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Chapter 20 - Economic Impact Analysis

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21 - Elements of Economic Impact Analysis

Economic impact analysis estimates the total effects of a program or project and the distribution of those effects among all sectors of an economy. The analysis measures the effects primarily by changes in employment and income within the economy of the geographic area most affected by the program or project.

The process is a series of steps outlined in this chapter that include:

1. Defining the scope and purposes of the analysis.
2. Selecting the method and measures for the analysis.
3. Defining the impact area.
4. Developing data for the impact area.
5. Developing the economic model.
6. Specifying the initial changes caused by program actions.
7. Estimating the economic impacts.

21.1 - Scope of Program or Project

All programs or projects produce economic impacts as long as they require inputs and produce outputs, either now or in the future. However, the impacts of individual small projects may not be large enough to analyze them accurately, may not be sufficiently significant to affect decisions to be made, may be relatively expensive to analyze relative to the effect on the decision, or may not be of appreciable public interest.

Section 1972.1 of the Forest Service Manual establishes direction on the types and sizes of projects for which full economic impact analyses should be made. For projects and plans on a relatively small National Forest, however, a partial analysis using multipliers derived from other analyses may be used, and the economic impacts may be estimated using the procedures described in sections 27 and 28. In such cases, the tasks described in section 26 of this handbook may be omitted.

As in economic efficiency evaluations, economic impacts can be estimated for activities already underway or completed, or for activities being planned for the future. Regardless of the size of the activities for which economic impacts are being estimated, or whether the activities are in existence or planned, they are called "programs" in this chapter.

21.2 - Purposes of Economic Impact Analyses

The first step in making an economic impact analysis is to define carefully the purpose of the analysis. This will affect subsequent definitions of impact area, selection of measures of impact, data needed on output and expenditure changes in alternative plans, and type and extent of the display of the analysis results.

Among the several purposes served by economic impact analyses are:

1. Describing the local economy. This is one of the first steps in preparing a National Forest plan or other analysis. The description will help the planning team to know what local industries are important, size of potential regional demands for recreation, and other matters. Such analyses do not require a predictive model, but descriptions of several assumed impact areas may be warranted.

2. Predicting impacts from changes in outputs and management activities of plan alternatives. This is the most common type of economic impact analysis. It requires the development of a predictive model, estimation of changes levels of output for each alternative, and calculation in impacts from those changes in output.

3. Determining the impacts of changing the structure of a local economy by introducing a new industry, or by the closure of an existing one. Such analyses not only require the development of a predictive model, but modification of it to accommodate the change in industrial sectors.

4. Analyzing the impacts of other aspects of resource management. These include the effects of resource constraints on local industries and the existence of pools of unemployed or under-employed labor.

21.3 - Ways to Estimate Economic Multiplier Effects

The principal objective of economic impact analysis is to estimate the effect of the economic transaction of the program or project on the overall economic transaction in an impact area. For each individual activity, an accounting can be made which, very simplified, would include such items as:

Inputs or costs		Outputs or benefits
Labor		Product A
Materials		Product B
Depreciation		Product C
Supplies		
Rent, profit		
Total	=	Total

Similarly, income and product accounts for an impact area would include analogous components, as:

Inputs or income	Outputs or products
Wages and salaries	Personal consumption
Property-type income	Government consumption
Indirect taxes	Capital investment
	Exports to outside
Imports from outside	
Total gross income	Total gross expenditure

The income and product accounts for an area are the sum of the component transaction within each account. A change in an individual transaction causes greater changes in the overall economy than only the direct change. This is because the material and supplies purchased are spent in part in other local sectors, wages and salaries are partially spent on locally produced goods and services, and the outputs may become materials for local industries. After several rounds of such effects, the total impact is some multiple of the direct impacts of individual activities.

The analytical problem is to estimate, reliably, the effect of changes of one or several activities on the overall economy of the impact area. The method that uses interindustry relationships most intensively is input-output analysis, which is the recommended Forest Service analytical method, and which is described starting in section 22.

22 - Methods of Estimating Economic Impacts

Among the methods economists have developed for estimating the impacts of specific programs and projects, the Forest Service regards input-output analysis as the most flexible and useful system currently available. This method of analysis is the standard approach for making Forest Service economic impact analyses.

