Appendix B - Description of the Analysis Process

Planning Situation

The National Forest Management Act (NFMA) directs each national forest to prepare a comprehensive land and resource management plan. The Chugach National Forest produced its first comprehensive Forest Plan in July 1984. The NFMA also directs that these management plans be revised at least every 15 years. The Chugach National Forest began the revision process in 1997 and published an Analysis of the Management Situation (AMS) in April 1998.

The purpose of this appendix is to present a discussion of the analytical processes used in the planning process. This discussion includes basic assumptions, analytical processes, methods, and constraints. The information supplements the broader, less technical descriptions included in the body of Chapter 2 and 3 of the FEIS. Additional information and documents used in the analysis process are contained in the planning record. The planning record in its entirety is incorporated here by reference.

Inventory Data and Information Collection

There are two general categories of data used in Chugach planning, spatial and tabular. A spatial database is, for all practical purposes, a map or electronic representation of a map (often referred to as a GIS “coverage”). Tabular data is something like economic information or timber growth and yield tables. These attributes cannot be mapped unless linked to some spatially known feature from a GIS coverage.

Overview. The inventory step of the planning process consists of the collection, development, and documentation of data to address the public issues, management concerns and resource opportunities. Two basic types of information are needed to facilitate the analysis and development of alternatives. The first consists of information related to the classification of land into categories with unique properties. This classification can be based on any attribute significant to planning issues. This type of information is tied directly to the map base. In the case of the Chugach National Forest, this map base is its GIS corporate database.

The second type of information is not directly tied to a map base, but has more to do with the estimation of how land will respond to certain management activities. This type of information comes from many sources: Regional procedural handbooks, resource assessment studies, research studies, available literature, etc. The most up-to-date and verifiable information available was used for the FEIS.

Database Development. Starting in 1988, a computerized GIS was developed for the Chugach National Forest Plan revision. A GIS links natural resource data with spatial (mapped) information. This linkage enables valuable spatial analysis and rapid display of resource information for forest planning. Automating resource information for the Chugach National Forest's 5.45 million acres has taken several years.

To capture the information for rapid retrieval in tabular form, data is stored in 631,528 grid points. These grid points are equivalent to capability areas, which are the smallest units of land (or water) for which data are collected in forest planning. They are discrete and recognizable units classified primarily according to physical (soil), biological (vegetation), and issue (wilderness status) factors. All land within a capability area is assumed to be homogeneous in its ability to produce resource outputs and in its production limitations. Each capability area represents approximately 10 acres. Placing a point in the center of each 10-acre cell developed a dot grid. The resource specialists then decided what information was needed for each capability area in order to assess resource opportunities and public issues. This information was collected and entered into the GIS. The point grid was then overlaid with the map information contained in the GIS. The map information under each point was then assigned as an attribute of the point. The map information from more than 50 different physical, biological, or administrative overlays was assigned to each point. An additional set of attributes was added to each point as derived coverages (i.e., covers derived from processes involving multiple coverages and models).

These attributes, as determined for each capability area, are stored in computer files to form the Chugach Land and Resource Management Plan revision database. The Chugach uses the ARC/INFO Geographic Information System (GIS). Once entered into the system, information on capability areas was retrieved, sorted, aggregated, and analyzed by various resource specialists on the Interdisciplinary (ID) Team.

Alternative Development and Analysis. Public issues, resource opportunities, and management concerns were the major elements used to reassess the management situation and to identify what might need to change in the current plan. The need to reassess led to formulations of alternative themes to respond to the analysis of the management situation and public comment. This FEIS contains eight alternatives. Each alternative represents a particular theme; from an emphasis on activities associated with non-development (Alternative F) to one of maximum commodity development (Alternative A).

The use of inventory data allows accurate reflection of the land base and provides the basis for scheduling activities and outputs. The Forest's database was used to identify those areas in need of special consideration (e.g., sensitive brown bear habitat) as alternatives were being developed.

Implementation and Monitoring. The inventory data will aid in the implementation of site-specific projects identified in the forestwide plan. Also, the inventory data will continue to be updated as new information is obtained through

monitoring. Data obtained from the evaluation of site-specific activities will be incorporated into the database for future estimates and planning analysis. Changes in the data and analysis procedures and results and findings from monitoring will be reported annually.

Geographical Information System Data Layers. Many different physical, biological, and administrative layers of resource related information are contained in polygonal form in the GIS. These layers formed the basis for the resource data used for programmatic analysis. Some of the commonly used GIS coverages are:

Administrative sites	Research Natural Areas
Aspect	Riparian areas
Biogeographical Provinces	Roadless Areas
Cliffs	Tentatively Suitable Forest Lands
Cultural Sites	Timber type map
Elevation	Tour ship and ferry routes
Eligible Wild, Scenic and Recreation Rivers	Trails
Estuaries	Wildlife Analysis Areas
Existing and potential Log Transfer Facilities (LTFs)	Wildlife Habitat
Existing Eagle Nests buffered 330 feet	USGS Quadrangles for the Chugach National Forest
Existing Recreation Places	Visual Resource inventory (VAC, distance zone)
Existing Recreation Sites	Watershed Associations (WAs)
Existing Roads	Slope
Forest watersheds	Soils
Lakes	Special Interest Areas
Land Status	Special Uses
Managed Timber Stands	Streams by process group and stream class
Minerals (known and inferred)	Structures
Potential arterial road and transmission corridors	Subsistence Use Areas
Primary Base Series Shoreline	

For a detailed description of the attributes available on these data layers, consult the Resources Information Management Data Dictionary, USDA Forest Service, Region 10, August 1995.

The Forest Planning Model

In a departure from normal Forest Service forest planning, the Chugach National Forest used a collaborative learning process with the public to identify issues and concerns; develop management area prescriptions, standards and guidelines, alternative themes and the range of alternatives, and finally, to allocate lands via the assignment of management area prescriptions for each alternative.

Because the primary resource emphasis on the Forest is for management of the recreation, fish and wildlife resources, the Forest did not use a traditional linear program such as FORPLAN or SPECTRUM to develop timber resource benchmarks, model and assign land allocations (management area prescriptions), or to model and calculate timber resource outputs resulting from the land allocation process.

Benchmark analysis and forest outputs associated with the land allocation process were calculated by means of Excel spreadsheets. A benchmark is a set of values that indicate a maximum (or minimum) level of production capable under certain, often limited, constraints. Benchmark reports are available in the Analysis of the Management Situation (AMS). Forest activities and outputs for each alternative are contained in Chapters 2 and 3 of the FEIS.

Management Area Prescription Development

A management area prescription defines what management activities and practices are allowed or not allowed on a specific area of land. The planning process concerns the allocation of land to various management area prescriptions.

Prescriptions were developed by the Interdisciplinary Team to represent the full range of possible management activities and outputs. The Interdisciplinary Team, during its collaborative development of standards and guidelines with the public for all prescriptions, ensured that the specific management requirements set forth in 36 CFR 219.27 would be met in accomplishing the goals and objectives for the Chugach.

Alternative Development

A forest plan alternative is a mix of management area prescriptions applied in specific amounts to areas of the Forest to achieve desired management objectives and goals. Each alternative within the range of alternatives was developed in accordance with the National Forest Management Act (NFMA). The alternative development process also follows National Environmental Policy Act (NEPA).

The alternative development process began in 1999 with a review of Forest issues, concerns, opportunities, and resource inventories; resource production capabilities identified in the analysis of the management situation; and applicable planning direction. Based on a review of these items, resource management options were developed. These management options were designed to

incorporate issues, reflect a particular level of management emphasis, and serve as a potential building block for Forest management alternatives.

In a collaborative learning process, the Interdisciplinary Team and the public then identified alternative themes. Alternatives were then developed by both the Interdisciplinary Team and members of the public to meet a variety of issues, concerns, and objectives. In all, 31 initial alternatives were developed. After identifying the differences and commonalities in the initial 31 alternatives, eight alternatives emerged from the process. These range from a non-market emphasis (Alternative F) to a production emphasis (Alternative A) to a representation of the 1984 Forest Plan (No Action Alternative).

Once the alternatives were drafted, the Interdisciplinary Team quantified the activities, outputs, costs, and benefits that would occur when these prescriptions were applied to a given unit of land. This quantification process produced the management activity output, cost, and benefit figures that are used in Chapters 2 and 3 of the FEIS.

Environmental Effects Analysis and Estimation

The GIS enables identification and stratification of land into logical groupings such as watersheds and management areas. The response of these groups to management activities was determined from a wide variety of existing data. All assumptions and effects estimates made in the analytical process have been developed from the following information sources.

