and wood products net earnings to a low point of approximately $90 million in 1991.

The annual growth rate for lumber and wood products net earnings in Lewis County has declined far below the net earnings growth rate for the whole county. This is due to a combination of weak markets in the early 1980's and harvest restrictions in the 1990's and expanding retail trade sectors in the rest of the county.

When comparing the net earnings growth rate for lumber and wood products for Lewis County to the whole state, the growth rate for Lewis County declines at a faster rate starting in the early 1980's (Figure II.11). However, from 1994-1996, the growth rate for Lewis County has exceeded that of the state. This was a period of high national and international prices for wood products. International prices collapsed in 1997-1998, so the gap may have changed again.

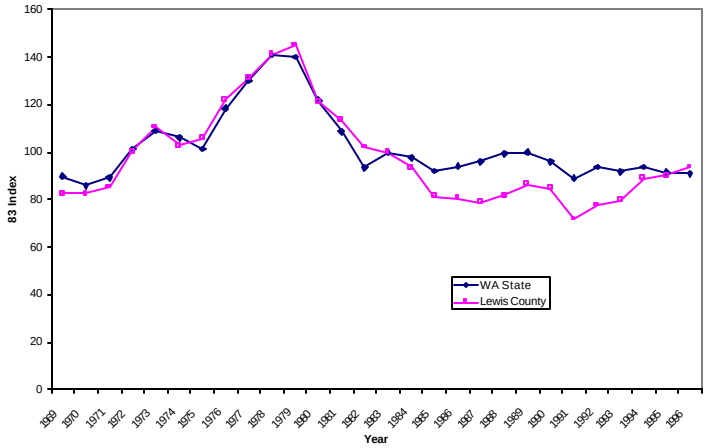


**Figure II.11: Lumber and Wood Products Net Wage Earnings State Comparison**
*Source*: REIS, 1996

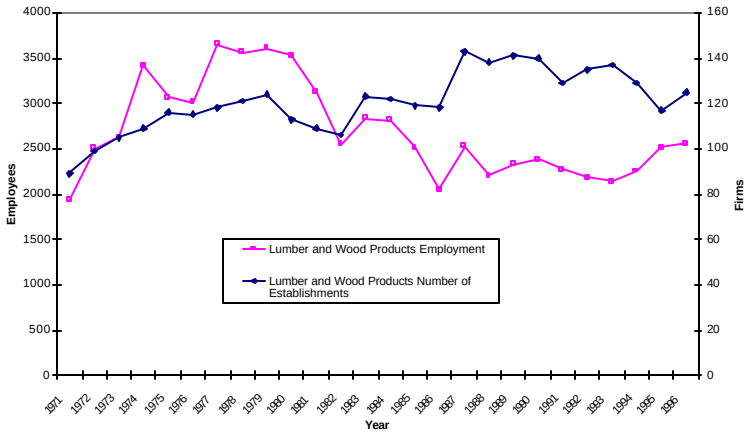


**Figure II.12: Lewis County Wood Employment vs. Number of Mills**
*Source*: REIS, 1996

As noted above, lumber and wood product employment declined during the 1980's. This resulted from the end of the US housing boom and the global recession in the early 1980's, which forced a restructuring resulting in mill efficiency gains. Surprisingly, the number of establishments for lumber and wood products actually rose during this same time period (Figure II.12). This was due to some employee intensive lumber mills shutting down while smaller secondary product establishments were established.

Lumber and wood product employment has been on a decline since the late 1970's to the late 1980's. However, this trend leveled off in the early 1990's and appears to be rising in recent years.

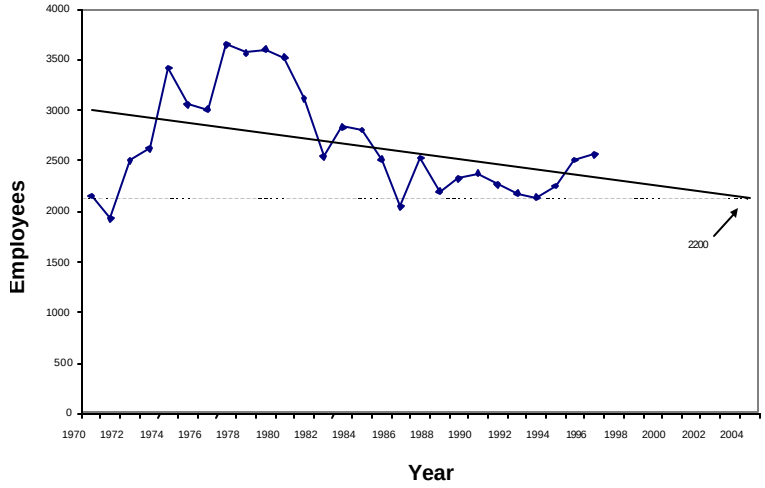


**Figure II.13: Lewis County Lumber and Wood Products Employment**
*Source*: CINTRAFOR, 1999

A straight-line trend projection for lumber and wood products employment out to the year 2004 would yield approximately 2200 employees (Figure II.13).

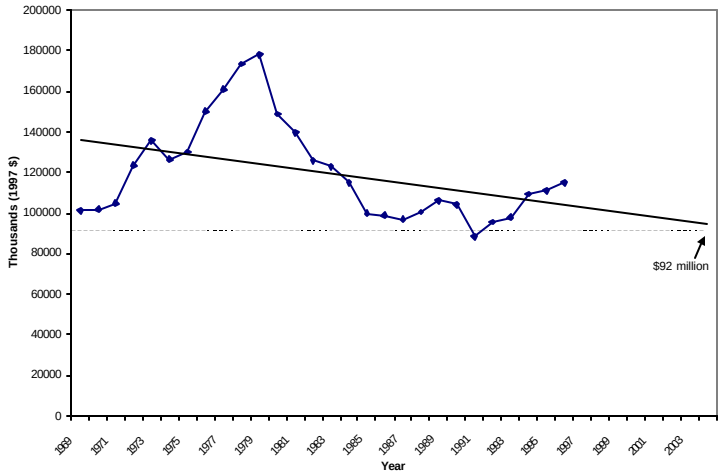


**Figure II.14: Lewis County Lumber and Wood Products Net Earnings**
*Source*: CINTRAFOR, 1999

Lumber and wood products net earnings have shadowed the trend for employment. projecting this trend out to the year 2004 would yield approximately $92 million (Figure II.14).

## III. FOREST SECTOR MANAGEMENT ALTERNATIVES: METHODOLOGY

The objective of this analysis is to characterize how Lewis County's timber harvest levels and their resulting economic impacts may be changing over time as a consequence of past harvest patterns, changing regulations and economic motivations. As will become evident, no one data source provided the detail on forest inventory and growth to evaluate forest management alternatives over time. The minimal forest inventory data for the analysis of management alternatives includes age-class by ownership for 3 zones that make up the county with site classifications to identify forest types and site indices, proximity to streams, unstable slopes and owl nests. The sources of data and processes for integration of the data to produce these classifications become a critical part of the analysis.

Forest inventory information for private lands is either considered proprietary or has not been collected by the owner. Bureaucratic obstacles have impeded access to the State's trust land inventories. In other words, continuous coverage or mapped forest inventory was not available for the state and private timberlands. For these owners it was necessary to infer inventories from the USDA Forest Service (USFS), Forest Inventory Analysis (FIA) data samples. These forest inventory samples were used in conjunction with Lewis County ownership and hydrological maps in a Geographical Information System (GIS) format. Continuous coverage of the Gifford Pinchot National Forest inventory was also available in GIS format.

A relational database was developed for each of the mapped and sampled forest inventory information sources. These databases were then queried to sort the recorded acreage's corresponding to each management alternative being considered. Thus, each sort represents a unique land-use allocation of the timberlands in Lewis County. These are essentially spatial allocations for the present time. A linear program was used to evaluate the impact of forest growth and harvest for several management alternatives over long time horizons.

### STATE AND PRIVATE FOREST INVENTORY DATA FOR LEWIS COUNTY

#### Background for FIA Data

The Forest Service is responsible for periodically determining the extent, condition, volume, growth, and depletion of the Nation's forests. This mandate was originally established by the McSweeney-McNary Forest Research Act of 1928 to determine the amount of timber available for harvest. More recently, the mandate has been extended by the Forest and Rangeland Renewable Resources Planning Act of 1974 and the Forest and Rangeland Renewable Resources Research Act of 1978. The contemporary inventory analysis extends well beyond timber availability.

To meet this objective, the Forest Inventory and Analysis program (FIA) has been implemented by the Forest Service through its regional research stations. On the West Coast this effort is organized as the Pacific Resource Inventory, Monitoring, and Evaluation program (PRIME). In western Washington, PRIME collects data on lands in all ownership except National Forest, reserved areas, and census water. This data is compiled in the Westside Data Base (WWDB) format, referring to the western United States (not west of the Cascades Crest). The National Forest System is responsible for obtaining data on the land it administers.

The FIA sample design is a nested sampling scheme by double sampling for stratification. Land areas are initially stratified into land use classes via aerial photography and/or Landsat satellite data interpretation. This is the primary sample. The secondary sample consists of measuring ground plots. PRIME maintains a permanent grid of field plots, which are re-measured approximately every 10 years. In 1963-1966, a 1.5 kilometer grid of 10-point (subplot) field plots was established in western Washington. In 1978-1979, new 5-point plots were established at these same locations. The five subplots are distributed over an area of approximately 2.7 hectares. Thus, this is a nested sampling scheme. On each sub-plot, trees 17.5-90.0 cm dbh are sampled with a metric 7-factor prism. Trees 12.5-17.4 cm are sampled with a 3.3 meter fixed-radius plot. Trees greater than 90 cm are sampled with a 17 meter fixed-radius plot. In the 1988/89 survey these plots were re-measured corresponding to every sixteenth primary

photo point. For western Washington, the 1988/89 WWDB consists of 2,772 plot records, 10,946 subplot records, and 51,173 individual tree records. Plot level attributes of interest include land class, ownership, county, site index, slope, county level expansion factors, and others.

At the subplot level, the primary attributes of importance are the proximity of the subplot to either a Class 1 or Class 2 stream. Class 1 waters are defined as valuable for domestic use or important for recreation and/or used by significant numbers of fish for spawning, rearing, or migration. Class 1 waters may include open bodies such as lakes. Class 2 streams generally have limited value for recreation or fish. The primary value of Class 2 streams lies in their ability to influence the downstream water quality and quantity. Proximity is recorded up to 65 meters.

At the tree level, attributes are either based on measurements or calculations. This study uses the measured variables breast height age, species, and diameter. Tree age, basal area, and density per tree are the calculated parameters used.

The evaluation of alternative forest management plans using a strategic level linear program requires information on ownership, age class by decade, species composition, slope, site class, proximity to stream, and stream class. Given these considerations, the PRIME data was summarized at the sub-plot level for this study. For each subplot PRIME records a county level expansion factor in units of acres. Initially, the PRIME data was screened for only those plots belonging to Lewis County and classified as timberland (adjusted ground land class = 20). This yielded 225 plots consisting of 1123 subplots representing 845,113 acres.

**Ownership**

This study is concerned with the ownership and management practices of four different owner classes: state, federal, industrial, and non-industrial private. The ownership types classified by the Lewis County FIA samples include county and municipal, DNR, forest industry, farmer owned, miscellaneous private, and like forest industry. Using known acreage from the Lewis County Geographic Information System (LC GIS) database it was determined that "forest industry" and "like forest industry" could be combined as forest industry. And, farmer owned and miscellaneous private could be combined as non-industrial private. Two plots representing county and municipal lands have been combined with DNR. Ownership was classified during the photo interpretation phase of the inventory.

Based on the FIA samples the total acres by ownership is as follows:

| | |
|---|---|
| DNR and other public | 126,777.5 |
| Forest industry | 546,722.1 |
| NIPF | 171,613.5 |
| Total | 845,113.1 |

Based on the Lewis County GIS database the total acres by ownership is as follows:

| | |
|---|---|
| DNR and other public | 114,199.0 |
| Forest industry | 536,481.0 |
| NIPF | 194,320.0 |
| Total | 844,920.0 |

It is very encouraging that the total acreage given by these two data sets is within 0.02% of one another. However, the discrepancies within each ownership category are more significant. These differences are most likely explained by the fact that the FIA data set is almost ten years old and during that time the DNR has sold and swapped a portion of Lewis County lands it manages. Differences amongst the private lands may be explained by the loosely described FIA classes of miscellaneous private and "like forest industry." In the final analysis, the LC GIS ownership patterns were taken to be the most accurate and used accordingly.

The linear program used to simulate the alternative management scenarios was set up to take only three owners per run. Two sets of three-owner groupings were simulated for each alternative in order to study the management implications for each of the four owner classes. The first set consisted of public, forest industry, and NIPF. The second set consisted of private, Gifford-Pinchot National Forest (GPNF), and other public.

**Age-class**

Both density and basal area have been recorded on a per acre basis. Thus, summing over all trees in a plot would give an estimate of either measure on a per acre basis. However, if subplots are treated as plots for the purpose of characterizing riparian zones, then the corresponding summations will yield estimates on a fifth-acre basis. This points to the fact that FIA data is collected for understanding trends on a national level. Further, in computing average age at the subplot level, the expansion factor of each tree must be considered. In other words, the correct average will be an average weighted by the individual tree expansion factors.

As mentioned above, all of the PRIME samples used for this study were collected in 1988 and 1989. To "update" the data set nine years were added to the age of each tree. Nine was chosen so that the PRIME data would correspond to the GPNF data, which was reported for 1998.

In addition to "aging" the trees, it was necessary to estimate the reduction of standing inventory stemming from nine years of timber harvest in the county. Several assumptions were used to model these harvests. The forest industry acres were assumed to be managed on a 50 year rotation, harvesting 2% of the timberland per year. Trees harvested ranged in age from 40 to 69 years. DNR managed lands were assumed to be on a 60 year rotation with trees cut from 50 to 79 years. NIPF timberlands were assumed to be managed on a 70-year rotation, harvesting trees between 60 and 89 years. The balance of these harvested acres was subsequently returned to the 0-9 age class.

**Sub-regional Zones**

The linear program used for this project made it possible to subdivide the county into 3 zones. Zone 1 was arbitrarily chosen to be west of I-5. The boundary separating zones 2 and 3 was chosen as the highway 7 running south to Morton, Highway 12 from Morton to Randle, and Forest Service (FS) Road #23 from Randle.

The FIA plots were assigned to zones using the Canopy 93 stand structure distribution as a guide. The Canopy 93 forest cover layer is a classification of satellite image data contracted by the DNR in 1993. The Canopy 93 GIS layer was first stratified on the basis of ownership. For each ownership strata plots were assigned to zones such that the FIA sample distribution at the plot level, using the stand age code records, corresponded to the classified image seral stage distribution.

**Species Composition**

Species composition was calculated from the tree records. Subplots having greater than 70% conifer basal area were considered conifer and greater than 70% hardwood basal area were considered hardwood. All other subplots were classified as mixed composition. For subplots sampled on recently harvested timberland no basal area is recorded. In order to classify these subplots, information was taken from the corresponding plot level "management type" records. Conifer management types were classified as conifer, high and low value hardwoods were classified as hardwood, and mixed conifer-high value hardwood were classified as mixed composition stands. For plots recorded as management stand absent, species composition was inferred from the plot level primary forest type records as either being conifer or hardwood. Note that primary forest type does not connote mixed stands, and is thus used as a last resort. Various nested if statements were used to write these queries.

**Site Index**

Plot level samples record the 50-year site index. Some of the management practices considered in this study propose buffer distances from two-thirds to three-quarters site potential tree height based on a 100 year index. The 50 year index heights where converted to 100 year heights using tables printed in the Fish and Forest Report draft dated February 10, 1999.

**Stream Classification**

As mentioned above, the proximity of a subplot to either a class 1 or class 2 stream is recorded. Class 1 streams are considered fish bearing, while class 2 are non-fish bearing. Thus, at the outset of this study FIA class 1 streams were considered equivalent to F and S streams. FIA class 2 streams were considered equivalent to N streams. Several management alternatives were assembled based on this assumption until the limitation of the relatively small number of samples became apparent. As mentioned, FIA was designed to monitor national trends. However, in trying to infer inventory at the resolution of county/zone/owner/stream type buffer the FIA approach leaves many gaps. Further, according to the current LC GIS database, the FIA no longer accurately represents the allocation among owners in Lewis County (see discussion above).

The GIS stream measures record stream types using the traditional 1-5,9 system classification. Having six unique stream types gives this classification system finer resolution and more flexibility. While it may be argued which of these types is fish bearing, the table below shows that no combination of stream types produces an FIA equivalence.

| STREAM TYPE | | FIA | |
|---|---|---|---|
| Type 1 | 16,262 | Class 1 | 11,200 |
| Type 2 | 2,061 | Class 2 | 129,201 |
| Type 3 | 27,729 | | |
| Type 4 | 61,105 | | |
| Type 5 | 212,116 | | |
| Type 9 | 254,170 | | |

In order to overcome these limitations, a strategy was designed to develop the acreage allocations for each management alternative using the LC GIS database and GIS functions for calculating riparian zone boundaries. This was also necessary as some proposed regulations for riparian zone size depend on stream length. The length of streams by type and owner is as follows:

| | OWNERSHIP TYPE | | |
|---|---|---|---|
| **Stream Type** | **DNR** | **Forest Industry** | **NIPF** |
| Type 1 | 45.5 mi. | 306 mi. | 193.5 mi. |
| Type 2 | 5.8 mi. | 46.9 mi. | 13 mi. |
| Type 3 | 104.8 mi. | 616.9 mi. | 176.4 mi. |
| Type 4 | 161.4 mi. | 871.6 mi. | 186.9 mi. |
| Type 5 | 570.2 mi. | 3086.2 mi. | 488.8 mi. |
| Type 9 | 450.1 mi. | 3266 mi. | 825.8 mi. |

Stream types 1, 2, and 3 are considered fish bearing; with 1 equivalent to shoreline (S) and 2 and 3 equivalent to F. Types 4, 5, and 9 are considered non-fish bearing; with 4 as perennial (NP), 5 as intermittent (NI), and 9 as currently undefined. Using the GIS, riparian zones are calculated for each alternative being simulated. Forest inventory distributions are then projected for each allocation (for example, upland reserves) within each zone and ownership from distribution within the zone's ownership as a whole. In other words, forest distributions are taken from the FIA samples broken down by zone and ownership. Within that breakdown, acres for each management allocation are computed from the LC GIS and the same distribution is assigned to each.