22.1 - Input-Output Analysis

Input-output analysis describes an economy as a system of interrelationships between industries. The analyst must evaluate the validity of the interrelationships and numerical estimates for the impact area in question. Include in this evaluation: Estimates of final demands for goods consumed by households, government agencies, capital investments, or exported out of the impact area, how the final demands are allocated to the industries that provide the consumption goods and services, how each industrial sector not only produces goods and services, but is a consumer itself, the requirements these industries have for intermediate goods from other industries, and services for which it produces wages and salaries, property-type income, and indirect business taxes.

As a formal economic model input-output analysis requires several significant assumptions that the analyst must consider to determine the appropriateness of using the tool for a particular evaluation. Among them are:

1. Industries produce outputs using fixed mixes of inputs. If the inputs are increased by a magnitude, then outputs are also increased by the same magnitude. Substitution of one input factor for another cannot occur, and no efficiencies or inefficiencies due to scale are recognized.

2. Each industry produces only one mix of commodities.

3. All required inputs are assumed to be available without limit; there are no shortages or scarce resources.

4. All production (final output) will eventually be consumed. It will be sold to intermediate consumers (to be used to provide other outputs), final consumers (e.g., household, governments), exported or placed in inventory for future sale.

5. All changes take place in an indeterminate period of time; the model has no explicit time dimension other than the data typically based on annual data.

While these assumptions are restrictive, they nevertheless simplify the problem of describing the interrelatedness of economies and may be relaxed as necessary to make modeling feasible. Recent research has developed techniques the analyst may use to construct accurate and reliable models that overcome many of the restrictions that result from these assumptions.

22.2 - Input-Output Tables

The table shown in exhibit 01 identifies the needed relationships and the components or quadrants of an input-output table.

			Purchasing Sectors				
			Intermediate Demand	Final Demand			Total Gross Output
			Agriculture, Mining, Manufacturing, Trade, Services, Finance (1 . . . . . j . . . . . n)	Household Cons.	Govt. Expenditures	Gross Domestic Capital Formation	Exports	
			I Intermediate Production & Consumption	II Final Outputs of Producing Sectors				
Producing Sectors	Intermediate Inputs	Agriculture 1	$X_{11} \ldots X_{1j} \ldots X_{1n}$	C_1	G_1	I_1	E_1	X_1
		Mining ⋮	⋮	⋮	⋮	⋮	⋮	⋮
		Manufacturing ⋮	⋮	⋮	⋮	⋮	⋮	⋮
		Trade i	$X_{i1} \ldots X_{ij} \ldots X_{in}$	C_i	G_i	I_i	E_i	X_i
		Services ⋮	⋮	⋮	⋮	⋮	⋮	⋮
		Finance n	$X_{n1} \ldots X_{nj} \ldots X_{nn}$	C_n	G_n	I_n	E_n	X_n
			III Primary Inputs to Production	IV Primary Inputs to Final Demand				
	Primary Inputs	Payments to Households	$H_1 \ldots H_j \ldots H_n$	H_C	H_G	H_I	H_E	H
		Government	$T_1 \ldots T_j \ldots T_n$	T_C	T_G	T_I	T_E	T
		Depreciation	$D_1 \ldots D_j \ldots D_n$	D_C	D_G	D_I	D_E	D
		Imports	$M_1 \ldots M_j \ldots M_n$	M_C	M_G	M_I	M_E	M
	Total Gross Outlays		$X_1 \ldots X_j \ldots X_n$	C	G	I	E	X

22.3 - Methods of Assembling Data

When the analyst concludes from his/her evaluation of the relationships and data that changes are required, several methods for gathering other information exists. The Department of Commerce develops a new national input-output tables every five years from a variety of economic data, particularly the economic censuses such as the Censuses of Manufacturers, Agriculture, Construction, Retail and Wholesale Trade, and Governments. Though these tables were not developed for states and smaller areas, they can be approximated by two methods:

1. Surveys to collect transaction data from industries in the impact area--distribution of sales to other sectors and final demand; purchases of intermediate goods and factors of production. Although some secondary statistical information may also be useful, such surveys are costly and require substantial lead time. The models produced are, however, generally regarded as superior.

2. Non-survey compilation of data from various statistical sources to estimate the values in the quadrants II and III, and deriving data for quadrant I from relationships in the national input-output model. Import and export flows, and other information, are generated by mathematical routines that consider those sectors present in an impact area. These models are much less costly and easy to produce, but nevertheless predict economic impacts reasonably well.

Data from non-survey compilations may be corrected or supplemented by information collected from industries or sectors of particular interest to the analysis. Such local data is often needed when new industries have come in to the area, or major technological changes have been adopted, since the year of the last national input-output tables and county-level data used.