1. Codes and definitions for many of the activities, outputs, and effects come directly from the National Activity Structure Handbook (FSH 1309.16).
2. The timber values and costs relating to timber harvest have been calculated using the most recent appraisal data that is available for Southcentral Alaska.
3. Old-growth timber yields are based on the timber type map and standing volume re-inventory.
4. Yields for regenerated second growth timber stands were derived from adjusted yield tables for western hemlock/Sitka spruce and/or white spruce.
5. Average percent utility volume and defect by geographic area was determined from the historical timber harvest data from the Forest and/or from the most recent appraisal data.
6. Alaska Department of Labor and the Forest Service IMPLAN Model were used to estimate future regional employment and income by resource.
7. The cost of construction and reconstruction of log transfer facilities (LTFs) is based on individual facility estimates and location.

Wildlife Analysis

For the Chugach National Forest revision, the habitat needs for sustaining viable populations of individual species are addressed in two ways. First, we used a coarse filter assessment to determine the level of protection offered through the land management prescription categories. Next, we reviewed the species on the Forest to determine if any species needed further analysis because they were at risk of not maintaining viable populations due to management. These management actions and conditions needed to ensure viable populations are addressed by guidelines for specific species or species groups. This is the fine filter approach to biological conservation.

The steps followed for the revision of the Forest Plan included:

1. developing the Analysis of the Management Situation (USDA Forest Service 1998b);
2. evaluating the risk to viability of wildlife species (Suring and Murphy 1998);
3. developing conservation assessments for endemic species and species with risks to viability (Poe and Murphy 1999, Lance 1999a, Lance 1999b, Howell 1999);
4. developing a proposed list of management indicator species;
5. considering various strategies for maintaining habitats for viable populations well distributed;
6. applying coarse and fine filter considerations during development of alternatives;
7. assessing the effects of the alternatives on the management indicator species and species with risks to viability; and,
8. developing monitoring questions and information needs.

All species not individually addressed under species assessments are addressed through a “coarse” filter or ecosystem approach.

The fine filter assessment itself is composed of three parts: 1) the management indicator species (MIS) and species of special interest (SSI); 2) Forest Service sensitive species (Biological Evaluation); and, 3) the Biological Assessment (BA) disclosing effects to threatened or endangered species. The Biological Assessment, along with documentation of correspondence related to the BA, is found in Appendix J of the FEIS.

Protection measures designed to provide habitat capability for those species addressed with the fine filter are evaluated. Implementing the protection measures will prevent sensitive species from trending toward listing as threatened or endangered as a result of proposed management activities on the Forest.

The Management Indicator Species (MIS) will be used to depict changes and effects by alternative and will be monitored and evaluated during Revised Forest Plan implementation.

Typically, habitat suitability index (HIS) models would be used to estimate existing and future habitat capability for each MIS. Habitat suitability models for the MIS have been developed for black oystercatchers, Kenai brown bear (Suring et al. 1998), moose, and mountain goats. No model has been developed for dusky Canada goose. Modeling of habitat suitability can produce misleading results without consideration for random environmental events such as spruce bark beetle epidemics and tectonic uplifts. Another limitation of HIS modeling is a requirement for a vegetation classification that is available for the entire area of interest. Differences in vegetation classification schemes make it difficult to compare model results. For this analysis, we have used the Moose HIS model (Lottsfeldt-Frost 2000) to represent likely outcomes regarding habitat suitability between alternatives. The moose HIS model is not appropriate for population viability and is not used in that regard.

The viability analysis followed the general outline of panels used for the viability analysis on the Tongass National Forest. Each species was considered using the available information about habitat requirements, the direct, indirect and cumulative effects of management actions or activities on the habitat for each species, and one of five outcomes was determined for each species considered.

- **Outcome I.** Habitat is of sufficient quality, distribution, and abundance to allow the species to maintain well distributed, breeding populations across the Chugach National Forest. The concept of well distributed must be based on knowledge of the species distributional range, and life history.
- **Outcome II.** Habitat is of sufficient quality, distribution, and abundance to allow the species to maintain breeding populations distributed across the Chugach National Forest. However, some local populations are more ephemeral because of reduced population levels and increased susceptibility to environmental extremes and stochastic (random) events associated with reduced habitat abundance and distribution. Vacated habitats may become recolonized in the future.
- **Outcome III.** Habitat is of sufficient quality, distribution, and abundance to allow the species to maintain some breeding populations, but with significant gaps in the historic distribution on the forest. These gaps are likely permanent and will result in some limitation of interactions among local populations. The significance of gaps must be judged relative to the species distributional range, and life history.

- **Outcome IV.** Habitat only allows continued species existence in refugia, with strong limitations on interactions among local populations. The significance of extirpations across islands or regional landscapes must be evaluated relative to the species distribution, range, and life history.
- **Outcome V.** Habitat conditions result in species extirpation from federal land.

The management indicator species, threatened, endangered, and sensitive species, and the species of special concern were considered in the assessment of the effects of the alternatives. A 100-year time period was considered.

All available information was considered, along with professional judgment in making the outcome determinations. The following information was used in making the outcome determinations.

Projections of the direction, rate, and amount of habitat change for the Kanai and Copper River Delta were determined through the vegetation modes.

Habitat distribution in spatial terms was described and described using the GIS information database. In particular, we used the wildlife habitat matrix as developed by Buchholtz and Poe (2000). We considered land ownerships and levels of habitat protection at three different scales: ecoregion, forest, and geographic areas (Kenai, Prince William Sound, and Copper River Delta). The distributions of wildlife habitats and categories of land management prescriptions were considered at the Forest, geographic, and watershed association scales.

Stressors (factors other than lack of habitat that place species at risk) were addressed through standards and guidelines at the Forest and management area prescription levels that provided fine scale habitat features (buffers or seasonal restrictions) (Murphy et al. 1999).

Landscape measures that reflected stressors (e.g., net changes in road miles, trail miles, or road density).

Measures to manage human activities (special use permitting, timing, seasonal area closures).

Current wildlife populations and their status relative to human uses were considered, as were unusual landscape scale disturbances; spruce bark beetle mortality and Copper River succession following tectonic uplift.

The cumulative effects of past management and management of non-forest lands within and adjacent to the Forest were considered.

Recreation Analysis

Introduction

The Recreation/Tourism Situation and interests revolve around three specific areas of: recreation settings, recreation facilities and recreation activities.

The complexity of the interests involves the full range of recreation opportunities currently available on the Chugach National Forest.

Recreation Settings

For recreation settings, the Recreation Opportunity Spectrum (ROS) process was used. The current ROS settings were inventoried (1998) to assess the existing mix of recreation settings (inventoried ROS). As a part of each management area prescription, specific ROS class ranges were identified, consistent with the intent of the prescription. Based on the prescription applied to a given area, the ROS classes were mapped with the assistance of the groups that proposed them, for each alternative, assigning a specific ROS class within the range identified in the prescription (prescriptive ROS).

The mix of recreation settings in each alternative was compared against the situation and interests to assess how well the alternative responded to the situation and interests.

Recreation Facilities

Using the interpretations of data in the Recreation and Tourism Assessment, several activities are expected to grow, requiring some type of facility to support them. While most activities are anticipated to show some growth over the life of the plan, growth in camping, cabin use and day-use activities are expected to increase the most.

The Chugach National Forest has been updating and revising the methods used in counting visitors to the Forest. This process began in 1996 and was generally complete in 1998, the last year of data on the Forest.

To analyze anticipated growth and what or how many facilities may be needed to accommodate the increase in use, the data from 1998 was used. While data exists all the way back to 1986, because the methods of counting changed in 1996, only 1998 data provides a reasonable base to project use. The Recreation and Tourism Assessment looked at longer-term trends and these results were used to project growth.

Based on the projected growth in camping and cabin use and day-use activities, scenarios were created for each alternative, developing different numbers of facilities. Alternative B was designed to fully meet the anticipated growth and the other alternatives met only a portion of the anticipated growth. A spreadsheet titled “Access Master v3.2” (in the planning record) shows the complete analysis by alternative.

Data Limitations
It is important to note that there are limits to using the recreation data. Recreation use is difficult to assess because of the mobility of the subject. Recreation data is collected randomly (with no statistical validity) and is used for relative comparisons of activity preferences or anticipated growth.

Recreation Activities

No special analytical process was used in addressing recreation activities. The crux of the interest is the conflicts that occur between certain activities or settings. To address these conflicts, extensive interactions were held between the interested groups to identify possible management area prescriptions that would provide for the range of interests. Each alternative addresses these combinations of interests in a different way.

Timber Resource Analysis Process

Steps in the timber resource analysis include 1) identification of timberlands that are tentatively suitable (TSTL) and suitable (STL) for timber production in accordance with 36 CFR 219.14(a) (timberland suitability process); 2) Stage II financial analysis to identify the direct costs and benefits for the range of timber management intensities in accordance with 36 CFR 219.14(b); and, 3) calculation of the long-term sustained yield (LTSY) and allowable sale quantity (ASQ) for each alternative with suitable timberlands.