**Gifford Pinchot National Forest (GPNF) Inventory Data**

All of the GPNF inventory, riparian reserve, and management allocation information is available in GIS format and can be obtained via the Internet. A GPNF database was developed for this project by intersecting several layers. The Gifford-Pinchot Vegetation 1998 (GPVEG1998) layer records many stand parameters including year of origin, species, structure class, and acres. The GPRR layer gives the boundaries of the riparian reserves from the Forest Ecosystem Management Standard (FEMAT) Option 9 plan. The Gifford-Pinchot Management (GPMGT) layer shows the boundaries of various land use allocations from matrix to congressionally withdrawn wilderness areas. These three layers were intersected together along with the zone boundary layer to produce a combined base layer. "Sliver" polygons less than one acre in size was eliminated. The resulting coverage contained 29,667 individual stand polygons.

**Forest Inventory**

The combined base layer mentioned above represents 445,709 acres. Some of these acres are "island" polygons not belonging to the GPNF. Selecting only the stands having a GPNF stand tag number reduces the total number of acres to 444,059. This compares favorably with the GPNF acreage given by LC GIS of 444,000 acres. Note 35,257 acres of Mt. Rainier National Park fall within Lewis County and are not included in this study. The following summation accounts for all of the acres in Lewis County:

| | |
|---|---|
| Total FIA acres (timberland and non-timberland) | 1,074,830 |
| GPNF | 444,059 |
| Mt. Rainier Park | 35,257 |
| Total | 554,146 |

*This total is within 0.2% of the total given by LC GIS.*

Non-forest land such as lakes, glaciers, and rock surfaces were screened from the GPNF base layer, giving 371,073 total forest acres. Further screening of wilderness, experimental, and recreational areas such as campsites leaves 296,042 acres of available timberland. These acres are allocated as LSR (late-seral reserve), AMA (adaptive management), or matrix (mixed management).

**Species Composition**

Given the continuous nature of the GPNF vegetation coverage stand parameters are primarily inferred from air photo interpretation and individual tree records are not sampled. Classification of species composition was carried out using stand structure and species codes given for each stand. Stands having a "hardwoods" structure are taken as hardwood. Stands that are not classified as hardwood and do not have a hardwood species listed as the minor stand species are taken as conifer. The remaining stands are considered mixed.

**Riparian Reserves**

The GPNF riparian reserve coverage is based on the FEMAT Option 9 plan. This plan buffers fish bearing streams with a distance of two site potential tree heights. Non-fish bearing streams are buffered by one site tree height. Unstable slopes are also included within the riparian reserve, even if they are not within the buffer area. Further, unstable slopes are not necessarily determined by slope alone.

**GROWTH, YIELD AND HARVEST PROJECTIONS**

While the inventory data provides important descriptive information that essentially determines what forestland is mature and available for harvest, growth and yield projections become critical to both harvest potential and habitat characteristics in just a few decades.

**Forest Productivity**

Forest productivity classes (site index classes) were selected for each owner - forest type combination and land category (i.e., upland or riparian) to reflect the average site index noted in the West Side timber supply analysis (Adams et al. 1992). With the starting inventories by land category, age class, and owner for three geographic zones of Lewis County, each of several possible management strategies were simulated with growth and yield simulators. Stands over 40 years old were assumed to be essentially unmanaged with growth projections taken from empirical yield tables (Chambers 1974, 1978, 1980). Stands less than 31 years old were assumed to have been restocked and were simulated by the method of Douglas Fir Simulation (DFSIM) (Curtis et al. 1981) as adjusted for empirically observed stocking levels. Stands between 31- 40 years of age were assumed to be half managed and half unmanaged, reflecting the transition to intensive management that took place in the 1960's.

**Management Practices**

Silvicultural options examined in the simulations included practices which are currently considered to be commercial as well as those stressing the development of stand structures to promote old forest conditions for biodiversity and habitat management purposes. Included is the option of no-management whereby the forest is placed in reserves and allowed to age undisturbed by man or natural disturbances. The specific options simulated for upland areas were:

1. no-management set-asides,
2. natural stand development without intervention except for final clear cut harvests at age 50 or later, and subsequent natural regeneration,
3. planted stands with pre-commercial thinning (PCT) and one commercial thinning (CT) at age 30 or later (with final clear cut harvest at age 50 or later),
4. biodiversity management pathways with planted stands followed by three periodic thins leaving ample quantities of woody debris, downed logs, and snags culminating in forests with most of the ecological functional equivalent features of old forests in about 100 years with rotations of 100 or more years,
5. a partial cut in existing 60-70 year old stands followed after 20 or more years by conversion to either the commercial or biodiversity pathways, and
6. for riparian areas, a periodic thin sequence similar to the biodiversity pathway used for upland areas was included with additional emphasis on retention of large trees for in stream habitat (stream recruitment) and no clear cut of the overstory.

**Stand Structure, Habitat and Economic Measures**

For each of these silvicultural treatment options a set of stand structure classifications and habitat indices developed in the Washington Forest Landscape Management Project (Carey et al. 1996) were determined for each stand class for every decade in a 200 year planning horizon. Habitat classifications as defined by the Washington State Forest Practices Board (1996) were also determined. A biodiversity index is available that measures the deviation of the current mix of stand structures from estimates of the mix in pre-European times. Some measures may not be particularly meaningful at a small spatial scale such as the biodiversity index. In addition, estimates of timber volumes removed during thinning and final harvest as well as standing timber inventory were made. Estimates were also made of woody debris, downed logs, and snags left behind after thinning and final harvest. These estimates are particularly important to the treatment options designed to promote biodiversity and to enhance habitat measures. These habitat and environmental measures are developed separately for each owner and zone including the three zones across the county as well as for uplands versus a defined riparian management zone.

In order to compare the environmental measures on a consistent basis between each alternative the same Riparian Management Zone (RMZ) is defined for each alternative. While there may not be a consensus on the relative importance of distance from fish and non-fish bearing streams, useful comparisons can still be made. In order to make useful comparisons between management alternatives, it is important that riparian areas for which habitat quality is to be compared are not only the same across alternatives, but also that they reflect similar degrees of importance to fish habitat. Since the Fish Agreement recently adopted in Washington State prescribes 50-ft zones

for non-fish bearing streams and approximately 170-ft zones for fish bearing streams. Theses distances were adopted for our defined RMZs as being relatively important to the quality of fish habitat. Considering a wider RMZ for non-fish bearing habitat would give undue weight to whatever forest conditions was found in that area. For S and F streams the RMZ was chosen to be 170 feet, which is the site potential tree height for site index II (100-year index). For N streams the RMZ extends out 50 feet. For management alternatives having a stream buffer distance less than the RMZ, the acres within the buffer plus the acres from the buffer boundary to the RMZ boundary (Outer RMZ) will sum to the total RMZ acreage. This would be the case for a 75 ft buffer for fish bearing streams, where 75 ft is less than 170 ft. For alternatives proposing a stream buffer greater than the RMZ boundary, the acres inside the buffer will match the acres inside the RMZ and the acres between the RMZ boundary and the buffer boundary is assigned to upland reserves.

Management treatments are identified with a geographic region, land category, and ownership type[1]. Spatial sensitive characteristics within a distinct land area are not maintained over time even though based on current GIS spatial data. Implementation of operational plans maintaining desirable spatial features should not deviate significantly from these simulated results at this scale.

For the economic analysis, all timber removals were characterized as a function of species and diameter. The revenue, employment, and state and local tax receipts were then determined for each treatment option based on harvest volumes, trend prices, costs and subsequent processing activities and indirect activities (Lippke et al., 1996).

**Harvest/Treatment Schedule**

Among these many stand-specific treatment options, the best harvest/treatment schedule was determined over a 200 year time horizon with the objective of maximizing landowner net present value (NPV using a 5% real discount rate) subject to constraints involving forest reserve set-asides required by regulations, habitat goals designed to meet minimum standards, and operational harvest flow constraints restricting the decade to decade change in harvest volumes over time. Harvest flow constraints were restricted to +/- 25% per decade for private owners consistent with historical fluctuations. For state and federal owners harvest flows were not allowed to decline from decade to decade to approximately mimic DNR and USFS policy. Thus, for each of several possible treatment options, a time profile of economic, environmental, and habitat attributes for the 200-year future were determined for each decade.

**Economic and Biological Comparisons**

Measuring the change from one management alternative to another provides an analysis of cost; employment and other economic measures versus forest stand structure, habitat and other environmental changes. Each management scenario is composed of an economic best mix of treatment alternatives to satisfy the habitat constraints, which are imposed either as regulatory requirements or habitat minimums. The output for each scenario includes a rich array of economic impacts and environmental attributes over time to measure the cumulative effects. Output measures are valued differently by different stakeholder groups. Measures of critical importance to key groups are:

- Net present value to timberland by owner group -landowners
- Rural employment in the rural region supported by Lewis County harvest levels -local communities
- Tax receipts -governments
- Habitat & other environmental measures -general public & environmental groups
- Economic activity -business, rural communities & governments

[1] Land classifications include two land categories, three geographic regions, and four ownership types, each with its own age-class distribution, for a total of 24 separate profiles.

The rural employment measures include direct and indirect employment generally found in a multi-county rural region based on regional modeling of the State of Washington; they are not specific to Lewis County, even though resulting from the harvest in Lewis County. Economic models have not been developed for each county and generic models adapted to the county level would not be reliable. Employment changes over time are responsive to changing harvests including the quality of the harvest but do not incorporate productivity improvements. A 1-2% improvement in productivity per year and decrease in direct employment is likely for at least several decades. To the degree that the productivity improvement results from increasing capital intensity, indirect employment increases in conjunction with increased secondary manufacturing may offset declines in direct employment.

**MANAGEMENT ALTERNATIVES**

In order to simulate various riparian buffer scenarios and management alternatives scenarios were developed as described below.

**Case 1: Baseline**

The baseline case is designed to replicate commercial management practices prior to regulations responding to the listing of endangered species. This case should correspond to the harvest potential for the several decades leading up to the 1990's. A 75 ft buffer is assumed on all fish bearing streams as the protection most owners had been providing during the last decade while managing for commercial objectives. The acres inside the buffer for the private and other public lands were calculated using the LC GIS database. A similar percentage of acres was assumed for GPNF for consistency in treatment across owners.

We did not have the same data set for federal lands to develop the acres in an RMZ. An average site potential tree height for fish bearing streams is estimated to be about 150 ft. Thus, a 75-ft buffer can be inferred by taking a quarter of the Option 9 riparian reserve acres. Likewise, the fish bearing RMZ distance was assumed to be half of the Option 9 distance. While this assumption may lead to fewer RMZ acres, it will be the same for each alternative. For type N streams, 1/4 of one site tree height will lead to a small stream buffer along these streams. One half (1/2) of one site tree height will produce an RMZ distance greater than 50 ft in most cases. This may offset the reduced RMZ along fish bearing streams. This method of estimating RMZ acres is used for all cases for federal lands.

**Case 2: New Minimum Regulations**

This scenario simulates FEMAT Option 9 for the GPNF and estimates the Forest and Fish Agreement impact applied on all private and other public lands. As a simplified description, the Forest and Fish agreement requires no or minimal management within 2/3 the site potential tree height (approximately 150 ft) for fish bearing streams and a 50 foot no management buffer for 1/2 the perennial non-fish bearing steams with basal area minimums for the outer riparian zone that have the affect of increasing somewhat the no-management area. All owl circles on federal land are assumed to fall within reserved lands. To balance this assumption, AMA acres are also considered reserved. Estimates provided by DNR show that up to 20 owl circles exist on DNR lands within Lewis County and 5 on private lands. Each circle typically includes 1,000 acres of mature forest on average (Lippke and Conway 1994). With these estimates as a guideline, mature upland forest for owl circles was re-allocated to upland reserve and set aside from management. The number of owl circles on state and private lands is substantially larger than were estimated several years ago yet the old forest inventory is quite small. This might suggest that fewer older forest acres are needed for protection in the owl circles. In any event, errors from these assumptions would seem to be small as they represent only a small percentage of the total acres.

**Case 3: Biodiversity Management State and Private**

This case simulates the application of various biodiversity oriented silvicultural regimes to private and other public lands. These regimes as noted above are designed to provide management options for otherwise set aside land in

order to restore old forest habitat functionality more quickly and at lower cost. Therefore, the owl circle acres set aside in Case 2 on state and private lands are not set aside in this case. The no-management area in the RMZ is reduced to 25 ft. along fish bearing streams and the same for the 1/2 of the stream length being protected for perennial non-fishbearing streams. GPNF land and management remains unchanged from Case 2. The maximum net present value criteria would generally not select these biodiversity treatment options as they are more costly than commercial treatments however they become a potentially lower cost option over the long term to restore old forest functions and other habitat requirements. To maintain at least as much quality habitat in both riparian and uplands as was produced under Case 2, late seral forest structure minimums were required by the 10th decade comparable to Case 2, with the fully functional old growth acres required to be at least 30% of the late seral total acreage. To avoid any early cut out of Nesting Roosting Foraging (NRF) habitat before the biodiversity treatments can be effective, a minimum NRF requirement was used for the first 5 decades. No commercial treatments are allowed within the RMZ boundary, resulting in either partial thinning treatments that promote restoration of old forest functions or no-management in this area.

**Case 4: Biodiversity Management All Owners**

This case extends the application of the biodiversity treatments to a portion of the federal timberland. The AMA lands are allocated to upland management along with the matrix lands. LSR lands remain upland reserves. Late seral and fully functional old growth requirements were established in the same manner as for state and private in Case 3, but the old forest habitat is a much higher share on USFS lands in Case 2 and hence will be as high in Case 4.

**Case 5: Expected Practice**

This case simulates the DNR HCP on other public lands instead of the Fish Agreement. The net impact is approximately equivalent to a 300-ft buffer along fish bearing streams and a 100-ft buffer along non-fish bearing streams since planned entries are minimal and substantially more reserves are maintained for owl habitat. The Fish Agreement with reserved owl circles is simulated for private lands as per Case 2. The FEMAT scenario from Case 2 is simulated for the GPNF (see Figure III.2 Case 5 acreage allocation impact). The allowed treatments on unstable slopes is not certain and has been considered in a supplementary analysis.

**Case 6: Wider Riparian Buffers**

This case simulates the impact of the wider riparian buffers comparable to Tribal and Washington Environmental Council proposals placing 300-ft buffers on private and other public land along fish bearing streams and a 100-ft buffer along non-fish bearing streams. The FEMAT scenario from Case 2 is simulated for the GPNF.

**SUMMARY OF ACREAGE ALLOCATIONS USED IN EACH CASE: MANAGEMENT ALTERNATIVES**

| Case | 1 | | 2 | | 3 | | 4 | | 5 | | 6 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Upland | 937,071 | 82.12% | 719,379 | 63.06% | 738,477 | 64.73% | 786,380 | 68.93% | 703,783 | 61.68% | 585,315 | 51.30% |
| Upland Reserve | 0 | 0.00% | 217,420 | 19.06% | 198,322 | 17.38% | 150,420 | 13.18% | 233,304 | 20.45% | 351,863 | 30.84% |
| Stream buffer | 24,459 | 2.14% | 129,763 | 11.37% | 89,261 | 7.82% | 89,261 | 7.82% | 138,620 | 12.15% | 203,864 | 17.87% |
| Outer RMZ | 179,511 | 15.73% | 74,303 | 6.51% | 114,951 | 10.07% | 114,951 | 10.07% | 65,338 | 5.73% | 0 | 0.00% |
| **Total** | **1,141,041** | | **1,140,866** | | **1,141,011** | | **1,141,012** | | **1,141,050** | | **1,141,047** | |

Note that the total acres simulated for each alternative range within 200 acres of each other as different techniques were used to calculate each alternative. By design, the total area within the RMZ is the same for each case. The RMZ area represents 17.8% of the timberland. This compares favorably with a study of southwest Washington that found 17.99% of timberland falling within an RMZ defined as 175 ft on A and B streams, and 50 ft on C and D streams. The no-management riparian buffers are reduced in Cases 3 and 4, allowing thinning treatments for

restoration of older forest habitat to within 25 feet of the stream bank and increased in Case 5 to reflect the wider buffers in the DNR HCP and in Case 6 to reflect a similar strategy on private lands as well.

The owl circle reserves for Case 2 include 8,199 acres for private (1.1%) and 7,825 acres for DNR (6.9%) with the remaining upland reserves of 201,397 (68%) on federal for a total upland/owl reserve of 217,420 (19%). The upland reserves are increased with the DNR HCP in Case 5 and with riparian buffers wider than the RMZ in Case 6, but reduced in Cases 3 and 4, which allow restoration management to substitute for owl reserves (see Summary of Acreage Allocations in Appendix II).

