

Details of the IMPLAN economic impact analysis for the Flathead Forest Plan EIS

The USDA Forest Service has a multiple-use mission to manage various forest resources such as timber, recreation, range, minerals, wilderness, fish, and wildlife, state and private forestry programs, etc. The Forest Service has used the input-output model, IMPLAN (IMpact analysis for PLANning) to assess the economic significance of various programs and activities at national, regional and forest levels. IMPLAN was originally developed by the Forest Service in the 1980's to estimate the economic impact of land management planning. Since the 1990's IMPLAN has been privatized, managed, and enhanced by the Minnesota IMPLAN Group (now named the [IMPLAN Group LLC](#)). The Forest Service uses the IMPLAN database and modeling system to carry out economic impact studies of the consequences of Agency decisions and proposed actions and to describe the current economic contribution of natural resource management on the National Forests and Grasslands.

Over many years, Forest Service economists have addressed changing economic issues by developing and updating a suite of tools, methods, data, and training. IMPLAN "out of the box" is a very generic economic impact modeling system so the Forest Service has invested in add-on applications using Visual Basic and Microsoft Excel, tailored to the requirements of Forest Service planning, research and policy analysis. A suite of tools has been developed and used for economic impact analysis in many applications, among them; affected environment analysis, forest and project planning, rural community diversity and dependency analysis, strategic planning, policy analysis, monitoring and recently for supporting the American Recovery and Reinvestment Act effort. In addition, these tools have been used by the Department of Interior (DOI) to analyze the economic contribution of DOI programs, management, and stimulus investments and by DOI Bureau of Land Management for several resource management plans.

For the Flathead National Forest Plan EIS, the Forest Service's primary tool for economic contribution and impact analysis, called Apheleia, was used to develop a Forest-level model, and populated with the most current data. The range of input data included: expected resource outputs from the Forest including all forest product related wood volume, estimated recreation and wildlife related visits, mineral extractions, permitted grazing AUM's, and a number of other model inputs including: budget estimates, Forest Service employee salaries, and Federal land payments. In Aphelia, these inputs are then converted into activities and scenarios for a custom IMPLAN model, with a Forest multi-county area selected.

IMPLAN utilizes input/output modeling techniques developed by economists to predict outcomes in jobs, income, and taxes from isolated economic events, or changes to industries. Input/output modeling requires inversion and other mathematical principles of matrices to stage and trace multiple rounds of business transaction across industries, as the multi-county industries adjust to meet final demand of the modeled impact. Using these mathematical principles, the custom model built for Aphelia traces the aggregated changes to demand in the multi-county area from FS operations and resources, and estimates labor income and jobs that would fulfill this demand. Using county business patterns, NAICS coded data, and leakage coefficients customized to the area, the model determines to what degree contributions to the economy remain in the given geographic set for the model.

The data input into the model is detailed. Figure 1 shows a screen shot of the Apeleia software and recreation visitation data provided in subcategories across alternatives including: local, non-local, day, overnight, downhill skiing, and wildlife fish activities. Figure 2, similar to Figure 1, shows estimated biomass, post and poll and timber harvest CCF; and approximately 45 different types of mineral and energy resource production estimates; all by alternative of the FEIS. Finally, Figure 3 shows some of the FS operations data including estimated payments to counties and states; estimated operations expenditure ratios including salary expenditures.

Figure 1. Example of Flathead Apeleia model recreation and range inputs

Date=> 05/28/16 Select a National Forest

Forest=> 0110 - Flathead NF 0110 Yes

This is a major shift from FEAST modeling methodology. User-defined activities are available for Ecosystem Restoration.