Timber Land Suitability

The timberland suitability process is used to identify timberlands that are suitable for timber production. This is accomplished in two steps: 1) the identification of lands which are legally and practicably capable of timber production, called tentatively suitable timberlands (TSTL) and 2) from the TSTL, the selection of lands which are suitable (STL) for timber production based on all the multiple-use objectives for the Forest.

Identification of the biologic criteria and availability of forest lands to be considered as suitable for producing industrial wood products are described in the National Forest Management Act (NFMA) Regulations 36 CFR 219.14 (a)(1) through (4). The determination of lands actually suitable for timber production begins in the analysis of the management situation (AMS) and culminates with the forest plan. Suitable lands in the forest plan constitute the land base for determining the allowable sale quantity (ASQ) and all vegetation management practices associated with timber production. The AMS and each alternative in the forest plan are limited to no more than the acres identified as TSTL.

Figure B-1 provides an overview of the process for determining tentatively suitable (TSTL) and suitable timberlands (STL).

Figure B-1: Process for identification of lands suitable for timber production.

Is the land forested?

No Unsuitable (nonforest)

Yes

Is the land capable of producing crops of Industrial wood?

No Unsuitable (nonindustrial wood)

Yes

Is irreversible damage likely to occur?

Yes Unsuitable (irreversible damage)

No

Can area be restocked within 5 years?

No Unsuitable (restocked)

Yes

Is adequate response Information available?

No Unsuitable (no information)

Yes

Is land withdrawn from timber production?

Yes Unsuitable (withdrawn)

No Then land is TSTL for timber production.

Is TSTL allocated to timber production in an alternative?

No[1] Not appropriate (unsuitable) in Preferred Alternative and Revised Forest Plan

Yes Then land is STL for timber production.

[1] (Management Area Prescriptions 312, 314, 321 or 411

Lands Suited for Timber Production

Five standards were used to identify the biologic criteria and availability of forestlands to be considered as capable of producing industrial wood products. They are:

- Is the land forested? (36 CFR 219.91(a)(1)).
- Is the land capable of producing crops of industrial wood?
- Is irreversible resource damage likely to occur? (36 CFR 219.14(a)(2)).

- Is there reasonable assurance of adequate stocking within five years after final harvest? (36 CFR 219.14(2)(3)).
- Is the land withdrawn from timber production? (36 CFR 219.14(a)(4)).

Those lands that remain after applying the five standards are termed tentatively suitable timberlands (TSTL). Each alternative uses the TSTL as the starting point for determining suitable timberlands (STL).

Is the land forested? This criterion listed in 36 CFR 219.14 considers whether a parcel of land is forested or not. Forestland is at least 10 percent occupied by forest trees or formerly having had such tree cover and not currently developed for non-forest use. Forest trees are defined as woody plants having a well-developed stem and usually more than 12 feet in height at maturity. Lands developed for non-forest use include areas for crops, improved pasture, residential or administrative areas, improved (constructed) roads of any width and adjoining road clearing, and powerline clearing of any width. The term occupancy, when used to define forest land, is measured by canopy cover of live forest trees at maturity. The minimum area for classification of forestland is 5 acres or greater, consistent with Regional mapping standards. Unimproved roads, trails, streams, and clearings in forest areas are classified as forest, if they are less than 120 feet in width.

Using the above criteria, the Forest's GIS corporate database was queried for all non-forested and forested cover types. The results of the query showed a total of 4,295,540 acres of non-forest cover types including freshwater and 1,196,040 acres of forested cover types.

Is Land Capable of Producing Crops of Industrial Wood? Lands that are not capable of producing crops of industrial wood are by definition classified as unsuitable for timber production. Species of trees, which are not currently utilized or not expected to be utilized within the next 10 years, constitute the primary criterion for assigning lands to this category. This does not preclude, however, the formulation of an alternative to display management opportunities, if a demand develops.

On the Chugach National Forest, species of trees, which are not currently utilized for commercial wood products, include black spruce and all hardwood species (i.e., aspen, birch, black cottonwood, and willow).

An additional criterion was added to this step for unproductive forest lands (lands not capable of producing at least 20 cubic feet per acre per year). Unproductive forestlands have never been managed for industrial products on the Chugach National Forest and are not expected to be during the planning period. These lands could have been included under the category of "Inadequate Response Information" since there is not adequate information available for these lands, based on current research and experience, to project response to timber management practices.

The total acreage excluded from tentatively suitable timberlands under this step amounts to 712,940 acres.

Is irreversible resource damage likely to occur? This criterion removes lands from timber production if there will be irreversible resource damage to soil productivity or watershed conditions. Specifically, 36 CFR 219.14(a)(2) states: Technology is not available to ensure timber production from the land without irreversible resource damage to soil productivity or watershed conditions. Soils may be damaged by erosion, nutrient removal, compaction, and mass movement (landslides). Of these, erosion, nutrient removal, and compaction may be mitigated on site, but landslides are difficult to mitigate. Riparian areas and wet soils are special areas, important for a variety of uses, besides timber production. However, under existing technologies, most of the impacts to wet soils and riparian areas on slopes less than 40 percent could be mitigated. Winter logging, logging on snow or frozen soils, or horse logging, and similar activities could be done while protecting resource values. Since wet soils and riparian areas can technologically be harvested, they were not excluded from the tentatively suitable timberland base under this step.

On July 5, 1995, the Forest Service published an overview of the characteristics controlling hillside stability in Southeast Alaska. The paper concluded, based on the findings, that Mass Movement Index 3 and 4 (MMI 3 and MMI 4, respectively) should be adjusted for the Tongass Land Management Plan (TLMP) revision. MMI 3 should be from 51 to 72 percent slope and MMI 4 should be a slope greater than 72 percent. Previously, 75 percent slope had been used for the cutoff. For the Chugach National Forest, lands in MMI 4 (72+ percent slope) are lands that have a high potential for mass movement. Timber production on these lands would likely result in irreversible resource damage, so lands on 72+ percent slope were excluded from the TSTL. Using the Forest's GIS, 74,630 acres of forested lands were identified as having potential for irreversible damage and were excluded from the TSTL.

Is there reasonable assurance of adequate restocking after five years after final harvest? This criterion is listed in CFR 219.27(c)(3) and includes having both the technology and adequate knowledge to assure that lands can be restocked with trees within five years after final harvest.

There is no inventory information available for forestlands that were added to the Chugach National Forest in ANILCA (called the ANILCA additions) other than satellite classification that they are forested lands. These lands are identified as needing further inventory, research, or information and are not considered as part of the TSTL, until such time that adequate information is available. Querying the GIS to identify lands classified as forest lands in the ANILCA additions resulted in 22,610 acres, which were excluded from the TSTL.

Is the land withdrawn from timber production? This criterion is found in CFR 219.14(a)(4), which states: "The land has been withdrawn from timber production by an Act of Congress, the Secretary of Agriculture, or the Chief of the Forest Service." These lands include Wilderness (currently the Chugach National

Forest has zero acres), Wilderness Study Areas (not excluded in this step for the purpose of analysis), Research Natural Areas (currently the Chugach National Forest has one RNA on Green Island which also was not excluded in this step for the purpose of analysis), lands purchased by EVOS (*Exxon Valdez* Oil Spill Settlement Funds), and lands still under selection by the State of Alaska or Native corporations (regional or village). The total acreage withdrawn from timber production and from TSTL is 103,250 acres.

Tentatively Suitable Timberlands (TSTL)

TSTL, identified in accordance with this process, are fixed input to the Forest planning model in the establishment and evaluation of benchmarks and alternatives, unless trade-offs, such as wilderness areas, are to be analyzed. Acres of TSTL are the same for all alternatives and are shown in Table B-1.

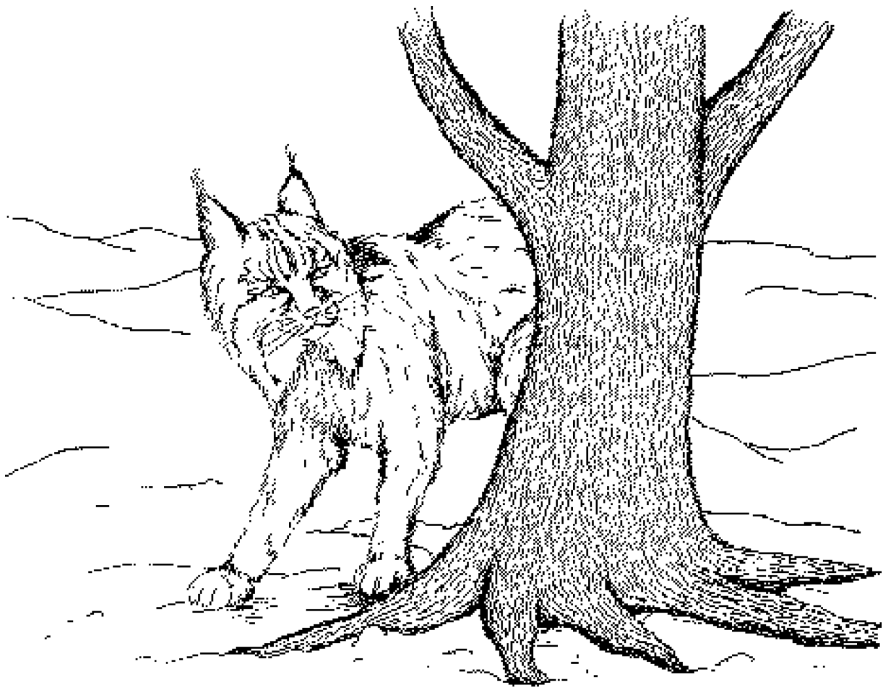

Table B-1: Land suitability classification for timber production by alternative.