22.4 - IMPLAN, the Forest Service System

The IMPLAN system comprises a data base that covers all counties in the U.S. and a set of computer programs to retrieve data and perform the computational tasks for input-output analysis.

Use the IMPLAN system for developing Forest Service economic impact models unless more appropriate or less costly options exist for a given impact area. The information in this handbook gives an overview of the IMPLAN process and is not dependent on any one system or version. Details of procedures may be obtained from the IMPLAN Analysis Guide and the IMPLAN users guide cited in section 29 - references of this handbook.

23 - Measures of Economic Impacts

The primary measures of economic impacts of a public program are the net changes in income and employment in the affected impact areas. The best way to express them depends on the purpose of the study and the use of the results. The first task of an economic impact analysis is

choosing which are most appropriate, unless the analysis is relatively standard, such as one for a National Forest plan.

Three general ways to measure the impacts on income and employment are:

1. By absolute measures, such as millions of dollars of additional income, or average number of jobs.

2. By multipliers--ratios of additional income or employment generated in the economy related to the direct income or employment produced by the program itself.

3. By response coefficients, which are similar to multipliers but are the ratios of additional income or employment generated to the increase in value of final sales of the output (instead of direct income), or to units of physical output itself such as MBF of timber or AUM's of range. Operationally these may be easier to use than multipliers themselves.

23.1 - Types of Impacts and Multipliers

Economic impact analyses can measure three levels of economic outputs or impacts produced by the activities of a program, namely direct, indirect, or induced effects.

23.11 - Direct Outputs

These outputs are those usually considered in economic efficiency evaluations, such as timber, forage, range, minerals, and recreation opportunities. There are two types:

1. Outputs, like recreation and many types of wildlife use, that are directly used by final consumers.

2. Intermediate outputs sold as inputs to other sectors which further process them, eventually producing products used by consumers.

Unlike economic efficiency evaluations, all direct outputs are measured in terms of contribution to final demands, or the expenditures to consume them. This should include the expenditures of the Forest Service, and perhaps other agencies, required for them, as well as expenditures of the users. See section 25 for the appropriate methods to use.

Only outputs actually used or consumed (real transaction have occurred) affect the economy. Unused recreation or range capacity, for example, and outputs for which users do not expend funds, such as local berry picking, should not be included.

23.12 - Indirect effects

This is the portion of the production of all supporting industries required to provide the inputs for the directly affected industries. Some of this production may require additional inputs and

these additional inputs may require still more basic inputs. Ultimately, they are all based on inputs of basic productive factors--labor (measured as wages), land (rental income), and capital (interest and other returns to ownership).

A ratio of income or value produced by both the direct and indirect effects to the income or value of the direct outputs is called a Type I Multiplier (sec. 23.2).

23.13 - Induced Outputs

One particular component of indirect effects is separated out because of its importance. Indirect effects that are linked to activity by households (as receivers and spenders of income). This particular indirect effect is referred to as the induced effect.

A ratio between the income produced by the direct, indirect, and induced effects to income produced by the direct outputs is called a Type II Multiplier (sec. 23.2).

23.2 - Impacts and Multipliers for Small Areas

The indirect and induced impacts of a program, and the related Type I and II multipliers, are most appropriate on areas most directly affected by the program. For National Forest projects or Forest plans, for example, the area of greatest interest includes those surrounding communities, counties, and states in which the outputs are used, from which most on-site users come, and from which most workers in directly affected sectors live. Criteria for delimiting impact areas are given in section 24.

When expansion of programs in small areas requires in-migration of labor, do not limit analysis just to direct and induced outputs based on existing industry structure. When this occurs, a Type III Multiplier can be computed. This multiplier is calculated as the sum of values for direct, indirect and increased induced demands based on the in-migration divided by the value of the direct outputs.

23.3 - Components of Impacts and Multipliers

Separate all types of income, impacts, and multipliers into income components as follows:

Type of Income/Multiplier	Factors Measured
1. Personal Income	1. Wages and Salaries, and other labor income (includes pension and social security contributions).
2. Total Income	2. Rental Income, Interest, Dividends, Profits and Allowances for Depreciation.
3. Value-added	3. 1 and 2 plus Indirect Business Taxes.
4. Employment	4. Paid Work Generated by the Program.

Value-added calculated with economic impact models is often used to compute gross regional product or the value of all new production for the year modeled.

Jobs in some industries may be all full time, while many jobs in other industries, such as retail trade and services, may require part-time or seasonal workers. Data reported in "job units" needs to be converted into person years for consistency. The employment multiplier may be distorted for an industry using year-long workers which requires inputs from industries that employ mostly temporary or seasonal workers, commonly found in resource based industries. Correcting this distortion will require adjustment of jobs created (or lost) by the appropriate conversion factor, sector by sector.