| Resource Type | Output/Outcome Description | Units | Average Annual Quantity by Alt ==> | | | | |
|--------------------|---|--------|------------------------------------|---------|---------|---------|---------|
| | | | Current | A | B Mod | C | D |
| Recreation | NL-Day Trips | Visits | 151,246 | 151,246 | 151,246 | 151,246 | 151,246 |
| Recreation | NL-OVN-NF | Visits | 31,292 | 31,292 | 31,292 | 31,292 | 31,292 |
| Recreation | NL-OVN | Visits | 20,862 | 20,862 | 20,862 | 20,862 | 20,862 |
| Recreation | L-Day Trips | Visits | 281,631 | 281,631 | 281,631 | 281,631 | 281,631 |
| Recreation | L-OVN-NF | Visits | 31,292 | 31,292 | 31,292 | 31,292 | 31,292 |
| Recreation | L-OVN | Visits | 5,215 | 5,215 | 5,215 | 5,215 | 5,215 |
| Recreation | NonLocal Downhill Skiing Day | Visits | 34,186 | 34,186 | 34,186 | 34,186 | 34,186 |
| Recreation | NonLocal Downhill Skiing OVN | Visits | 80,802 | 80,802 | 80,802 | 80,802 | 80,802 |
| Rec NL Use Defined | NonLocal Recreation User Defined Category 3 | | 0 | 0 | 0 | 0 | 0 |
| Rec NL Use Defined | NonLocal Recreation User Defined Category 4 | | 0 | 0 | 0 | 0 | 0 |
| Rec NL Use Defined | NonLocal Recreation User Defined Category 5 | | 0 | 0 | 0 | 0 | 0 |
| Recreation | Local Downhill Skiing Day | Visits | 192,682 | 192,682 | 192,682 | 192,682 | 192,682 |
| Recreation | Local Downhill Skiing OVN | Visits | 3,108 | 3,108 | 3,108 | 3,108 | 3,108 |
| Rec L Use Defined | Local Recreation User Defined Category 3 | | 0 | 0 | 0 | 0 | 0 |
| Rec L Use Defined | Local Recreation User Defined Category 4 | | 0 | 0 | 0 | 0 | 0 |
| Rec L Use Defined | Local Recreation User Defined Category 5 | | 0 | 0 | 0 | 0 | 0 |
| Range | Cattle and Horses AUMs | AUMs | 2,960 | 2,960 | 2,960 | 2,960 | 2,960 |
| Range | Sheep and Goats AUMs | AUMs | 0 | 0 | 0 | 0 | 0 |
| WildlifeFish | NL-Day Trips | AUMs | 27,839 | 27,839 | 27,839 | 27,839 | 27,839 |
| WildlifeFish | NL-OVN-NF | AUMs | 4,640 | 4,640 | 4,640 | 4,640 | 4,640 |
| WildlifeFish | NL-OVN | Visits | 6,960 | 6,960 | 6,960 | 6,960 | 6,960 |
| WildlifeFish | L-Day Trips | Visits | 200,952 | 200,952 | 200,952 | 200,952 | 200,952 |
| WildlifeFish | L-OVN-NF | Visits | 11,599 | 11,599 | 11,599 | 11,599 | 11,599 |
| WildlifeFish | L-OVN | Visits | | | | | |

Figure 2. Example of Flathead Apeleia model forest products and mineral inputs

Change Date to Today Add Regional Unit Code to Forest Name

Date=> 05/28/16 Select a National Forest

Forest=> 0110 - Flathead NF 0110 Yes

| WFL Use Code | Local Wildlife & Fish User-Defined Category 3 | CCF | 21,850 | 31,816 | 30,369 | 21,692 | 32,780 |
|--------------|---|-----|--------|--------|--------|--------|--------|
| Timber | Harvest-Softwood Sawtimber | CCF | | | | | |
| Timber | Harvest-Softwood Pulp | CCF | | | | | |
| Timber | Harvest-Hardwood Sawtimber | CCF | | | | | |
| Timber | Harvest-Hardwood Pulp | CCF | | | | | |
| Timber | Poles | CCF | | | | | |
| Timber | Posts | CCF | 200 | 294 | 281 | 200 | 303 |
| Timber | Fuelwood | CCF | 10,927 | 16,058 | 15,328 | 10,948 | 16,544 |
| Timber | All Other Products | CCF | 12,135 | 17,833 | 17,022 | 12,159 | 18,373 |