Timber Land Suitability Classification	No Action	Preferred	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F
Total National Forest (item 1 plus item 2)	**5,491,580**	**5,491,580**	**5,491,580**	**5,491,580**	**5,491,580**	**5,491,580**	**5,491,580**	**5,491,580**
1. Non-Forest Land (includes water)	4,295,540	4,295,540	4,295,540	4,295,540	4,295,540	4,295,540	4,295,540	4,295,540
2. Forest Land	1,196,040	1,196,040	1,196,040	1,196,040	1,196,040	1,196,040	1,196,040	1,196,040
3. Forest Land Withdrawn from Timber Production	103,250	103,250	103,250	103,250	103,250	103,250	103,250	103,250
4. Available Forest Land (item 2 minus item 3)	1,092,790	1,092,790	1,092,790	1,092,790	1,092,790	1,092,790	1,092,790	1,092,790
5. Non-productive Forests: Not capable of producing crops of industrial wood	712,940	712,940	712,940	712,940	712,940	712,940	712,940	712,940
6. Available Timberlands (PFL) (Item 4 minus item 5)	379,850	379,850	379,850	379,850	379,850	379,850	379,850	379,850
7. Timberlands Physically Unsuitable	74,630	74,630	74,630	74,630	74,630	74,630	74,630	74,630
8. Timberlands Inadequate Information	22,610	22,610	22,610	22,610	22,610	22,610	22,610	22,610
9. Tentatively Suitable Timberlands (Item 6 minus items 7 and 8)	282,610	282,610	282,610	282,610	282,610	282,610	282,610	282,610
Percent of Total Forest Lands Tentatively Suitable for Timber Production	**23.60%**	**23.60%**	**23.60%**	**23.60%**	**23.60%**	**23.60%**	**23.60%**	**23.60%**
10. Tentatively suitable timberlands not appropriate for timber production:								
a. Resource protection (Forestwide standards & guidelines)	73,360	73,360	73,360	73,360	73,360	73,360	73,360	73,360
b. Pending withdrawal, productive Wilderness (Recommended or Study Area)	28,530	98,300	0	20,790	42,270	125,080	131,390	164,370
c. Pending withdrawal, productive Selected Lands (State or Native)	0	430	0	70	470	1,230	4,330	4,840
d. Not appropriate - RNAs	1,970	2,130	920	2,580	2,580	3,610	3,170	3,610
e. Not appropriate - Other Developed Visitor Facilities	0	1,210	0	0	0	300	0	60
f. Not appropriate - Dispersed Primitive Recreation	0	450	0	1,590	1,260	1,260	10,470	0
g. Not appropriate - Dispersed Backcountry Recreation	45,030	67,040	54,440	57,750	70,540	47,580	49,050	23,150
h. Not appropriate - Sensitive Animal	0	2170	530	1,480	1,480	3,260	0	880
i. Not appropriate - Fish & Wildlife Conservation Areas	54,810	28,310	3,140	63,540	78,530	22,080	9,110	9,630
j. Not appropriate - Mineral Claims	350	350	350	350	350	350	350	350
k. Not appropriate - Transportation/Utility/Electronic Site Corridors	730	520	730	730	730	730	730	730
l. Not appropriate - Special Alternative Management Direction	0	0	0	0	3,660	0	0	0
m. Not Appropriate – Economic feasibility	0	0	0	0	0	0	0	0
n. Unsuitable – Not needed to meet Alt. Mgmt. Objectives per CFR 219.14(c)(3)	0	8,340	0	0	7,380	3,770	650	1,630
Total (Items 10a through 10n)	204,810	282,610	133,470	222,240	282,610	282,610	282,610	282,610
11. Net Remaining Acres (Item 9 minus Item 10 a-n)	**77,800**	**0**	**149,140**	**60,370**	**0**	**0**	**0**	**0**

Suitable Timberlands (STL)

This section describes the process used to identify the STL, or more precisely, the portion of TSTL that is not appropriate for timber production. The criteria used for this process are contained in 36 CFR 219.14 (c) and (d). Table B-1 displays the results of the tentatively suitable process (36 CFR 219.14(a)) and lists those lands identified as not appropriate for timber production in accordance with 36 CFR 219.14(c) and (d).

TSTL not appropriate for timber production were identified using the following criteria:

(1) Minimum Management Requirements. These lands are identified as not appropriate for timber production activities because it is anticipated that the minimum management requirements of 36 CFR 219.27 cannot be met. 36 CFR 219.27 includes direction for resource protection, vegetative manipulation, silvicultural practices, even-aged management, riparian areas, soil and water, and diversity. Lands with extreme mass movement hazard soils were removed from timber harvest consideration in the analysis of TSTL (36 CFR 219.14(a)).

(2) Multiple-use Objectives. These lands are identified as not appropriate for timber production because of other multiple-use values or the land is proposed for resource uses that preclude timber production for the alternative. Management area prescriptions that preclude commercial timber production (ASQ) are displayed in Table B-2. Four of 32 management area prescriptions allow commercial timber production (chargeable volume (ASQ)). These are identified in Table B-2. The other 28 management area prescriptions do not allow commercial timber production.

Lands identified as not appropriate for timber production are classified as unsuitable and displayed in Item 10 (a through n) in Table B-1. The acreage in each of these categories, which varies by alternative, is displayed for each revision alternative, including the Preferred Alternative.

After subtracting the total acreage of item 10 (not appropriate) from the TSTL, the net balance (item 11 in Table B-1) is land identified as appropriate for timber production, or STL.

The classification of unsuitable lands will be reviewed at least every 10 years (36 CFR 219.14(d)). This review is part of a monitoring item contained in Chapter 6 of the Revised Forest Plan. Land suitability may be adjusted at any time due to changed conditions; monitoring will assess the magnitude of any changes and could lead to amendments to the Revised Forest Plan.

Table B-2: Management area prescription allocations for timber production.

Prescription	Commercial Timber Harvest ASQ
111 - Primitive	No
121 - Wilderness Study Area	No
131 - Recommended Wilderness	No
132 - Wild River	No
133 - 501(b) - Recommended Wilderness	No
135 - 501(b) - 1	No
141 - Research Natural Area	No
210 - Backcountry*	No
211 - Backcountry	No
212 - Backcountry Motorized	No
213 - 501(b) - 2	No
221 - EVOS Acquired Lands	No
231 - Scenic River	No
241 - Municipal Watershed	No
242 - Brown Bear Core Area	No
244 - Fish and Wildlife Conservation Area	No
312 - Fish, Wildlife and Recreation	Conditional
313 - Backcountry Groups	No
314 - Forest Restoration	Yes
321 - 501(b) - 3	Conditional
331 - Recreational River	No
341 - Developed Recreation / Reduced Noise	No
411 - Resource Development	Yes
441 - Developed Recreation Complexes	No
521 - Minerals (site specific)	No
522 - Major Transportation / Utility Systems (site specific)	No

Stage II Analysis

Prior to the formulation of alternatives, each acre classified as tentatively suitable for timber harvest was analyzed to determine the costs and benefits for a range of management intensities (36 CFR 219.14(b)). For the purpose of this analysis, the planning area was stratified into categories of land with similar costs and returns. The stratification also took into account those factors, which influence costs and returns such as physical and biological conditions of the site and transportation requirements. Stage II analysis is used to identify management intensities of timber production for each category of land, which results in the largest amount of discounted net revenues. It also identifies those categories of land that are economically sensitive to even slight changes in management intensity. Stage II analysis provides insight into the overall economic condition of the tentatively suitable land base. This enables planners to evaluate and predict potential economic bottlenecks during the next step of the planning process; the formulation of alternatives.

Outputs

Sawtimber (cubic feet and board feet)

Information Source:

Economics derived from the Haynes and Brooks stumpage price projections and the Region 10 Appraisal Handbook. Merchantable volume of existing stands in

Prince William Sound and lower Copper River is derived from the 1978 timber inventory, while a 1987 timber inventory is used for the Kenai Peninsula. Volume of regenerated stands is obtained from the western hemlock/Sitka spruce and white spruce yield tables adjusted for latitude.

Occurs With or Varies By:
At harvest, the volume of merchantable timber produced generates a per mbf (thousand board foot) revenue that varies based on geographic area and volume class.