24 - Defining the Relevant Impact Area

After the scope of analysis has been defined and the economic measures selected, the next step in an economic impact analysis is to define the impact area. Impact areas may vary depending on the policy issue being analyzed.

The impact area should be defined as (1) a functional economic unit of a size appropriate to the policy issue and (2) an area that includes most of economic factors that are most directly affected by the policy.
Counties are the smallest areas for which substantial and consistent economic information is available from the various censuses and other sources. They are thus the basic geographic unit of the IMPLAN data base, which generates the basic data for most Forest Service economic impact analyses.

Thus, a practical limitation is that economic impact areas must be some combination of individual counties. This limitation has serious consequences for some analyses. It may result in lack of focus on the communities of most interest, which may be overshadowed by other

towns or cities within the same counties. When the impacts needed are for a specific community, other methods such as community specific survey techniques should be employed.

24.1 - Criteria for Defining Impact Analysis Areas

There is no step-by-step procedure for defining impact areas, and selection of counties must be based on judgment. Often adjustment in the impact area should be made after the initial area is defined and the data generated for it (see section 25). Consider the following potentially significant factors in defining the area: issues being addressed in the planning, economic center or centers, trade patterns, forest/county boundaries, worker places of residence, and use of program products from other counties.

24.11 - Economic Center

Select the counties of the economic center(s) or central city (or cities) most affected by the program. An economic center or central city/place is the region's largest and most highly developed city in the sense that it has the most diverse set of industrial sectors. In situations in which this center is a metropolitan area, however, the impacts of a Forest Service program may be relatively small compared to the metropolitans area economy. In a absolute sense these impacts may be large when compared with smaller rural economies.

24.12 - Trade Patterns Based on Raw-Material Outputs

If the program produces raw materials for other processes, consider what other raw materials are also used. If the bulk of these other inputs are produced in counties within reasonable transport distance, include the counties. An example of such "backward linked" counties might be the areas in which National Forest grazing permittees raise the hay and feed for winter feeding (and generally have their home ranches). On the other hand, raw materials processed by local plants may be intermediate products for further processing into consumer goods. Examples of such "forward-linked" industries are those that produce ties or lumber to be pressure treated, or made into pallets, millwork, or furniture (all in separate industry sectors). Of course, if all the locations of further processing were included in the impact area, it might become too large. Criteria for including counties are the following:

1. If the processed product is generally sold to final consumers in the area, include the county.

2. If the processed product is sold widely, but its production location depends on the program outputs for transport cost or other reasons, include the county.

3. If the production location is not dependent on local raw materials but the industry can easily substitute materials from a wide area, it is not necessary to include the county.

24.13 - Trade Patterns Based on the On-Site Use of Outputs

Recreation uses, including hunting and fishing, bring final consumers to forest or rangeland areas. Special land-use outputs, such as radar and telecommunication sites, power generation and transmission areas, are also on-site uses because they depend on specific land attributes. The county of residence of these users may or may not be included in the impact area depending on the policy issue.

24.14 - Counties with Program Lands

If the analysis includes estimating the consequences of 25 percent fund payments and payments in lieu of taxes, then all counties with forest land related to the program, and/or counties which receive payments in lieu of taxes, should be considered for inclusion in the impact area. However, it is not necessary to include them for that reason alone. Do not include counties if their contribution to economic impacts are negligible.

24.15 - Residences of Labor Force

Generally, include in the impact area counties in which numerous workers either in the program, or in industries dependent on program outputs, reside. Commuting often separates the residence of workers or owners of processing plants or commercial establishments from their places of work. Therefore, to properly capture and allocate the induced income and employment effects of Forest Service activities, the impact area should include major affected "bedroom" counties. The analyst must determine what constitutes a major bedroom community from data on commuting and residential patterns.

24.2 - Additional Impact Areas

In some situations, it may be important to analyze the impacts on one or more individual counties, as well as a larger impact area. Because analyses of impacts of additional areas using IMPLAN are relatively inexpensive, separate analyses are recommended rather than forcing anomalous situations into a single analysis.

Each impact area is a unique economy with a mix of characteristics, and results of analyses must relate to the characteristic of each area and the reasons why that area was selected.

Though the IMPLAN data base does not include for subcounty areas, it is possible to disaggregate data, if the important economic sectors of interest are concentrated in part of a county, and data on work force residences is obtained by survey. For the methodology, see the IMPLAN analysis manual (sec. 29).