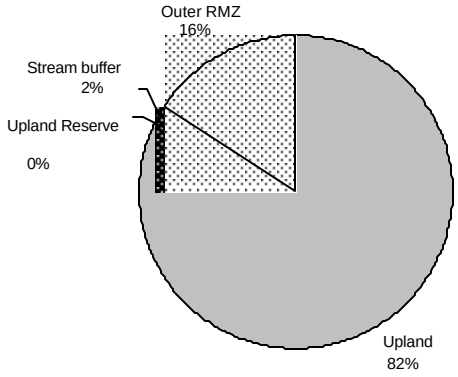


**Figure III.1: Base Case Acreage Allocation Impact**

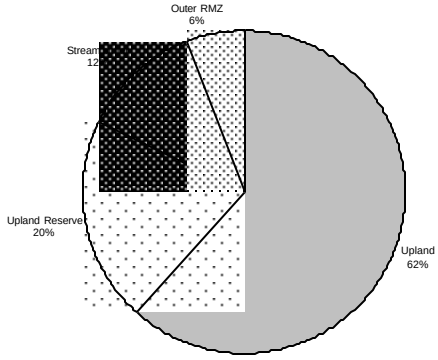


**Figure III.2: Case 5 Expected Practice Acreage Allocation Impact (excluding unstable slopes)**

## IV. FOREST SECTOR MANAGEMENT ALTERNATIVES: RESULTS

**Base Case (for comparison to historical period and benchmarking)**

This case simulates the harvest potential with relatively little habitat protection as was the case for the several decade historical period leading up to the 1990's. Even the 3% of the acres that are assumed to be in 75 ft no-management buffers around fish bearing streams might overstate the general practice for all but the last decade. With minimal habitat constraints, comparing this case with history provides some evidence of the sustainable harvest rate for the county's land base.

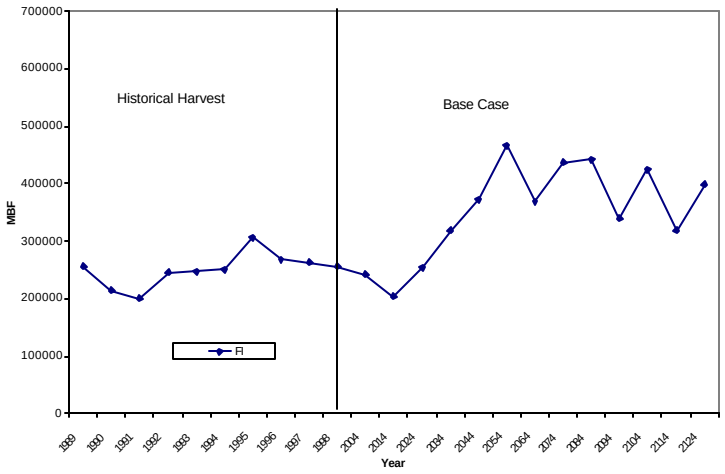


**Figure IV.1: Historical vs. Base Case Harvest Volume for Private Industry Lands**

Management objectives within the private forest industry should be very similar to that used in the simulation, namely to maximize landowner net present value, and the comparison of the projection to the prior harvest history seems to bear that out. The historical harvest level of 275mmbf ft per year increases slowly to 360 million by 2025 (Figure IV.1). If there had been any excess in mature inventory, the harvest level would have been higher for the first several decades and then declined in order to maximize NPV. So with no evidence of liquidation in the first two decades, or a decline in harvest that would be caused by harvesting above sustainable rates, the projection implies that the industry has been harvesting at its maximum potential. Even so, with the more intensive management practices of the last few decades, it can increase the sustainable harvest by about 40% over the next several decades. This projection reflects what some have called the "wall of wood" that will come on market as the cutover of more naturally grown forests are replaced by more intensively managed second growth forests. With almost no excess mature inventory and therefore few owl sites, the harvest reductions experienced in other parts of the state were more significant on private industry lands than in Lewis County.

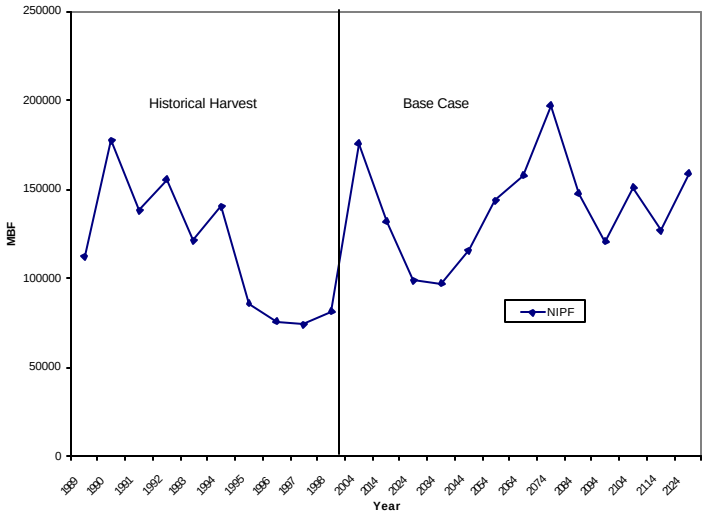


**Figure IV.2: Historical vs. Base Case Harvest Volume for Non-Industrial Private Lands**

While the harvest pattern for the NIPF lands is quite similar to that of industry from the 1990's forward, with sustainable levels of about 175 mmbf, there is some evidence of liquidation of mature inventory in the late 1980's and early 1990's, perhaps as a consequence of rising markets after the recession years of 1981-86 and the rising concerns about future constraints (Figure IV.2). The low reliability of the harvest statistics, which are derived by allocations between industry and NIPF owners, prevents making any stronger conclusion. It is possible that the projected sustainable harvest rates for NIPF lands are overstated. Survey's were not conducted for management intentions or reduced land productivity estimates over industry practices. Some have questioned the degree of intensive management practiced on NIPF lands. The noticeable increase in NIPF harvest rates for the first two decades of the simulation reflects the liquidation of stands that are mature as a consequence of maximizing the NPV. Since some NIPF owners prefer to maintain older forests this liquidation may not occur, lowering harvest levels by as much as 50 mmbf per year over the two decades.

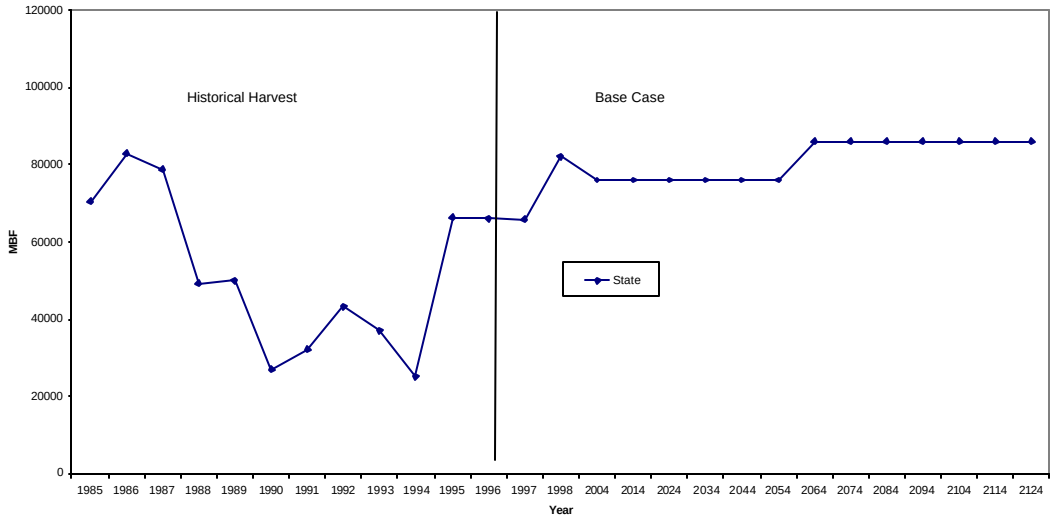


**Figure IV.3: Historical vs. Base Case Harvest Volume for Other Public (state) Lands**

Given somewhat different management objectives, the harvest patterns for public lands might be expected to be different. State lands show a long-term sustainable harvest rate of 90 mmbf, almost twice the average in the historical period (Figure IV.3). At the statewide level, state harvest rates were cut in half in the early 1990's as a consequence of conservative policies to protect owl habitat. With relatively little old inventory and few owl circles in Lewis County, the impact may have been almost the opposite of that in other regions of the state. Lewis County may have provided disproportionately more land that was not tied up by concerns over owl habitat. However, the harvest levels still fell substantially below the simulation's estimate of long-term sustainable rates for the first 5 years of the decade.

Federal lands show a potential sustainable harvest base level of almost 200 mmbf per year. This estimate may of course be too high because it ignores multiple use objectives, which have long been practiced by federal managers. Historically, harvest levels were that high prior to 1989 but have since declined to near zero as a consequence of the FEMAT recommendations and adoption of the Clinton Administration's Forest Management Plan to protect habitat for owls and other endangered species.

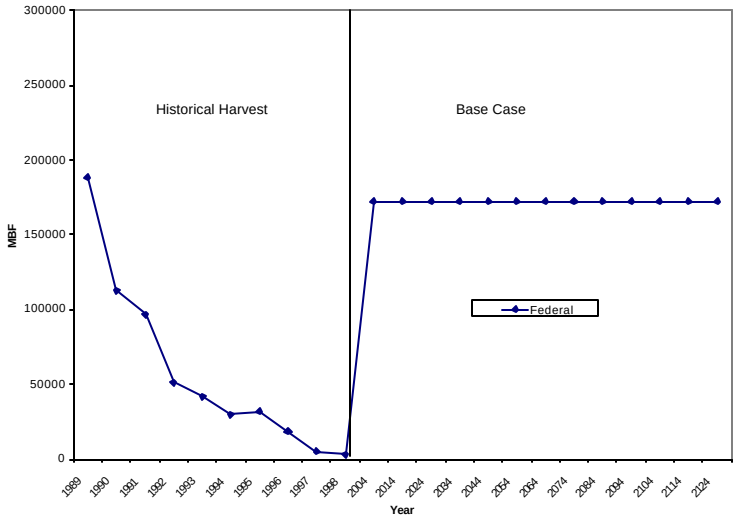


**Figure IV.4: Historical vs. Base Case Harvest Volume for Federal Lands**

Across all owner groups the sustainable harvest potential rises to 750 mmbf per year from historical harvest levels over the last decade of just under 500 mmbf per year. The projected sustainable rate is comparable to a 33.2 mbf average harvest level over a 50-year rotation. Growth and yield simulations would suggest averages above 36 mbf for industry lands and less than 30 mbf (or longer rotations) for federal lands. There is no evidence from comparisons of the historical period and the simulation period to suggest a significant modeling bias of more than a few percent one way or the other. The substantial changes that have occurred in harvest levels over time are more logically a result of changing management objectives by the different owner groups, in conjunction with their changing distribution of age classes. However the assumptions of future management intentions are more problematic as will become more evident in the other simulations.

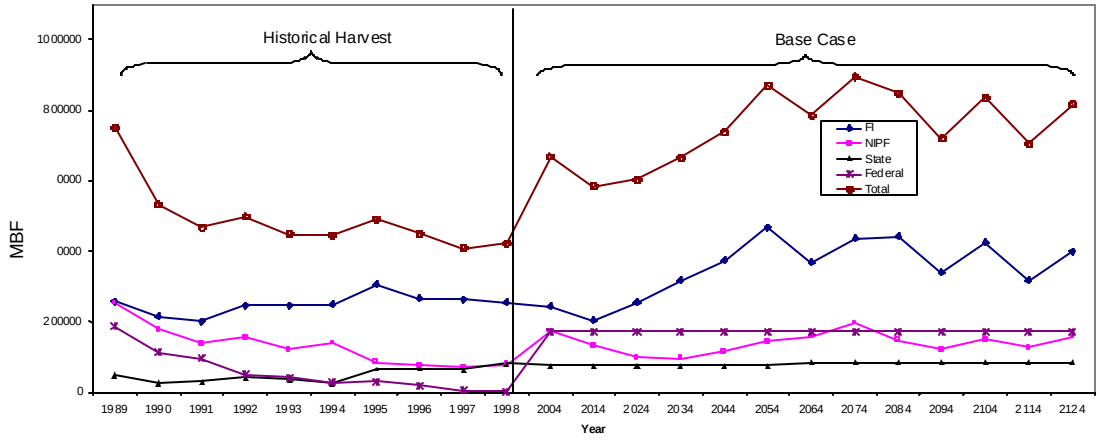


**Figure IV.5: Historical vs. Base Case Harvest Volume Comparison**

The potential harvest level for the first two decades of just over 600 mmbf is still well above the recent harvest history, however, the potential harvest level for the first two decades by non-federal owners of 450 mmbf is not substantially different than recent harvest levels. The harvest level on Federal lands has become almost negligible with no expectation of a substantial increase or return to its potential sustainable harvest rate.

One notable consequence of commercial management by all owners as simulated in this case would be the near elimination of old forest structures. The 10% of the acres currently in the late seral stage are primarily on federal lands and the total late seral acres would decline to 1-2% (all in the riparian buffer zones) by universal commercial management objectives adopted by all owners. This eventuality of course has produced the regulatory pressures to protect the remaining old forest habitat as simulated in the other cases. Table IV.1 contains summary statistics for economic and environmental impacts across 4 cases simulating different levels of reserves. More detailed consequences are provided in the Appendix.

The commercial economic value under these conditions of minimal habitat constraints, but policies of non-declining harvest flows from decade to decade on public lands, produces an NPV of $5.2 billion; $2.0 billion on industry land, $1.1 billion on NIPF land, $0.6 billion on state land, and $1.5 billion on federal land.

**Table IV.1: Management Alternatives for Lewis County**

| CASES | NPV ($ billions) | % Change | Harvest mmbf/yr 1-20 yrs | % Change | Harvest mmbf/yr average | % Change | Employment Ave. annual (000s) | % Change | Tax Receipts 1-20 Yr Ave. ($ millions) | % Change | Late – Seral Acres Current Level | Late – Seral Acres Upland yr55 | Late – Seral Acres Average yr105 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Case 1:** | **Base with 75 ft no-mgt buffer class 1-3 streams** | | | | | | | | | | | | |
| Total | 5.2 | | 626 | | 759 | | 30.7 | | 157 | | 10 | 1 | 2 |
| Industry | 2.0 | | 224 | | 364 | | 14.0 | | 72 | | 0 | 0 | 1 |
| NIPF | 1.1 | | 154 | | 138 | | 5.4 | | 28 | | 0 | 0 | 1 |
| Other Public | 0.6 | | 76 | | 83 | | 3.4 | | 17 | | 2 | 0 | 3 |
| Federal | 1.5 | | 172 | | 173 | | 7.9 | | 40 | | 36 | 8 | 2 |
| | 5.2 | | 626 | | 759 | | 30.7 | | 157 | | 10 | 1 | 2 |
| **Case 2:** | **Minimum Regulations with Fish Agreement and Fed Forest Plan** | | | | | | | | | | | | |
| Total | 3.25 | -37% | 395 | -37% | 561 | -26% | 22.2 | -28% | 114 | -28% | 10 | 14 | 22 |
| Industry | 1.66 | -19% | 185 | -17% | 334 | -8% | 13.0 | -7% | 67 | -7% | 0 | 2 | 8 |
| NIPF | 0.99 | -10% | 139 | -10% | 130 | -6% | 5.0 | -7% | 26 | -6% | 0 | 2 | 6 |
| Other Public | 0.43 | -30% | 48 | -37% | 74 | -11% | 3.2 | -6% | 16 | -8% | 2 | 6 | 13 |
| Federal | 0.18 | -88% | 23 | -87% | 23 | -87% | 1.0 | -87% | 5 | -87% | 36 | 47 | 63 |
| | 3.26 | | 395 | | 561 | | 22.2 | | 114 | | 10 | 14 | 22 |
| **Case 5:** | **Fish Agreement, with DNRHCP and Fed Forest Plan** | | | | | | | | | | | | |
| Total | 3.12 | -40% | 378 | -40% | 543 | -28% | 21.5 | -30% | 110 | -30% | 10 | 15 | 24 |
| Industry | 1.66 | -19% | 185 | -17% | 334 | -8% | 13.0 | -7% | 67 | -7% | 0 | 2 | 8 |
| NIPF | 0.99 | -10% | 139 | -10% | 128 | -7% | 4.9 | -9% | 26 | -6% | 0 | 2 | 6 |
| Other Public | 0.3 | -51% | 30 | -61% | 58 | -30% | 2.6 | -24% | 18 | -25% | 2 | 7 | 29 |
| Federal | 0.18 | -88% | 23 | -87% | 23 | -87% | 1.0 | -87% | 5 | -88% | 36 | 47 | 63 |
| | 3.13 | | 377 | | 543 | | 21.5 | | 110 | | 10 | 15 | 24 |
| **Case 6:** | **Wide Riparian Buffers plus DNR HCP and Federal Forest Plan** | | | | | | | | | | | | |
| Total | 2.4 | -55% | 284 | -55% | 418 | -45% | 16.8 | -45% | 86 | -45% | 10 | 15 | 32 |
| Industry | 1.1 | -46% | 123 | -45% | 235 | -35% | 9.3 | -34% | 48 | -33% | 0 | 2 | 21 |
| NIPF | 0.8 | -30% | 108 | -30% | 101 | -27% | 3.9 | -28% | 20 | -28% | 0 | 3 | 18 |
| Other Public | 0.3 | -51% | 30 | -61% | 58 | -30% | 2.6 | -24% | 13 | -25% | 2 | 7 | 29 |
| Federal | 0.2 | -88% | 23 | -87% | 23 | -87% | 1.0 | -87% | 5 | -87% | 36 | 47 | 63 |
| | 2.4 | | 284 | | 417 | | 16.8 | | 86 | | 10 | 15 | 32 |

The percentage of acres in late-seral structures provides a good summary measure of biological diversity and multi-species habitat. Currently, 10% of the total forestland in Lewis County can be defined as late-seral structures. The Base Case results indicate that after 50 years, 1% of the forestland acres will be late-seral and 2% after 100 years. This decline is almost all the result of commercial management on federal lands, which currently provide 98% of the late seral structures.