Assumptions:
For existing stands, volume class provides estimates of piece size (diameter, etc.). For regenerated stands, age and productivity group (site index) is used to determine piece size. All revenues from timber are weighted to include the volume classified as utility. It is assumed that existing old growth volumes are constant (i.e., through time, growth equals mortality).

Utility Volume (cubic feet and board feet)
Information Source:
Economics derived from the Haynes and Brooks stumpage price projections and the Region 10 Appraisal Handbook. Merchantable volume of existing stands in Prince William Sound and lower Copper River is derived from the 1978 timber inventory, while a 1987 timber inventory is used for the Kenai Peninsula. Volume of regenerated stands is obtained from the western hemlock/Sitka spruce and white spruce yield tables adjusted for latitude.

Occurs With or Varies By:
At harvest, the volume of merchantable timber produced generates a per mbf revenue that varies based on Administrative area and volume class. Administrative Area affects this revenue due to the information from the Appraisal Handbook. Assumptions: For existing stands, volume class provides estimates of piece size (diameter, etc.). For regenerated stands, age and productivity group (site index) is used to determine piece size. All revenues from timber are weighted to include the volume classified as utility.

Assumptions:
The utility volume from regenerated stands is only about five percent whereas the utility component of existing old growth stands averages 18 percent. This difference results from the mixed diameter distribution of old growth stands and the impact of defect to potential sawlogs.

Timber Harvest Costs used in the Stage II Analysis
All costs used in the Stage II analysis are adjusted to base year 1999, first quarter. Cost information was used from as early as 1995 through 1999, depending on the activity. Only average and summarized values are used in this section. The actual cost figures used in the analyses are available in the planning record.

Timber Sale Preparation and Administration. This is the cost to the Forest Service of administering and laying out timber sale areas. Attributes that affect

sale preparation costs were identified: roaded vs. unroaded areas, higher costs in group selection/single tree selection versus other clearcut, and higher costs in some operability classes. In general, sale preparation costs range from $100 to $121 per mbf.

Road Construction, Maintenance, and Reconstruction. The cost of local, arterial, and collector road construction costs varies due to the management emphasis of an area. Areas with an emphasis on visual quality (natural settings, etc.) will have higher road construction costs. Roads in these areas will require longer transportation of roadbed material (due to fewer rock quarries per mile of road construction), increased engineering support costs (strategic placement of road), and road location (often constructed in a place that is less cost efficient). On the Chugach, the cost per mile of road ranges from $30,000 to $125,000.

Information Source:
For timberlands in Prince William Sound and the lower Copper River area, road construction, maintenance, and reconstruction estimates and costs are based on the same contracted sale appraisals used for LTFs. For the Kenai Peninsula, haul distances per unit of output and costs used in the Environmental Assessment (EA) completed in 1988 for the Primrose/Snow River Salvage Sale were used.

Occurs With or Varies By:
Harvest, geographical location, current road development, and whether the harvest is existing old-growth or a second-growth stand.

Assumptions:
All harvest requires some road construction and reconstruction. If the area is classified as roaded, then the majority of roading activity is reconstruction. Otherwise, road construction is the primary activity. The amount of road construction or reconstruction required depends on the geographic location of the harvest area. Each watershed has a distinct roading requirement coefficient. This coefficient is in the terms of miles of roads required to access 1,000 acres of timber land. The average for the Chugach is approximately seven miles of road per 1,000 acres in Prince William Sound and lower Copper River and 26 miles of road per 1,000 on the Kenai Peninsula (this does not include temporary roads). Reconstruction is the only activity once timber harvest is comprised solely of regenerated timber stands. Road maintenance occurs annually on all roads that are anticipated to be used frequently.

Log Transfer Facility (LTF) Costs. The cost of LTF construction or reconstruction and timber hauling was determined from existing information and engineering estimates.

Information Source:
Only lands in Prince William Sound and a portion of the lower Copper River area would require LTF construction or reconstruction. The Kenai Peninsula is roaded and does not require LTFs. The Forest GIS coverage contains existing and proposed LTFs. Costs and construction levels are based on the most recent available data, which are two contracted timber sale appraisals for timberlands in

Prince William Sound. One appraisal was for Tatitlek Village Corporation lands in 1995 and the other was for University of Alaska lands in 1999.

Occurs With or Varies By:
Acres harvested.

Assumptions:
Each acre is assigned a proportion of the Area's total LTF cost potential. The cost is incurred at time of harvest. The LTF costs associated with the harvest of regenerated stands are one-half that of existing old-growth harvest. This assumes LTF reconstruction only.

Timber Hauling. The hauling cost represents the cost to get one mbf of timber from the landing to the mill and varies by haul distance.

Information Source:
For timberlands in Prince William Sound and the lower Copper River area, haul distances and costs are based on the same contracted sale appraisals used for LTFs. For the Kenai Peninsula, haul distances per unit of output and costs used in the Environmental Assessment (EA) completed in 1988 for the Primrose/Snow River Salvage Sale were used.

Occurs With or Varies By:
Mbf.

Assumptions:
Hauling cost includes all anticipated modes of transport likely used to transport logs from the landing to the mill. This may include truck, barge, and/or log raft. Both the sawlog and utility component of harvest incur this cost.

Road Reconstruction Costs. Roads that have been constructed and only minimally maintained must be reconstructed to get the road up to standards suitable for timber hauling. The cost of reconstruction is determined by the amount of maintenance and time since last reconstruction or construction. The average cost of road reconstruction is $25,000 per mile.

Road Maintenance. Once roads are constructed there is often a certain amount of annual maintenance. Road maintenance depends on current road use and anticipated future logging activity. Average road maintenance cost is $0.25 per mbf.

Site Preparation, Regeneration and Regeneration Certification. The predominant form of forest regeneration following clearcut harvesting is natural regeneration. Very little planting or seeding is done in the coastal areas of Prince William Sound and lower Copper River on the Chugach National Forest. The soils and weather conditions are very conducive to natural regeneration. The Forest Service certifies successful regeneration five years following clearcut harvesting. In the event of unsuccessful regeneration, more aggressive regeneration actions are undertaken. The average cost of certifying that regeneration has occurred has been $11.42 per acre.

Information Source:
Five year average (1994-1999) costs experienced on the Forest.

Occurs With or Varies By:
Acres harvested.

Assumptions:
Natural regeneration without site preparation is assumed for harvested stands in Prince William Sound and the lower Copper River area and approximately 75 percent of harvested stands on the Kenai Peninsula. Site preparation and planting is assumed for 25 percent of the harvested stands on the Kenai Peninsula. Certification occurs for every acre harvested and the cost is incurred at time of harvest. This activity usually takes place from three to five years after harvest but for planning purposes, the cost is incurred at time of harvest. It also is assumed that all stands will be certified as regenerated by year five.

Precommercial Thinning. The Forest has an active program of precommercial thinning. This improves the health of the stand and permits greater understory development for wildlife. This thinning operation is termed "precommercial" because no revenues are derived from the sale of the harvested trees. The average cost for precommercial thinning on the Chugach is $500 per acre. This silvicultural activity is generally conducted when the stand is between 15 and 20 years old.

Information Source:
Chugach 5-year average precommercial thinning costs, 1994-1999. Based on a 100-acre per year precommercial thinning program.

Occurs With or Varies By:
Acres receiving a timber prescription permitting this activity.

Assumptions:
Applied between the ages of 15 and 20 years.

Logging Costs. Logging cost is the amount of money a timber buyer spends to build temporary roads and fell, buck, and skid the trees to the landing. The logging cost estimates were determined using the procedures outlined in the Forest Service Handbook 2409.22 - Timber Appraisal Handbook. The costs include yarding, log sorting and loading, general logging overhead, felling and bucking, temporary road construction, camp mobilization, depreciation, and erosion control. The cost of this activity varies by harvest type (e.g., clearcut size), operability (type of harvesting system required), and size, or age, of the trees (big trees are less expensive on a board foot average).

Information Source:
Estimated using procedures in FSH 2409.22 - Timber Appraisal Handbook and the most recently available logging cost data for similar lands in Southcentral Alaska, which are a 1995 timber appraisal study for Tatitlek Village Corporation lands in Prince William Sound, a 1999 timber appraisal study for University of Alaska lands in Prince William Sound, and a 1998 Primrose/Snow River Salvage

Sale Environmental Assessment (EA) for national forest lands on the Kenai Peninsula.

Occurs With or Varies By:
Management area prescription, logging operability, and geographic area.

