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**Montana Forest and Conservation Experiment Station, School of Forestry, University of Montana, Missoula, Montana 59812**

## Economic-Base Multipliers and the Wildland-Based Economy of Montana

**By Ervin G. Schuster**

An evaluation of alternative wildland programs in Montana requires that the likely consequences of each program be assessed in terms of changes in economic activity. Employment and wage levels are two common indicators of economic activity. Aggregate change in economic activity can be divided into primary and secondary changes. Primary changes in economic activity result from wildland-based industries responding to changing product mixes associated with resource management programs. Secondary changes reflect the fact that wildland-based industries are linked to other industries and to the economy in general.

Assessments of changes in economic activity typically involve separate measurements of primary and secondary change. Measurement of primary change requires knowledge of the relationship between creation of wildland products and economic activity in the industries using those products (for example, see Schuster 1978). Measurement of secondary change requires knowledge of the relationship between the wildland-based industries and other sectors of an economy. Two methods of analysis are commonly used: input-output (or interindustry analysis) and economic base analysis. They differ in many important regards, not the least of which is the degree to which linkages between industrial sectors are specified.[1] Input-output analysis requires a high degree of specification; economic base requires relatively little specification. Either method can produce a multiplier by which change in primary economic activity is linked to change in aggregate economic activity in an economy. Secondary change is simply the difference between primary and aggregate change.

This paper is designed to support assessments of aggregate changes in economic activity within the framework of economic base analysis. Regional scientists have attempted to explain growth of an area's economy in terms of its economic activity within the framework of economic base. Fundamental to this concept is the fact that since local areas do not print their own currency, money flows into the area when outside markets purchase goods and services from the area's economy. Firms that

*Ervin G. Schuster is associate professor of forest economics, School of Forestry, University of Montana, Missoula.* *The research reported here was carried out as part of Project 789-2, "Survey of Employment and Wages Associated with Wildland-Dependent Recreation in Montana," of the Montana Forest and Conservation Experiment Station. This research was supported by a cooperative agreement between the U.S. Forest Service, Intermountain Forest and Range Experiment Station, and the Montana Forest and Conservation Experiment Station.*

[1] Input-output analysis is one of the most powerful tools of regional study, allowing the analyst to make relatively sophisticated measurements of both primary and secondary economic change. Other things equal, input-output analysis is more comprehensive and may be a more desirable analytical tool, compared to economic base analysis. Unfortunately, as in the case of Montana, they are sufficiently expensive to preclude routine updating, often are not uniformly available at substate levels, and require access to computer-based data sets to be usable. These problems can be significantly reduced with economic base analysis. Both techniques have major technical problems and limitations. Readers needing a more comprehensive treatment of input-output analysis should consult Miernyk (1965). Consult Tiebout (1962) for economic base analysis. Those needing critique of economic base analysis should consult Barkley and Allison (1968), Berking and Isserman (ca 1978) and Bell (1976).

export most of their output and thereby create a flow of money into the area are classified as "basic." They are often termed "export" because they serve markets outside the area.[2] Part of the income flowing to an area goes to pay other local industries for necessary goods and services, thus providing the base for additional economic activity. These industries are often called *non-basic, residentiary* or *service* industries. Growth of an area's economy results from changes in the receipt of income to the area through basic industries, although growth can occur in other ways, such as by an increase in the relative importance of non-basic sectors in an area's economy. In economic base analysis, changes in economic activity for non-basic industries is attributed to changes in basic industries. The multiple or aggregate effect on economic activity, due to changes in basic industries, is measured by the *economic base multiplier.* Analyses in wildland management that use economic base multipliers are appropriate if, and only if, the wildland sector being altered is part of the area's economic base.