Statewide employment, which includes direct and indirect employment supported by the Lewis County harvest, averaged 30,700 job opportunities per year. About 15,350 job opportunities would be expected outside of the metropolitan communities. The number of job opportunities in Lewis County would be even lower. The number of direct wood product jobs in Lewis County would be less than half of these. Since facilities that use the chip residuals and secondary manufacturing of lumber are generally outside of the county, neighboring counties also benefit significantly from the Lewis County harvest.

The average annual total state tax receipts for the first two decades based on the gross state product supported by the Lewis County harvest (a statewide impact) are estimated at $157 million. The non-federal timber excise tax contribution from the Lewis County harvest is estimated at $9 million per year for the first two decades.

**Case 2: New Minimum Regulations**

This scenario simulates FEMAT Option 9 for the GPNF and estimates the Forest and Fish Agreement impact applied on all private and other public lands as a projection for new minimum regulations (see summary statistics in Table IV.1). It also includes minimum protection for owl circles on state and private land.

The sustainable harvest is reduced 26%, 8% on industry land, 6% on NIPF land, 11% on other public land, and 87% on federal land. The increased losses on federal lands reflect the impact of the Option 9 management plan. The increased loss on other public land reflects the estimate on the greater concentration of owl circles on state land. The somewhat smaller losses on NIPF lands than industry lands is derived from the GIS data for the county and hence largely reflects spatial ownership patterns along fish bearing streams and their immediate headwaters. The sample size for age class by owner was insufficient to properly characterize age class differences by owner hence there may be age class difference affects across owners that were not captured.

The first two-decade harvest is reduced more than the sustainable harvest on all non-federal owners, as the reserves for the estimated owl sites ties up mostly mature acres. This results in a disproportionate reduction in the current available acres for harvest compared to several decades in the future when stands will have aged. The first two-decade harvest is reduced by 37%, 17% on industry 10% on NIPF, and 37% on other public. The near term harvest loss is twice as large as the sustainable loss for industry land, somewhat less than double for NIPF land but more than double for other public land.

The total NPV of $3.3 billion is 37% below the Base Case, $1.7 billion for industry (-19%), $1 billion for NIPF (-10%), $0.4 billion other public (-30%) and $0.2 billion federal (-88%). The NPV reductions are more greatly affected by near term events and hence heavily impacted by the harvest reductions in the first two decades.

Average annual statewide employment supported by the Lewis County harvest is 22,200 (-28%), with about half of the jobs in rural communities. Statewide tax receipts for the same period are reduced to $114 million (-28%). The non-federal timber excise tax receipts are reduced to $7 million (-18%).

The biological gains measured by late seral forest structures are substantial. The increased federal reserves, state and private owl circles and riparian buffers all contribute to some restoration of late-seral forest structures over time. Late seral structures increase from 10% to 14% by age 55 and 22% by age 105. Most of the improvement is reached in the later decades. About 60% of the riparian acres and 30% of all acres reach late seral conditions by 135 years, compared to 16% and 3% respectively for the Base Case.

**Case 5. Fish Agreement, DNRHCP and Federal Forest Plan: Expected Practices**

This case simulates the DNR HCP on other public lands instead of the Fish Agreement. Since the stream buffers with almost no management are larger and more reserves are maintained for owl habitat the impacts are somewhat greater than minimum requirements. The HCP may however reduce the risk of reductions from even more constraining regulations in the future. The Fish Agreement with reserved owl circles is simulated for private lands as with Case 2. The FEMAT scenario from Case 2 is simulated for the GPNF. This case may reflect the most likely scenario of management assumptions for each owner in the near future among the cases illustrated. Given some uncertainty on the impact of unstable slopes we provide an additional estimate for unstable slopes in Case 5A.

The sustainable harvest for Case 5 is reduced 28%; (-30% on other public land compared to -11% for Case 2). The first two decade harvest is reduced 40% (-61% other public compared to –37% for Case 2).

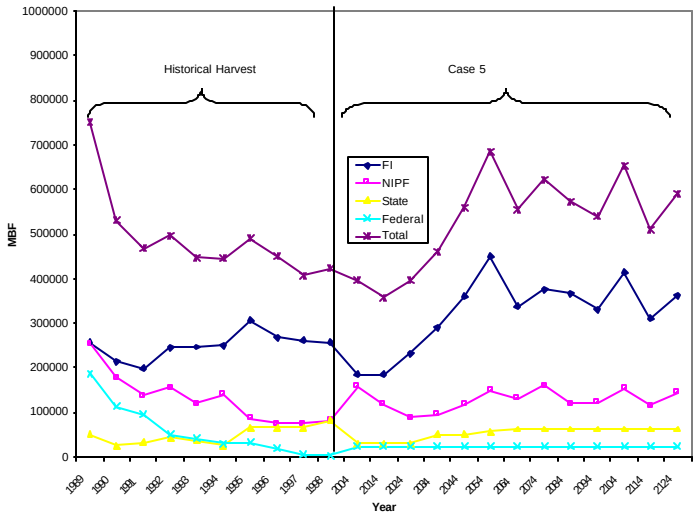


**Figure IV.6: Historical Harvest Flows vs. Expected Management Practices**

The total NPV of $3.1 billion is 40% below the Base Case, $1.7 billion for industry (19%), $1 billion for NIPF (-10%), $0.3 billion other public (-51%) and 0.2 billion federal (-88%).

Statewide employment is reduced to 21,500 jobs (-30%). Statewide tax receipts for the same period are reduced to 110 million (-30%). The average annual private timber excise tax receipts are reduced to 7 million (-22 %).

Upland habitat under the DNR HCP is only increased marginally over Case 2 by age 55, but attains twice as much late seral structure by age 135. Late seral structures across all owners increases from 10% to 15% by age 55 only a one-percentage point improvement over Case 2. By age 105, they reach 24% only 2 points better than Case 2, and by age 135 they reach 30%, 3 points better than Case 2. While the increase in late seral on DNR lands is substantial their land base is relatively low reducing the percentage impact across all owners. The impact on the RMZ is somewhat greater with the late seral only marginally increased over Case 2 by age 55 but twice as much late seral structures by age 135 across all owners.

**Case 5A: Expected Management Practices with Unstable Slopes**

Case 5 did not account for the presence of unstable slopes on forest industry land, which would influence the NPV and harvest flow results for the simulation. Unstable slopes are an important issue addressed in the Forest Practice Board's "Forest and Fish Agreement." In this report, the DNR states that, "the goal of management on unstable slopes (as described in this Appendix) will be to prevent or avoid an increase or acceleration of the naturally occurring rate of landslides due to forest practices" (DNR Forests and Fish Report, April, 1999). Additionally, the DNR states that it "will screen each forest practice application for risks associated with unstable slopes. In connection with the exercise of their current land rights to evaluate and comment on such applications, affected Tribes may also screen forest practice applications for risks associated with unstable slopes" (DNR, Forests and Fish, April 1999). Therefore, it is important to address the impact of unstable slopes while noting that the natural rate of landslides that has been described as the benchmark was undoubtedly heavily influenced by the frequency of fires which are greatly reduced under active management.

Since state land is managed under the DNR HCP, unstable slopes (12.4% of state land) have already been accounted for in the Case 5 simulation. Also, it is assumed that the small amount of unstable slopes on NIPF land (only 2.8%) has an insignificant impact on NPV and harvest flow, since a large portion of this land probably lies in the reserved land. However, 14.9% of the forest industry land has been determined to lie on unstable slopes, consequently

designating it potentially unharvestable under the Fish and Forest Agreement. However, the forest age distribution contained within the unstable slope acreage that is not already contained in a riparian buffer has not been determined so it is unknown what percentage of this acreage was harvested in Case 5. Therefore, the impact of including unstable slopes on forest industry lands is presented under a high and low scenario: High Impact—All 14.8% of the unstable slope forest acreage is ineligible for harvest, Low Impact—8.8% of the unstable slope forest acreage is ineligible for harvest. It is also assumed that the unstable slope acreage is distributed across riparian and upland habitat in the same proportion as the total forest industry acreage.

Under the above assumptions, the high scenario results in unstable slopes comprising 15,396 acres of the riparian habitat and 64,796 acres of the upland. This would decrease the forest industry NPV by $205 million and the average harvest flow by 50 mmbf. Under the low scenario, the unstable slopes would comprise 8065 acres in the riparian habitat and 33,941 acres in the upland. This would decrease the forest industry NPV by $107 million and the average harvest flow by 23 mmbf. In short, including unstable slopes in Case 5 would reduce the NPV 7 to 12% and the average harvest flow 6 to 15%.

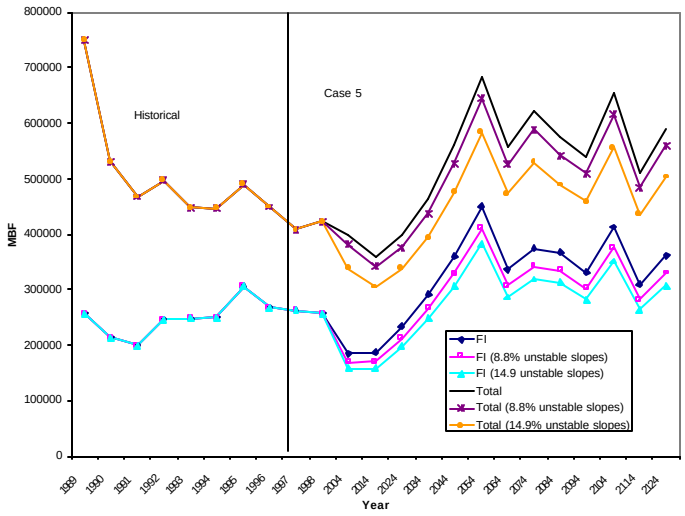


**Figure IV.7: Historical Harvest vs. Expected Harvest Flow with and without Unstable Slopes**

In addition to the reduction in harvest from unstable slopes on industry lands, a best estimate of expected future conditions might also account for a lower probability of liquidating the excess mature inventory on NIPF lands as was discussed earlier. This would lower the harvest another 50 mmbf, but only for the first two decades of the simulation period.

### Case 6: Wider Riparian Buffers

This case simulates the impact of the wider riparian buffers comparable to Tribal and Washington Economic Council (WEC) proposals placing 300-ft buffers on private and other public land along fish bearing streams and a 100-ft buffer along non-fish bearing streams. The FEMAT scenario from Case 2 is simulated for the GPNF.

The sustainable harvest is reduced 45%; (-35% on industry compared to –8% in Case 5, -27% on NIPF compared to -7% in Case 5, -30% on other public essentially the same as Case 5). The first two-decade harvest is reduced 55% (compared to -40% for Case 5).

The total NPV of $2.4 billion is 55% below the Base Case, $1.1 billion for industry (-46%), $0.8 billion for NIPF (-30%), $0.3 billion other public (-51%) and 0.2 billion federal (-88%). It is also $0.7 billion below Case 5 with all of the impact on private owners.

Statewide employment is reduced to 16,800 jobs (-45%), another 22% lower than Case 5. Statewide tax receipts for the same period are reduced to $86 million (-45%). The annual average private timber excise tax receipts are reduced to $4 million (-55%).

Late seral structures increase from 10% to 15% by age 55 insignificantly improved over Case 5, and to 32% by age 105, an 8-point improvement over Case 5. Most of the improvement is reached in the later decades. Increased habitat in the RMZ is more noteworthy at least in the long term, reaching 22% by age 55 and 74% by age 105 compared to 20% and 52% in Case 5 and 5% and 36% in Case 2.

**Case 3: Biodiversity Management State and Private**

This case simulates the application of various biodiversity-oriented silvicultural treatments to private and other public lands that might be adopted in the context of an HCP to actively restore late seral structures more quickly and at a lower cost than reserves. The protection strategy inherent in all of the previous scenarios is no-management reserves. For this case, the owl circle acres set aside in Case 2 are not placed in reserves, relying instead on a shifting mosaic of late seral forestland and active management to more rapidly convert overly dense stands to late seral conditions. The no-management buffer in the RMZ is reduced to 25 ft. along fish bearing streams and the same for the half of the stream length for perennial non-fishbearing streams while more rapidly restoring the rest of the RMZ by using periodic thinning regimes. Habitat levels noted in Case 2 are exceeded by setting minimum requirements for the production of late seral forest structures. GPNF land management remains unchanged from Case 2. The greater cost for these treatments over the Base Case would require either incentives to manage to habitat goals comparable to Case 2 or a similar cost reduction through an HCP negotiation as an alternative to Case 2.

The sustained harvest level is 10% higher than Case 2, and 6% higher for the first two decades. The total NPV return is 8% higher. Employment over the first decade is also 10% higher than Case 2.

The biological gains measured by late seral forest structures are substantial. Late seral structures reach 21% by age 55 compared to 14% in Case 2 and 28% compared to 22% by age 105 for a much more rapid restoration of old forest functionality. Restoration in the RMZ was even more pronounced with late seral structures reaching 56% by age 55 compared to only 20% in Case 2 and 73% by age 105 compared to 36% in Case 2.

While the economic benefits are substantial, it should be recognized that these gains derive from substituting active management for reserves which requires some form of incentives. The only current institutional framework for such an incentive is development of a habitat conservation plan.

One impediment to managing timber on longer rotations for habitat restoration will be the available infrastructure to process larger logs of higher quality. The reduction in federal harvests has resulted in the closure of almost all of the mills that can process larger diameters resulting in few bidders for this material and depressed prices for high grade timber. Efforts to restore old-forest functionality will be more costly and more difficult to motivate if there is not a commensurate effort to provide processing capacity and a scale of such operations that can be efficiently managed.

**Case 4: Biodiversity Management All Owners**

This case extends the application of the biodiversity treatments to federal timberland. The AMA lands are allocated to upland management along with the matrix lands. LSR lands remain upland reserves. Late seral and fully functional old growth requirements were established in the same manner as for state and private in Case 3, but the

old forest habitat is a much higher share on USFS lands in Case 2 and hence will remain as high in Case 4. Riparian management buffers remained the same.

With a portion of the federal acres in dense stands available for thinning treatments, while accelerating their conversion to late seral structures, the sustained harvest level increased 14% and the first two decades increased 12% over Case 2. The NPV increased 16% and the first two-decade employment increased 20%. In this scenario, employment responds to the additional thinning treatments in the short term as well as the production of higher quality wood in the long term.

The total late seral acres show the same improvement as Case 3 compared to Case 2 since the minimum habitat requirements were not changed.

**Harvest Comparison Summary**

The Base Case demonstrated that sustainable harvest rates with minimal habitat protection could be restored to the levels observed in the prior decade. For expected management practices, Case 5 and 5A, harvests are expected to decline further to 375 mmbf (345 for Case 5A) for the first two decades, followed by increases in harvest for the next four decades increasing to 600mmbf before leveling off. The first two decades could be as low as 295 mmbf considering both the unstable slopes on industry land and no further liquidation of mature inventory on NIPF land. The projected long-term sustainable harvest reduction compared to the 1986-89 level of about 750mmbf reflects a decline of 20% compared to the current statewide harvest decline of almost 50%. The first two decades could be as much as 60% below 1986-89 levels.

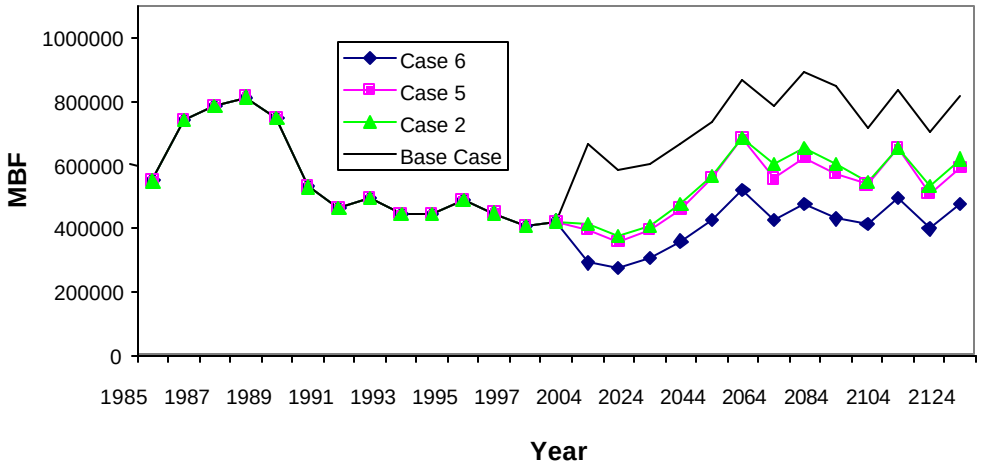


**Figure IV.8: Harvest Comparison of Total Harvest**

**Employment Comparisons Summary**

The previous simulations estimate total statewide employment related to a unit of harvest based on a Washington State economic model. Without a county level economic model it is difficult to adjust the simulations to line up with the narrower definition of direct wood products employment at the county level. A visual representation of the direct Lewis County wood products employment possibilities associated with each simulation are provided below scaling the total workers estimated in the simulations to direct wood products sector workers at the county level. Obviously increasing the harvest flow constraints reduces the number of employment opportunities in the forest sector. This trade-off is most significant comparing the Base Case to Case 6 as the average annual number of

employees supported by the county's harvest dropped by 45%. The simulations do not assume continued productivity improvements, which at least for direct forest sector workers as contrasted with indirect workers supported by the forest sector seems probable. The direct worker employment could decline 1-2% faster than shown.

