

greater impact in slowing the spread of invasive species, which benefits herbaceous vegetation and ultimately livestock grazing in the future.

- Under all alternatives the permitted use of the existing grazing allotments would continue. Based on current rangeland and riparian conditions and the need to revise allotment management plans for many allotments, changes in the amount of permitted AUMs are difficult to predict. Project-level analysis will determine future stocking rates and other management adjustments to meet desired conditions under all alternatives. Permitted head months over the long-term could possibly decrease under all alternatives due to more intensive management of RMZs and aquatic TES habitat.
- Motorized access on allotments could become more restricted under alternatives that contain RWAs. Some allotments may be more difficult to administer if a travel variance to use motor vehicles is not authorized. However, most of the RWAs are already semi-primitive and/or roadless under current management and contain very small amounts of suitable rangeland and range infrastructure. Therefore, allocation of RWAs should be insignificant for livestock grazing within the plan area.
- All alternatives have the opportunity to implement vegetation treatments, such as timber harvest, prescribed fire, and to allow wildfire to provide resource benefits where feasible. Vegetation should move towards a desired mix of conditions from these treatments and thus provide a secondary benefit of improving forage conditions and transitory range in the future.

3.29 Timber and Other Forest Products

3.29.1 Introduction

The HLC NF contains valuable timber resources, including products in demand by the American public such as lumber, house logs, pulpwood, and fuelwood. Timber harvest may be used to supply timber products as well as move vegetation towards desired conditions and meet other resource objectives such as improving watershed condition, improving wildlife habitat, and reducing wildfire risk. Timber harvest also provides jobs and income in logging and manufacturing of wood products.

Other special forest products include plant and fungi materials that are gathered from NFS lands. The most common of these products provided by the HLC NF is Christmas trees. Other products that are commonly utilized include posts and poles and, periodically in recent fire areas, mushrooms.

Timber and other forest products are analyzed at the scale of all NFS lands across the plan area. Timber demand is evaluated across the counties associated with the HLC NF.

Key indicators that will be used to measure effects of alternatives are:

- Timber suitability (acres)
 - Lands suitable for timber production
 - Lands unsuitable for timber production where harvest may occur for purposes other than timber production
- Timber supply [million board feet (mmbf) and million cubic feet]
 - PTSQ
 - PWSQ
 - sustained yield limit
- Timber demand (qualitative)
- Acres harvested by decade (acres)
- Other forest products (qualitative)

Timber harvest and timber production were raised as issues during public scoping, including desires to increase the amount of harvest, lands suitable for timber production, and/or the volume outputs over time; as well as concerns for the impacts of harvest on other resources and a desire to limit this use.

Definitions and metrics compared for alternatives

The metrics for estimated timber volume outputs have changed from the 1982 planning rule (which guide the current plans and no-action alternative); and those defined in the 2012 Planning Rule (which would guide the action alternatives). The metrics defined for the current forest plans in 1986 are disclosed to describe alternative A. However, to provide a direct comparison, alternative A was also included in the modeling to calculate the metrics as defined in the 2012 Planning Rule. The timber volume metrics from both planning rules and/or associated directives are defined as follows:

- *Long term sustained yield capacity* (applies to alternative A) is the highest uniform wood yield from lands being managed for timber production that may be sustained under a specified management intensity consistent with multiple-use objectives (47 FR, 219.3 1982).
- *Allowable sale quantity* (applies to alternative A) is the quantity of timber that may be sold from the area of suitable land covered by the forest plan for a time period specified by the plan. This quantity is usually expressed on an annual basis as the "average annual allowable sale quantity." (47 FR, 219.3 1982).
- *Sustained yield limit* (applies to alternatives B, C, D, E) is the amount of timber, meeting applicable utilization standards, which can be removed from a forest annually in perpetuity on a sustained-yield basis. It is the volume that could be produced in perpetuity on lands that *may be suitable* for timber production. Calculation of the limit includes volume from lands that may be deemed not suitable for timber production after further analysis during the planning process. The calculation of the SYL is not limited by land management plan desired condition, other plan components, or the planning unit's fiscal capability and organizational capacity. The sustained yield limit is not a target but is a limitation on harvest, except when the plan allows for a departure (USDA, 2015).
- *PWSQ* (alternatives B, C, D, E) is the estimated quantity of timber and all other wood products that is expected to be sold from the plan area for the plan period. The PWSQ consists of the PTSQ (below) as well as other woody material such as fuelwood, firewood, or biomass. It includes volume from timber harvest for any purpose based on expected harvests that would be consistent with the plan components. It is also based on the planning unit's fiscal capability and organizational capacity. It is not a target nor a limitation on harvest. (USDA, 2015).
- *PTSQ* (alternatives B, C, D, E) is the estimated quantity of timber meeting applicable utilization standards that is expected to be sold during the plan period. As a subset of the PWSQ, it includes volume from timber harvest for any purpose from all lands in the plan area based on expected harvests that would be consistent with the plan components. The PTSQ is also based on the planning unit's fiscal capability and organizational capacity. It is not a target nor a limitation on harvest. (USDA, 2015).

It is not appropriate to compare the measures estimated using the 1982 planning rule directly against the measures calculated based on the 2012 Planning Rule and associated directives.

Timber suitability for alternative A was also updated to account for additional regulation and policy that have changed the management situation since 1986, such as the designation of IRAs. This was important to ensure that the depiction of alternative A accurately reflects what the management situation would be if this alternative were selected. As with timber volume outputs, this also allows for a direct comparison to the suitability determinations made for the action alternatives.

3.29.2 Regulatory framework

36 CFR 223.1 allows that trees, portions of trees, and other forest products on NFS lands may be sold for the purpose of achieving the policies set forth in the Multiple Use Sustained Yield Act as amended and the Forest and Rangeland Renewable Resources Planning Act of 1974, as amended.

36 CFR 223.239 and 240 provide regulations for free-use without a permit for members of Tribes with treaty or other reserved rights related to special forest products.

36 CFR 261.6 lists activities regarding timber and other products that are prohibited.

3.29.3 Assumptions

Much of the timber analysis is based on harvest schedule modeling conducted with the Spectrum model; many assumptions are associated with modeling, as detailed in appendix B.

Harvest prescriptions are generalized for this broad scale analysis. During implementation of the forest plan under any alternative, site-specific prescriptions and silvicultural practices would be tailored to the forest stand to be treated. Further, site-specific mitigations and BMPs, such as those that apply in RMZs, would apply as described in the plan. These site-specific factors would not materially change the broad scale volume estimates made for planning purposes.

For the action alternatives, it is assumed that all management strategies described in appendix C of the revised forest plan would generally be followed.

3.29.4 Best available scientific information used

The affected environment was described using FS cut and sold reports from the Timber Sale Accountability database and treatment records in the FACTS database. Information on the location and condition other forest products that could be gathered is limited.