This report presents findings of research investigations designed to identify the economic base of Montana and five multi-county planning regions, to determine the relationship between wildland-based sectors and the economic base, and to develop a set of economic base multipliers, one for employment and the other for wages. Economic bases and economic base multipliers were calculated using the *location quotient* approach as described by Tiebout (1962) with the modifications recommended by Isserman (1977). All calculations were made on four-digit data with the federal government always included in an area's economic base. Wage and employment data were obtained from the U.S. Bureau of Economic Analysis and the Montana Employment Security Division, in the form of unsuppressed ES-202 files read onto magnetic tapes and written records for the agriculture and government(s) sectors. Quarterly data were obtained for 1975, 1976 and 1977 and were ultimately aggregated into annual totals. All wage data were converted to 1977 dollars based on the Consumer Price Index (BEA 1978). Wildland-based sectors were defined on the basis of the Standard Industrial Classification system (OMB 1972).[3]

The remainder of this report presents study results. First, results pertaining to the entire state of Montana are presented. These are followed by a brief example illustrating the use of multipliers. The second section discusses economic-base multipliers and wildland-based sectors in each of five multi-county planning areas in Montana.

The ratio between total employment or wages in Montana and in those industrial sectors which partly or totally constituted the economic base was found to be very stable over the 1975-1977 period. Figure A indicates that this ratio, known as the economic-base multiplier, averaged 2.68 for employment and 2.45 for wages over that period. That is, for every person employed in the economic base, 2.68 persons were employed in total, including the one in the economic base. The ratio for wages has a similar interpretation.

The fact that the ratio for employment is larger than the ratio for wages is noteworthy. It means that the average annual wage rates per employee in economic base sectors were in the aggregate higher than average annual wages for non-basic sectors. Economic base wage rates were about 15.1 percent [ $=(2.68-1/2.45-1)\times 100$] greater than those in non-basic sectors and about 8.9 percent ($=2.68/2.45\times 100$) greater than the total state average. These relationships imply that, for a given change in Montana's economic base, the percentage change in total employment will be greater than the percentage change for wages.

But if a changed level of economic activity in wildland-based sectors is to affect other sectors through the mechanism of economic base, the wildland sectors must then be a part of that base. Table A provides some data on wildland sectors vis-a-vis Montana's economic base. As shown in column 4, the wildland-based sectors constitute about four to 10 percent of Montana's economic base.[4] The magnitude of these levels is a direct reflection of a sector's importance to the economic base. A zero entry would indicate a non-basic sector. Given these data, it is appropriate to use the method of economic base to analyze aggregate changes in economic activity for Montana resulting from changes in the wildland-based sector.

The method used in this study to identify Montana's economic base presupposed that each industrial sector can be divided into two segments, one that serves export markets and one that serves internal markets. Only the export market segment is included in the economic base.Table A (column 3) shows the average, aggregate

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[2]It is not necessary for output to be exported, but rather for income to be imported. In most cases, these concepts will not be in conflict. However, this point is important in the case of recreation, recreation commodities typically being produced and consumed locally. The recreation industry is "basic" then to the extent that recreationists from outside an area come to the area and spend money earned outside the area. Income is effectively imported while output is not exported.

[3]The 4-digit SIC codes comprising industrial sectors of the wildland-based economy are: a. *Mining* (all sectors within major groups 10, 11, 12, 13, and 14); b. *Timber-Using* (all sectors within major groups 24 and 26); *Range* (because of the lack of relevant specificity in the code and the preponderance of single proprietorships, overall estimates for agricultural wages were used as proxies for range data, instead of ES 202 files based on the standard industrial classification system); *Recreation* (the following industry sectors were used: 4119, 4131, 4222, 4459, 4469, 4511, 4521, 4722, 5311, 5331, 5399, 5411, 5511, 5521, 5541, 5551, 5561, 5571, 5599, 5611, 5621, 5651, 5699, 5810, 5941, 5946, 5947, 7011, 7032, 7033, 7512, 7519, 7699, 7997, 7999, 8641).

[4]Please note that these percentages are somewhat ambiguous for the range and recreation sectors. They are both probably exaggerated. The percentage for range is really that of agriculture, only part of which is the range-livestock industry. The recreation sector includes industries (e.g., gasoline stations and motels) expected to be relatively abundant in a large, sparsely populated state which must rely on these industries for normal commerce. In both cases, the problem resides in lack of specificity in the Standard Industrial Classification system. Further research is needed.