Assumptions:
These costs include all temporary roads, felling, bucking, skidding and landing construction. Logging costs increase as the management area prescription becomes more restrictive due primarily to decreasing clearcut unit size and a greater number of system set-ups required to achieve similar volumes. The size of the logs also influences logging costs. Volume class, productivity group, stand age, and the use of precommercial thinning is used to estimate the average log size and volume per acre for each unit. Typically, larger logs result in less logging cost per mbf feet. The logging operability classification of the area heavily influences the logging costs due primarily to the different harvest systems required. Helicopter logging is used in isolated stands while normal operable lands can utilize standard tractor logging systems

Timber Harvest Benefits
The benefits derived from timber are based on appraised value. Value is based on tree size, species composition, amount of defect, and other factors. Timber benefits are measured as pond log value. Pond log values are the estimates of price a timber buyer would pay for a log at the mill site. To get the stumpage value of this log, all estimated costs that are incurred to get the log to the mill must be subtracted from the pond log value. The resulting stumpage price is assumed to be the price the timber buyer pays for the log (bid price). Bid price represents money to the U.S. Treasury. The average pondlog value is $611/mbf in a high-market cycle, $397 per mbf in a mid-market cycle, and $347/mbf in a low market cycle.

Stage II analysis was conducted for applicable management intensities: There are many economic factors that contribute to the calculation of net revenue. The table below shows average net revenue by category. These are weighted averages (i.e., based on the number of acres in each category). Table B-3 is a summary of Chugach Stage II analysis.

Table B-3: Stage II economic summary by geographic landscape area and market condition (net revenue per acre, $) for tentatively suitable timberlands.

Timber Market Conditions	Net Revenue Per Acre Kenai Peninsula	Net Revenue Per Acre Prince William Sound	Net Revenue Per Acre Lower Copper River	Net Revenue Per Acre Forestwide
High Market	(1,514)	1,662	1,056	1,237
Mid-Market	(1,862)	(3,405)	(3,840)	(3,431)
Low Market	(2,210)	(4,555)	(4,950)	(4,509)

Allowable Sale Quantity (ASQ) and Long-term Sustained Yield (LTSY)
The ASQ and LTSY calculations for each alternative with suitable timberlands are constrained by timber policy constraints. These constraints represent legal

or policy requirements of national forest timber management. These are required to ensure that all timber harvest meets sustained yield and culmination of mean annual increment requirements.

Sustained Yield/Non-declining Flow. A constant flow (non-declining yield) of harvested timber volume is Forest Service policy. This means all timber harvest volume in any given decade must be at least as great as the previous decade's harvest volume.

The LTSY calculation ensures harvest flow (in cubic feet) will not decline in any decade over the planning horizon per national policy. Harvest volumes may increase but all subsequent harvests must be at least as much as the previous decade's harvest.

Culmination of Mean Annual Increment. The age at which a managed stand is harvested is called the rotation age. Agency policy is that rotation age can be no earlier than the age at which 95 percent of culmination of mean annual increment (CMAI) occurs. CMAI is the age at which the stand achieves its highest average volume. The CMAI was used in the calculation of the ASQ. On the Chugach, this translates to a range of rotation ages of about 160 years for western hemlock/Sitka spruce in Prince William Sound and the Copper River Delta to 200 years for white spruce on the Kenai Peninsula in management area prescriptions 314 and 411 and 200 and 250 years, respectively in management area prescriptions 312 and 321. CMAI varies by stand productivity, management prescription, and administrative area and is calculated using merchantable cubic foot volume.

Allowable Sale Quantity (ASQ) and Suitable Acres

The ASQ for each alternative with suitable lands was calculated with the Hanzlik formula. In this formula:

$$ASQ = \frac{V_m}{R} + I$$

Where; V_m = Volume of mature timber

R = Rotation Age

I = M.A.I. (Mean Annual Increment) of immature stands

The ASQ and suitable acres are shown in Table B-4 for each alternative. The ASQ is shown here as the first decade harvest volume in board feet (sawlog and utility). This is the decadal volume possible under the constraints and land allocations represented by the various alternatives. The suitable acres are lands on which timber harvest is permitted based on management area prescription and alternative-specific management attributes and are scheduled for harvest.

Table B-4: ASQ and suitable acres.

Alternative	Suitable Timberland Acres	ASQ (MMCF) Decade 1	ASQ (MMBF) Decade 1
No Action	77,800	16.0	74.9
Preferred	0	0	0
A	149,140	34.6	162.9
B	60,370	12.9	61.1
C	0	0	0
D	0	0	0
E	0	0	0
F	0	0	0

A complete list of alternative outputs can be found in Chapters 2 and 3 of the FEIS and in the planning record.

Maximum Timber Potential over the Planning Horizon

The LTSY was calculated by using the formula:

$$\text{LTSY} = \frac{\text{alternative suitable acres} \times \text{expected inventory net yield}}{\text{rotation period}}$$

One of the constraints requires that the volume harvested in the first decade be sustained for the entire planning horizon. This is called non-declining yield (NDY) or sustainable harvest volume constraint. Table B-5 compares the ASQ with the LTSY in Decade 1 by Alternative.

Table B-5: Timber harvest over the planning horizon.

Alternative	Timber Harvest ASQ (MMCF) Decade 1	Timber Harvest ASQ (MMBF) Decade 1	Timber Harvest LTSY (MMCF) Decade 1	Timber Harvest LTSY (MMBF) Decade 1
No Action	16.0	74.9	34.4	141.6
Preferred	0	0	0	0
A	34.6	162.9	75.8	311.0
B	12.9	61.1	27.4	112.3
C	0	0	0	0
D	0	0	0	0
E	0	0	0	0
F	0	0	0	0

Economic Efficiency

Net Public Benefits - Net public benefits are the "overall long-term value, to the nation, of all outputs and positive effects (benefits) less all associated Forest inputs and negative effects (costs) whether they can be quantitatively valued or not" (36 CFR 219.3). Net public benefits represent the sum of the net value of priced outputs plus the net value of non-priced outputs. The Social/Economic Section in Chapter 3 explains and describes the elements of public benefits that may be a function of Forest planning and management activities.

Summary of Timber Resource Analysis Process

In response to initial public scoping and continued collaborative input from the public and interest groups, the ID Team developed a set of 25 management area prescriptions that responded to the range of interests expressed by the public in

allowing or not allowing activities to take place on the National Forest. A final set of 25 management area prescriptions was approved by the Forest Supervisor before the ID Team proceeded to the next step in the planning process.

Each management area prescription specified which activities would be allowed, not allowed, or conditionally allowed, if that management area prescription was applied to a set of acres on the ground (FEIS, Appendix J). Four of the twenty-five management area prescriptions (312 - Fish, Wildlife and Recreation; 314 - Forest Restoration; 321 - 501(b) 3; 411-Resource Development) allowed ASQ commercial timber harvest on lands classified as suitable for timber.

Once management area prescriptions were developed, alternatives to the No Action Alternative were developed by the ID Team and members of the public or interest groups who wished to develop their own alternative. Each alternative had a theme and a set of objectives. For each alternative, management area prescriptions were assigned to acreages by the alternative developer(s) until all National Forest acres had been assigned one of the twenty-five management area prescriptions. Initial alternative development resulted in 30 alternatives which were then collaboratively combined and consolidated into the final set of eight alternatives which included the No Action, the Preferred and Alternatives A, B, C, D, E, and F.

The No Action Alternative and Alternatives A and B were the only alternatives that used one or more of the four management area prescriptions that allowed ASQ commercial timber harvest. Since the areas that these management area prescriptions were assigned to contained lands classified as suitable for timber production, these alternatives had ASQs of 74.9, 162.9, and 61.1 MMBF (FEIS, Chapter 3, Production of Natural Resources, Forest Products, Table 3-85 and FEIS, Appendix B, Table B-1) respectively for the first decade planning period. The Preferred Alternative and Alternatives C, D, E, and F did not use any of the four management area prescriptions that allowed ASQ commercial timber harvest, therefore the ASQ for each of these alternatives was zero. The Preferred Alternative was developed by the Chugach National Forest leadership team and recommended by the Forest Supervisor as the Forest Service Preferred Alternative. The Preferred Alternative proposes no ASQ but does provide for other Forest management activities dealing with forest health, fuel reduction and revegetation issues on the Kenai Peninsula.