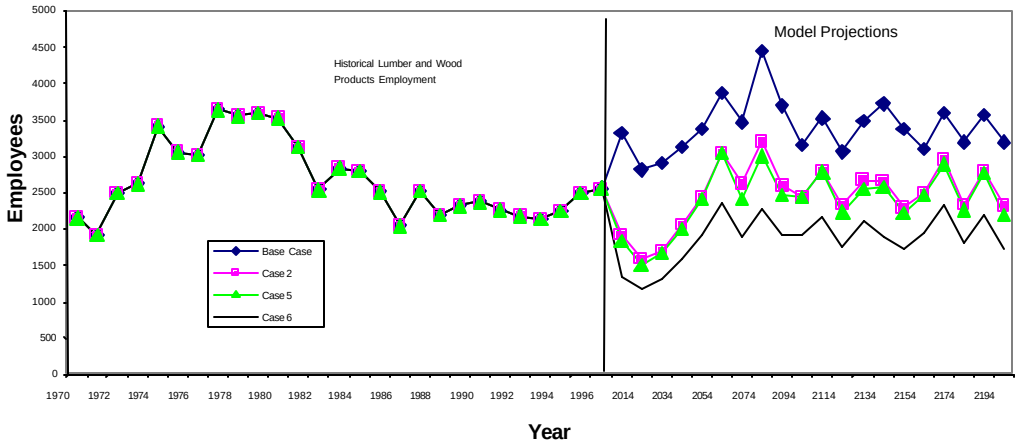


**Figure IV.9: Comparisons of Direct Wood Products Employment in Lewis County**

**Comparisons of Late Seral Forest Habitat:**

Forest policy over the past decade has been driven largely by efforts to protect the habitat of endangered species. While it is not practical with the current state of knowledge to predict populations of endangered species as a result of forest management alternatives, we can project various forest structures that are known to be important to the endangered species of current interest. Northern spotted owls are known to be more prevalent in late seral forest structures. Similarly, old forest conditions along streams were used as the target for desired future conditions in the Forest and Fish Agreement. Late seral forests include stands that have regained diverse characteristics measured by downed logs, snags, a redeveloped understory and larger trees, but exclude stands in open structures, competitive exclusion structures with essentially no understory, and stands where the understory is beginning to restore itself.

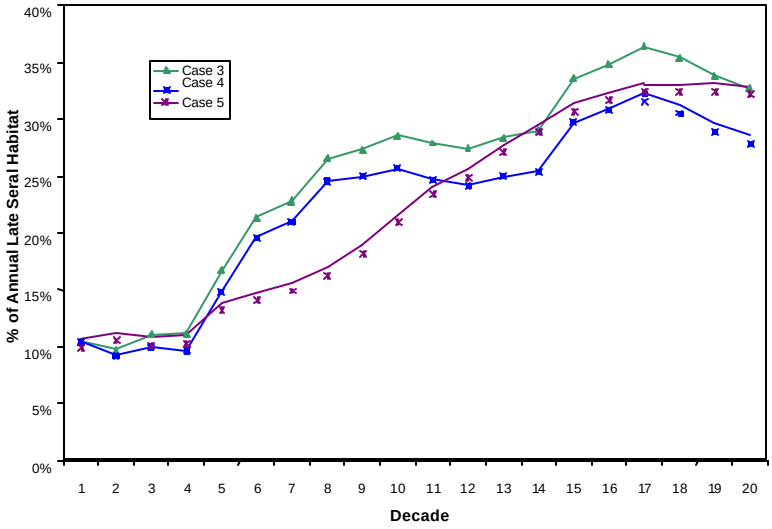


**Figure IV.10: Late Seral Habitat Over Time – All Lands**

Cases 3 and 4 simulate biodiversity management pathways to achieve late seral structures earlier in the time span and at lower costs than Case 5 where FEMAT, DNR HCP, and the Fish Agreement are implemented for the federal, other public, and private (including NIPF) lands respectively. From the 6$^{th}$ to 9$^{th}$ decades, late seral structures exceed that in Case 5 by about 40% with private land contributing most all of the habitat increases (Figure IV.10).

During this same period late seral structures in the RMZ exceeded that in Case 5 by 50-150%.

**Late Seral Structure in the RMZ Over Time**

A more dramatic story can be told when comparing the RMZ late seral habitat levels for Cases 3, 4, and 5. Relatively no management within the RMZ zones (as indicated in Case 5) results in substantially lower levels of late seral habitat than in Cases 3 and 4. Overall, biodiversity management results in more than doubling the late seral habitat in the RMZ compared to the simulated expected practice scenario, Case 5 (Table IV.2).

**Table IV.2: Late Seral (LS) Percentage in RMZ**

| Case No. | Percent RMZ LS age 55 | Percent RMZ LS age 105 |
|---|---|---|
| Base Case | 3 | 11 |
| Case 2 | 18 | 49 |
| Case 5 | 20 | 52 |
| Case 6 | 22 | 74 |
| Case 3 | 56 | 73 |
| Case 4 | 56 | 73 |

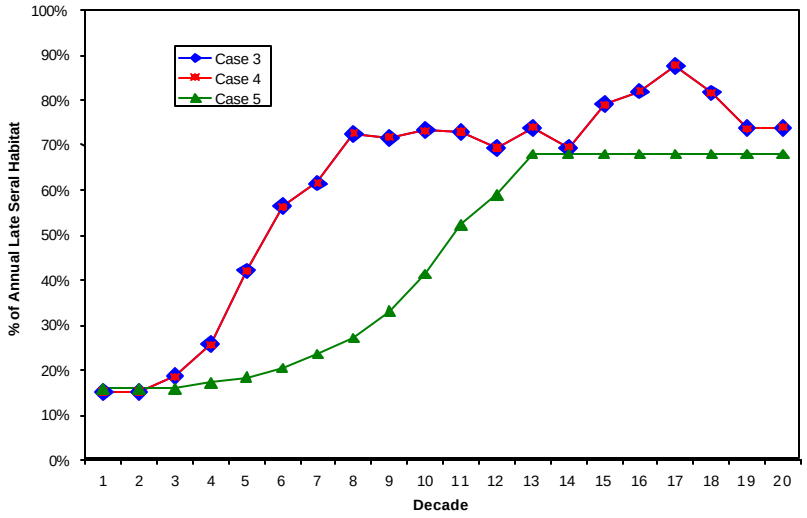


**Figure IV.11: Late Seral Habitat Over Time in RMZ**

**Late Seral Structures vs. NPV**

The trade-off between old growth habitat and NPV loss can most effectively be seen in Table IV.3. The gains in late seral acres correspond to substantial NPV losses or costs. The reason that the cost per acre of late seral gained by age 55 is so high is that the natural aging progression is so slow. The active management scenarios accelerate the restoration of LS structures such as Case 4 and result in only about half the cost per acre of LS restoration by age 55.

Using similar treatments to those used in Case 3 and 4 within an HCP context and compared to Case 5 is shown in the last row of the table. The reduction in NPV loss translates to $11,228 gain per acre of LS restoration, providing substantial motivation to provide active management instead of reserves so long as the regulator treats them as equally good habitat.

**Table IV.3: Cost vs. Increase in LS Structures**

| Case No. | NPV loss vs. Base by age 55 | LS gain by age 55 | $ cost/acre LS by age 105 | LS gain by age 105 | $ cost/acre LS |
|---|---|---|---|---|---|
| Case 2 | $1.94 bil. | 13% | $13,068 | 20% | $8,490 |
| Case 5 | $2.07 bil. | 14% | $12,945 | 22% | $8,240 |
| Case 6 | $2.84 bil. | 14% | $17,761 | 30% | $8,290 |
| Case 3 | $1.67 bil. | 20% | $7,312 | 26% | $5,625 |
| Case 4 | $1.43 bil. | 19% | $6,590 | 23% | $5,443 |
| Case 4 vs. 5 | $.64 bil. Gain | 5% | $11,228 gain | 1% | $58,180 gain |

Since historical natural aging processes had the benefit of periodic natural disturbances such as fire that are now suppressed, the simulations may be understating the length of time for natural aging to reach LS structural conditions.

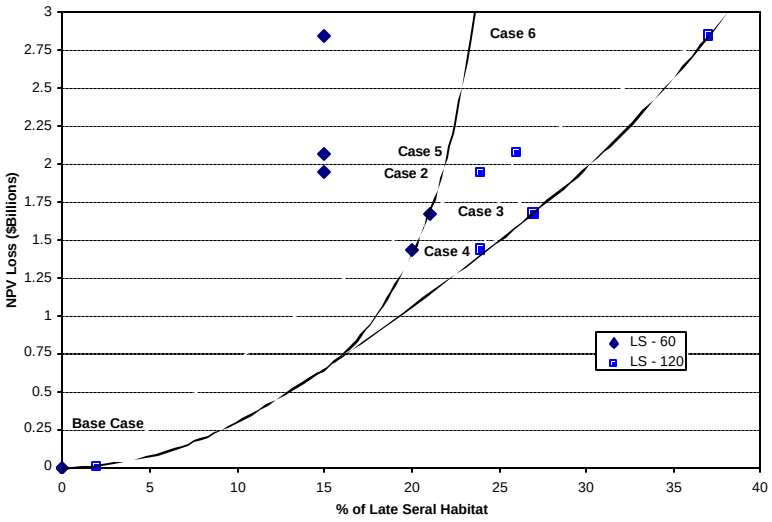


**Figure IV.12: Late Seral Structures vs. Loss in NPV**

Another way to characterize the cost of different alternatives is to construct cost curves as a function of late seral restoration. We have not simulated all possible management regimes and hence may not have demonstrated the lowest cost alternatives. Since Case 3 and 4 provided the lowest cost among the alternatives we considered, the envelope of the lowest cost cases runs through Case 3 and 4 (Figure IV.12). All other cases fall above the curve of lowest costs, as they are less efficient. Since it is more difficult to reach a late seral target as the age is shortened, the cost curve becomes almost vertical as the percentage of LS structures increases. As the age is allowed to reach 120 it becomes easier to reach high LS levels hence the cost curve may become vertical but it will only do so at even higher levels of LS. If we had investigated other alternatives, we might have found even lower costs than Cases 3 and 4, so the cost curve sketched in the figure is simply the lowest cost envelope of the cases we considered. The cost curves demonstrate clearly that the cost to produce the same level of LS falls substantially if a longer time is allowed.

**Employment Trade and Tradeoffs**

Historically, the trend loss in employment within the forest sector in Lewis County has coincided with gains in the retail trade sector. The most likely wood products employment projection corresponding to Case 5 suggests a rise in the forest sector employment after 3 decades but the long-term projection still indicates a continuation of the sector's downward trend (Figure IV.13). The employment gains in retail trade have exceeded the employment losses in the forest sector. Projecting this historical trend out 20 years reveals an even wider disparity between the two sectors, with a net employment gain of over 3000 job opportunities. Even if local indirect employment is assured to be about 1 person per direct forest products employment, the direct plus indirect forest products employment is falling below retail trade employment.

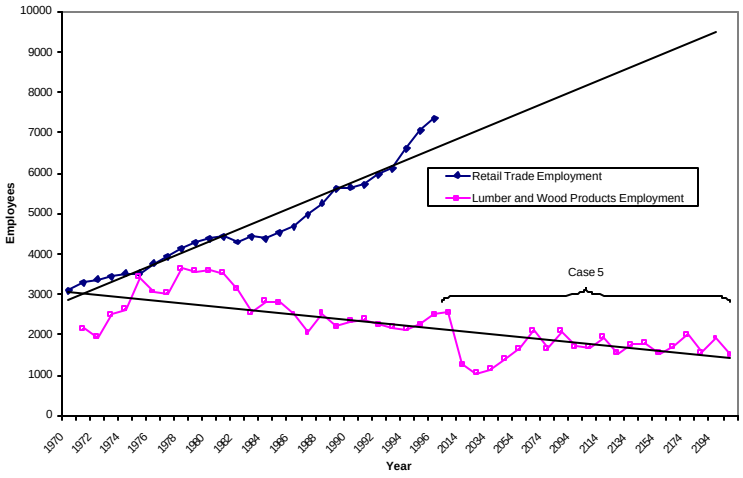


Figure IV.13: Employment Trends for Retail Trade Vs. Wood Products with Case 5 Projections

In conclusion, the simulations reveal the trade-off between losses in economic measures and late seral habitat. The Base Case provides the highest NPV and the lowest amount of late seral habitat. Conversely, Case 6 provides the largest percentage of late seral structures and the lowest NPV. The late seral/NPV tradeoff for Cases 2 and 5 is very similar. The determination of the optimal simulation depends on the relative importance placed on each variable.

## V. TOURISM SECTOR

The tourism sector in Lewis County, which is composed of a variety of outdoor and general scenic activities, has the potential for substantial growth. The increasing levels of traffic along the I-5 corridor through Lewis County have enabled the tourism sector to expand, with most of the expansion occurring in the last 10 years. The majority of the expansion in retail trade and tourism oriented services has occurred along the corridor which is to be expected given the fact that the population density is greatest in this area.

Due to the higher level of demand, there is a greater density of parks and recreational facilities along the I-5 corridor compared to the rest of the state. A total of 4 county, 16 municipal, and 3 state facilities are within close proximity to the corridor. In contrast, a total of 2 county, 5 municipal, 6 state and 22 federal facilities are present in the rest of the entire county.

The imbalance of tourist activity along the I-5 corridor compared to the rest of the county is further exemplified by an examination of the tax revenues generated from hotels/motels and eating/drinking places in corridor cities compared to the rest of the county. Tax revenues generated from hotels/motels in Centralia and Chehalis accounted for 49% of the county total, and tax revenues generated from eating/drinking places in these cities accounted for 70% of the total. However, this imbalance may decrease if the proposed road from Mount St. Helens to Highway 12 is implemented. Traffic along this road, passing through the eastern portion of the county, could generate a significant increase in "back-country tourism."

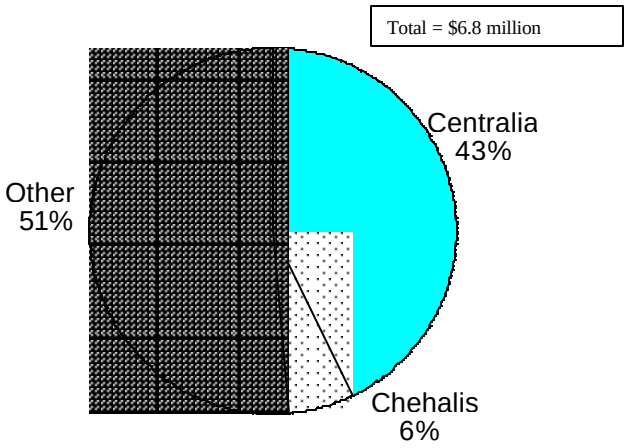


**Figure V.1: Hotels/Motels Tax Revenues by Area**

*Source*: REIS, 1996

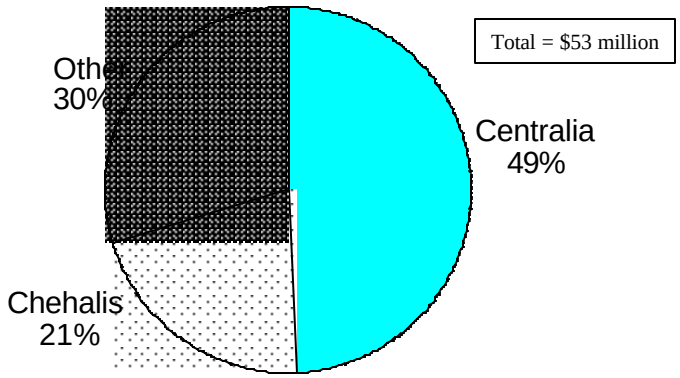


**Figure V.2: Eating/Drinking Places Tax Revenues by Area**

*Source*: REIS, 1996

Overall, Lewis County has experienced an increasing number of visitors, particularly within the last 10 years. Even within the last five years, this increase is significant. From 1993 to 1997, the total number of visitors per year in Lewis County increased from 32,000 to 51,000, a 30% increase. In monetary terms, the number of dollars spent by visitors was $73 million in 1993 and $107 million in 1997.

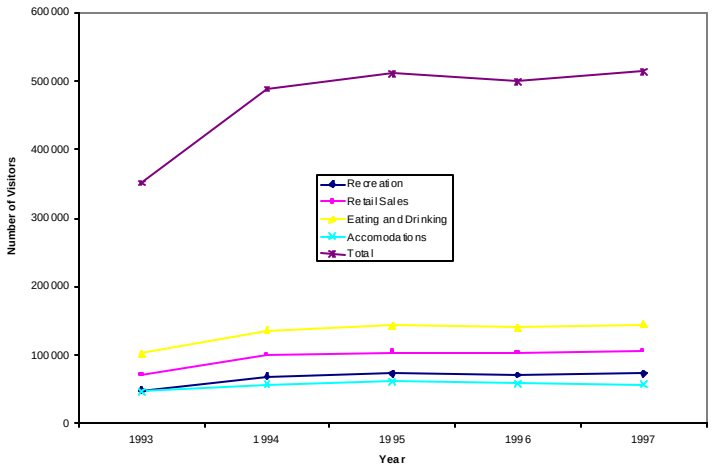


**Figure V.3: Lewis County Number of Visitors**

*Source*: Washington State Tourism Report, 1997

This rapid rise in the number of visitors has allowed for the expansion of all the tourism sub-sectors in Lewis County. These sub-sectors include; portions of retail trade, eating and drinking places, hotels and other lodging places, and amusement and recreation services. The net earnings in each of these subsectors have exhibited an annual growth rate of 2.7%, 2.1%, 6.3%, and 1.7% respectively.