**Table 2. Selected economic characteristics of wildland-based sectors in Region 2, 1975-1977.**

| Wildland-based Sector | Year | % Sector in Economic Base | % Sector of Economic Base | Wage per Employee[1,2] |
|---|---|---|---|---|
| Timber-using | 1975 | 44.1 | 0.2 | $ 8,105 |
| | 1976 | 50.0 | 0.2 | 7,759 |
| | 1977 | 50.4 | 0.3 | 8,290 |
| Mining | 1975 | 64.3 | 1.9 | 14,373 |
| | 1976 | 65.7 | 2.1 | 14,056 |
| | 1977 | 68.5 | 2.3 | 14,252 |
| Range | 1975 | 64.7 | 7.1 | 5,433 |
| | 1976 | 55.7 | 5.1 | 4,783 |
| | 1977 | 51.4 | 3.9 | 4,667 |
| Recreation | 1975 | 16.0 | 5.8 | 6,304 |
| | 1976 | 18.2 | 6.9 | 6,271 |
| | 1977 | 20.5 | 7.8 | 6,163 |

[1]Expressed in 1977 dollars
[2]Average Region 2: 1975 — $9,639
1976 — $9,618
1977 — $9,746

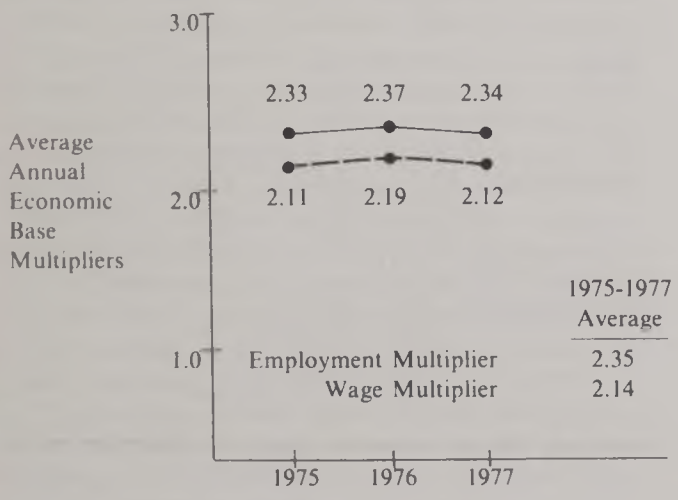


**Figure 2. Average annual employment and wage multipliers for Region 2, 1975-1977.**

**Table 3. Selected economic characteristics of wildland-based sectors in Region 3, 1975-1977.**

| Wildland-based Sector | Year | % Sector in Economic Base | % Sector of Economic Base | Wage per Employee[1,2] |
|---|---|---|---|---|
| Timber-using | 1975 | 0.0 | 0.0 | $ 7,435 |
| | 1976 | 0.0 | 0.0 | 8,043 |
| | 1977 | 0.0 | 0.0 | 9,479 |
| Mining | 1975 | 64.0 | 2.7 | 17,383 |
| | 1976 | 57.8 | 2.6 | 18,003 |
| | 1977 | 63.6 | 3.2 | 19,069 |
| Range | 1975 | 62.1 | 7.4 | 5,437 |
| | 1976 | 50.6 | 4.8 | 4,799 |
| | 1977 | 47.2 | 3.8 | 4,673 |
| Recreation | 1975 | 25.7 | 8.2 | 5,287 |
| | 1976 | 28.0 | 8.9 | 5,167 |
| | 1977 | 22.3 | 6.9 | 5,136 |

[1]Expressed in 1977 dollars
[2]Average Region 3: 1975 — $9,657
1976 — $9,586
1977 — $9,852