Economic Analysis

IMPLAN Analysis

Several portions of the economic analysis were completed using an input-output economic model called Impact Analysis for Planning (IMPLAN). This model was originally developed by the Forest Service and is now owned and maintained by the Minnesota IMPLAN Group (MIG 1999). The Forest Service contracts annually to receive updated versions of the model and income and employment data formatted for use in the model. For the Chugach Forest Plan revision, IMPLAN Professional, version 2 was used with 1996 data. Until 1999,

employment and income data for use with IMPLAN was only available by borough or census area. MIG now offers data by zip code. For the Chugach revision, zip code data was used for the following areas:

Zip Code	Community	Borough or Census Area
99501-99524	Anchorage	Municipality of Anchorage
99574	Chenega Bay	Valdez-Cordova Census Area
99572	Cooper Landing	Kenai Peninsula Borough
99574	Cordova	Valdez-Cordova Census Area
99574	Eyak	Valdez-Cordova Census Area
99587	Girdwood	Municipality of Anchorage
99605	Hope	Kenai Peninsula Borough
99611	Kenai	Kenai Peninsula Borough
99631	Moose Pass	Kenai Peninsula Borough
99664	Seward	Kenai Peninsula Borough
99669	Soldotna	Kenai Peninsula Borough
99672	Sterling	Kenai Peninsula Borough
99677	Tatitlek	Valdez-Cordova Census Area
99686	Valdez	Valdez-Cordova Census Area
99693	Whittier	Valdez-Cordova Census Area

This was done to limit the number of surrounding communities that do not border or interact with the Chugach National Forest directly. The zip code files were then individually updated and adjusted to better reflect 1999 employment and income in the area. This was done using the 1999 Alaska Business Directory, which lists most businesses in a community and indicates the type and size of each firm. The zip code files for all communities except Anchorage were then merged and adjusted based on the business directory. The Anchorage zip code files were used to develop a separate model that was not combined with the other areas surrounding the Chugach National Forest. This was done to prevent the size and complexity of Anchorage's local economic activities from overwhelming, or washing out the direct impacts of forest planning on the smaller communities surrounding the Chugach National Forest. The resulting databases were used in the Chugach revision economic contribution and impact analysis sections.

All dollar values reported in the economic section were converted to real 1999 dollars using the Economic Report of the President, 2000 consumer price indexes for 1999 unless otherwise stated. This allows consistent comparison of current values with past and future values.

Contribution Analysis

The contribution analysis for employment was completed to illustrate the level of forest resource-related industry activities within the project area. The database described above was used to separate forest resource-related industries from other employment. To do this, specific IMPLAN sectors were selected as a proxy, or representation of the forest resource-related industries of interest in

Forest planning. The following table illustrates the sectors selected by the four forest resource-related industries.

Sector	Forest resource-related industry
	Recreation and Tourism
434	local transit
436	water transport
437	air transport
439	travel services
449	general store
450	food store
451	service station
452	clothing store
454	eating and drinking
455	general retail
463	hotel and lodging
468	personal services
477	auto rental
488	amusement and recreation services
	Wood Products
22	forest products
24	forestry products
133	logging camps and logging operations
134	sawmills and planning mills
135	hardwood dimension
136	special products sawmills
137	millwork
138	wood kitchen cabinets
139	veneer and plywood
140	structural wood members
141	wood containers
142	wood pallets and skids
	Mining
40	dimension stone
41	sand and gravel
42	clay and ceramic
	Commercial Salmon Fishing and Processing
25	commercial fishing
26	agriculture, forestry, and fishery services
97	canned and cured sea foods
98	prepared fresh or frozen fish

MIG 1999.

The recreation-tourism sector information was further adjusted using information from the McDowell Group's 1991 survey "Alaska's Visitor Industry: An Economic Profile" to determine what percentage of employment within each sector is related to recreation or tourism activity. This was done because recreation and tourism is not a separate sector, but a combination of all the businesses that play a part in recreation and tourism activity around the Forest. Because these businesses also serve individuals not engaging in recreation and tourism, it is important to separate that portion of each business that serves other local or

business needs from activity directly related to recreation and tourism. The percentages used for each recreation tourism sector are displayed in the following table:

Recreation and tourism sectors

Sector		McDowell visitor study percent
434	local transit	0.72
436	water transport	0.47
437	air transport	0.31
439	travel services	0.46
449	general store	0.06
450	food store	0.03
451	service station	0.07
452	clothing store	0.04
454	eating and drinking	0.21
455	general retail	0.07
463	hotel and lodging	0.66
468	personal services	0.02
477	auto rental	0.14
488	amusement and recreation services	0.66

McDowell, 1991

The results of the contribution analysis are only a proxy of employment related to Chugach forest resources. Results would differ if other sectors were included as forest resource-related. In the analysis presented, a consistent and conservative approach was taken to illustrate the relative importance of the Chugach National Forest activity within the study area.

Impact Analysis

The employment and income changes in the wood products industry by alternative were estimated using the IMPLAN database described above with output, cost and revenue information provided by the timber specialist. The following is a description of the economic analysis of wood products outputs.

Using IMPLAN, which is a linear program, the flow of impacts due to wood product activity in the study area was determined on a per mmbf (million board foot) basis. IMPLAN accounts for employment and wage income impacts in terms of direct, indirect, and induced effects, with total effects being the sum of the three effects. These are defined by MIG as:

> "Direct effects are the changes in the industries to which a final demand change was made. Indirect effects are the changes in inter-industry purchases as they respond to the new demands of the directly affected industries. Induced effects typically reflect changes in spending from households as Income increases or decreases due to the changes in production." (MIG 1999)

The IMPLAN model used a Type II multiplier that captures direct and indirect effects. In addition to the inter-industry effects, the Type II multiplier also takes into account the income and expenditures of households. The household income

and the household expenditures are treated as industries. This internalizes the household sector, including the induced or household spending effects. (MIG 1999)

The following tables and text explain each part of the wood products economic analysis.

A. Program effects of proving and managing wood products resources by the Forest Service

	Direct	Indirect	Induced	Total
Employment/mmbf	7	2	2	11
Wage income/mmbf	$498,611	$126,639	$122,149	$747,354

This estimate is based on Budget Object Code data for 1996 and a Chugach National Forest timber harvest level of 3.3 mmbf.

B. IMPLAN effects for $1,000,000 in household spending

	Direct	Indirect	Induced	Total
Employment/mmbf	8	2	1	11
Wage income/mmbf	$211,842	$47,228	$38,354	$297,424

This estimate accounts for the spending of medium income households within the study areas. For every one million dollars spent, 11 total jobs are supported. This estimate is used to calculate the impact of spending by those households working for the Forest Service supporting the timber program.

C. IMPLAN effects of logging 1mmbf of Forest Service stumpage

	Direct	Indirect	Induced	Total
Employment/mmbf	.6	.2	.2	.9
Wage income/mmbf	$21,340	$6,295	$4,099	$31,734

In this step, the value of Forest Service stumpage to the logging sector is estimated based on a stumpage value of $61/mmbf. This accounts for the effects of logging, but not for the direct employment and spending of the loggers. Using historical logging jobs/mmbf information in Southeast Alaska a total of 1.95 logging jobs are added for each mmbf in the alternatives. Direct wage income effects are based on spending 70 percent of a total wage of $104,419/mmbf from IMPLAN, or $73,093 total wage income spent per mmbf by loggers. This wage income effects on the study area are summarized in the following table.

D. IMPLAN effects of direct logging wages spent per 1mmbf of Forest Service stumpage

	Direct	Indirect	Induced	Total
Employment/mmbf	.6	.1	.1	.8
Wage income/mmbf	$15,484	$3,452	$2,803	$21,740

E. IMPLAN effects of sawmills per 1mmbf of Forest Service stumpage

	Direct	Indirect	Induced	Total
Employment/mmbf	1.3	.5	.3	2
Wage income/mmbf	$44,380	$16,363	$9,001	$69,744

Next, the value of the harvested timber is estimated based on a value of $80/mmbf. This accounts for the effects of sawmill activity, but not for the direct employment and spending of those working in the sawmill. Using historical logging jobs/mmbf information in Southeast Alaska a total of 3.33 sawmill jobs are added for each mmbf in the alternatives. Direct wage income effects are based on spending 70 percent of a total wage of $119,324/mmbf from IMPLAN, or $83,527 total wage income spent per mmbf by sawmill employees. This wage income effects on the study area are summarized in the following table.

F. IMPLAN effects of direct sawmill wages spent per 1mmbf of Forest Service logs

	Direct	Indirect	Induced	Total
Employment/mmbf	.9	.2	.2	1.3
Wage income/mmbf	$25,278	$5,635	$4,577	$35,490

G. Total effects of 1mmbf of Forest Service stumpage on the study area

	Direct	Indirect	Induced	Total
Employment/mmbf	15.8	2.7	2.5	21
Wage income/mmbf	$828,835	$158,384	$142,629	$1,129,849

This is the final matrix used to analyze each alternative's level of timber harvest.

Budget Feasibility Analysis

This Analysis uses the new Budget Formulation and Execution System (BFES) budgeting process. The purpose of this analysis is to estimate the Forest budget constraint and fund code dollar mix needed to implement the alternatives and compare this level to the current constraint. The BFES system is a new budgeting approach implemented in 2001. It was used to prepare the out-year request for FY 2003 and will be used for budget allocation and execution in FY 2002. The system is designed around a series of specific activities represented by a single output that can be measured and reported. These activities are intended to encompass the full span of work we do and all costs of doing business are assigned to these activities. Based on an identified constraint level, the Forest determines the spread of dollars needed to accomplish the highest priority work and the outputs that can be accomplished within the constraint. The result is a set of unit costs for providing outputs at various funding levels that can be applied, with some modifications, to the outputs described for, or implied in, an alternative. Specific modifications are discussed later in this document.