FIA data and a variety of GIS data were used to determine the lands that may be suitable for timber production (see appendix B). Yield tables were developed using the Forest Vegetation Simulator. This information along with Spectrum modeling was used to estimate acres treated by treatment type and volume outputs, as described in appendix B. The actual timber harvest level that would occur during implementation of the plan is dependent on many variables, including the demand for products.

There is no incomplete or unavailable information for the timber analysis. This analysis was completed at the strategic level, using forest level data sources. Site-specific data at the project scale is expected to result in some changes to timber suitability and volume outputs. The data used is the latest available information. The effects of recent disturbances, including the fires of 2017, are not portrayed by this data. However, the analysis of alternatives includes the potential for future fire and therefore the relative comparisons at the programmatic scale remain valid.

3.29.5 Affected environment

Use and development of natural resources on the HLC NF and surrounding lands played an essential role in the economy and growth of the area since the early settlement by European-origin Americans. Mining for gold and other minerals boomed in the late 1800's, and tree cutting that occurred for fuelwood, mine timbers, and railways was extensive in accessible drainages. Harvest became associated with a demand for pulpwood during World War II and to support numerous small mills (USDA, 1986a, 1986b). The original mission of the FS focused on protecting water and timber (Kline & Mazzotta, 2012), and harvest continues to be an important use. Timber harvested on the HLC NF provides a variety of wood products, such as sawlogs, veneer logs, and house logs, as well as logs used for pulpwood, posts and poles, firewood, furniture, and energy.

Timber suitability

Lands suitable for timber production were used to derive the allowable sale quantity in the current 1986 forest plans. These plans determined 282,307 acres to be suitable for timber production on the Lewis and Clark NF and 251,600 acres to be suitable on the Helena NF (USDA, 1986a, 1986b). Timber suitability was determined through the use of resource data and computer models and followed the handbook and planning regulations that were in place at the time. Refer to appendix A for maps of lands suitable for timber production. The acres suitable for timber production in the existing condition are equivalent to that of alternative A.

There have been changes to timber suitability as the forest plans have been implemented. These changes include de-facto reductions in lands suitable for timber production caused by the designation of IRAs. There have also been changes in available vegetation data and land ownership status. To accurately portray the existing condition (and alternative A), timber suitability was recalculated to reflect these changes. Based on these updates, roughly 430,489 acres are suitable for timber production in the existing management paradigm, which is 103,405 fewer acres are suitable for timber production than in the original 1986 forest plans and represents about 15% of the total HLC NF.

Currently, harvest may occur on an additional 40% of NFS lands on the HLC NF that are not suitable for timber production but where harvest may occur for purposes other than timber production. The existing acres unsuitable for timber production where harvest may occur for other purposes is equivalent to that of alternative A. The lands where harvest may occur are shown including and excluding IRAs. While harvest could occur in IRAs, it would be constrained by the 2001 Roadless Area Conservation Rule.

Timber supply

Forest growth rates influence potential timber production over time. Site productivity is generally considered to be fixed based upon site attributes such as topography, soil type, and climate. On the HLC NF, site productivity in terms of tree growth is estimated to be between 20 and 84 cubic feet per acre per year on suitable lands with average rotation ages ranging from 95 to 150, depending on the species and site (USDA, 1986a, 1986b).

Figure 20 displays the total volume of timber cut and sold on the HLC NF from 1986 to 2016. Much of the timber cut from 2009 to 2013 was mountain pine beetle-killed lodgepole pine which was sold as nonsaw material. Firewood has been a consistent contributor to wood volume sold, and has been abundant in the last decade due to the availability of dead trees in areas affected by fire and mountain pine beetle. The last several years (2014-2016) have seen an increase in sawtimber sold compared to the last decade.

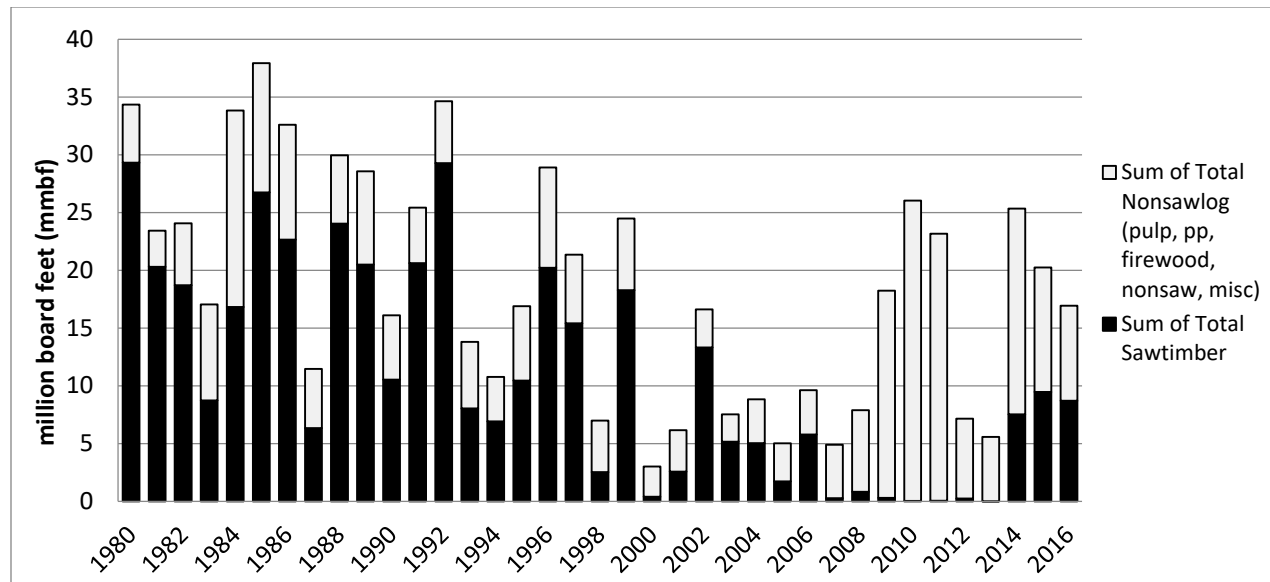


Figure 20. Timber product volume sold from the HLC NF 1986-2016

The long term sustained yield capacity calculated for the 1986 forest plans was 21.3 mmbf for the proclaimed Helena NF and 20.5 mmbf for the proclaimed Lewis and Clark NF. The allowable sale quantity as defined for the 1986 forest plans is 15 mmbf on the Helena NF and 12 mmbf on the Lewis and Clark NF, for a total of 27 mmbf. The actual annual timber volume of timber products offered averaged 12.54 mmbf for the period 2000 through 2016.