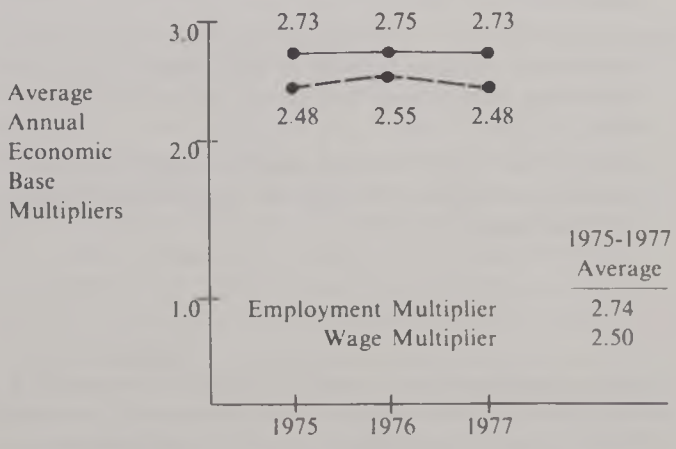


**Figure 3. Average annual employment and wage multipliers for Region 3, 1975-1977.**

PLEASE NOTE PRINTING ERRORS
Headings for Table A and Figure A on page three should indicate Montana rather than Region 1. Also on page three, a reference to Table 1 (column 6) should read Table A (column 5).

**Tab**
**wildl**

| Wildland-based Sector | Year | Economic Base | Economic Base | Wage per Employee[1,2] |
|---|---|---|---|---|
| Timber-using | 1975 | 81.0 | 6.8 | $12,351 |
| | 1976 | 79.5 | 6.4 | 13,201 |
| | 1977 | 79.5 | 6.5 | 13,829 |
| Mining | 1975 | 69.6 | 4.3 | 16,127 |
| | 1976 | 65.7 | 3.7 | 16,146 |
| | 1977 | 63.1 | 3.5 | 16,565 |
| Range | 1975 | 60.6 | 6.8 | 5,434 |
| | 1976 | 50.2 | 4.7 | 4,795 |
| | 1977 | 46.3 | 3.6 | 4,675 |
| Recreation | 1975 | 20.8 | 8.8 | 6,005 |
| | 1976 | 22.9 | 10.4 | 5,983 |
| | 1977 | 21.7 | 9.6 | 5,928 |

[1]Expressed in 1977 dollars
[2]Average Region 1: 1975 — $9,598
1976 — $9,469
1977 — $9,715

proportion of each wildland-based sector contained in Montana's economic base over the 1975-1977 time period. These range from about 21 percent for recreation to about 80 percent in the timber-using sector. Technically, to use the method of economic base the economic activity change in the wildland-based sector must be occurring in the export market segment of that sector. Understanding whether or not this is the case requires specific knowledge outside the scope of this study. For example, if a change in range management were to occur in which the analyst had special knowledge to indicate that all additional livestock production would be sold to outside markets, it would be appropriate to attribute all economic activity change to the export sector of that industry, in spite of the fact that about 46 percent of industry was involved in export activity during 1977.

*Example:* Suppose that timber harvest in Montana were to increase by 1.0 million board feet in 1977 and that all other timber harvests were to remain constant. What are the aggregrate employment and wage effects of this change? First determine whether the timber-using sector is part of the economic base. Table A (column 4) indicates that it is. Then determine the primary employment and wage effects. Suppose the primary employment effect turns out to be 9.0 employees. Table 1 (column 6) indicates that the wages per employee were $13,829. The primary wage effect would be $124,446 (= 9.0 X $13,829). What portion of these primary effects should be attributed to changes in the economic base segment of the timber-using industry? Table A (column 3) shows that 79.5 percent of this sector was included in Montana's economic base that year. If we assume that the timber harvest change will generate economic change in the same ratio, then an employment change of 7.2 (= 9.0 X .795) and a wage change of $98,935 (= $124,446 X .795) should

