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Forest Plan Timber Analysis

Shoshone National Forest

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Section on availability of lands for timber was updated May 2009. Rest of document is current as of August 2008.

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Introduction

This report documents the analysis conducted to support the suitable land use identifications, timber sale program quantity (TSPQ), and long-term sustained-yield capacity (LTSYC) portrayed in the revised plan.

Inventory data

Three sources of inventory data were used in the timber analysis. Inventory data are the source for the utilization standards and volume equations used in the analysis.

Inventory information for estimating stand characteristics and volumes was obtained from the Forest Inventory and Analysis data and from the Shoshone's common stand exam data. Forest Inventory and Analysis provides a statistically based sample of forest resources across all ownerships that can be used for planning and analyses at local, state, regional, and national levels. Summary documentation of the Forest Inventory and Analysis data for the Shoshone is provided in Forest Resources of the Shoshone National Forest (USDA Forest Service 2008). Stand inventory data for the Forest Inventory and Analysis are available online. Information from the Forest's common stand exam (USDA Forest Service2008) was used to supplement the Forest Inventory and Analysis inventory data. These data are available electronically within the Forest's FSVeg database.

The vegetation mapping for the Forest was derived from the R2Veg database. R2Veg is the Rocky Mountain Region's corporate vegetation database. It consists of existing vegetation data in a spatial layer and a series of tables containing vegetation attributes. The spatial and tabular components are housed together in an ArcGIS geodatabase. R2Veg data were captured as part of the Integrated Resource Inventory effort using a combination of photo interpretation and field verification. Information was recorded at the basic level of life form or ground cover (tree, shrub, grass, forb, barren, or water), species, size, and density (USDA Forest Service 2005).

Yield projection

Timber yield tables used in the analysis were developed using the Forest Vegetation Simulator. The Forest Vegetation Simulator is a forest growth and yield model designed to forecast forest stand development from stand forest inventory data. The Forest Vegetation Simulator grows individual forest stands into the future with regard to current stand conditions, regionally embedded growth and mortality relationships, and user-defined management options. Post processing of multiple stand simulations to describe the average stand condition for a group of similar stands is completed to create stratum-based yield tables. Yield tables were then produced for multiple strata under multiple management options for use in the timber model to allocate treatments on the landscape in order to obtain desired conditions.

Documentation of the development of the timber yield tables is found in Summary of Yield Table Development for Forest Plan Revision (USDA Forest Service 2006). A graphical representation of yield tables as they exist in the timber model is included in the Plan Set of Documents (USDA Forest Service 2008). Some adjustments were made to yield tables during the process of model development (see below).

Timber sale program quantity and long term sustained yield capacity estimates

Timber model

Spectrum, a forest planning model, was used to estimate the TSPQ and LTSYC for the Shoshone National Forest plan revision. Spectrum is a linear program-based model used to optimize the allocation of land and the scheduling of activities and outputs on a forest over a planning horizon (USDA Forest Service 2000). Spectrum is available from the Forest Service's Inventory and Monitoring Institute in Fort Collins, Colorado. The latest version, Spectrum 2.6, was used in this analysis.

Spectrum software consists of data entry forms, a matrix generator, and reporting software for the solution. A commercial linear program solver called C-Whiz (version 2.0) was used to solve the matrix generated by Spectrum. C-Whiz can be purchased from Ketron Management Science.

Spectrum land units and strata

Spectrum utilizes data components that include land units, management actions, activities and outputs, costs and revenues, management objectives, and a planning time frame or horizon (USDA Forest Service 2000). Land units in Spectrum are defined by up to six layers of descriptive qualifiers or attributes. For the Shoshone model, the planning area was stratified into land units based on four layers: timber suitability, cover type (dominant species), habitat structural stage (stand density and size class), and roadless classification. (Further discussion on the stratification is found in the timber suitability section).

Vegetation management schedules and yields in Spectrum are defined for specific strata, which are a subset of the land units in Spectrum. These strata are identified by layers 2 and 3, or cover type and habitat structural stage, respectively. The yield tables mentioned previously were assigned to specific combinations of strata and management schedules within the model.

After some preliminary test runs in Spectrum, yield tables were further adjusted within the model to allow for more timing choices in the harvest schedules, remove duplicate timing choices, create additional management schedules, and to provide additional outputs for reporting (Armel 2008).

There were 163 analysis units representing 326,389 acres of lands modeled within Spectrum. This included all lands that are forested and generally suitable for timber harvest.

Spectrum runs were made to calibrate the model, check for data errors, and validate assumptions. The final model labeled 071108_model represents the most current set of data including land units, yield tables, management actions, economics, and constraints.