The primary species utilized for sawtimber is lodgepole pine. This is one of the most common species on the HLC NF and it dominates the most productive and accessible landscapes. Lodgepole is valuable for a variety of products and has been favored as a timber species due to the ease with which it regenerates. Douglas-fir is the second most prevalent sawtimber species.

Interrelated factors such as site productivity, climate, disturbances, and human activities influence the availability of timber. Stand replacing fires were common on the HLC NF in the late 1800's. These fires along with early forest practices were followed by a relatively moist climate period suitable for tree establishment and growth. In general, forest cover established quickly in the early 1900's in burned or cut-over areas. The moist conditions that prevailed during most of the next century limited the potential for wildfires and insect outbreaks. These factors along with forest management policies contributed to decades of successful fire suppression. Thus, relatively extensive continuous forests of the same age and density developed.

These forests were susceptible to drought stress when the climate shifted into a warm/dry climate phase in the 1980's. The buildup of fuels that resulted in some areas along with the dry climate resulted in more large wildfires. From 1980 to 2013 approximately about 20% of the HLC NF burned in wildfire. Of this, about 55,400 acres burned in areas deemed suitable for timber production in the 1986 forest plans. Where stand-replacing fires occurred, forests were returned to an early successional stage of development, and it will be at least 50-60 years before the trees reach a size where commercial harvest may be feasible.

These factors also helped fuel a recent mountain pine beetle outbreak. At the peak of the outbreak in 2009, over 900,000 acres across the HLC NF were infested, over 400,000 of which were on lands suitable for timber production as defined in the 1986 forest plans. Mortality was most extensive in mature

lodgepole pine forests. In areas where the sawtimber component was substantially impacted, the availability of lodgepole timber will be reduced until new forests grow to a merchantable size.

Timber demand

Ultimately, the U.S. market demand for lumber is a derivative for the demand for construction of residential and commercial structures. As a derived demand, lumber markets tend to reflect shifts in national housing construction rates. Across subsectors, residential construction in particular is the single largest consumer of lumber nationwide. Housing starts are measured by the U.S. Census Bureau. The losses and eventual recovery following the great recession in 2008 are evident. Since then, starts have rebounded, but to a more steady state rising and flattening out above 1 million annually (U.S. Census Bureau). Demand for new and remodeled housing can and will change over the planning decades, but for the present, markets which consume U.S. lumber are considered relatively healthy with room for growth.

Regionally, demand for sawlogs remains stable, but Montana Forest Industries experienced less rebounding and more flattening out post-recession. Employment regained 300 jobs since a low in 2010, with an estimated 7,556 jobs statewide in 2015, but compared to 2005, industry employment remains down a few thousand from an estimated high of 9,821 jobs. Similarly, in 2005 primary sales were over \$1 billion, and more recently Montana Forest Industry gross sales have leveled out below \$600 million; (\$589 million in 2015). This evident downshift in Montana Forest Industries largely reflects permanent closures and loss of invested capital and infrastructure including the state's only pulp mill in 2010 (Morgan 2017).

Today, approximately 80 primary forest product firms are operating in Montana. Most of them are small and nearly all are directly dependent on timber from public lands. A much higher proportion of remaining mills exist in western Montana where the resource is still most economical. Collectively, these 80 firms have a vastly shrunken capacity from Montana's historic industry levels. Montana's total timber capacity and harvest levels have consistently trended down since 1990. Capacity to harvest ratio is historically higher, which has improved competitiveness of sawlog prices and helped ensure successful timber sales across Montana. Higher ratios also suggest the industry is capable of scaling in the short term to meet increased national lumber demand, as long as timber supply remains elastic. Empirical data indicates that sawlog prices may remain in a relative steady state or increase in Montana, save for another housing recession or similar market shock.

Relative to the multi-county plan area for the HLC NF, timber production remains of economic importance. The demand for timber has changed over time. In 1998, there were 32 active primary wood products facilities in the primary 13-county plan area. However, by 2017, this number dropped to 11.

In 2015, the amount of timber-related employment in the primary plan area was very small, with the largest amount occurring in the western area (Broadwater, Jefferson, Lewis and Clark, and Powell Counties), which derived a higher percentage of its employment (1.9 percent or 546 jobs) from timber-related industries than either the state (0.9 percent) or the nation (0.7 percent) (USDC 2017). The only two counties in the primary plan area that had any substantial amount of timber-related employment in 2015 were Broadwater County, where timber-related employment accounted for 19.3 percent of private employment (165 jobs) and Powell County, where it accounted for 25 percent (280 jobs). The 165 timber-related jobs in Broadwater County in 2015 occurred primarily in sawmills. In Powell County, most employment was associated with growing and harvesting, which accounted for 113 of the 280 timber-related jobs.

U.S. Census Bureau, County Business Patterns estimates 813 private jobs of the 16-county area's 233,079 total jobs were employed by the timber industry in 2015. These jobs include positions related to the growth and harvesting of trees, sawmills, and other wood products manufacturing. The economic impact analysis provided in the social science and economic section estimates 119 total direct, indirect, and induced jobs are currently associated with the timber program of the HLC NF.

Timber harvest

Timber harvest is a tool used not only to provide timber products and contribute to the local economy but also to achieve multiple resource objectives. These include but are not limited to reducing insect or disease impacts, improving wildlife habitat, increasing tree growth, improving timber productivity, lowering fuels and fire risk, and altering vegetation conditions to enhance forest resilience. Three main types of harvest were analyzed: even-aged regeneration harvest (such as clearcutting, shelterwood, and seed-tree cuts); uneven-aged regeneration harvest (such as group selection and single-tree selection); and intermediate harvest (such as commercial thins and improvement cutting).

Table 271 shows acres harvested from 1940 to 2013. Roughly 138,649 acres of harvest have been recorded. The majority (91%) occurred on lands suitable for timber production.

Table 271. Harvest by type and decade for the HLC NF, 1940-2017

Decade	Even-Aged Regeneration Harvest		Other Harvest		All harvest types	
	Total Acres	Average Annual	Total Acres	Average Annual	Total Acres	Average Annual
1940-1959	7,641	764	639	64	8,270	827
1960-1969	33,367	3,337	3,416	342	36,783	3,678
1970-1979	21,434	2,143	2,785	279	24,219	2,422
1980-1989	18,392	1,839	5,133	513	23,525	2,353
1990-1999	20,385	2,039	10,390	1,039	30,775	3,078
2000-2009	7,566	757	3,114	311	10,680	1,068
2010-2017	3,698	462 ¹	5,866	733 ¹	9,564	1,196 ¹

1. The average is based on 8 years rather than a full decade

Included in the acre figures are salvage projects that occurred after wildfires. The volumes produced from salvage projects are part of the total volume sold in the past as depicted in Figure 20. However, these volumes are not part of the estimated future timber outputs over time shown in the environmental consequences section. In the past, salvage has occurred on a small proportion of burned acres on the HLC NF as shown in Figure 21. Since 1986, salvage has occurred on about 2% of wildfire acres, and was focused in lands suitable for timber production. Salvage cutting after fire is a controversial management approach. More information on the ecological impacts of post-fire salvage is provided in the terrestrial vegetation and snags/downed wood sections.