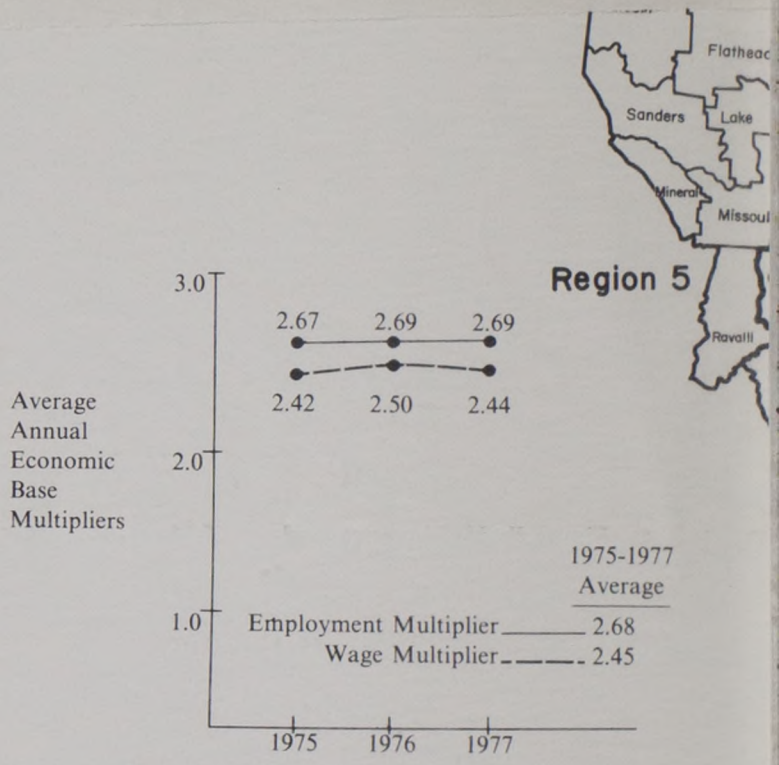


**Figure A. Average annual employment and wage multipliers for Region 1, 1975-1977.**

be ascribed to the economic base. Based on the 1977 multipliers shown in Figure A, aggregate employment change is 19.4 (= 7.2 X 2.69) and aggregate wage change is $243,380 (= $98,935 X 2.46).

In many instances the wildland program will affect a specific portion of Montana, rather than the whole state. This situation requires a localized analysis equivalent to the general analysis just illustrated. Any particular local area will be found within the boundaries of one of the five official state planning regions in Montana. Figure B shows these multi-county groupings. It is entirely possible for a wildland project to take place in one or more region(s) and for the resulting economic activity change to take place in a different region(s). In the situation of multiple regions, multiple analyses should be conducted. The region(s) within which the economic activity change takes place must always be the focus of analysis. For example, a change in timber management for Lewis and Clark County (Region 4) may be determined to affect economic activity not only in Lewis and Clark County and in other counties in Region 4, but also in Fergus County (Region 3) and Flathead County (Region 5). The effects of this management change on Regions 3, 4 and 5 must be analyzed.

A series of tables and figures are presented in the appendix. These contain information for each region which is exactly equivalent to that already presented for the state. Each should be interpreted and used as previously discussed.