Spectrum model parameters

The Shoshone model uses a 200-year planning horizon, beginning in 2006. This time span consists of 20 periods or decades; each period is 10 years. A discount rate of 4 percent was used for economics.

Spectrum model costs and revenues

Economics costs and revenues from timber management activities were based on actual forest costs in the last 2 to 4 years. Costs for stand exam surveys, timber cruising, stand thinning, and tree planting were based on recent contract costs on the Shoshone and

Bighorn National Forests. Sale planning, preparation, and administration, and road maintenance, construction, and reconstruction costs were based on actual costs and budgets for timber sale work in fiscal years 2006 through 2008. The Forest's archaeologist provided costs of conducting heritage surveys. Revenues were based on timber sales in fiscal years 2005 through 2008.

Timber volume constraints

Constraints were applied to the Spectrum model to prevent unrealistic solutions such as scheduling all timber harvest in the first few decades or not scheduling any harvest at all in a given decade. Two types of constraints were used. The first type called 'harvest policy constraints' are pre-built into Spectrum and are designed to meet National Forest Management Act requirements for non-declining even flow of timber, long term sustained yield, and ending forest inventory. The harvest policy constraints were used in the final runs—those estimating LTSYC and TSPQ.

A constraint was applied to cap the amount of timber volume removed from lands suitable for timber harvest. On these lands, timber harvest may be used as a tool for other resource objectives such as wildlife habitat improvement, visuals, etc. Volume was limited to 8 million board feet per period (800,000 board feet per year). This constraint was based on what the Forest is currently producing from these lands and what is predicted will be produced in the foreseeable future. This level of harvest should be adequate to meet desired conditions on timber harvest lands where production of timber is not a primary objective. This level of harvest is also consistent with the level that was established in the Allowable Sale Quantity amendment to the 1986 Forest Plan (USDA Forest Service 1994).

Acres harvested flow constraints

Other constraints were user defined and designed to meet management objectives and reach desired conditions. For example, the current model contains a number of flow constraints designed to even out large fluctuations in harvest volume between cover types and management strategy from decade to decade.

Constraints were added to prevent more than a 75 percent change in acres harvested from one decade to the next in the first 50 years in Douglas-fir, lodgepole pine, and spruce/fir cover types. A similar flow constraint that did not allow harvest acres to vary by more than 50 percent in the first 50 years was applied to acres that were not timber production acres. These flow constraints prevented the model from scheduling harvest in a given timber strata all at once, leaving holes in subsequent periods. In addition to the flow constraints in these cover types, a constraint was added to force a minimum of 10 acres to be treated per decade. This constraint forced the model to begin cutting cover types in the first decade and not defer initial entry to a cover type into a future decade.

Clearcutting was limited to species or cover types where practical and presently applied. In addition, clearcutting was used as a management practice for species that are normally not a commercial species but for which we wanted to model output, such as in aspen, limber pine, and whitebark pine. When these species occur in mixed conifer stands, their yields are modeled within the mixed conifer management strategy. When they are modeled in pure stands, we did not have management strategies other than clearcutting modeled. In pure stands these species are rarely harvested for timber production purposes and a common management strategy is clearcut or patch clearcut. It was felt the strategy provided accurate enough information for the few acres of that harvest that are modeled. More information on these species is presented later in this report. Within these cover types, clearcutting was further constrained with flow

constraints. In lodgepole pine, the practice was limited to 75 percent of the total acres harvested from lands suitable for timber production. This was to allow for the use of other harvest methods where needed in this strata to meet desired conditions. On lodgepole pine stands in lands suitable for timber harvest, clearcutting was limited to 25 percent of the total acres. The rationale for the latter constraint is these lands will be treated for other resource needs, such as wildlife habitat or fuel reduction, and harvest by clearcut may not meet those other desired conditions.

Selection harvest was constrained in spruce/fir stands to 25 percent of the acres cut from lands suitable for timber production and to 75 percent from lands suitable for timber harvest. Selection harvest is also limited to 75 percent of total acres of Douglas-fir cut from lands suitable for timber harvest. Selection harvest is more commonly applied in areas where timber production is not the main objective since less volume is removed. A mix of management activities is generally applied to any given strata on the Forest so this constraint was needed to better reflect the mix of treatments that would be used to meet desired conditions.

Selection harvest was also constrained in lodgepole pine on lands suitable for timber production where the model was scheduling individual tree selection in a relatively large number of acres. The prescription was limited to 20 percent of the total acres harvested in these strata. Again, this constraint was added to better reflect the mix of treatments that would be used to meet desired conditions.