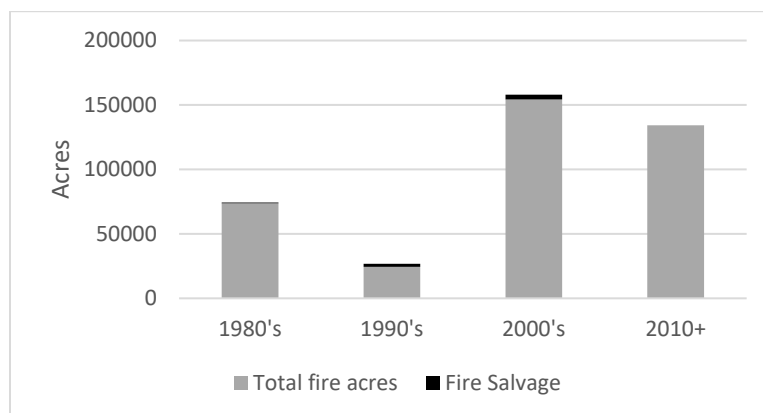


Figure 21. Fire salvage acres compared to total wildfire area burned by decade since 1986

Other activities associated with the tending of harvested stands occur on the HLC NF, including reforestation, pre-commercial thinning, and prescribed burning. Stands treated with regeneration harvest are reforested either naturally from available seed or artificially through planting. Reforestation also occurs following natural disturbances. This activity tends to be focused on lands suitable for timber production in order to maintain appropriate forest cover, but may also occur on other burned lands to meet other resource objectives. Pre-commercial thinning may occur on a subset of previously harvested areas to improve composition or density of young trees. Prescribed burning to reduce fuels and/or prepare seedbeds for reforestation are also common forest management activities.

Other Forest Products

Special forest and botanical products include, but are not limited to, mosses, fungi (including mushrooms), roots, bulbs, berries, seeds, wildflowers, forbs, sedges, grasses, nuts, ferns, boughs, bark, cones, burls, transplants, and Christmas trees. Mushrooms are also periodically harvested in burned areas. Other than personal use Christmas tree permits, the HLC NF offers little in the way of commercial or personal use permits for special forest products due to the limited demand relative to the resources needed to administer the permits. The supply of special forest products is dependent on ecological conditions and distribution of potential growing sites. Forest management or natural disturbances can influence the supply of certain products. For example, fire can increase availability of mushrooms, and thinning of young sapling stands and conifer regeneration can increase production of Christmas trees for a period of time.

Special forest and botanical products have importance to the Tribes as traditional and cultural uses. As per current handbook direction (FSH 2409.18, sec 87.13), the Forest considers “treaty rights, customary and traditional uses (including subsistence and other historical uses of plant material by Tribes), the federal trust responsibility to Tribes, and competitive market demands in determining which products would be excluded from or allowed for sale to commercial harvesters. When there is a shortage of any particular special forest product for tribal use, commercial permits would be issued only to the extent that the tribal use can be accommodated.”

Benefits to people

Timber products and other forest products are identified as multiple uses and key ecosystem services provided by the HLC NF. The economy of local communities can directly benefit from the use of these products. Please refer to the social and economics section for more information about multiple uses, key ecosystem services, and benefits to people.

3.29.6 Environmental consequences

Effects common to all alternatives

Timber suitability

Lands suitable for timber production were determined following the 2012 Planning Rule (USDA, 2012a) and associated directives (USDA, 2015). Lands that *may be suitable* for timber production are the same for all alternatives and total 667,119 acres. These lands are physically and biologically capable of timber production and have not been administratively withdrawn; the process for determining these factors is summarized in Figure 22. Based on management direction and desired conditions, lands determined to be suitable for timber production varies by alternative and represent a subset of the lands that may be suitable for timber production.

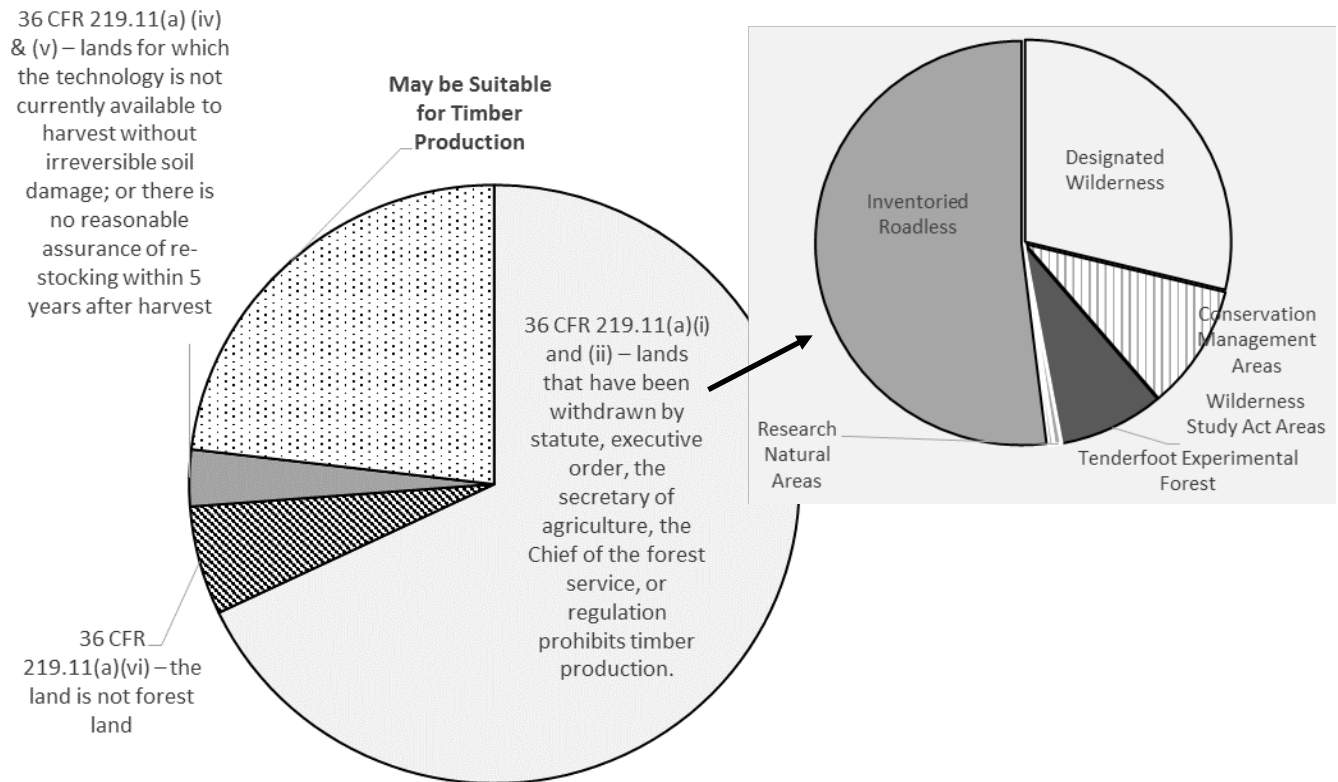


Figure 22. Determination of lands that may be suitable for timber production

Broad-scale information is used to determine suitability. Changes may occur at the project-scale level using site-specific data. Changes to lands suitable for timber production would be monitored during implementation of the plan.