25 - Generating and Modifying Basic Data for Impact Area Using the IMPLAN Data Base

25.1 - Generating and Reviewing County Data

Once the counties within the economic impact area have been selected, the next task is to retrieve the basic data from the data base. The essential required data for each county and for each sector existing in the county is:

1. Final demands: Personal consumption expenditures, gross private capital formation, inventory change, state and local government expenditures, federal government expenditures, and foreign exports.

2. Final payments: Employee compensation, property-type income (rent, interest, and profits), and indirect business taxes.
3. Total industry output.

4. Production employment.

All of the final demand and final payment data are in constant dollars of the data base year. Revisions to the basic data, and data used in applications of the model to program alternatives, must be converted to constant dollars of that base year.

Because these data are estimates based on diverse statistical sources, some of which may be several years old, review the data for each county included in the model. The most crucial, and obvious, review step is making sure that data is obtained for the proper counties. Other checks should pay special attention to sectors that may be affected by the program alternatives, or which are important locally, and comparisons of the total gross output levels with more recent data and local knowledge. For example, determine if important local industries recently changed levels of activity, or have closed, or if new industries moved in.

Check production employment against appropriate recent state and local data to see if employment is still at the approximate levels suggested by the data retrieved. Many sources of employment may not be comparable to IMPLAN data because of differences in data definitions.

In particular, examine data for sectors or industries that are unique to the area, or of "high profile," because of their economic or historical importance. Such industries may have been grouped with somewhat dissimilar establishments in the national sectors. Consequently, the national coefficients may not be representative of the local industry.

25.2 - Modifying Data at the County Level

Modify the basic data retrieved as follows:

1. Correct individual data items for sectors to more current or accurate values based upon the review. This is not difficult, though the procedures of the IMPLAN system must be followed carefully.

2. Delete or add entire sectors to the model. Eliminating a sector because the only plant or plants have closed, or would close under all alternatives, merely requires setting its total gross output to zero. Adding a sector, which is required if a new industry will be created by a program alternative, is more complicated. Estimates of the data listed above must be obtained from a larger area to determine approximate relationships of categories of final demand and final payment, and production employment to total gross output. Refer to guidelines for extending the economic impact analysis (sec. 28.2) and the IMPLAN Analysis Guide.

26 - Developing a Regional Economic Model

26.1 - Steps in Model Development

The steps in developing a regional model are largely computational tasks performed by computer programs that accomplish the following data manipulations:

1. Accumulation of the basic data for each county into totals for the impact area, and construction of a complete transaction table for all sectors. Information from the national interindustry transaction table (Quadrant I in Figure 1) is selected for the sectors present and adjusted for the area. A most important aspect is estimation of the amount of each sector's purchases that come from within the impact area (with the remainder "imported"), as well as the proportion of the outputs that are consumed as final demands or intermediate goods within the area (with the remainder exported).

2. Mathematical inversion of the resulting table or matrix to produce the multipliers. Inversion can be done under two assumptions:

   a. Using an "open" model, which does not include the household sector, produces estimates of direct and indirect impacts but not induced effects. The multipliers computed are Type I.

   b. Using a "closed" model, with the household sector within the inverted matrix, computes induced impacts also. The multipliers computed are Type II. They include the effects of wages, salaries, and other income of the household sector being recirculated in the economy. In the IMPLAN system, Type III multipliers, which provide for changes in the population base, can also be computed.

3. Aggregation of individual sectors should be done before the matrix is inverted.

Analysts must follow the procedures in the user manuals.

26.2 - Aggregating Sectors of the Regional Model

Experience has generally shown that the less the aggregation of impact area models, the more realistic the results. Therefore, aggregation to just a few sectors is unwise, despite cost savings but limited aggregation may be warranted.

If sectors are aggregated, several guidelines apply:

1. Do not aggregate a sector that will be directly affected by a program alternative because aggregation may introduce input requirements or sales of products that are not relevant.

2. Do not aggregate sectors with large total industry outputs in the impact area, even if the final demand for these sectors will not be directly affected by program alternatives.

3. Avoid aggregating sectors with different one-digit Standard Industrial Classification (SIC) codes. Sectors within the same one-digit codes often have a similar pattern of requirements and sales, while those in different groups may not be similar at all.

4. Do not combine industries that are unique to an area or are "high-profile" local institutions. These industries will be of special interest to the public, and thus should be kept separate for ease of identification.