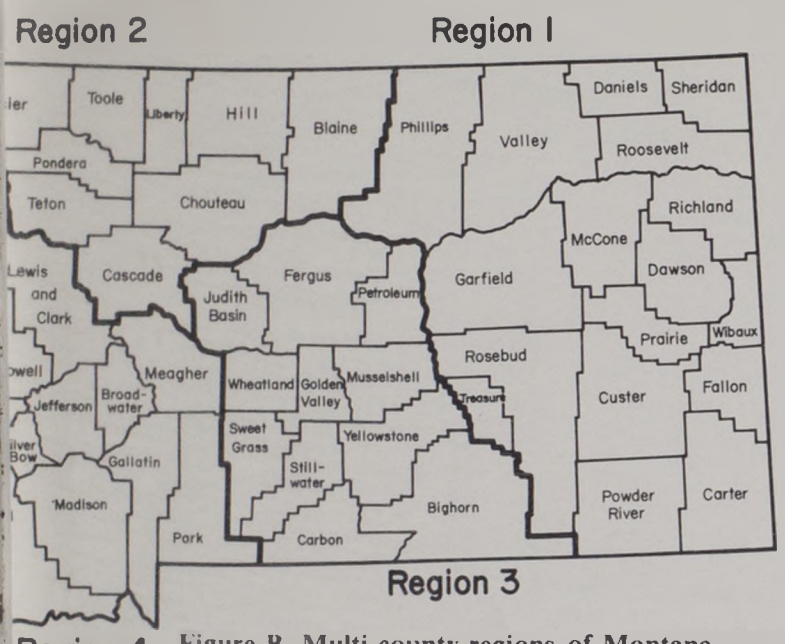


**Figure B. Multi-county regions of Montana.**

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## APPENDIX

**Figures and tables describing multipliers and selected economic characteristics for regions in Montana.**

**Table 1. Selected economic characteristics of wildland-based sectors in Region 1, 1975-1977.**

| Wildland-based Sector | Year | % Sector in Economic Base | % Sector of Economic Base | Wage per Employee[1,2] |
|---|---|---|---|---|
| Timber-using | 1975 | 33.1 | 0.4 | $10,346 |
| | 1976 | 36.6 | 0.5 | 10,887 |
| | 1977 | 39.8 | 0.5 | 10,704 |
| Mining | 1975 | 78.1 | 5.1 | 16,795 |
| | 1976 | 80.0 | 6.0 | 16,767 |
| | 1977 | 81.5 | 6.6 | 16,221 |
| Range | 1975 | 82.8 | 16.6 | 5,432 |
| | 1976 | 78.8 | 13.1 | 4,799 |
| | 1977 | 78.0 | 11.4 | 4,679 |
| Recreation | 1975 | 24.1 | 11.9 | 6,236 |
| | 1976 | 27.2 | 13.8 | 6,422 |
| | 1977 | 25.4 | 12.7 | 6,255 |

[1]Expressed in 1977 dollars
[2]Average Region 1: 1975 — $9,145
1976 — $8,525
1977 — $8,827

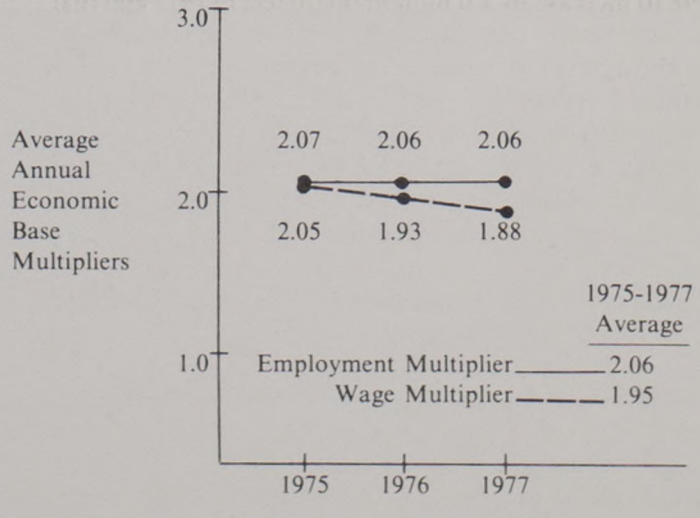


**Figure 1. Average annual employment and wage multipliers for Region 1, 1975-1977.**

**Table 4. Selected economic characteristics of wildland-based sectors in Region 4, 1975-1977.**

| Wildland-based Sector | Year | % Sector in Economic Base | % Sector of Economic Base | Wage per Employee[1,2] |
|---|---|---|---|---|
| Timber-using | 1975 | 77.3 | 2.6 | $ 9,932 |
| | 1976 | 78.3 | 3.0 | 10,732 |
| | 1977 | 77.2 | 2.9 | 11,682 |
| Mining | 1975 | 97.0 | 10.5 | 15,993 |
| | 1976 | 96.0 | 8.1 | 16,000 |
| | 1977 | 96.2 | 7.0 | 16,735 |
| Range | 1975 | 49.2 | 3.6 | 5,430 |
| | 1976 | 36.7 | 2.2 | 4,797 |
| | 1977 | 32.3 | 1.7 | 4,678 |
| Recreation | 1975 | 23.2 | 8.3 | 5,845 |
| | 1976 | 24.3 | 9.0 | 5,833 |
| | 1977 | 23.5 | 9.0 | 5,878 |