Aspen restoration constraints

The Shoshone model contains a special management prescription and accompanying yields for converting Douglas-fir and spruce/fir stands to aspen or willow. This prescription is designed to meet desired conditions in the proposed revised plan. To model this activity, Spectrum is required to schedule treatment on a minimum of 900 acres of either Douglas-fir or spruce/fir per period, or 90 acres per year. At least 300 of the 900 acres must come from each cover type, but no more than 10 percent of all acres (any strata) can be assigned to this treatment.

Aspen, limber pine, and whitebark pine constraints

For these cover types, the proposed revised plan requires vegetation manipulation to achieve desired conditions in some situations. As noted above, clearcutting is used as the management strategy for these species within the model. The following constraints were designed to model desired conditions for these cover types.

Harvest in the aspen cover type is limited to 5 percent of all aspen acres, per decade, throughout the 200-year planning horizon. However, in the first 3 decades, harvest must be at least 3 percent of the total aspen acres (per decade). This constraint emphasizes the focus on increasing the acres of aspen cover type and then maintaining those acres over time.

Harvest in limber pine is limited to 1 percent of all limber pine acres per period over the 200-year horizon. This constraint emphasizes the desired conditions for maintaining this cover type.

Whitebark pine harvest in periods 1 through 20 is limited to 1 percent of all whitebark pine acres in the model, but in the first 3 decades, harvest must be at least 200 acres per decade. This constraint emphasizes the focus on whitebark pine cover type and then maintaining those acres over time.

Model projections

The following are the definitions for the two management emphasis categories used in the tables.

Timber emphasis is the purposeful growing, tending, harvesting, and regeneration of regulated crops of trees to be cut into logs, bolts, or other round sections for industrial or consumer use (36 CFR 219.16). In addition, timber emphasis is managing land to provide commercial timber products on a regulated basis with planned, scheduled entries.

Other emphasis is the purposeful growing, tending, harvesting of forest vegetation to improve wildlife habitat, to maintain or improve scenic resources, to maintain or improve the recreational experience of visitors, to improve the resiliency of forested ecosystems to disturbance events, including management to protect communities from losses associated with disturbance events, and to achieve other management objectives besides timber production.

Table 1 and Table 2 show the estimated average annual vegetation treatments and the average annual TSPQ for the first 3 decades under the revised forest plan. The projected outputs reflect past and projected budget levels and the organization capacity to accomplish timber harvest activities. The TSPQ is identified as an objective in the proposed revised plan.

These acres and volumes are estimates made during plan development. They are not firm commitments to offer timber at these levels during the plan decade. Like other plan components, they describe activities designed to meet desired social, economic, and ecological desired conditions. The estimated volumes may change due to project-level data, unforeseen events, or modified conditions.

The following are the definitions for the two management emphasis categories used in the tables.

Timber emphasis is the purposeful growing, tending, harvesting, and regeneration of regulated crops of trees to be cut into logs, bolts, or other round sections for industrial or consumer use (36 CFR 219.16). In addition, timber emphasis is managing land to provide commercial timber products on a regulated basis with planned, scheduled entries.

Other emphasis is the purposeful growing, tending, harvesting of forest vegetation to improve wildlife habitat, to maintain or improve scenic resources, to maintain or improve the recreational experience of visitors, to improve the resiliency of forested ecosystems to disturbance events, including management to protect communities from losses associated with disturbance events, and to achieve other management objectives besides timber production.

Table 1–Annual average treatment area (acres) in the first 3 decades for lands generally suitable for timber harvest

Practice	Decade 1 Management Emphasis			Decade 2 Management Emphasis			Decade 3 Management Emphasis		
	Timber	Other resources	Total	Timber	Other resources	Total	Timber	Other resources	Total
	Lands where timber production achieves, or is compatible with desired conditions and objectives								
Even aged harvest	515	99	614	497	130	627	529	41	570
Uneven aged harvest	109		109	94		94	88		88
Other harvest		44	44		2	2		81	81
Subtotal	624	143	767	591	132	723	617	122	739
	Other lands								
Even aged harvest		17	17		2	2		27	27
Uneven aged harvest		70	70		87	87		46	46
Other harvest		46	46		88	88		88	88
Subtotal		133	133		177	177		161	161
Grand Total	624	276	900	591	309	900	617	283	900

Table 2 Annual average TSPQ (mmcf) in the first 3 decades for lands generally suitable for timber harvest