26.3 - Review of Model Results and Multipliers

Review the multipliers resulting from the model. Note unusually large or small values and major differences between groups of industries.

The reasons for the differences can usually be traced to differences in input requirements or in distribution of sales between final consumption, intermediate goods within the area, and exports.

The review should highlight the sectors that will be directly affected by the programs alternatives and locally unique or important industries.

27 - Specifying Economic Changes from Action Programs

Once the economic impact model has been constructed, it may be used to predict changes in the impact area economy. The essential next step in such application of the model is to determine how each program alternative will affect the area economy. This is often the most technically difficult aspect of economic impact analysis, and the one which most calls upon the analyst's knowledge of the local economy and ingenuity in devising approaches.

The primary application of such models in Forest Service planning is to determine the impact of changes in levels of output from alternative plans for National Forests, or from other programs. Other applications are evaluating constraints on the gross outputs of sectors, including limits on program expenditures, regional structure changes, and changes in the labor force.

27.1 - Specifying Changes from Alternative Levels of Program Activities

Program alternatives in natural resource management generally affect local and regional economies in two principal ways. First, the flows of outputs from the program are sold or used in the impact area, often affecting the businesses of many economic sectors. Second, the program must purchase goods and services from the local economy in order to perform the management activities.

The overall strategy in simulating the effect of such changes is to describe them as demands for final outputs expressed in dollars. The model will solve for the indirect and induced impacts. The procedure for converting changes in outputs into changes in final demand is as follows:

1. Identify the outputs that will be changed, the end stage of production (see next section) in harvesting or utilizing them, and their usual units of measure.

2. Determine the changes in outputs from current levels for each alternative.

The impact multipliers may be expressed in the form of response coefficients if the analysis is conducted for one output at a time (sec. 23).

3. Estimate the per unit values at the end stage of production.

4. Allocate per unit values to appropriate sectors in model.

5. Adjust values to constant dollars of the year of the data base.

27.11 - Identify Outputs and Processes

Specify the types of outputs in as much detail as possible. Broad categories such as developed recreation, or dispersed recreation should be reclassified into the various types, since each often has quite different associated expenditures and thus impacts. Timber should be subdivision into types if possible--softwood and hardwood sawtimber and pulpwood, fuelwood, and other products. Minerals should be separated into kinds, since each kind requires specific processing.

At the same time, the process by which the output is harvested, extracted, or used must be considered. The process starts with the output on the land but may extend to various stages of processing or use, depending on circumstances of the resource and the local economy. For example, some timber may be harvested and exported from the region as sawlogs; it should be valued as the final sale to export of logs. Other timber may be processed into lumber (an

intermediate product) within the impact area, and the lumber should be valued as a final demand. Three general possibilities exist for the end stage of the process:

1. The stage (or sector) in which the output is finally consumed. This is the case for most types of recreation and wildlife use;

2. The stage (or sector) in which the output is exported as an intermediate product out of the impact area such as lumber;

3. The stage (or sector) which sells the output into a large competitive market area. Firms buying the output may obtain it from local sources but could as easily buy it from substitute sources elsewhere. Or the output is sold to too many industries to determine the expenditures in further processing.

Some outputs may have no economic impacts or inconsequential ones. They are important only if users pay for them, or incur costs in their harvest, extraction, or use. For example, people walking or berry picking in forests located near their residences may have no additional expense, and no appreciable decrease in other consumption. These activities are thus not part of regional or national income. (This is not a defect of impact analysis but the way income is counted in our economy. If a paid person washes clothes or prepares dinner, it is part of national income; if an unpaid person washes the same clothes or fixes the same dinner, it is not.) Instructions and examples for specific outputs are given in the IMPLAN Analysis Guide (sec. 29).

27.12 - Specify Changes in Physical Units

In most analyses, determine the changes in outputs levels, since such changes in income or employment are the information of interest. In other cases, it may be useful to determine the entire impact of current levels of output, or of total levels under each alternative plan, and those levels can be specified in place of the change.

Specify only the amounts of outputs associated with actual consumption. In some cases, the supply of an output, such as campsite days or forage capacity, may exceed that actually consumed. Outputs evaluated by Forest planning models, when properly formulated, are only those consumed.

27.13 - Estimate Per Unit Values

For each output calculate the value at the end stage of production in harvesting or use. For outputs that are sold as final goods or intermediate process, the appropriate value is the average selling price at the end stage of production specified. For example, if sawlogs are exported from the impact area, the average sawlog value is appropriate. For timber processed by sawmills in the area (after which it is exported or bought by diverse sectors), it is the average price for the products sold by the sawmills. Valid prices can often be obtained from appraisal

information, or from trade sources. These prices usually are not the appropriate price to use in an efficiency analysis.