Timber harvest is allowed on lands not suitable for timber production for purposes other than timber production, when consistent with management direction for the area. Timber harvest on these lands is not scheduled or managed on a rotation basis, but does contribute towards projected sale quantities. Unsuitable lands where harvest would never be allowed include designated wilderness, RWAs, WSAs, RNAs, and primitive recreation settings. Of these, only RWAs and primitive settings vary by alternative.

Timber supply and timber harvest

All alternatives provide for availability of timber. The availability of products would fluctuate based on disturbances as well as the implementation of harvest projects. In addition, the actual amount of timber offered would be influenced by a variety of factors, including site-specific environmental analyses, public involvement, harvest methods, and administrative appeals and litigation (Morgan & Baldrige, 2015). Site-specific project analyses would consider factors that are not well-represented by programmatic level modeling, such as specific design criteria that may apply to meet resource objectives such as scenic integrity and wildlife habitat requirements.

Under all alternatives the amount of harvest that occurs would be limited by the budget and workforce capacity, which are not expected to increase.

With any alternative, timber volume offered is influenced by factors outside the authority of the FS. For example, the USFWS provides direction that limits harvest levels to protect threatened and endangered species. Further, conditions and activities on adjacent lands can limit harvest when certain conditions are needed at broader scales, because harvest on other ownerships is taken cumulatively into account when assessing the environmental impacts of projects on NFS lands.

Timber demand

Under any alternative, if additional non-sawtimber infrastructure were developed in the nearby communities, new opportunities may arise that could enhance the amount and types of material utilized from NFS lands (for example, more biomass utilization could result in greater volume removal achieved versus the disposal of material in burn piles).

Other forest products

Under all alternatives, personal use of special forest products would be allowed across the Forest, so long as the use does not conflict with other management guidance, with the exception of the Tenderfoot Creek Experimental Forest. In this 8,870 acre research area, personal use of firewood, Christmas trees, boughs, and surface rock is prohibited in all alternatives. Personal use of other materials would be allowed.

Under all alternatives, commercial use of special forest products would not be allowed in designated wilderness, RWAs, the Tenderfoot Creek Experimental Forest, or RNAs.

Fire may influence the availability of some special forest products, such as mushrooms. Future wildfire patterns and amounts have a high degree of uncertainty; all alternatives would have potential to provide special forest products that are linked to fire. Timber harvest and other management activities may increase or decrease the availability of some special products. For example, the availability of Christmas trees may be increased after regeneration harvest. All alternatives propose harvest to some amount, and would have opportunity to affect the availability of associated products.

Areas that are suitable for commercial or personal use of special forest products and that allow access by road or trail would provide greater potential opportunities for gathering of special forest products. Conversely, the potential for over-harvest of special forest products may increase with greater access. In general, areas expected to have the most road access are those that are established in the plan as suitable for timber production, because roads are more likely to exist for vegetation management purposes.

Climate change

Climate is integrated into the SIMPPLLE model and is a major driver of vegetation change and effects of the alternatives over time, and thus may influence the availability of timber. Potential effects considerations to forests associated with climate change are described in the terrestrial vegetation section.

The lands that may be suitable for timber production were mapped with the best available data for vegetation and site potential. Lands at the margins of producing forest cover, where reforestation may not necessarily be assured due to harsh site conditions, were not included. The potential that future climate may further inhibit tree growth on sites that are currently suitable for timber production, particularly in the warm dry broad PVT, is unknown. It is possible that continued drought may cause shifts on some of the driest lands, and thus the lands suitable for timber production could decrease in the future. It would be paramount to determine suitability at the project level during implementation of the plan to identify such areas. It is not possible to further anticipate possible decreases in expected timber volume outputs.

The expected change in climate in future decades could influence availability of other forest products. Increased frequency or severity of fire could cause changes or shifts on the landscape in plant species compositions or abundance. Uncertainty exists regarding possible effects of climate change on vegetation, and thus on the availability and distribution of plants that may be gathered as special forest products.

Effects from forest plan components associated with:

Access and infrastructure

In all alternatives, limits related to road access on existing roads as well as construction of new roads (both permanent and temporary) could impact the ability to conduct harvest on portions of the forest, due to lack of economically feasible access. The magnitude of this influence cannot be calculated, but is implied within recreation opportunity settings that are included in the timber model.

Mining and mineral extraction

Mining undergoes site-specific analysis to determine effects and required mitigation, and effects to vegetation from mining is determined at the project level. Generally, the impacts to timber from mineral extraction on the forest are localized, and at the forestwide scale would be minor.

General wildlife management

Plan components for wildlife may limit specific actions such as timber harvest. In all alternatives, plan components for species such as bats and raptors would limit disturbances caused by harvest to specific areas during certain sensitive time periods, but these locations and restrictions would not be so extensive as to alter the general expected harvest levels.

Effects common to all action alternatives

All action alternatives contain the same plan components for timber and other forest products. The proposed plan was developed under the 2012 Planning Rule, and all action alternatives provide direction for sustainable levels of forest products. The expected effects of plan components related to timber for the action alternatives is summarized in Table 272.