Practice	Decade 1 Management Emphasis			Decade 2 Management Emphasis			Decade 3 Management Emphasis		
	Timber	Other resources	Total	Timber	Other resources	Total	Timber	Other resources	Total
	Lands where timber production achieves, or is compatible with desired conditions and objectives								
Even aged harvest	597	140	737	554	251	805	679	75	754
Uneven aged harvest	33		33	81		81	80		80
Other harvest		120	120		4	4		56	56
Fuel wood		126	126		126	126		126	126
Subtotal	630	386	1016	635	381	1016	759	257	1016
	Other lands								
Even aged harvest		13	13		5	5		26	26
Uneven aged harvest		8	8		10	10		9	9
Other harvest		139	139		145	145		125	125
Fuel wood		224	224		224	224		224	224
Subtotal		384	384		384	384		384	384
Grand Total	630	770	1400	635	765	1400	759	641	1400

Figure 1 and Figure 2 display the LTSYC and TSPQ for timber production and other lands. For the revised plan, the average annual TSPQ must be less than or equal to the LTSYC. This limit does not prohibit the responsible official from salvage or sanitation harvesting from areas substantially damage by fire, windthrow, or other catastrophe, or which are in imminent danger from insect or disease attack. This shall not prohibit capturing, and including in the TSPQ, wood fiber not represented in the utilization standards used in calculating LTSYC. The majority of the fuelwood projection in the TSPQ displayed above falls within this category. A large percentage of the fuelwood is non-merchantable material left over after timber sales or other dead material that does not meet utilization standards. The responsible official may either substitute such timber for timber that would otherwise be offered under the plan or offer such volume above the planned volume (Forest Service Handbook 1909.12 63.5).

Figure 1—Display of LTSYC and TSPQ on lands suitable for timber production (mmcf)

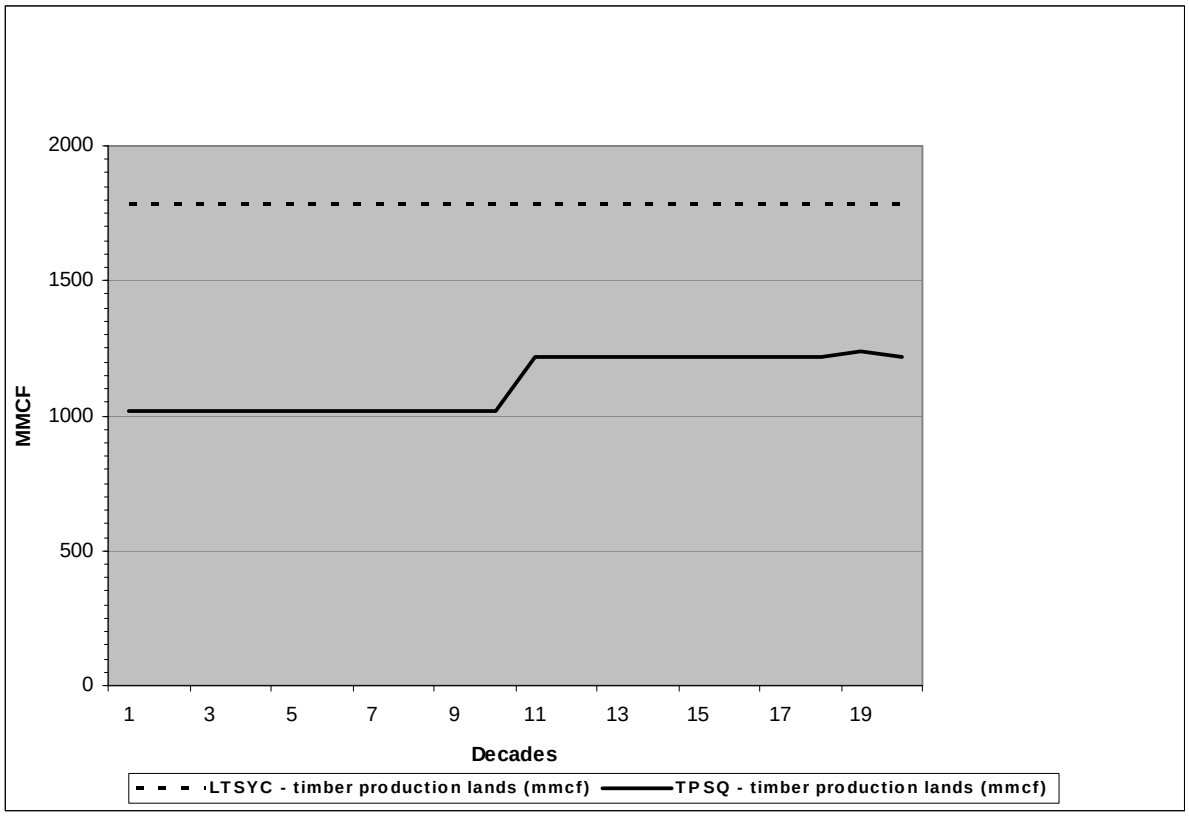
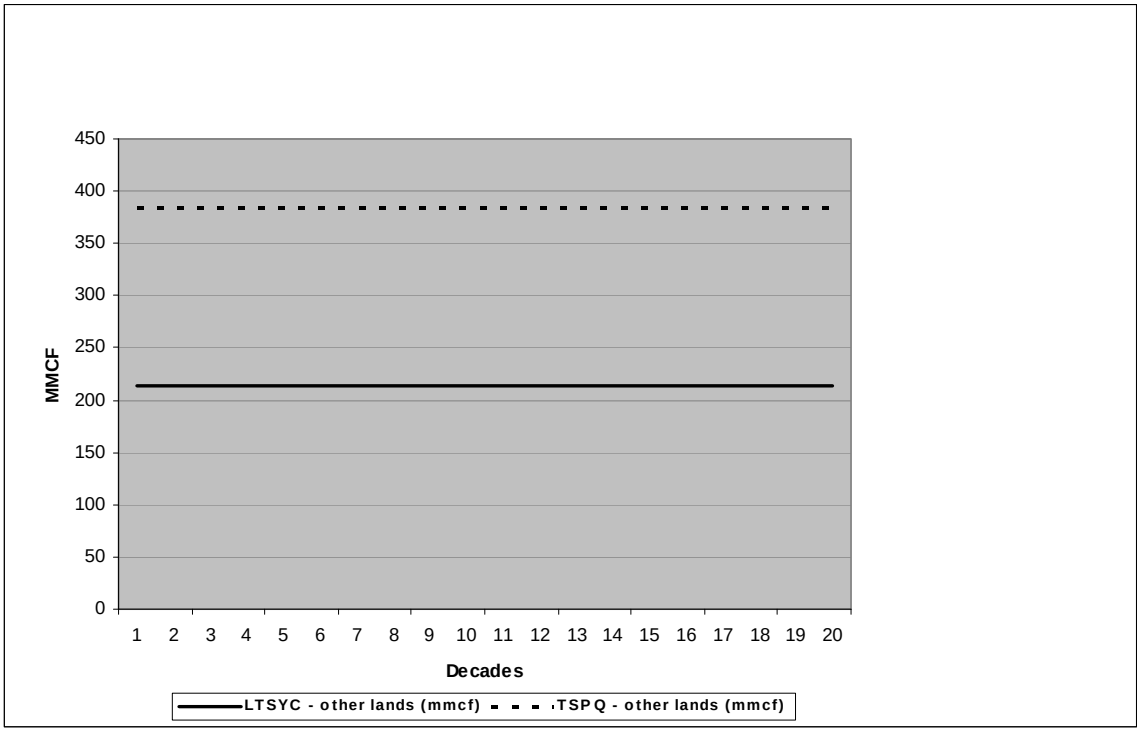