[1]Expressed in 1977 dollars
[2]Average Region 4: 1975 — $9,705
1976 — $9,607
1977 — $9,747

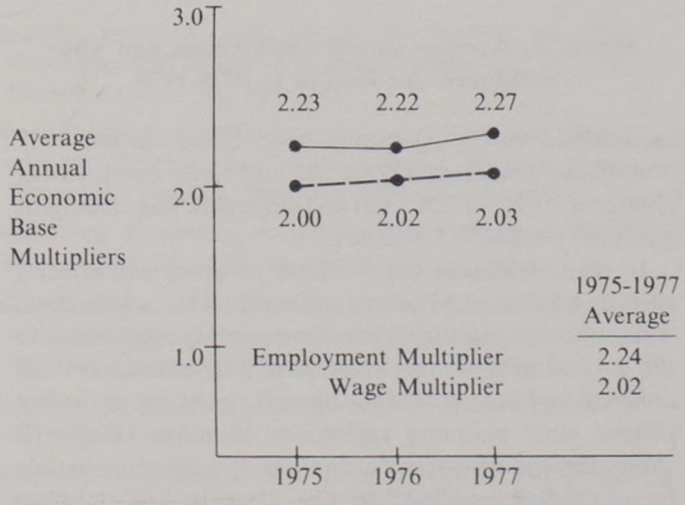


**Figure 4. Average annual employment and wage multipliers for Region 4, 1975-1977.**

**Table 5. Selected economic characteristics of wildland-based sectors in Region 5, 1975-1977.**

| Wildland-based Sector | Year | % Sector in Economic Base | % Sector of Economic Base | Wage per Employee[1,2] |
|---|---|---|---|---|
| Timber-using | 1975 | 94.9 | 26.6 | $12,876 |
| | 1976 | 94.2 | 24.7 | 13,846 |
| | 1977 | 94.3 | 25.6 | 14,374 |
| Mining | 1975 | 90.0 | 1.3 | 14,891 |
| | 1976 | 92.2 | 1.2 | 14,070 |
| | 1977 | 91.2 | 1.1 | 14,043 |
| Range | 1975 | 0.0 | 0.0 | 5,443 |
| | 1976 | 0.0 | 0.0 | 4,798 |
| | 1977 | 0.0 | 0.0 | 4,682 |
| Recreation | 1975 | 21.8 | 8.4 | 5,982 |
| | 1976 | 24.8 | 9.8 | 5,850 |
| | 1977 | 22.5 | 8.8 | 5,802 |

[1]Expressed in 1977 dollars
[2]Average Region 5: 1975 — $9,523
1976 — $9,569
1977 — $9,859

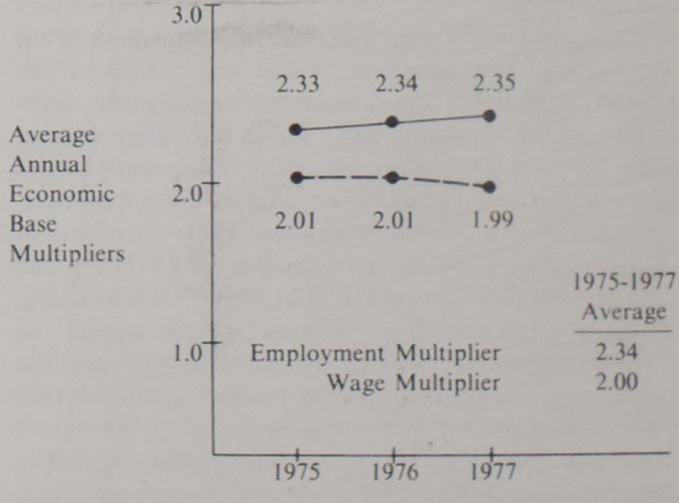


**Figure 5. Average annual employment and wage multipliers for Region 5, 1975-1977.**

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