Table 272. Summary of plan components for timber and other forest products– all action alternatives

Plan Component(s)	Summary of expected effects
FW-RMZ-STD and GDL	Numerous RMZ standards and guidelines would impact timber harvest, including direction regarding RMZs and certain activities within these zones. Collectively these components would limit harvest in riparian areas.
FW-SOILS-STD and GDL	Soil standards and guidelines would place limitations on detrimental soil conditions, skid trails, landings, temporary roads, and ground based equipment use, as well as guiding effective ground cover and coarse woody debris to be left behind. These measures place limitations on harvest, but conversely would result in protecting soil productivity and therefore would help provide for timber productivity in the long term.
FW-VEGT-OBJ-01; FW-PRISK-OBJ-01	These objectives would result in the accomplishment of timber harvest activities on the HLC NF.
FW-VEGT-GDL-02, 03, 04	These guidelines provide direction for reforestation and reseeding, helping to ensure the prompt establishment of appropriate vegetation after harvest.
FW-VEGF	The desired conditions, standards, and guidelines in this section frame the vision of future vegetation on the HLC NF, and as such provide a framework to guide timber harvest to achieve those conditions.
FW-WL-DC, GDL	Wildlife desired conditions and guidelines place limitations on harvest to protect wildlife, including timing restrictions for winter range and avoidance of nest and den sites. These measures would influence how projects are planned but would not substantially alter expected outputs.
FW-ROS-GDL	These guidelines describe appropriate levels of vegetation management within desired ROS classes. This limits timber harvest in primitive and semi-primitive non-motorized settings.
FW-REC-GDL-02; FW-REC-SUIT-01;	These guidelines address the use of timber harvest within developed recreation sites, eligible WSR corridors, and the Lewis and Clark National Historic Trail. These areas are

Plan Component(s)	Summary of expected effects
FW-WSR-GDL-01; FW-LCNHT-SUIT-01	not suitable for timber production and limitations on harvest would not substantially alter expected timber outputs or treatment acres.
FW-SCENERY-GDL-01	This guideline limits timber harvest in certain SIOs, primarily very high and high classes.
FW-IRA-GDL-01	This component influences harvest in IRAs. The establishment of IRAs greatly limits timber harvest across a large portion of the HLC NF.
FW-RECWILD-SUIT-04	This component ensures that no timber harvest would occur in RWAs; the amount of acres affected varies by alternative but has fairly small impacts on projected timber outputs and acres treated because most of these areas are also IRAs.
FW-RNA-SUIT-01	No timber harvest would occur in RNAs.
FW-RT-STD & GDL	New or temporary roads that are constructed and used for timber harvest would not adversely impact other resources.
FW-TIM-DC, GO, OBJ, STD, and GDL	Forestwide timber plan components provide extensive direction on timber management. These include limitations on timber harvest required by law, primarily the NFMA, such as assurance of restocking. An exception to the 40-acre maximum opening size created by even-aged harvest is specified for cool moist forests. These components collectively ensure that harvest occurs, is conducted within law and policy, is sustainable over time, and is designed to move the forest towards desired vegetation conditions.
BB-MISCOR-SUIT-01; LB-SMITH-SUIT-01; LB-SHOWSKI-SUIT-01; LB-TCEF-SUIT-01, 02, 03; LB-KHSB-SUIT-01; RM-TETONSKI-SUIT-01.	These components state that certain areas are unsuitable for timber production, although in some cases harvest may be allowed for other purposes. In addition, the LB-TCEF components limit the availability of other forest products. These areas are generally small and have little to no impact on the overall timber output or harvest acre estimates.
DI-SHRA-SUIT	This component for the South Hills Special recreation area varies by alternative. In alternative B, C, and D, this area is unsuitable for timber production and timber harvest for other purposes is emphasized. In alternative E, there is no special area; some of the lands within the area would be suitable for timber production.
EH-WMU-SUIT-01, 02; EH-TIM-GDL-01	While the Elkhorns Management Unit is not suitable for timber production, timber harvest could be used for purposes such as restoration. Conflicts would be avoided with elk winter range when conducting harvest of timber or other forest products.
RM-BTM-SUIT-01; RM-CMA-SUIT-01	The Badger Two Medicine area and conservation management areas are not suitable for timber production, although some harvest may be used for other purposes. These components would limit harvest on most of the lands on the Rocky Mountain Range GA which are not designated as wilderness.
SN-TIM-GDL-01	This guideline would direct managers to emphasize timber harvest as a tool to achieve purposes such as ponderosa pine habitat restoration in the Snowies GA, although the area is unsuitable for timber production.
UB-WL-GDL-01	This guideline would restrict harvest to some extent in some key locations for wildlife connectivity in the Upper Blackfoot GA.
FW-OFP-DC and GDLs	These components are designed to support sustainable levels of other forest products, including firewood.
GAs (Chapter 3)	The plan components found in GAs map the lands suitable for timber production, and include components to complement the forestwide plan components for all resources. GAs also include maps of ROS settings, SIOs, and special designations which would guide timber harvest on lands both suitable and unsuitable for timber production.

Timber supply

The Spectrum model projects an average of 23 cubic feet per acre per year of growth across all forested areas of the HLC NF across the 5-decade modeling period.

Sustained yield limits must be calculated for each proclaimed forest. A sustained yield limit of 5.03 million cubic feet (26.68 mmbf) was calculated for the proclaimed Helena NF; and 4.02 million cubic feet (21.30 mmbf) for the proclaimed Lewis & Clark NF, totaling 9.05 million cubic feet (47.98 mmbf) for the administratively combined HLC NF. The PTSQ may not exceed this amount, unless a departure limit is specified by the responsible official for the first decade or two of the plan to achieve multiple-use management objectives. No departure limit is currently proposed under any alternative.

Alternative A, no action

Alternative A is bounded by the forest plan components found in the existing forest plans (USDA, 1986a, 1986b) developed under the 1982 planning rule. The expected effects of plan components related to timber for the action alternatives is summarized in Table 273.

Table 273. Summary of plan components for timber and other forest products – 1986 forest plans, alternative A

Plan Component(s)	Summary of expected effects
Helena NF	
Forestwide Timber Standard, II/23(1)	This standard describes the requirements from the NFMA, such as requiring silvicultural prescriptions and using clearcutting only where it is the optimum method. This component is similar to components found in the draft revised forest plan and would ensure that timber activities are consistent with the law.
Forestwide Timber Standard, II/23 (3)	This standard for the design of transportation plans and logging systems would ensure that these are efficient and meet the needs of other resources.
Forestwide Timber Standard, II/23 (4)	This standard describes the 40-acre opening maximum. In contrast to the action alternatives, this standard does not supply an exception to the size limit. This standard would ensure compliance with NFMA regarding maximum size openings.
Forestwide Timber Standard, II/23 (5)	This standard requires feasibility analyses of sales over one mmbf and would help ensure that timber sales are economically viable.
Forestwide Firewood Standards, II/24 (1-6)	These components would help ensure a viable firewood program is provided.
Forestwide Cultural Resources Standards, II/15-16	Forestwide cultural resources components would ensure that cultural and historical sites are surveyed and protected from damage from timber harvest activities.
Forestwide Wildlife & Fisheries Standards II/17-22.	This section provides standards that would guide and/or limit timber harvest activities, including but not limited to elk hiding cover, elk thermal cover, Montana Cooperative Elk-Logging Study recommendations, grizzly bear, bald eagle, gray wolf, plant species of concern, old growth, and snags.
Forestwide Watershed, Soil, & Air Standards II/24-26.	This section provides soil standards that would guide and/or limit timber harvest activities. These standards are generally more qualitative and less specific than the revised plan components found in the action alternatives.
Forestwide Protection Standards, II/33	These standards would help guide timber management to be used as a tool for preventative pest management, and guide the forest to harvest stands at high risk for mountain pine beetle attack and to break up contiguous natural fuel. The effect may be to lessen tree mortality where harvest is feasible.
Forestwide Prescribed Fire Standards, II/34	These standards would ensure that prescribed fire that occurs in lands suitable for timber production would be conducted in a manner that enhances timber productivity.
Forestwide Riparian Standards, II/34-35	These standards would limit timber harvest in riparian areas, and are less quantitative than the plan components found in the draft revised plan.
Management Areas (III/2-III/93)	Management area guidance describes what areas are suitable for timber production. They also state the required visual quality objectives and other resource objectives (such as recreation, wildlife, range, soil, water, and minerals) that would guide and potentially limit timber harvest.
Lewis and Clark National Forest	