Figure 2–Display of LTSYC and TSPQ on other lands (mmcf)



Availability of lands for timber

The timber availability classification for the Shoshone National Forest applied the planning regulation (Forest Service Handbook 1909.12) criteria in a step-wise process. Forest-wide geographic information system data were used to analyze and map the classification. Ranger district timber personnel reviewed the results and adjusted criteria to reflect on-the-ground experience. Table 5 displays a summary of the suitability analysis. The process and rationale are described below.

Identification of lands generally not available for timber harvest

Criteria for determining lands generally not available for timber harvest are outlined in Forest Service Handbook 1909.12, 62.1 and are repeated here.

1. Timber harvest is not permitted for one or more of the following reasons:
    a. Statute, executive order, or regulation generally prohibits timber harvest on the land, or the land has been withdrawn from timber harvest by the Secretary of Agriculture or the Chief of the Forest Service as described in section FSH 1909.12 62.11.
    b. Soil, slope, or other watershed conditions will be irreversibly damaged or substantial and permanent impairment of the productivity of the land by timber harvest as described in section FSH 1909.12 62.12.
    c. There is no assurance that such lands can be adequately restocked within five (5) years after harvest as described in section FSH 1909.12 62.13.
    d. Trees are unable to grow due to environmental conditions (such as insufficient rainfall, low temperature, or other growing conditions preventing the establishment of tree).
2. Timber harvest of any kind, including salvage activities, is not compatible with desired conditions and objectives. In other words, an area where the desired

conditions are such that vegetation must remain undisturbed by human intervention.

Under criteria 1a areas were identified as not available for timber harvest. These included designated wilderness, the DuNoir Special Management Unit, and High lakes Wilderness Study Area. The Glacier Addition to the Fitzpatrick Wilderness is not included with this group. The wilderness designation for that area allows timber harvest for bighorn sheep management.