For most types of nonmarket final consumer outputs, such as recreation, fees (if any) may not represent the importance of their economic impacts. The appropriate values are the average total expenditures required to participate in one unit of the recreational activity, including travel, lodging, meals, and other incremental expenses. Sources of expenditure information are available from expenditure surveys and studies.

Local prices, preferably ones for the data base year, should be used if they are available. Otherwise prices may have to be adjusted to local conditions or adjusted by deflation factors to the base year.

27.14 - Allocating Values to Appropriate Sectors

For raw materials, assign the values to the sectors in the model at the end state of production specified for them. For example, values of sawlogs exported from the impact area should be assigned to the Logging sector; those for lumber processed by sawmills in the area to the Sawmill sector.

Special procedures are necessary for allocating the values of final consumer expenditures typically bought through wholesale and retail channels. Following the conventions in national income accounting, for such purchases only the trade margin or markup is assigned to the wholesale and retail trade sector, the remainder is assigned to the industries that manufacture the goods. These markups represent the value of the distributional services. For many personal consumption expenditures, this requires apportioning the values among numerous industries. Tables of suggested allocations are presented in the IMPLAN Analysis Guide (sec. 29).

27.15 - Adjusting Values to Constant Dollars

If the value data is not available in constant dollars of the base year, adjust the data by dividing them by price deflators. It is better to use deflators specific to individual sectors, if possible, rather than use aggregate national deflators, such as those for the gross national product.

27.2 - Direct and Indirect Changes in Government Expenditures

Three types of activities deserves the analyst's special attention. For each alternative plan, the land management activities of the Forest Service affect the economy not only through the production of outputs but by the purchase of goods and services. If timber is harvested, purchasers may get credits for the roads they build on National Forest land. In addition, the Federal Government shares receipts based on National Forest ownership.

In each case, the procedures for assembling the needed information are similar, though the Forest Service expenditures should be accounted for in the Federal Government sector and the receipt sharing through the State and Local Government sector. Project and allocate the anticipated expenditures or receipt shares needed for each alternative.
Since neither sector is within the usual interindustry transaction matrix (Quadrant I in exhibit 01), the analyst must disaggregate the funds to specific sectors. The first step is to determine the proportion going for salaries. Separate these amounts into types of personal expenditure according to procedures outlined in the IMPLAN Analysis Guide (sec. 29). Allocate the remaining funds using the most logical distribution of expenditures.

27.21 - Forest Service Expenditures

The non-salary expenditures are best distributed according to total Federal expenditures, but not including expenditures for national defense.

27.22 - Purchaser-Credit Roads

Road costs for which timber purchasers are given credit are not included in the selling price. The Federal government in effect pays for the construction of the roads, which become permanent assets. Purchaser credit funds can be handled as "other government expenditures" or as an expenditure in the "New Construction" sectors of IMPLAN. None of these funds go for salaries.

27.23 - Shared Receipts

The shared receipt payments related to National Forest System lands include the receipt-sharing of gross payments collected for outputs. A share (generally 25 percent) is given to state governments for redistribution to counties (the "25-percent fund"). Payments in lieu of taxes (PILT) are also made by the federal government. The payments are generally used for schools and roads. For each alternative, including the current program, estimate the anticipated payments, and determine how individual states distribute the funds.

For money spent on schools, the estimation of effects should be assigned to the State and Local Governments sector. Allocate the proportion spent on salaries according to the distribution of personal expenditures, and the remainder through the distribution of public school expenses given in the IMPLAN Analysis Guide. Assign payments spent on roads to the "New Construction sector".

28 - Estimating Economic Impacts

28.1 - Economic Impact Calculations

The analyst determines the total economic impacts from each alternative on each sector by aggregating the changes in final demand as estimated from each change in output and

government activity. These aggregate changes are multiplied by the appropriate multipliers for each sector. In the IMPLAN system subprogram IMPACT is used to calculate the total impacts.

Tables are normally produced for both Type I multipliers, including the direct impacts, and Type II or Type III multipliers, which include the induced impacts of recycling the amounts spent by household on additional demands. These output tables show the changes in final demand, employee compensation, property-type income, total income, value added, and employment (number of jobs). Using the IMPLAN system they are also produced by the subprogram IMPACT. These impacts for separate sectors can be grouped or aggregated for ease of presentation.