One important concept about BFES that should be remembered is that the total dollar constraints provided were based on historic funding levels and not necessarily on need. This factor perpetuated a problem in the previous allocation process. The Alaska Region has significantly higher cost of doing business than much of the rest of the Forest Service due to factors it cannot control. Because of Cost of Living Allowances, salary costs are 15-25 percent higher than anywhere else in the Nation. Most transportation for people, supplies, materials, and equipment is by boat or airplane as well as vehicle greatly increasing costs. Costs of supplies and materials are significantly higher. Davis-Bacon wage rates used in many contracts are generally the highest in the country. This results in at least 40 percent higher unit costs when compared nationally. The budget allocation system that was replaced by BFES, and on which the BFES constraints were based, allocated dollars at the same unit cost nationwide with the exception of the Recreation Management related fund codes. As a result, outputs in Alaska were relatively low when compared to total dollar constraint.

In this analysis there are references to the BFES terms P1, P2, P3, and P4. Each represents a specific Forest constraint level used in the planning process. P2 was intended to represent the FY 2001 final allocation level although in reality it was slightly lower at the Forest level (approximately 5 percent) because of some regional level commitments. P1 was 90 percent of P2, P3 was 125 percent of P2 and P4 was defined as monetarily unconstrained.

Analysis Process

This analysis was completed as follows:

- The Interdisciplinary Team abstracted or estimated the outputs contained or implied in the FEIS.
- The outputs were organized by BFES Activity.
- The activities were sorted into two groups: Operation and Maintenance Activities and Facility Construction and Improvement Activities. They were then sorted by Fund or Program code.
- The unit costs identified in the FY 2003 BFES system were applied to the outputs to determine budget needed to implement each alternative.
- The result was reviewed and modifications were made to some outputs and unit costs where there was an obvious and explainable skewing of the result.
- A final data set was completed for the Operations and Maintenance Activities.
- The Construction and Improvement Activities were analyzed in relation to the Alaska Region as a whole because the constraint is managed as a regional pool.

Analysis of the Construction and Improvement Activities

The three Construction and Improvement Activities are Facilities Construction and Improvement, Road Construction and Improvement, and Trails Construction and Improvement. Unlike the rest of the activities that are handled as part of a Forest constraint, these activities are handled as a part of a constrained regional pool. The money is allocated from the pool on a project specific basis. As such, this analysis is limited to comparing forest plan costs with an average annual forest share of the regional pool.

For the Facilities Construction and Improvement Activity, the Forest has approximately 57 percent of the regional recreation facility capacity and 23 percent of the FAO Facility Capacity. Historically, approximately two-thirds of the funding is allocated to Recreation Facilities and 1/3 to FAO Facilities. The forest could reasonably expect 47 percent of the combined Facilities pool.

For the Roads Construction and Improvement Activity, the Forest has approximately 2.5 percent of the road mileage in the Region and could reasonably expect 2.5 percent of the pool.

The Roads and Facilities pools were combined in FY 2003 planning. Therefore the above percentages were dollar weighted based on historical funding proportions between Roads and Facilities. The Forest could reasonably expect to receive an average of 35.5 percent of the combined pools over a ten-year period.

For the Trails Construction and Improvement Activity, the Forest has approximately one half of the trails mileage in the Region and could reasonably expect to receive approximately one-half of the regional pool. This was assumed for the analysis.

One other factor to be considered is the potential for additional funding outside the regular appropriated constraint. Currently the Forest Service has a special appropriation known as Title VIII that, in part, provides significant funding for the elimination of backlogged maintenance work on roads, facilities and trails. Much of the work identified and implied in the FEIS for facilities and trails reconstruction is backlog maintenance. If that work could be funded from Title VIII, the remaining costs in the Facilities, Roads and Trails Construction and Improvement Activities may be within the P3 constraint in the regularly appropriated funds pool.

Modifications to Outputs and/or Unit Costs by Activity

The modifications to outputs and/or unit costs and the rationale for those modifications are documented below. Most were in the NFRW program area and resulted from a change in unit of measure and/or quality standard between the system in place at the time the alternatives were being developed and analyzed and today's BFES system.

Monitor Forest Plans—Downward adjustment in unit cost--based on independent analysis. Costs adjusted to the existing P2 level of $201,000 plus $600,000 special monitoring plan implementation funding currently requested.

General Forest Areas
Unit cost adjusted downward-- P2 programmed target was only 5 percent of Forest plan target. This results in highly skewed unit cost. Skew results from Cost Pools, program management and the fact that the highest cost areas were programmed at the P2 level. Skew is demonstrated by reductions in unit costs at the P4 levels to 40 percent of P1. P4 still only accomplished 16 percent of total Preferred Alternative level. An estimate of unit costs was made by doing an incremental reduction in unit costs from the P4 level to the Preferred Alternative level. The cost was then further reduced because it is recognized that the cost to move management from the 90 percent "to standard" level to the 100 percent "to standard" level is extremely high –at least 30 percent of the total—and is not in the public interest for most areas which have not reached use capacity levels.

Interpretation and Education
Unit Costs adjusted downward—BFES Data shows a steady decrease in unit cost per product with increase in number of products. P4 level outputs are significantly below FEIS outputs so unit costs should be below P4 unit costs. Therefore a 10 percent reduction from P4 level was made.

Heritage Resources
Outputs adjusted downward. FEIS outputs show management of all sites to standard every year. However, the standard does not require active work every year and, in fact, monitoring activities once every five years on the average should still meet the standard. FY 2003 BFES uses targets for actively managed sites and reflects the once every 5 years approach at P4. It is further estimated that at this level, approximately 30 sites per year will be managed in connection with Section 106 support to projects, Revised Forest Plan monitoring activities, and cooperative projects with researchers and Heritage Expeditions at no cost to the Heritage Resource Management Activity.

Trails Maintenance
Unit cost downward adjustment-- Unit costs in BFES are for a single year and in this case the costs include some backlog maintenance needs on the trails to be maintained at a particular Preference Level. In the FEIS analysis maintenance was routine maintenance only and backlog maintenance needs were included as rehabilitation projects under trail improvement and construction.

Special Use Authorization Administration (Recreation and Lands)
Downward adjustment in unit costs-- With the implementation of Cost Recovery regulations we are estimating approximately $70,000 return to the Forest in these activities which is not included in the FEIS analysis. This would result in an average of $145 per permit administered.

Operate Developed Sites
Outputs adjusted downward—The definition of the output "PAOT-Days" differs slightly between the FEIS analysis and the BFES analysis. The definition used in the FEIS analysis incorporates the old working performance standard. It was "if a site was open, functional and safe on a particular day" the output was produced. Under BFES, the meaningful measures full service standard must be

met to take full credit for that day. This would include care and policing, law enforcement, and elimination of deferred maintenance to full meaningful measures standard. In the process of developing the BFES outputs for FY 2003, we determined that it was inordinately expensive to meet the last 10 percent of the standard. We were therefore only able to take credit for 90 percent of the output in a given day when operating the site at the standards implied in the FEIS and acceptable to the average user. To be comparable, it was necessary to reduce the FEIS output by 10 percent to convert to BFES outputs.

Manage Wilderness

Outputs adjusted downward—Currently the Forest has no designated Wilderness or Wild and Scenic Rivers and receives no budget constraint for this activity. Further the Forest Service can only recommend such designation to Congress. If one or more areas are designated it is assumed that an appropriate increase in the Forest constraint will be provided. Therefore this analysis does not allocate funds to this activity.

Air Quality Management

Unit cost downward adjustment. No unit cost available below the P4 level. Project and outputs in P4 were very small and high cost. Unit cost is a gross estimate.

Wilderness Management

The Forest currently has no designated Wilderness and has developed no cost estimates or program of work to accomplish this activity. Further, the Forest has never received Wilderness management funding in its constraint. This assumed that if Congress acts on Wilderness recommendation in the FEIS, there would be a specific increase in the Forest constraint to implement a Wilderness management work plan. BFES input from the Tongass National Forest that would be the most similar management situation to the Chugach was used because of the marine environment and the lack of road access to the perimeter of the Wildernesses, and cost of doing business. It was estimated a constraint increase of $1,080,000 would be needed to fully implement the Wilderness management component of the alternatives.

Conclusions Applicable to the Operational and Maintenance Activities (except Wilderness)

1. No alternative can be implemented at the P2 level.
2. The No Action Alternative, the Preferred Alternative, and Alternatives D, E and F can be implemented at a P3 level of funding, but will require some constraint adjustments between fund codes.
3. All alternatives are within 5 percent of P3.

Conclusions Applicable to the Construction and Improvement Activities

1. No alternative can be implemented at either the P2 or P3 levels with regular appropriated funds.
2. An increase in the regional pool constraints of at least 100 percent would be required to fund the Preferred Alternative at the P3 level.
3. Congressional interest in providing special funding for backlog maintenance activities in programs outside this analysis may resolve some or all of the gaps between the Preferred Alternative and projected BFES funding constraints.