Criteria 1b, c, and d are considered together since there is overlap between data used to screen for the criteria. Table 2 displays lands excluded from timber harvest and the criteria under which they fall.

Table 3—Areas where irreversible damage, adequate restocking, and other environmental conditions make the area not available for timber harvest

Land conditions	Criteria rationale
High elevations above 11,000 feet	Adequate restocking and environmental conditions
Low elevations and southwest aspects[1]	Adequate restocking and environmental conditions
Slopes greater than 40 percent	Irreversible damage
Areas of water, rock, or barren	Environmental conditions

Areas where the desired conditions are not compatible with timber harvest include the designated Clarks Fork Wild and Scenic River segment. These lands were identified as not available for timber harvest under criteria 2.

Identification of lands generally available for timber harvest

All lands that do not meet the criteria described above were identified as lands generally available for timber harvest (Forest Service Handbook 1909.12 62.2).

These lands include:

1. Lands where timber production achieves, is compatible with, or could contribute to the achievement of desired conditions and objectives established by the plan (lands suitable for timber production), as described in section FSH 1909.12 62.21.
2. Other lands where trees may be harvested for multiple-use values other than timber production as described in section FSH 1909.12 62.22.

Lands suitable for timber production.

From the lands available for timber harvest, lands suitable for timber production meet all the following criteria:

1. Lands are not withdrawn from timber production by Statue, Executive order, regulation, policy (sec FSH 1909.12 62.31), and
2. Lands are forested land (sec. FSH 1909.12 62.32), and
3. Timber production would achieve, be compatible with, or could contribute to the achievement of, desired conditions and objectives (36 CFR 219.12; Forest Service Manual 1921.12), and

[1] Elevations were adjusted by ranger district from north to south to reflect on-the-ground experience (Clarks Fork Ranger District below 7,200 feet, Greybull & Wapiti Ranger Districts below 7,600 feet, Wind River Ranger District below 8,000 feet, and Washakie Ranger District below 8,400 feet).

4. A flow of forest products can be planned and scheduled on a reasonably predictable basis over time and the regeneration of the stand is intended.

Timber production may be a primary use. However, in many cases, timber production may be secondary to other multiple uses. If timber production would achieve, be compatible with, or contribute to the achievement of, desired conditions and objectives, and those products can be planned, scheduled, and regenerated on a reasonably predictable basis, the land should be identified as generally suitable for timber production. An important factor in determining whether desired conditions and objectives are compatible with timber production is whether regeneration of the stand as an element in maintaining the desired conditions of forest vegetation is planned at any time in the future. If regeneration is not planned at any time in the future, those lands should be identified as “other lands”. The identification of lands generally suitable for timber production is not a final decision approving projects or activities.

For the Shoshone, lands within the general forest recreation setting were included in this category, excluding those lands that meet the criteria described in the next section.

Other lands where timber production is not compatible with desired conditions or resource objectives

These are lands available for timber harvest where timber production is not compatible with achieving desired conditions or objectives, but trees may be harvested for multiple use values other than timber production (36 CFR 219.12(a)(4)). Categorization of lands as “other lands” is not a determination of the suitability of the land for resource uses. It is merely a determination that timber harvest may be used at some time as a tool to assist in achieving the desired conditions or objectives.

On some lands, timber production is not compatible with the resource objectives. Those lands are described in Table 4.

Table 4—Lands where resource objectives are not compatible with timber production

Lands description	Rationale
Cover types of aspen, cottonwood, pinyon	Resource objectives are to maintain these cover types. These are not commercial timber species.
Cover types where more than 66 percent of the treed portion of the stand is whitebark pine or limber pine	Pure stands of these species are not compatible with timber production. They do not generally produce marketable products in pure stands. This does not apply when they occur in mixed stands with other conifer species.
Cover types of grasslands and shrublands	Resource objectives are to maintain these cover types.
Moraine soil type (in the Washakie geographic area)	Highly rocky soils are not compatible with timber production.

On some lands, the desired conditions for special areas, proposed special areas and some recreation settings are not compatible with timber production.

Special areas and proposed special areas were identified where the desired conditions are not compatible with timber production. These include, Line Creek Plateau Research Natural Area, eligible wild and scenic rivers that are classified as wild, and proposed research natural areas and special interest areas.

Some recreation settings desired conditions were also identified as not being compatible with timber production. These included the following recreation settings: travel and recreation corridors, access corridors, and all back country settings.