28.2 - Extensions of Economic Impact Analysis

The analyst must consider several extensions of input-output analysis that have been developed to contend with limiting assumptions of the methodology. All of the following extensions are currently part of the IMPLAN system. Specific instructions are given in the IMPLAN Analysis and User Guides (sec. 29).

28.21 - Supply-Constrained Industries

An underlying assumption of input-output analysis is that the supply of any product to meet demand is potentially unlimited. Any sector can expand indefinitely as long as demands for its products increases.
Since this assumption is not always true, the analyst can specify that outputs of some sectors may be limited by resource constraints, while outputs of other sectors are solved by usual input-output techniques. The analyst must supply the limits of output of the constrained sectors from information outside the model.

Review the results from such analysis closely since the outputs of industries that require the products of constrained sectors may be too high, and are thus inconsistent. These additional industrial sectors in turn must be constrained also, and the analysis repeated.

28.22 - Structural Change

Another assumption of standard economic impact analyses is that industrial sectors not present in the original economy will not move into the impact area. If certain industries are apt to move into the area (or are required to harvest, extract, or use the outputs to be produced), then the analyst must modify the model to represent the new industries.

Inserting a new industry requires estimates of the approximate size of the industry, either in terms of total gross output or employment, and corresponding estimates of employee compensation, property-type income, and indirect business taxes. The proportions of these components of final payments may be approximated from data from another state in which that sector is active. Reanalysis of the model can be conducted under several assumptions:

1. Existing industries will not expand to meet the input requirements of the new industry, though some existing imports may be redirected to it.

2. All existing industries will add capacity to meet the input requirements of the new industry, and that new industries may in turn be attracted to the impact area.

Depending on the time frame of the analysis, the development of the economy in the impact area may be somewhere between these assumptions. The IMPLAN analysis guide should be consulted for procedures in handling new sectors.

28.23 - Labor Force Utilization

The analyst must also consider the assumption of input-output analysis that each new job is filled by someone from outside the impact area--that is, there is full employment within the impact area. Thus, when employment expands, each new employee would spend an additional amount, similar to existing workers.

In most cases, some new jobs would be filled by those unemployed, or underemployed, in the impact area. Instead of spending like another worker that migrates into the area, such new jobholders would spend in addition only the difference between the pattern of expenditures while unemployed, on welfare, or as underemployed and the pattern of expenditures with larger income when fully employed.
Procedures have been developed in the IMPLAN system to specify a pool of unemployed labor by category, from which new jobs are first filled. Only when the pool is empty, do new workers migrate in. In the reverse, when jobs are lost through changes in output from alternatives the pool enlarges.

29 - References

Useful methods and analyses can be found in the following publications:

Alward, Gregory S.; Palmer, Charles J. 1983. IMPLAN: An input-output analysis system for Forest Service planning. Proceedings of the First North American Conference on Forest Sector Models, 1981, Williamsburg, Virginia. A B Academic Publishing, Oxford. p 1231-140.

Miernyk, W. H. 1965. The elements of input-output analysis. Random House, New York, NY. 156 p.

Miller, Ronald E.; Blair, Peter D. 1985. Input-output analysis: foundations and extensions. Prentice-Hall. Englewood Cliffs. NY. 464 p.

USDA Forest Service. 1985. IMPLAN Version 1.1: analysis guide. Land Mgt. Plan. sec., USDA Forest Service, Fort Collins, CO. vp.

USDA Forest Service. 1983. IMPLAN User's guide. Land Mgt. Plan. Sec., USDA Forest Service, Fort Collins, CO. vp.

The components, or quadrants of the table, are as follows:

1. The upper left quadrant (I) has rows and columns for each industry sector, numbered from 1 to N. The columns indicate the industries from which each industry buys its intermediate goods; the rows indicate where each industry sells its output. Firms in each industry often buy and sell to others in the same industry.

2. The upper right quadrant (II) shows the amount of sales of each industry, from 1 to N, to final consuming sectors-- household, government, capital expenditure, and exports from the impact area to all areas outside. The sum of each complete row--sales to both other industry and final consumers--is the total gross output of the industry.

3. The lower left quadrant (III) indicates the purchases of each industry (or payments) for basic factors of production-- wages for labor, indirect taxes to government, rental and other property type income, depreciation (or the consumption of capital), and for imports from outside the impact area. The entire column for each industry sums to the total gross outlays, which equal the total gross output on the right border.

4. The lower right quadrant (IV) records the primary inputs into final demand sectors, such as salaries of government employees and imports from outside the impact area consumed directly by households.