Figure V.4 reveals a sharp increase in the net earnings for recreation in 1981, which can be attributed to newfound curiosity in the area around Mt Saint Helens, after it's May 1980 eruption. However, this event had little impact on the other sectors during the same time period.

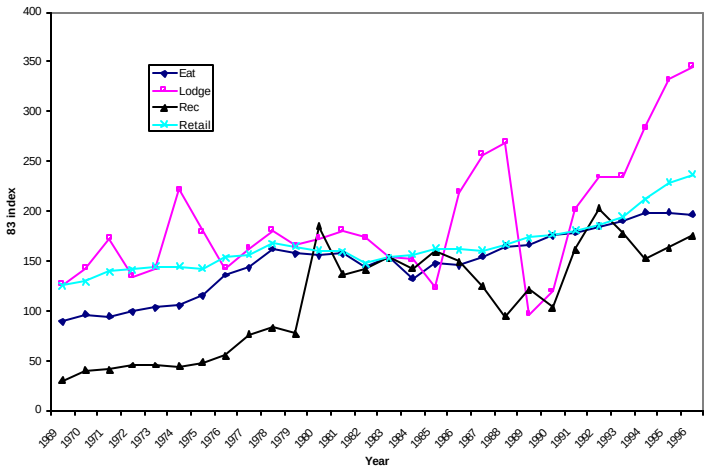


**Figure V.4: Tourism Net Earnings Comparison in Lewis County**

*Source*: REIS, 1996

Employment in the tourism sector has exhibited a high growth rate in the last 10 years. An examination of the employment trend for retail trade in Lewis County reveals a 3% annual growth rate over the last thirty years compared to a 2% growth rate for total employment in the state. However, the growth rate in the last 10 years for retail trade employment in the county has jumped up to 4%.

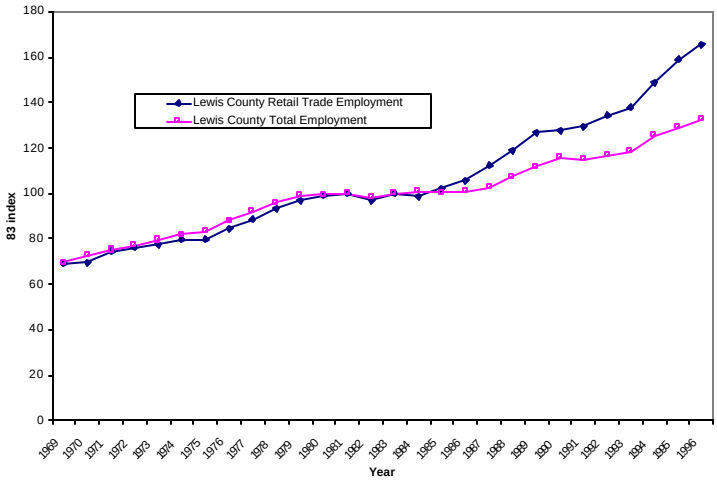


**Figure V.5: Lewis County Employment Comparison**

*Source*: REIS, 1996

The number of establishments in the tourism sector has also increased at considerably high growth rates. The number of establishments for eating and drinking places, hotels and lodging places, and amusement and other recreational services have exhibited annual growth rates of 3.0%, 5.6%, 4.8% respectively. The majority of that growth was experienced in the last 10 years due to the large influx of visitors during that time.

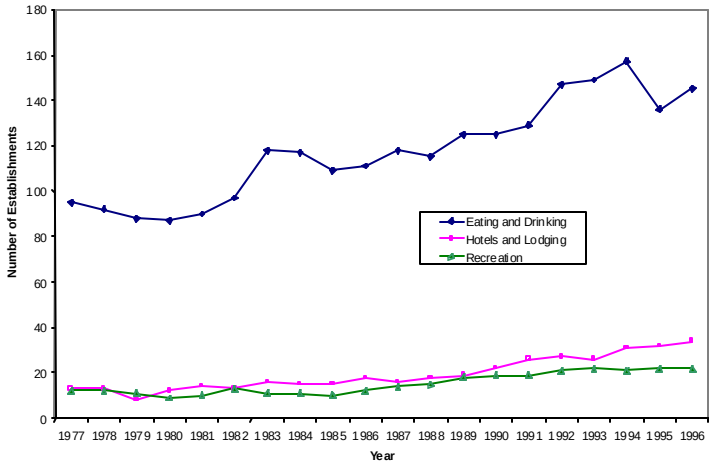


**Figure V.6: Lewis County Tourism Number of Establishments**

*Source*: REIS, 1996

Tourism growth in Lewis County exceeded growth rates for the rest of Washington State as a whole. From the period of, 1991-1997 travel expenditures grew at an annual rate of 7.7% for Lewis County and 2.2% for Washington State. In 1997, the $107 million in travel expenditures for Lewis County was 1.2% of the state total.

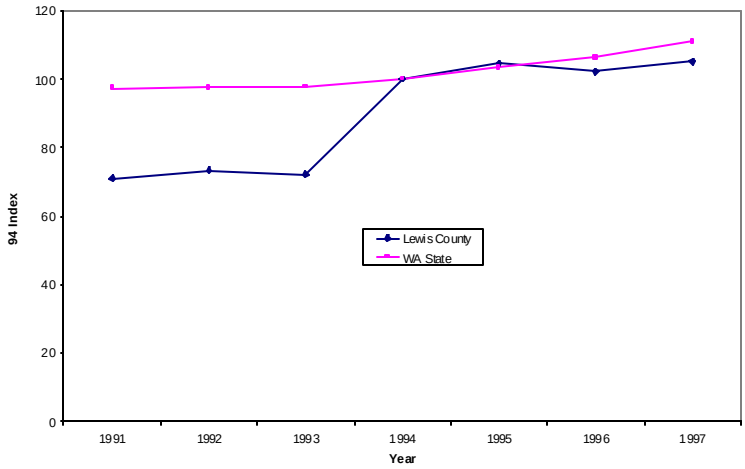


**Figure V.7: Travel Expenditure Comparison**

*Source*: Washington State Tourism Report, 1997

Comparing retail trade establishments in Washington State with Lewis County reveals high growth for both areas; however, Lewis County's growth appears to be greater within the last 10 years. In Washington State, wholesale and retail trade employment rose from 158,300 in 1947 to 537,900 by 1992, an annual rate of 2.8%. This sector projects 1.5% annual growth from 1990-2010. Services employment in Washington grew from 76,300 in 1947 to 554,100 by 1992, annual growth rate of 4.5%. This sector is projected to expand a lesser, but still significant, 3.2% from 1990-2010 (Washington Economic History & Outlook, 1947-1992).

In Lewis County, the annual growth over the last 30 years for accommodation establishments, recreational establishments, and eating and drinking places has been 6.4%, 5.1%, and 3.0%, respectively. In comparison, the annual growth rate in Washington State in these same categories has been 3.1%, 5.8%, and 4.1%, respectively. However, in the last 10 years, the growth of the number of establishments of both accommodations and recreational establishments in Lewis County has greatly exceeded that of Washington State while growth in the number of eating and drinking places has remained the same between the two areas.

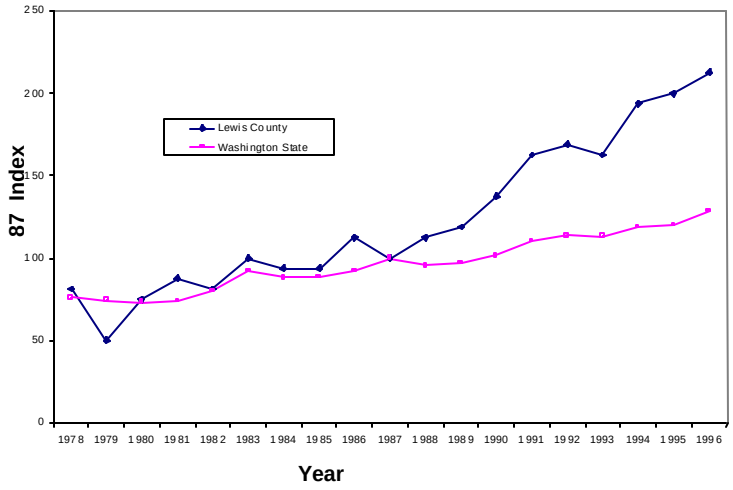


**Figure V.8: Number of Accommodations Comparison**

*Source*: REIS, 1996

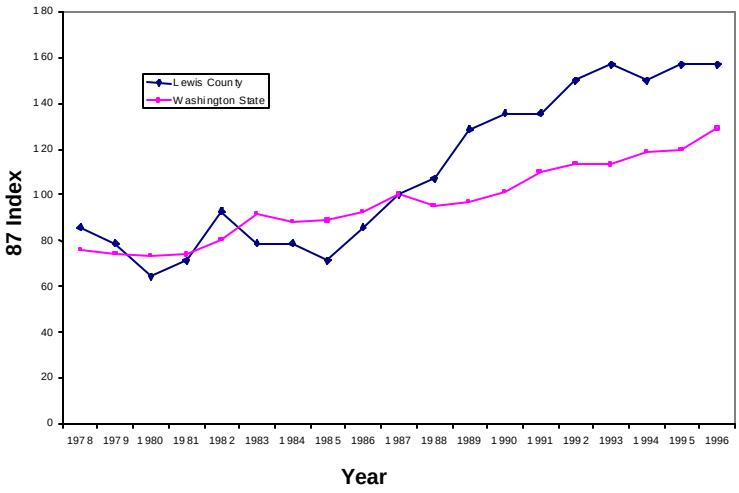


**Figure V.9: Number of Recreation and Amusement Places Comparison**
*Source*: REIS, 1996

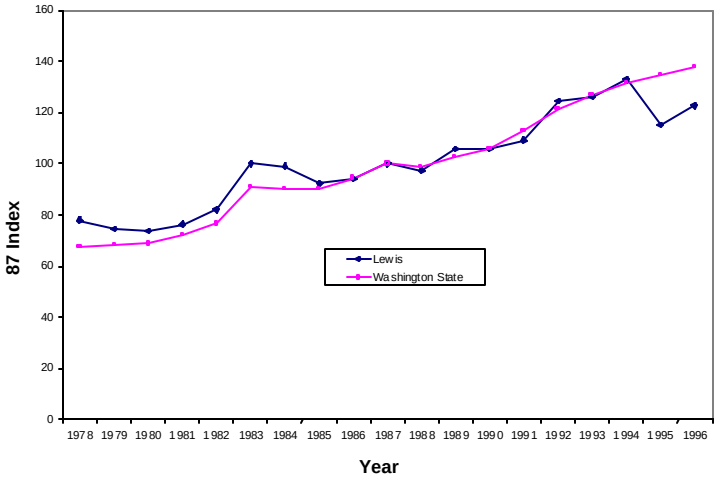


**Figure V.10: Number of Eating and Drinking Places Comparison**
*Source*: REIS, 1996

Surprisingly, Washington State matches this high growth in tourism in Lewis County when comparing retail trade employment. Both growth rates increased at an annual rate of approximately 3%. However, retail trade employment may not capture the overall employment generated from travel spending. In fact, when examining the number of jobs created by travel spending in Lewis County over the period of 1993-1997, an annual growth rate of 6% is exhibited. The estimated number of jobs generated by travel spending jumped from 1,170 in 1993 to 1,630 in 1997.

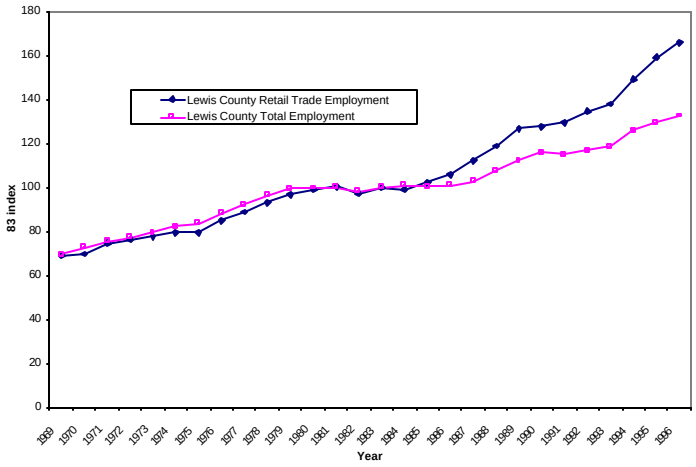


**Figure V.11: Retail Trade Employment Comparison**
*Source*: REIS, 1996

Projecting the retail trade employment in Washington State out to the year 2004 reveals 6900 employees. However, if Lewis County retail trade employment remains above the trend as much as it was in 1999, it would be projected to 8700 in 2004.

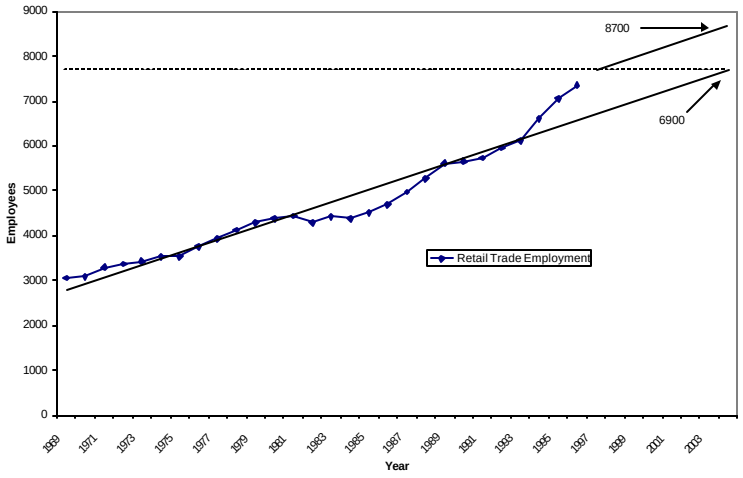


**Figure V.12: Lewis County Retail Trade Employment**
*Source*: CINTRAFOR, 1999

Projecting out the growth rate for retail trade net earnings in Lewis County reveals a value of $115 million in 2004. If retail trade net earnings remains above trend proportional to 1999, it would be $130 million in 2004.

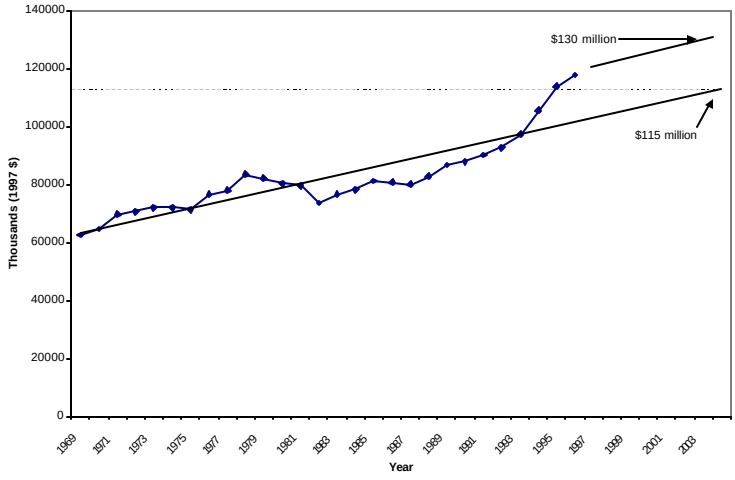


**Figure V.13: Lewis County Retail Trade Net Earnings**

*Source*: CINTRAFOR, 1999

## VI. MINING SECTOR

Mining within Lewis County includes the extraction of coal, oil, and gravel. Coal Mining comprises the majority of employment and net earning tabulations. However, gravel extraction is expected to acquire more of this market due to the impending construction projects along Highway 504. (Highway 504 provides access to Mount St. Helens from Highway 12 and other access roads.)

The Centralia Power Plant and mine is the largest generating resource within the state of Washington and underwrites the largest payroll in Lewis County. The Centralia Plant and mine accounts for the majority of the employment and revenues for the mining sector within Lewis County. A closer analysis of this facility is essential in forecasting the future of the mining industry. The Centralia Plant has recently undergone heavy public and government scrutiny for the amount of sulfur dioxide ($SO_2$) emissions. This scrutiny has negatively impacted the mining industry within Lewis County in recent years.

As illustrated in Figure V.1, eight companies comprise the Centralia Power Plant, with Pacificorp owning the greatest percentage of shares (47.5%). The Centralia Mine owned solely by Pacificorp directly supplies the plant with 4.8 million tons of coal per year. Another 1.2 million tons are imported annually, which accounts for a grand total of 6 million tons of coal that is consumed by the Centralia Power Plant per year. The mine capacity is between 4.8 and 5.3 million tons annually, with coal reserves totaling 150 million tons (based upon 1994 figures).

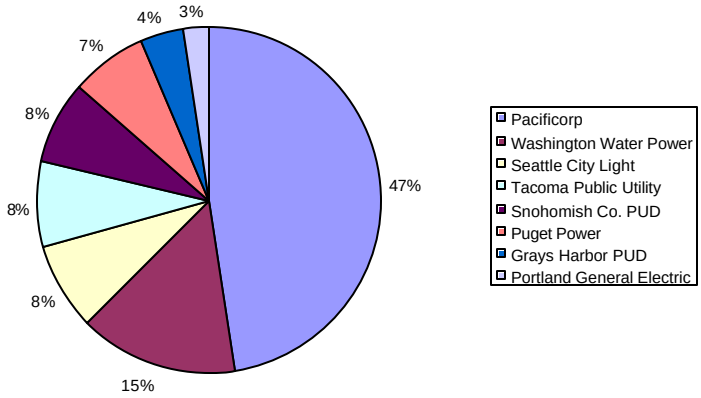


**Figure VI.1: Shared Ownership of Centralia Power Plant**
*Source*: CINTRAFOR, 1999

Mining within Lewis County comprises 7% of the employment captured by the four resource-based sectors. Employment within the mining sector has increased for both Washington State and Lewis County over the last three decades. After 1975, mining employment within Lewis County grew by 1.5% per year while total employment for the County grew by an annual percentage rate of 1.7 (see Figure V.1 for comparison). Throughout the 1970's, the number of mining establishments within Lewis County decreased by more than half, but interestingly, the number employed jumped from 100 in 1970 to 647 in 1979. In 1994, Lewis County accounted for 711 mining employees. The Centralia Power Plant and mine alone employed over 90% of the mining workers. In 1996, this plant and mine employed 675 workers.