Table 5—Summary of availability of areas for timber harvest and production

Category	Acres	Acres generally not available for timber harvest	Acres generally available for timber harvest	Acres not suitable for timber production
1. Total National Forest System lands within the plan area	2,437,550			
2. Lands generally not available for timber harvest (sec. 62.1)		1,782,955		1,782,955
a. Lands not available for timber harvest due to statue, Executive order, regulation, policy or physical and biological conditions (first screen)(sec. 62.1)		1,780,024		
b. Lands where timber harvest is not compatible with desired conditions and objectives (second screen)(sec. 62.1)		2,931		
3. Lands generally available for timber harvest (sec. 62.2)			654,596	
a. Lands suitable for timber production (sec. 62.21)[2]			163,810	
b. Other lands where trees may be harvested for multiple use values other than timber production (sec. 62.22)			490,786	490,786
4. Lands generally not suitable for timber production, all lands except 3(a). (sec. 62.3)				2,273,741

Other timber exhibits

Table 6 and Table 7 display additional information as outlined in Forest Service Handbook 1909.12 65.5.

Table 6 displays information on how existing conditions compare to desired conditions for the age class distribution of forested stands. For the display, age class groups are defined as: young age class refers to stands in a seedling sapling stage; older age class refers to stands aged over 200 years for Douglas-fir, whitebark pine, spruce/fir, and limber pine, over 150 years old for lodgepole pine, and over 80 years old for aspen; and middle age class refers to all other age classes between young age class and older age class.

[2] Timber production achieves or is consistent with desired conditions and objectives

Table 6—Current conditions and desired conditions age class distribution for forest cover types, displayed as a percentage for each cover type

Forested cover type	Existing conditions			Desired conditions		
	Young age class	Middle age class	Older age class	Young age class	Middle age class	Older age class
Aspen	Data inconclusive			10-20	50-70	>20
Douglas fir	6	78	16	5-15	45-70	>25
Spruce fir	6	64	30	5-15	35-65	>30
Lodgepole pine	15	63	22	10-20	50-70	>20
Whitebark pine	3	74	23	5-10	45-70	>25
Limber pine	3	69	28	5-15	45-70	>25

Table 7 displays various measures of timber conditions on the Shoshone. All information is from Forest Resources of the Shoshone National Forest (USDA Forest Service 2008). Actual data used in the report are from 1998. These numbers do not reflect the increase in mortality that has resulted from the insect epidemics since 2000. For the display, the measures are defined as: net volume refers to the volume of all live trees 5.0 inches in diameter and greater; total biomass include boles, bark, and branches of all live trees 1.0 inches diameter and greater; total basal area is a cross-sectional area of tree stem/bole at the point of measurement; gross annual growth refers to the growth of live trees 5.0 inches diameter and greater; annual mortality is the estimated average annual mortality based on trees 5.0 inches in diameter and greater that have died in the last 5 years; and net annual growth is the difference between gross annual growth and annual mortality.

Table 7—Forest conditions for forested lands on the Shoshone (Menlove 2008)

	Forested lands		
	All	Outside designated wilderness	Outside designated wilderness and inventoried roadless
Net volume (million cubic feet)	3,227	1,266.8	367
Total biomass (million tons)	57.1	21.2	5.9
Total basal area (million square feet)	147.4	58.9	16.5
Gross annual growth (million cubic feet)	40	18	7
Annual mortality (million cubic feet)	36.6	10.2	2.6
Net annual growth (million cubic feet)	3.4	7.8	4.3

Plan provisions for resource management

This section provides background, further information, and a cross reference to the plan components that meet the direction for plan provisions for resource management (36 CFR 219.12 (b)).

Projects and activities to harvest timber on forest lands may only be authorized when (16 USC 1604 (g)(3)(E)

Soils and watersheds are protected

Specifically soils, slope, or other watershed conditions will not be irreversibly damaged. Streams, streambanks, shorelines, lakes, wetlands, and other bodies of water are protected from detrimental changes in water temperatures, blockages of water courses, and deposits of sediment where harvests are likely to seriously and adversely affect water conditions or fish habitat.

Soils and watershed conditions along with our resources are protected through the application of design criteria from the Forest Service Handbook 2509.25 Region 2 Watershed Conservation Practices management measures.

The plan includes guidance that land management activities included design criteria to protect soil and water resources.

Restocking

Regeneration harvests for timber production should not be planned unless there is reasonable assurance the desired species can be adequately restocked within 5 years of final regeneration harvest. In some cases, even within the areas where timber production achieves or is compatible with desired conditions and resource objectives, timber harvest will be conducted for purposes other than timber production. In these cases, restocking is not required within 5 years. This determination should occur with a project-level decision after comparing the existing vegetation condition to the objectives and desired vegetation conditions stated in the plan. Examples of when timber harvest without restocking can occur include but are not limited to:

- Commercial removal of trees encroaching on a riparian complex to restore the desired conditions
- Not restocking after timber harvest to create greater age-class diversity in a uniformly forested landscape
- Harvesting within a scenic view to improve visual diversity or create vistas

The plan includes guidance that regeneration harvest for the purposes of timber production should only be used when there is a reasonable assurance of restocking within 5 years.