Note: Assignment of old FEAST mineral categories to the new IMPLAN 536 sector scheme was based on 2012NaicsToImplan536.xlsx when the 440 to 536 industry bridge provided this data is part of Aphy and be downloaded from: http://implan.com/index.php?view=document&alias=255-2013-naics-to-implan-bridge&category_slug=2013-data-informa

| IMPLAN Sector | Minerals | Current | A | B Mod | C | D |
|---------------|-------------------------|--------------|---|-------|---|---|
| 20 | Natural Gas: 20 | M Cubic Feet | | | | |
| 20 | Crude Oil: 20 | Barrels | | | | |
| 20 | Carbon Dioxide: 20 | M Cubic Feet | | | | |
| 20 | Nitrogen: 20 | M Cubic Feet | | | | |
| 20 | Sulfur: 20 | Long Tons | | | | |
| 21 | Natural Gas Liquids: 21 | Gallons | | | | |
| 22 | Coal Mining: 22 | Short Tons | | | | |
| 23 | Iron Ore Mining: 23 | Short Tons | | | | |
| 24 | Copper: 24 | Short Tons | | | | |
| 24 | Gold: 24 | Troy Ounces | | | | |
| 24 | Molybdenum: 24 | Short Tons | | | | |
| 24 | Silver: 24 | Troy Ounces | | | | |
| 25 | Silver Ore Mining: 25 | Troy Ounces | | | | |
| 26 | Lead: 26 | Short Tons | | | | |
| 26 | Zinc: 26 | Short Tons | | | | |
| 27 | Copper: 27 | Short Tons | | | | |
| 27 | Gold: 27 | Troy Ounces | | | | |
| 27 | Molybdenum: 27 | Short Tons | | | | |
| 27 | Silver: 27 | Troy Ounces | | | | |

Figure 3. Example of Flathead Apeleia model Forest and county inputs

Forest Financial Data Entry

Open Apeleia Command Center

| Secure Rural Schools Act full payments, and/or 25% , and PILT payments | | | | | | |
|--|------------------------------|----------------|----------------|----------------|----------------|----------------|
| Payments to Counties | Total Payments to Counties | \$1,000 | \$2,333 | \$2,333 | \$2,333 | \$2,333 |
| | Total PILT Payments | \$1,000 | \$2,741 | \$2,741 | \$2,741 | \$2,741 |
| Enter Percent of Payment Used For: The percents in the 4 cells below MUST add to 100 percent for each alternative the | | | | | | |
| Payments Percent | Roads | percent | 0.43 | 0.43 | 0.43 | 0.43 |
| | Schools | percent | 0.43 | 0.43 | 0.43 | 0.43 |
| | General Govt | percent | 0.01 | 0.01 | 0.01 | 0.01 |
| | Title II Projects | percent | 0.14 | 0.14 | 0.14 | 0.14 |
| | Total | percent | 100.00% | 100.00% | 100.00% | 100.00% |
| Mineral Payments | Minerals Other25/NotIncluded | \$1,000 | | | | |
| | Minerals Div_Non25_Dist | \$1,000 | | | | |
| Enter Percent of Payment Used For: The percents in the 4 cells below MUST add to 100 percent for each alternative the | | | | | | |
| Min Payments Percent | Roads | percent | 50% | 50% | 50% | 50% |
| | Schools | percent | 50% | 50% | 50% | 50% |
| | General Govt | percent | | | | |
| | Total | percent | 100.00% | 100.00% | 100.00% | 100.00% |
| Total Distributed Payments to Counties | Roads | \$1,000 | \$991 | \$991 | \$991 | \$991 |
| | Schools | \$1,000 | \$991 | \$991 | \$991 | \$991 |
| | General Govt | \$1,000 | \$2,757 | \$2,757 | \$2,757 | \$2,757 |
| | Title II Projects | \$1,000 | \$333 | \$333 | \$333 | \$333 |
| Total Distributed Mineral Payments | Roads | \$1,000 | \$0 | \$0 | \$0 | \$0 |
| | Schools | \$1,000 | \$0 | \$0 | \$0 | \$0 |
| | General Govt | \$1,000 | \$0 | \$0 | \$0 | \$0 |

Secure Rural Schools Act full and/or 25% payments PLUS Minerals

An appropriate multi-county area IMPLAN model was uploaded into Apeleia. Apeleia input data was then entered into the software from various Forest-level sources. Data obtained from other resource programs documented in the EIS were provided including estimated: recreation visitation, timber and forest product harvest, mineral extraction, federal land payments, and forest service operations; by alternative. Modeled data was not substantially altered across alternatives, with the exception of timber harvests, because resource program reports did not identify or estimate substantial differences across alternatives.

Apheleia was also used to alter imported IMPLAN model data by setting leakage coefficients and household spending profiles to a geography related baseline values. Apheleia was then run to generate model results.