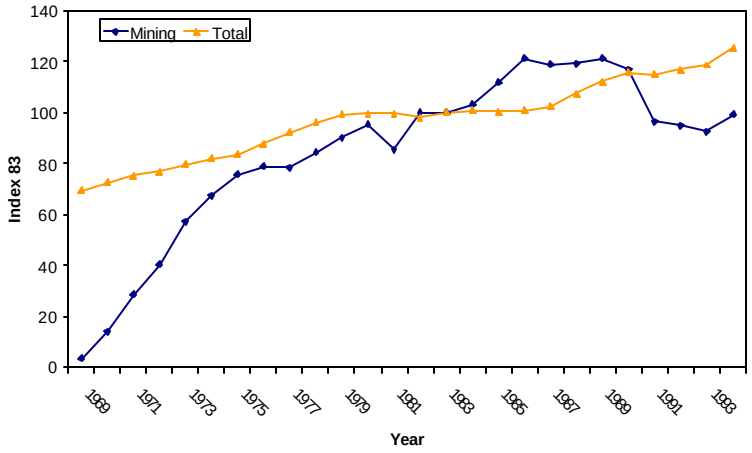


**Figure VI.2: Lewis County – Total Resource-based Employment vs. Mining Employment**
*Source*: REIS, 1996

Net revenues from mining in Lewis County decreased by 20.4% from 1986 to 1994, while total net revenues increased by 33% (see Figure 3). During that same time period, Washington State mining revenues only decreased by 12.8%. This mining earning reduction within Lewis County can be attributed largely to the increase in excavation costs and environmental compliance costs at the Centralia Power Plant and mine.

In 1996, the Centralia Plant submitted a full scrubbing operation proposal to comply with the federal and state Clean Air Acts. At a period when energy prices were in decline, tax exemptions were granted to help alleviate the high costs of operations thus increasing net revenues. Furthermore, TransAlta, based out of Calgary, Alberta Canada, has purchased both the Centralia Power Plant and mine. TransAlta is a dominant company in the coal-fired power plant industry. They foresee no employment cuts or production setbacks in the near future. They also are advocates in operating both the plant and mine more efficiently, further reducing extraction and production costs.

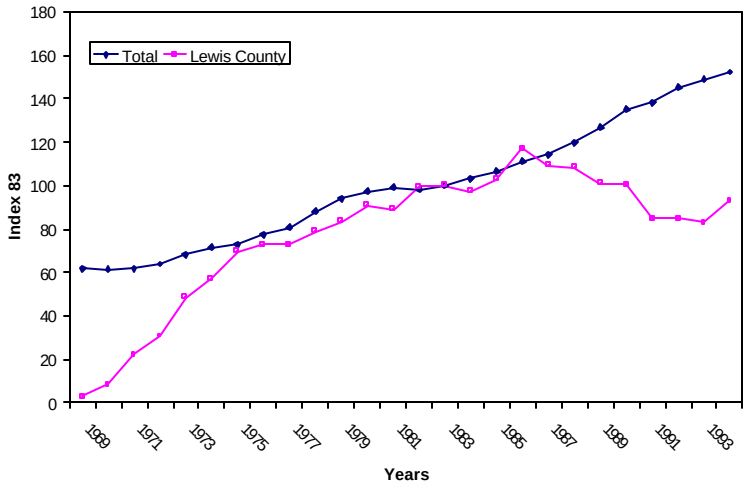


**Figure VI.3: Lewis County Mining Earnings**

*Source*: REIS, 1996

Figure V.4 compares Lewis County mining earnings with Thurston County. The Centralia plant and mine are in close proximity to Thurston County. Yet, mining earnings within Thurston have plummeted from over $8 million per year during the early 1980's to under $2 million per year during the start of a slow recovery in the early 1990's (an average growth reduction of 16% each year). In comparison to Thurston County, Lewis County's mining industry has remained relatively stable.

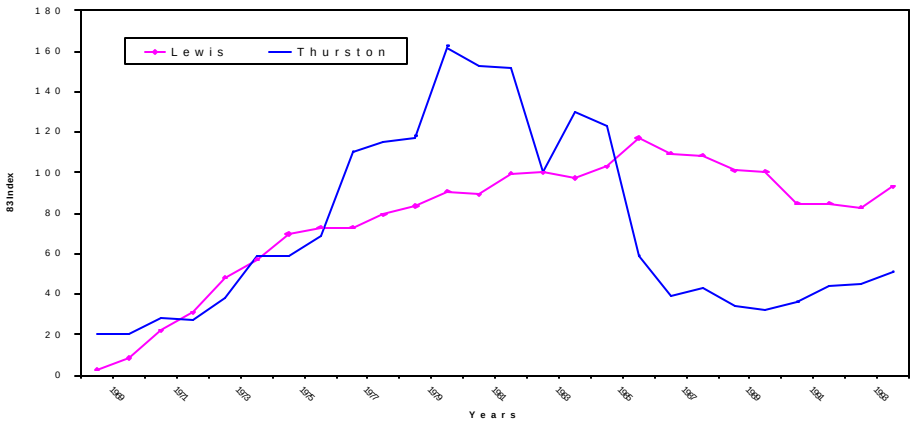


**Figure VI.4: County Comparison of Mining Earnings**

*Source*: REIS, 1996

Table VI.1 shows how mining employment and net earnings have changed between Lewis County and adjacent counties for over two decades. Overall, Lewis and Cowlitz counties experienced significant annual growth for both employment and net earnings over the 24-year period with net earnings growing at nearly twice the rate of employment. Also within these two counties, one can assume employees are now earning more money (when corrected for inflation) for their services. This trend could be attributed to lower production costs, more technical skills required, and/or employing less part-time workers. Even though Cowlitz County is expanding at a faster rate than Lewis County in both employment and net earnings, Lewis County dominates the actual proportion. Within these four counties, Lewis County employs 55% of the total mining employment, which accounted for 68% of the total net revenues.

**Table VI.1: County Comparison between Mining Employment and Net Earnings**

| | Employment | | | Net Earnings ($97) | | |
|---|---|---|---|---|---|---|
| **County** | | | **% Growth** | | | **% Growth** |
| | 1970 | 1994 | Rate | 1970 | 1994 | Rate |
| Cowlitz | 19 | 177 | 9.7 | 668.9 | 9635 | 11.8 |
| Lewis | 100 | 711 | 8.5 | 3763.4 | 41429.1 | 10.5 |
| Pierce | 163 | 286 | 2.4 | 5637.7 | 7254.2 | 1.1 |
| Thurston | 37 | 105 | 4.4 | 1065.8 | 2631.6 | 3.8 |

*Source*: CINTRAFOR, 1999

The mining industry within Lewis County is expected to rebound from the last 10-year trend. Net revenues are projected to reach $620,000 in the year 2001 (as shown in Figure VI.5). The Centralia Plant and mine are fundamental to Lewis County's economic stability. The driving forces in a market base economy are not where the end products are being consumed but rather an industry's dependence within the economy. The Centralia Power Plant exports their generated energy. A common fallacy is rationalizing that revenues should be liquidated within the County while minimizing "outside" expenditures. This scenario is believed to create more employment and revenue opportunities for the residents. In reality, importing and exporting contributes stability to the base economy because these industries are not dependent on the local economy for survival. Therefore, the Centralia Power Plant and mine are relatively more stable industries since the end products are dispersed among larger regions, which further increases job security.

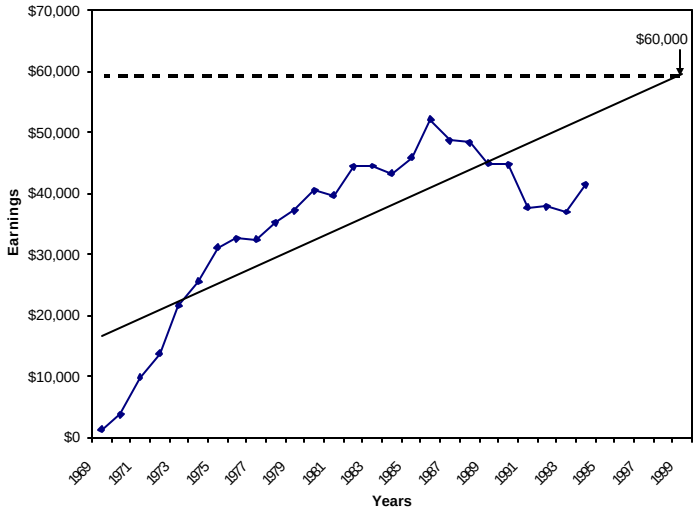


**Figure VI.5: Lewis County Mining Net Revenues**
*Source*: CINTRAFOR, 1999

## VII. AGRICULTURE SECTOR

Agriculture within Lewis County has been a historically viable sector. However, concurrent with a nation-wide technology boom at the turn of the century, Lewis County became less dependent on natural resources. As a result, agriculture within Lewis County has continued to show reductions in employment, establishments, and net earnings within the last two decades. Even the demographics have changed. For example, the average age of farmers has steadily increased as younger generations have pursued careers outside of the agriculture sector. Furthermore, farm employees have decreased as number of acres per establishment have increased. In other words, larger "corporate" owners have bought up smaller owners and thus significantly reduced farming employment numbers.

Agriculture contributed to 4.5% of Lewis County's total employment in 1996. However, the agriculture sector within Lewis County has significantly declined in employment when compared to both Washington State farming employment and Lewis County total employment. The mid-1980's brought economic hardships to the agriculture industry. In Lewis County between 1984 to 1988, employment decreased by 8.5% (as seen in Figure VII.1) while Washington State only recorded a 0.6% decrease for the same time period. For the past ten years, farm employment in Lewis County has remained stable. Even with the offset of employment declines in the farming sector, total employment for the County has steadily increased at an average 2% growth rate since 1969. Retail trade accounts for most of this growth.

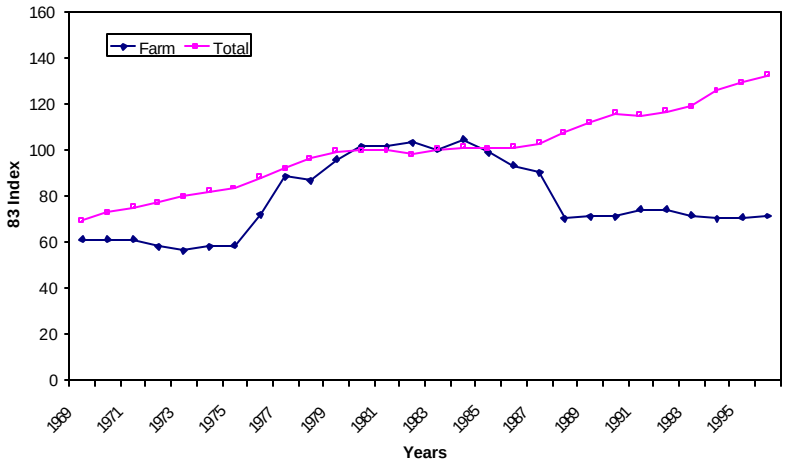


**Figure VII.1: Lewis County – Total vs. Farm Employment**

*Source*: REIS, 1996

Cowlitz and Lewis counties employment in agriculture have increased by 34% and 14% respectively from 1970 to 1996 while Pacific, Pierce, Skamania, and Thurston counties have shown decreases in employment (see Figure VII.2). However, these figures disguise the fluctuations within the two decades. At the same time, viewing historical county trends provides insight into the future growth of the agriculture sectors. By comparing counties with similar economic activities, more realistic explanations on future productivity levels are foreseen than when compared to only Washington State.

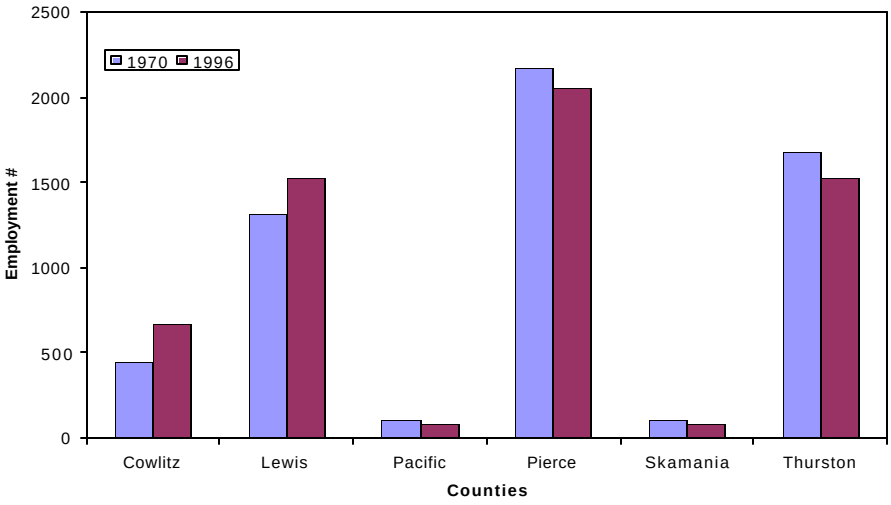


**Figure VII.2: County Comparison between Farm Employment**

*Source:* CINTRAFOR, 1999

Figure VII.3 shows the market value of cattle, dairy, poultry, and grain crop products sold within the last two decades. Since the early 1970's, dairy products have accounted for an average of 40% of the total market value of products sold. However, this value has declined by 15% since the 1978-1982 period. Cattle products have followed a similar trend declining by almost 20%. Poultry has provided major contributions to the overall market value of products sold, most notably in the last two decades as it increased by 25%. In addition to poultry growth, the market value of grain crop products sold has increased substantially, evidenced by more than 100% increase since the early 1970's.

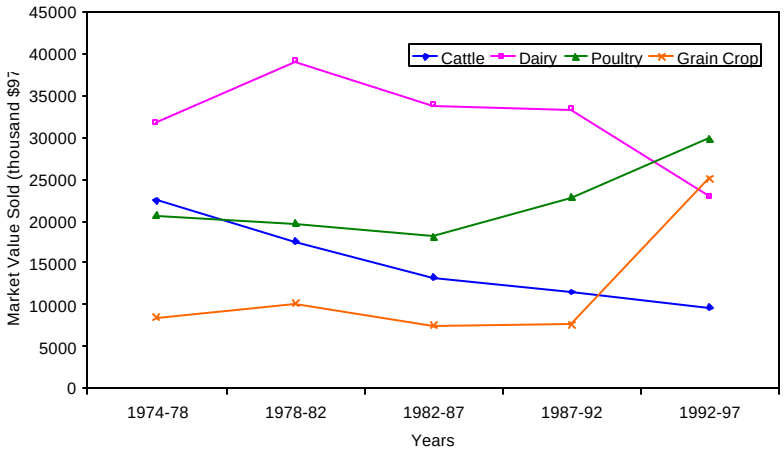


**Figure VII.3: Market Value of Agricultural Products Sold ($97)**

*Source:* REIS, 1996

As an interesting comparison, the number of establishments gives insight into how widespread each agriculture subsector is throughout Lewis County. Within Lewis County, grain crop and cattle establishments together contributed to 85% of the total farm establishments in 1992-1997 (see Figure VII.4). This figure is relatively the same for earlier time periods even when all sectors showed an average of 40% decrease from 1978 to 1992 in establishments. During the last five years, grain crops and poultry establishments have slightly increased, but this expansion is projected to remain stable (if not stagnant) in future years.

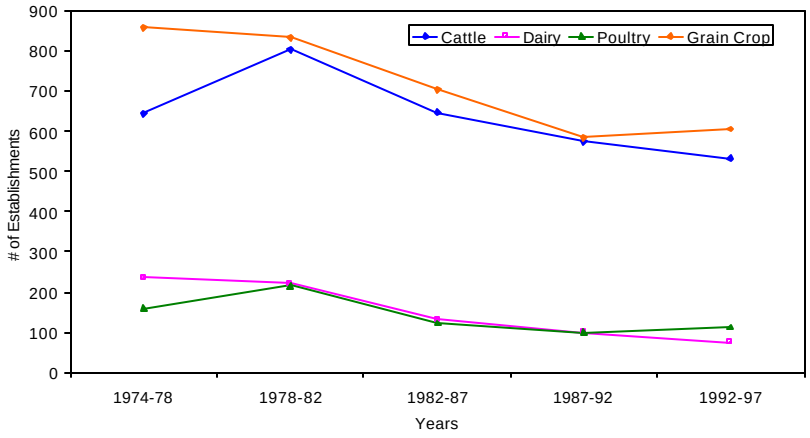


**Figure VII.4: Number of Farm Establishments**

*Source:* REIS, 1996

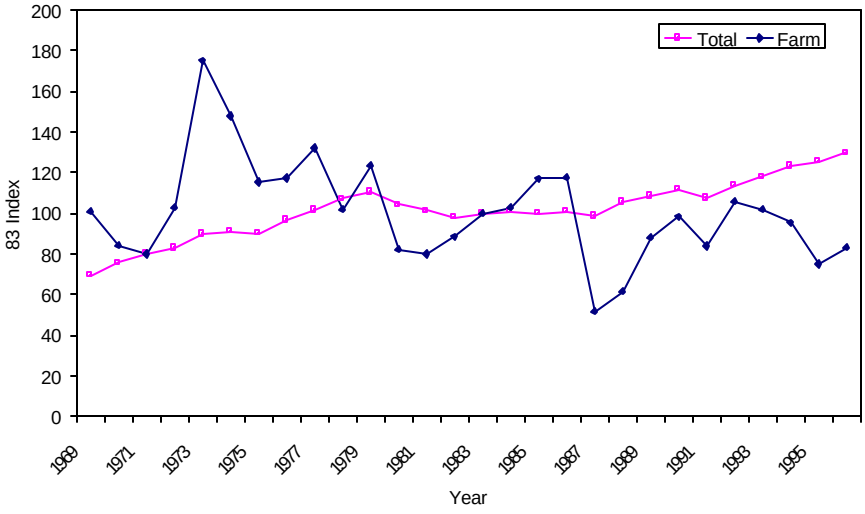


**Figure VII.5. Lewis County – Total vs. Farm Earnings**

*Source:* REIS, 1996

Lewis County, as well as the rest of Washington State (as a whole) have experienced instability in farm earnings over the last three years. Since farming is reliant on many climatic conditions, variations in production yields and

market prices can cause significant changes in farm earnings from year to year. Overall, farm earnings in Washington State and Lewis County declined in growth by merely 1.2% since the late 1960's. Specifically, within Lewis County, farm-earning fluctuations produce minimal effects on total earnings generated. As a total, farm earnings only constituted 4.5% of the total earnings made within Lewis County (see Figure VII.5).