Table 8 is provided as a guide that can be used along with professional judgment to determine stocking level adequacy.

Table 8—Stocking guidance by forest cover type and site productivity class

Forest cover type	Site productivity (cu ft/ac/yr)	Planting density (trees/ac)	Seedling stocking per acre	
			Minimum	Desired
Spruce-fir	85+	360-680	200	340
	50-84	306-540	200	280
	20-49	300	150	155
Mixed-conifer	85+	435-680	205	310
	50-84	435-550	205	255
	20-49	300-360	190	240
Lodgepole pine	85+	435-680	245	340
	50-84	360-540	200	280
	20-49	300	150	250
Aspen	All	NA	300	600

Harvesting system selection

The harvesting system to be used is not selected primarily because it will give the greatest dollar return or the greatest unit output of timber.

The plan guidance is provided that indicates harvesting systems should be selected based on their ability to meet plan desired conditions and not strictly on a volume or economic production basis.

Cutting methods, such as clearcutting, seed tree cutting, shelterwood cutting, and other cuts designed to regenerate an even-aged stand of timber may only be authorized when (16 USC 1604) (g)(3)(F)

Even-aged harvesting

Clearcutting should only be selected when it is the optimum method for meeting desired conditions. Seed tree, shelterwood, and other even aged cuts are appropriate when they meet the desired conditions and objectives of the plan (16 U.S.C. 1604 (g)(3)(F)(i)).

The following are examples of situations where even-aged treatments may be appropriate.

- Establishing, maintaining, or improving habitat for threatened and endangered species, species of concern, or species of interest
- Obtaining a desired ecological or multiple-use outcome by reducing hazardous fuels, enhancing wildlife habitat, creating age class or structural diversity within a forested landscape, or providing for recreation by improving scenery, utility corridors, road corridors, facility sites, reservoirs, or similar development areas
- Rehabilitating lands adversely affected by events such as fires, windstorms, or insect or disease infestations
- Precluding or minimizing the occurrence of potentially adverse impacts or disease infestations, windthrow, logging damage, or other factors affecting forest health

- Providing for the establishment and growth of desired trees or other vegetation species that are shade intolerant
- Rehabilitating stands poorly stocked due to past management practices or natural events
- Meeting research needs
- Achieving economic and social objectives

  The forest plan includes guidance on addressing the optimality of clearcutting and the appropriateness of other even-aged treatments.

Interdisciplinary review and project design

In designing a project that utilizes even-aged treatments to meet forest plan desired conditions and objectives the following needs to occur or be considered:

- Interdisciplinary reviews are conducted and the potential environmental, biological, aesthetic, engineering, and economic impacts are assessed on each advertised sale area and a determination is made that the cutting methods are consistent with the multiple use of the general area, including the forest plan (16 U.S.C. 1604 (g)(3)(F)(ii))
- Cut blocks, patches, or strips are shaped and blended to the extent practicable with the natural terrain (16 U.S.C. 1604 (g)(3)(F)(iii))
- Cuts are carried out according to the maximum size limit requirements for areas to be cut during one harvest operation
- Timber cuts are carried out in a manner consistent with the protection of soil, watershed, fish, wildlife, recreation, aesthetic resources, cultural and historic resources, and the regeneration of timber resources

The plan includes specific guidance on conducting reviews, designing cut blocks to meet scenic integrity objectives, and on cut block sizes. The plan direction and guidance in its entirety provides additional direction to ensure that harvest activities are consistent with the protection of other resources.

Culmination of mean annual increment

Stands of trees are harvested according to requirements for culmination of mean annual increment of growth (16 U.S.C. 1604 (m).

Culmination of mean annual increment of cubic volume does not occur at a precisely predetermined age. It varies by species, site quality, and by management practices applied to stands.

Stands of trees planned for regeneration harvest should generally have reached culmination of mean annual increment of growth when they are being harvested for timber production purposes. Stands of any species that are damaged, sparse, or low quality may be regenerated prior to culmination of mean annual increment. Salvage and sanitation harvesting of timber stands substantially damaged by fire, windthrow, or other catastrophe, or which are in imminent danger from insect or disease attack are not subject to the culmination of mean annual increment guide.

The plan contains guidance that stands should have achieved culmination of mean annual increment when they are harvested for timber production purposes.

Timber practices

This section being developed – a brief narrative summary for practices and how the practices can achieve desired conditions and objectives.

References

This section is in progress.