Plan Component(s)	Summary of expected effects
A-7, Cultural Resource Management	This component would ensure that cultural resources are protected.
C-1, Wildlife Coordination and Habitat Management; C-4, Wildlife Trees	This standard includes elements that would guide and/or limit timber harvest, including but not limited to big game cover analysis, Montana Cooperative Elk-Logging Study recommendations, TES, snags, and downed woody debris.
E1 (Timber Management), E2 (Firewood), E-3 (Reforestation), E-4, (Timber Harvest)	These standards provide detailed guidance for timber and other forest products, including reforestation, riparian considerations, soils, cultural resources, old growth forest, threatened and endangered species, economic feasibility of timber sales, and grizzly bears. The standards ensure compliance with law and policy.
F-3, Soil, Water and Air Protection	This standard includes components that would guide timber projects, such as sustaining site productivity.
P-1, Protection	This standard would result in harvest being emphasized in stands at high risk to mountain pine beetle; and to break up continuous natural fuels; controlling insects and disease with silvicultural and biological practices; and to use prescribed fire.
P-2, Debris Control	This standard would guide where dozer piling can occur and the location and how much woody debris could be left after timber harvest.
Management Areas (Chapter 3)	Management area guidance describes what areas are suitable for timber production. They also state the required visual quality objectives and other resource objectives (such as recreation, wildlife, range, soil, water, and minerals) that would guide and potentially limit timber harvest.

Timber suitability

Timber suitability for the no-action alternative is based on the 1986 forest plans as amended and implemented. The total land area considered suitable for timber management under the no-action alternative is roughly 15% of the HLC NF. Timber harvest would be allowed on lands unsuitable for timber production for purposes other than timber production, when consistent with other management direction. In alternative A, lands unsuitable for timber production where harvest is allowed represent roughly 40% of the HLC NF, although harvest may be very limited in some of these areas depending on management direction and objectives, as well as existing vegetation conditions. The following section compares timber suitability across all alternatives.

Timber supply

Timber supply metrics for the no-action alternative would be as described in the affected environment, including the allowable sale quantities (which total 27 mmbf for the HLC NF).

However, due to regulatory changes on the landscape, including changes to the areas that may be suitable for timber production, the estimates in the 1986 plans no longer reflect the management situation in the future if alternative A were selected. For these reason, and to make direct comparisons to the action alternatives, the allowable sale quantities in the 1986 forest plans were updated to display a PTSQ and PWSQ following current handbook requirements using the Spectrum model. As required by the planning rule and handbook direction, the PTSQ and PWSQ reflect currently foreseeable budget levels. However, for analysis purposes the sale quantities are also estimated without a budget constraint to understand sustainable volumes under potentially higher budgets.

The PWSQ is expected to be about 22 mmbf for the first decade and about 30 mmbf for the second decade. The following section provides a comparison of timber supply outputs across all alternatives.

Timber harvest

The harvest levels achieved during the implementation of the 1986 plans to date is shown in the affected environment section. The Spectrum model was used to estimate the expected acres of harvest treatments that would occur under alternative A, based on existing management direction found in the 1986 plans as

well as new laws and regulation and the updated lands suitable for timber production. The following section provides a comparison of timber harvest acres across all alternatives.

Effects that vary by alternative

Timber suitability

Based on management guidance and desired conditions, the lands suitable for timber production vary by alternative, as shown in Table 274. Alternative A has the least amount of land suitable for timber production, and is nearly identical to alternative D. Alternative E has the most lands suitable for timber production. Alternatives B and C represent a midpoint, with about 3% more land suitable for timber production than alternative A but 6% less than alternative E. Nevertheless, overall the values are somewhat similar for all alternatives. The lands suitable for timber production in alternatives A, B/C, and D all represent roughly 15% of the HLC NF, and 16% in alternative E. There is relatively little variance because of primary factors that do not vary by alternative, such as the inherent capability of the land and designations such as IRAs.

Table 274. Lands suitable for timber production by alternative

Land Classification Category	A	B and C	D	E
A. Total NFS lands in the plan area	2,883,339	2,883,339	2,883,339	2,883,339
B. Lands not suited for timber production due to legal or technical reasons.	2,216,220	2,216,220	2,216,220	2,216,220
C. Lands that may be suited for timber production (A-B)	667,119	667,119	667,119	667,119
D. Total lands suited for timber production because timber production is compatible with the desired conditions and objectives established by the plan	430,489	442,601	434,730	474,184
E. Lands not suited for timber production because timber production is not compatible with the desired conditions and objectives established by the plan (C-D)	236,630	224,518	232,389	192,935
F. Total lands not suited for timber production (B+E)	2,452,850	2,440,738	2,448,609	2,409,155

Table 275 displays the lands suitable for timber production by alternative in each GA. Alternative D results in slightly less land suitable for timber production across all GAs, while alternative E results in slightly higher amounts, most substantially in the Divide and Snowies GAs.

Table 275. Acres and percent of NFS land suitable for timber production by GA and alternative

GA	Alternative A		Alternative B/C		Alternative D		Alternative E	
Big Belts	43,538	14%	67,379	21%	67,283	21%	69,295	22%
Castles	17,743	26%	18,450	27%	17,859	26%	18,450	27%
Crazies	12,826	22%	7,089	12%	6,509	11%	7,517	13%
Divide	76,023	38%	62,640	31%	60,081	30%	71,656	35%
Elkhorns	0	0%	0	0%	0	0%	0	0%
Highwoods	1,170	3%	0	0%	0	0%	1,048	3%
Little Belts	208,975	26%	232,217	29%	226,716	28%	232,222	29%
Rocky Mountain	1,683	<1%	0	0%	1,458	<1%	0	0%
Snowies	16,030	14%	0	0%	0	0%	17,377	15%
Upper Blackfoot	52,502	16%	54,825	16%	54,825	16%	56,618	17%

To the extent that RWAs and primitive settings vary by alternative, so too does the area where harvest may be allowed on lands unsuitable for timber production. Table 276 compares the acres of unsuitable lands where harvest may occur forestwide. The total acres as well as those that are within IRAs are displayed. This distinction is useful because within IRAs, only very limited harvest could occur per the 2001 Roadless Area Conservation Rule. Alternative E has the most lands unsuitable for timber production where harvest could occur, but alternatives B/C have the most of these lands which are not also IRAs. The acres shown include nonforested vegetation types where little to no harvest would occur.