In Figure 4, an example is shown of program-level model results, highlighting jobs, revenues, and taxes by resource programs. In Figure 5, final EIS table results are aggregated for EIS reporting.

Figure 4. Example of Flathead Apheleia model impact tables

Employment, Income and Tax Impacts

Open Apheleia Command Center View [Report All Impacts](#) Worksheet

0110 - Flathead NF: National Forest
 Result YEAR: 2014
 For Alternative: Current
 Region Contact: Jordan Larson jordanlarson@fs.fed.us

| RESOURCE PROGRAMS | Employment (Jobs) | Employee Compensation (M\$) | Employee Comp/Job (\$) | Labor Income (M\$) | Total Income (M\$) |
|-----------------------------------|-------------------|-----------------------------|------------------------|--------------------|--------------------|
| Recreation All Other: non-local | 368 | 6,784 | 18,412 | 8,339 | 11,752 |
| Wildlife & Fish Rec: non-local | 31 | 616 | 20,197 | 796 | 1,109 |
| Livestock Grazing | 5 | 227 | 45,005 | 167,9215 | 281 |
| Timber Products | 345 | 13,730 | 39,795 | 16,016 | 23,756 |
| Minerals & Energy Production | 0 | 0 | 24,290 | 0 | 1 |
| EcoSystem Restoration | 0 | 0 | 0 | 0 | 0 |
| Payments to States/Countries | 125 | 4,493 | 36,063 | 5,008 | 6,526 |
| FS Resource Mgmt Investments | 506 | 18,392 | 36,384 | 20,110 | 23,501 |
| Total Forest Management | 1,379 | 44,244 | 32,080 | 50,437 | \$66,925 |
| Forest Total as a % of Total Area | 1.54% | 0.00154% | | 0.00148% | 0.00132% |

Includes Non-Local Recreation and Fish & Wildlife 108

| ECONOMIC SECTORS | Employment (Jobs) | Employee Compensation (M\$) | Employee Comp/Job (\$) | Labor Income (M\$) | Total Income (M\$) |
|-----------------------------------|-------------------|-----------------------------|------------------------|--------------------|--------------------|
| Agriculture | 108 | 2,543 | 23,470 | 3,307 | 3,699 |
| Mining | 15 | 48 | 3,186 | 218 | 344 |
| Utilities | 2 | 219 | 107,366 | 259 | 493 |
| Construction | 23 | 597 | 26,061 | 928 | 1,216 |
| Manufacturing | 154 | 6,477 | 42,190 | 6,548 | 10,524 |
| Wholesale Trade | 24 | 1,279 | 53,698 | 2,192 | 2,956 |
| Transportation & Warehousing | 20 | 787 | 39,229 | 1,073 | 1,569 |
| Retail Trade | 115 | 2,830 | 24,706 | 3,350 | 4,027 |
| Information | 11 | 492 | 46,355 | 547 | 1,241 |
| Finance & Insurance | 21 | 1,134 | 53,742 | 1,200 | 1,785 |
| Real Estate & Rental & Leasing | 46 | 306 | 6,712 | 632 | 6,543 |
| Prof. Scientific, & Tech Services | 70 | 1,220 | 17,354 | 2,349 | 2,619 |
| Mngt of Companies | 3 | 279 | 99,795 | 278 | 328 |

Figure 5. Example of Flathead Apheleia model EIS tables

There are resource programs that are intentionally not covered in a Forest Service IMPLAN economic impact analysis for forest planning. Restoration activities are not included in forest plan revision impact models because restoration activities can be measured and analyzed in much greater detail at the project level, where more complete cost-benefit and impact analyses can be conducted, using other forest service project analysis tools. At the planning level, it remains unknown where and to what extent restoration activities will occur, and with what available funding. Ecosystem Services are also not included in the IMPLAN economic analysis for forest plans. Ecosystem services are not directly linked to economic industry data, and though they provide tremendous benefits including what economist describe as “consumer surplus”, jobs and income are not the most direct, or important benefits from ecosystem services. The state of ecosystem service sciences is acknowledged by the 2012 planning rule which refrains from requiring this type of analysis, but instead requires an internal process to identify key ecosystem services for each forest, and to describe risks and stressors which may link to the delivery of key services.