## REFERENCES


Bare, B. B., B. R. Lippke, W. Xu, Martin Mendoza. 1999. "Economic and Environmental Impact Assessment of Forest Policy Changes in Western Washington." CINTRAFOR, Special Paper 27, College of Forest Resources, University of Washington, Seattle, WA.

Bare, B. B., Lippke, B. R., Moffet, Jeffrey, Oliver, Chadwick D., Waggener, Thomas R., Weihuan, Xu. January 1997. "Demonstration of Trust Impacts from Management Alternatives to Achieve Habitat Conservation Goals on Washington Department of Natural Resources Managed Lands." College of Forest Resources, University of Washington, Seattle, WA.

Bureau of Economic Analysis. 1969-1997. "Personal Income and Employment estimates for all countries and metropolitan areas in the United States." Regional Economic Information System, Bureau of Economic Analysis, Washington, D.C.

Business and Economic Research Division, "Timber Marketing in Lewis County." Business to Business. 1999. "Canadian firm plans to buy steam plant, mine." Centralia, WA.

Connaughton, Kent P., McGinnis, Wendy J., Phillips, Richard H., Raettig, Terry L. April 1997. "County Portraits of Washington State." General Technical Report PNW-GTR-400. United States Department of Agriculture, Forest Service.

Conway, Richard S. Jr. February 1994. "The Forest Products Economic Impact Study, Current Conditions and Issues." Prepared for: Washington Forest Protection Association, Washington State Department of Natural Resources, Washington State Department of Trade and Economic Development.

Interior Columbia Basin Ecosystem Management Project. February 1998. "Economic and Social Conditions of Communities: Economic an Social Characteristics of Interior Columbia Basin communities and an Estimation Effects on Communities from the Alternatives of the Eastside and Upper Columbia River Basin Draft Environmental Impact Statements." U.S. Department of Agriculture, Forest Service and U.S. Department of Interior, Bureau of Land Management.

Lippke, Bruce R., J. Sessions, A. B. Carey. 1996. *Economic Analysis of Forest Landscape Management Alternatives: Final report of the working group on the economic analysis of forest landscape management alternatives for the Washington Forest Landscape Management Project.* Special Paper 21, CINTRAFOR, College of Forest Resources, Univ. of Washington, Seattle, WA. 157 pp.

Lippke, Bruce and R. S. Conway. 1994. Economic Impact of Alternative Forest Practices Rules to Protect Northern Spotted Owl Sites. Washington State Forest Practices Board, State of Washington, Olympia, WA. Approx. 200 pp.

Northwest Economic Associates. June 1992. "Coos Bay Forest Industry Impact Analysis, Preliminary Study." Prepared for: Pacific Rim Trade Association. Vancouver, WA.

Northwest Policy Center. 1996. "The 1996 Portrait, Regional Economic Review and Outlook." University of Washington, Seattle, WA.

Office of the Forecast Council. March 1995. "Washington Economic and Revenue Forecast." Volume XVIII, No. 1.

Office of Financial Management. August 1992. "1992 Long-Term Economic and Labor Force Trends for Washington." Employment Security Department, Labor Market and Economic Analysis Branch.

Office of Financial Management. July, 1991. "1991 Long-Term Economic and Labor Force Trends for Washington." Employment Security Department, Labor Market and Economic Analysis Branch.

Schuster, E. G. May 1976. "Local Economic Impact, a Decision Variable in Forest Resources Management." Montana Forest & Conservation Experiment Station, School of Forestry, University of Montana, Missoula.

United States Department of Agriculture. 1987. "Soil survey of Lewis County Area, Washington." Soil Conservation Service, Washington State Department of Natural Resources, Olympia, WA.

Washington State Department of Commerce and Economic Development, Olympia, WA.

Washington State Department of Revenue. Calendar Year, 1997. "Quarterly Business Review. A compilation of Statistics on Gross Income, Taxable Retail Sales and Accrued Tax Liability as Reported by Washington State Excise Taxpayers for Calendar Year, 1997." Prepared by: The Research Division, Mary Welsh, Assistant Director.

Washington State Department of Revenue, 4th Quarter, 1998. "Quarterly Business Review. A compilation of Statistics on Gross Income, Taxable Retail Sales and Accrued Tax Liability as Reported by Washington State Excise Taxpayers for October, November, December 1998." Prepared by: The Research Division, Mary Welsh, Assistant Director.

Washington State Employment Security Labor Market and Analysis Branch. Third Quarter 1998. "Employment and Payrolls in Washington State by County and Industry."

Washington State Department of Natural Resources. March, 1999. "Washington Timber Harvest 1997." Prepared by: David N. Larsen, Resources Planning and Asset Management Division.

# APPENDICES

# APPENDIX I

# TABULAR DATA ON CASE OUTPUT

# MANAGEMENT ALTERNATIVE FOR LEWIS COUNTY

## APPENDIX I. TABULAR DATA ON CASE OUTPUT

**Tabular Data Summary**

| CASE # | DESCRIPTION |
|---|---|
| Base Case: | Minimal regulations |
| Case 2: | Minimum regulations on State and Private with Federal NW Forest Plan |
| Case 3: | Biodiversity Management pathways on non-federal lands |
| Case 4: | Biodiversity management pathways on all owners |
| Case 5: | DNRHCP, minimum regulations private, Federal NW Forest Plan |
| Case 6: | Wide riparian buffers per Tribal and WEC proposal |

## Management Alternatives for Lewis County

| | NPV ($ billions) | % change | Harvest mmbf/yr 1-20yrs | % change | Harvest mmbf/yr Average | % change | Rural Employment 1-20 yr avg. (000s) | % change | Rural Employment Ave. (000's) | % change | Late-seral acres Upland average (% of acres) Current | yr 55 | yr 105 | Current RMZ | Yr55 | Yr 105 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Case 1: Base with 75 ft no-mgt buffer class 1-3 streams** | | | | | | | | | | | | | | | | |
| Total | 5.19 | | 626 | | 759 | | 13.8 | | 15.5 | | 10 | 1 | 2 | 19 | 3 | 11 |
| Industry | 2.04 | | 224 | | 364 | | 4.4 | | 7.0 | | | | | | | |
| NIPF | 1.10 | | 154 | | 138 | | 3.1 | | 2.5 | | | | | | | |
| Other Public | 0.61 | | 76 | | 83 | | 1.7 | | 1.5 | | | | | | | |
| Federal | 1.45 | | 172 | | 173 | | 4.7 | | 4.0 | | | | | | | |
| Non-Federal | 3.74 | | 454 | | 586 | | 9.0 | | 11.5 | | | | | | | |
| **Case 2: Minimum Regulations with Fish Agreement and Fed Forest Plan** | | | | | | | | | | | | | | | | |
| Total | 3.25 | -37% | 395 | -37% | 561 | -26% | 7.9 | -43% | 11.1 | -28% | 10 | 14 | 22 | 19 | 18 | 49 |
| Industrv | 1.66 | -19% | 185 | -17% | 334 | -8% | 3.5 | -19% | 6.5 | -7% | | | | | | |
| NIPF | 0.99 | -10% | 139 | -10% | 130 | -6% | 2.7 | -12% | 2.5 | 0% | | | | | | |
| Other Public | 0.43 | -30% | 48 | -37% | 74 | -11% | 1.0 | -42% | 1.6 | 7% | | | | | | |
| Federal | 0.18 | -88% | 23 | -87% | 23 | -87% | 0.7 | -85% | 0.5 | -88% | | | | | | |
| Non-Federal | 3.07 | -18% | 372 | -18% | 538 | -8% | 7.2 | -20% | 10.6 | -8% | | | | | | |
| **Case 5: Fish Agreement, with DNRHCP and Fed Forest Plan** | | | | | | | | | | | | | | | | |
| Total | 3.12 | -40% | 378 | -40% | 543 | -28% | 7.5 | -45% | 10.8 | -31% | 10 | 15 | 24 | 19 | 20 | 52 |
| Industrv | 1.66 | -19% | 185 | -17% | 334 | -8% | 3.5 | -20% | 6.5 | -7% | | | | | | |
| NIPF | 0.99 | -10% | 139 | -10% | 128 | -7% | 2.7 | -12% | 2.5 | -2% | | | | | | |
| Other Public | 0.3 | -51% | 30 | -61% | 58 | -30% | 0.6 | -64% | 1.3 | -13% | | | | | | |
| Federal | 0.18 | -88% | 23 | -87% | 23 | -87% | 0.7 | -85% | 0.5 | -88% | | | | | | |
| Non-Federal | 2.82 | -25% | 348 | -23% | 485 | -17% | 6.9 | -23% | 9.45 | -18% | | | | | | |
| **Case 6: Wide Riparian Buffers plus DNRHCP and Fed Forest Plan** | | | | | | | | | | | | | | | | |
| Total | 2.35 | -55% | 284 | -55% | 418 | -45% | 5.7 | -58% | 8.4 | -46% | 10 | 15 | 32 | 19 | 22 | 74 |
| Industry | 1.10 | -46% | 123 | -45% | 235 | -35% | 2.3 | -47% | 4.7 | -34% | | | | | | |
| NIPF | 0.77 | -30% | 108 | -30% | 101 | -27% | 2.1 | -33% | 2.0 | -22% | | | | | | |
| Other Public | 0.30 | -51% | 30 | -61% | 58 | -30% | 0.6 | -64% | 1.3 | -13% | | | | | | |
| Federal | 0.18 | -88% | 23 | -87% | 23 | -87% | 0.7 | -85% | 0.5 | -88% | | | | | | |
| Non-Federal | 2.17 | -42% | 261 | -42% | 395 | -33% | 5.0 | -44% | 7.9 | -31% | | | | | | |
| **Case 3: Alternative Mgt non-Fed** | | | | | | | | | | | | | | | | |
| Total | 3.52 | -32% | 418 | -33% | 614 | -19% | 8.7 | -37% | 13.8 | -11% | 10 | 21 | 28 | 19 | 56 | 73 |
| Industry | 1.73 | -15% | 182 | -19% | 379 | 4% | 3.7 | -15% | 8.6 | 23% | | | | | | |
| NIPF | 1.04 | -5% | 141 | -8% | 139 | 1% | 2.8 | -10% | 3.0 | 18% | | | | | | |
| Other Public | 0.58 | -5% | 72 | -5% | 72 | -13% | 1.5 | -9% | 1.7 | 13% | | | | | | |
| Federal | 0.18 | -88% | 23 | -87% | 23 | -87% | 0.7 | -85% | 0.5 | -88% | | | | | | |
| Non-Federal | 3.34 | -11% | 395 | -13% | 591 | 1% | 8.0 | -11% | 13.3 | 15% | | | | | | |
| **Case 4: Alternative Mgt All Owners** | | | | | | | | | | | | | | | | |
| Total | 3.76 | -28% | 444 | -29% | 639 | -16% | 9.5 | -31% | 14.4 | -7% | 10 | 20 | 25 | 19 | 56 | 73 |
| Industry | 1.73 | -15% | 182 | -19% | 379 | 4% | 3.7 | -15% | 8.6 | 23% | | | | | | |
| NIPF | 1.04 | -5% | 141 | -8% | 139 | 1% | 2.8 | -10% | 3.0 | 18% | | | | | | |
| Other Public | 0.58 | -5% | 72 | -5% | 72 | -13% | 1.5 | -9% | 1.7 | 13% | | | | | | |
| Federal | 0.42 | -71% | 49 | -72% | 49 | -72% | 1.5 | -68% | 1.1 | -73% | | | | | | |
| Non-Federal | 3.34 | -11% | 395 | -13% | 590 | 1% | 8 | -11% | 13.25 | 15% | | | | | | |

**TABULAR DATA BY CASE, FLOW CONSTRAINT, AND MANAGEMENT ZONE**

Base Case:
- NDF Public, 25% Flow Private
- 25% Flow All
- Riparian Zone: NDF Public, 25% Flow Private
- Riparian Zone: 25% Flow All

Case 2:
- NDF Public, 25% Flow Private
- 25% Flow All
- Riparian Zone: NDF Public, 25% Flow Private

Case 3:
- NDF Public, 25% Flow Private
- Riparian Zone: NDF Public, 25% Flow Private

Case 4:
- NDF Public, 25% Flow Private
- Riparian Zone: NDF Public, 25% Flow Private

Case 5:
- NDF Public, 25% Flow Private
- Riparian Zone: NDF Public, 25% Flow Private

Case 6:
- NDF Public, 25% Flow Private
- Riparian Zone: NDF Public, 25% Flow Private

# APPENDIX II

# SUMMARY OF ACRES ALLOCATED TO ZONES

# TABULAR DATA BY CASE, FLOW CONSTRAINT, AND MANAGEMENT ZONE

**SUMMARY OF ACRES ALLOCATED TO ZONES**

**Tabular Data on Acreage Information by Ownership, Species, Decade, Class, and Management Zone**

| CASE # | DESCRIPTION |
|---|---|
| Base Case: | Minimal regulations |
| Case 2: | Minimum regulations on State and Private with Federal NW Forest Plan |
| Case 3: | Biodiversity Management pathways on non-federal lands |
| Case 4: | Biodiversity management pathways on all owners |
| Case 5: | DNRHCP, minimum regulations private, Federal NW Forest Plan |
| Case 6: | Wide riparian buffers per Tribal and WEC proposal |

# APPENDIX III

# KEY TABLES FOR REPORT AND SPREADSHEETS: ACRONYMS

## APPENDIX III. KEY FOR REPORT ACRONYMS

| ACRONYM | DEFINITION |
|---|---|
| AMA | Adaptive Management Areas |
| CINTRAFOR | Center for International Trade in Forest Resources |
| CT | Commercial Thinning |
| CTED | Center for Trade and Economic Development |
| DFSIM | Douglas Fir Simulation |
| DNR HCP | Department of Natural Resources Habitat Conservation Plan |
| FEMAT | Forest Ecosystem Management Team |
| FIA | Forest Inventory Analysis |
| FS | Forest Service |
| GIS | Geographic Information Systems |
| GPMGT | Gifford Pinchot Management |
| GPNF | Gifford Pinchot National Forest |
| GPVEG1998 | Gifford Pinchot Vegetation (year) |
| HCP | Habitat Conservation Plan |
| LC GIS | Lewis County Geographic Information System |
| LSR | Late-Seral Reserve |
| NIPF | Non-Industrial Private Forests |
| NPV | Net Present Value |
| NRF | Nesting-Roosting-Foraging |
| PCT | Pre-Commercial Thinning |
| PRIME | Pacific Resource Inventory, Monitoring, and Evaluation Plan |
| RMZs | Riparian Management Zones |
| USDA | United States Department of Agriculture |
| USFS | United States Forest Service |
| WEC | Washington Economic Council |
| WWDB | Western Washington Database |
| WWII | World War II |

**KEY FOR SPREADSHEET ACRONYMS**

| ACRONYM | DEFINITION | MEASUREMENT |
|---|---|---|
| **Harvest Economics** | | |
| NR | Net Revenues | Million $/year |
| HF | Harvest Flow | Million board feet/year |
| INV | Inventory | Billion board feet |
| **Stand Structures** | | |
| EI | Ecosystem Initiation | Per 1,000 acres and % |
| CE | Competitive Exclusion | Per 1,000 acres and % |
| UR | Understory Re-initiation | Per 1,000 acres and % |
| DU | Developing Understory | Per 1,000 acres and % |
| ND/BD | Niche Diverse/Botanically Diverse | Per 1,000 acres and % |
| FF/OG | Fully Functional/Old Growth | Per 1,000 acres and % |
| LS | ND/BD plus FF/OG "Late-Seral" | % |
| **Habitat Classes** | | |
| DSP | Dispersal Habitat | Per 1,000 acres |
| Y/M | Young/Marginal Habitat | Per 1,000 acres |
| NRF | Nesting, Roasting, Foraging, Habitat | Per 1,000 acres |
| **Regional Economic** | | |
| EMPL | Employment | 1,000 workers |
| GDP | Gross Domestic Product | Billion/Million $ |
| **Habitat Indices** | | |
| ECO | Habitat Suitability (owl food chain) | Percent of max |
| VERT | Habitat Suitability Vertebrates | Percent of max |
| BRI | Biodiversity Index vs. pre-European | Percent of pre-European |