Table 276. Acres (and proportion) of NFS lands unsuitable for timber production by alternative

	Total acres unsuitable for timber production	Unsuitable lands where Harvest may Occur ¹	
		Total	Outside IRAs
Alternative A	2,452,850 (85%)	1,151,728 (40%)	418,133 (15%)
Alternative B/C	2,440,738 (85%)	1,573,374 (55%)	489,392 (17%)
Alternative D	2,448,609 (85%)	1,195,455 (41%)	444,840 (15%)
Alternative E	2,409,155 (84%)	1,664,257 (58%)	463,414 (16%)

1. Excludes lands where harvest would not be permitted for any purpose, such as designated wilderness, WSAs, RWAs, RNAs, or primitive recreation settings. For alternative A, additional areas are excluded based on management area direction that prohibits harvest.

Table 277 displays the lands unsuitable for timber production where timber harvest could occur by alternative and GA. Most GAs do not vary substantially across alternatives, with the Divide, Highwoods, Rocky Mountain Range, and Snowies showing the greatest shifts.

Table 277. Acres and proportion of NFS lands unsuitable for timber production where harvest can occur by GA and alternative

GA	Alternative A		Alternative B/C		Alternative D		Alternative E	
	Total ¹	Outside IRAs	Total ¹	Outside IRAs	Total ¹	Outside IRAs	Total ¹	Outside IRAs
Big Belts	191,757 (61%)	80,404 (26%)	201,578 (64%)	69,230 (22%)	179,325 (57%)	68,982 (22%)	215,061 (68%)	67,943 (22%)
Castles	23,005 (33%)	18,533 (27%)	51,258 (74%)	21,876 (31%)	21,243 (31%)	20,258 (29%)	51,258 (74%)	21,876 (31%)
Crazies	23,314 (40%)	4,650 (8%)	50,579 (88%)	13,005 (23%)	26,190 (45%)	10,831 (19%)	50,150 (87%)	12,576 (22)
Divide	73,484 (36%)	46,793 (23%)	107,758 (53%)	73,827 (36%)	82,179 (41%)	69,094 (34%)	130,986 (65%)	66,984 (33%)
Elkhorns	113,833 (71%)	83,026 (51%)	161,251 (100%)	86,482 (54%)	112,021 (70%)	84,376 (52%)	161,251 (100%)	86,482 (54%)
Highwoods	14,105 (33%)	1,167 (3%)	42,291 (100%)	2,677 (6%)	33,692 (80%)	2,677 (6%)	41,242 (98%)	1,628 (4%)
Little Belts	270,531 (34%)	114,212 (14%)	472,298 (59%)	130,254 (16%)	381,168 (47%)	120,832 (15%)	486,783 (61%)	130,249 (16%)
Rocky Mountain Range	254,589 (33%)	28,307 (4%)	324,852 (42%)	32,281 (4%)	198,128 (26%)	7,730 (1%)	324,852 (42%)	32,281 (4%)
Snowies	31,271 (26%)	2,755 (2%)	22,243 (19%)	19,770 (17%)	22,244 (19%)	19,770 (17%)	11,942 (10%)	2,869 (2%)
Upper Blackfoot	155,841 (47%)	38,286 (11%)	139,267 (42%)	40,292 (12%)	139,267 (42%)	40,292 (12%)	190,731 (57%)	40,527 (12%)

1. Excludes lands where harvest would not be permitted for any purpose, such as designated wilderness, WSAs, RWAs, RNAs, or primitive recreation settings. For alternative A, additional areas are excluded based on management area direction that prohibits harvest.

Timber supply

Projected timber and wood sale quantities were estimated using the Spectrum model based on reasonably foreseeable budget levels, as shown in Table 278. The model was run with a mix of objective functions based on the theme of the alternative. Alternatives A, B/C, and D had the objective to move towards vegetation desired condition as quickly as possible, while meeting other resource constraints. Alternative E had an objective to first maximize timber and then move towards desired conditions. Outputs are average annual outputs (averaged across the decade). The model projected roughly 2/3rd of the volume to be removed from lands suitable for timber production and about 1/3rd to be removed from lands unsuitable for timber production. Alternatives A, B/C and D are nearly identical in expected timber outputs. Alternative E would remove the most volume.

Table 278. Average annual projected timber and wood sale quantities by alternative – decades 1 and 2 with reasonably foreseeable budget, Spectrum model

Category	Decade	Alternative A		Alternatives B/C		Alternative D		Alternative E	
		mmcf	mmbf	mmcf	mmbf	mmcf	mmbf	mmcf	mmbf
Timber Products ¹ A1. Lands suitable for timber production	1	3.54	16.46	3.13	14.47	3.15	14.57	4.69	22.78
	2	3.62	17.02	3.67	17.36	3.71	17.56	4.53	21.92
Timber Products ¹ A2. Lands not suitable for timber production	1	0.80	3.22	1.12	4.71	1.12	4.71	2.72	13.28
	2	2.02	9.22	2.05	9.41	2.01	9.23	2.88	13.93
PTSQ (A1 + A2)	1	4.34	19.68	4.25	19.18	4.26	19.28	7.41	36.06
	2	5.64	26.25	5.72	26.77	5.73	26.79	7.41	35.84
Other Wood Products ² B. All lands	1	2.01	2.95	1.99	2.88	1.99	2.89	2.46	5.41
	2	2.19	3.94	2.21	4.02	2.21	4.02	2.46	5.38
PWSQ– (A1+A2+B)	1	6.35	22.63	6.24	22.06	6.25	22.17	9.87	41.46
	2	7.83	30.18	7.93	30.78	7.94	30.81	9.87	41.22

1. Timber Products and PTSQ include volumes from harvested material (other than salvage or sanitation) that meet timber product utilization standards.
2. Other Wood Products - Fuelwood, biomass, and other volumes that do not meet timber product utilization standards (small diameter 3 -7 inches).

The Spectrum model was also run without a budget limitation, as shown in Table 279. Because all resource constraints are considered, these outputs levels represent what could be generated given the ecological conditions of the HLC NF, coupled with regulatory direction and the management emphasis of each alternative. To achieve the increased outputs, budgets would have to increase by the magnitude of \$1 million per year to \$12 million per year depending on the alternative and period. The sensitivity analysis conducted on the Spectrum model confirmed that the budget constraint was the most influential on projected volume outputs as well as planned harvest and attainment of the desired future conditions; see appendix B for a detailed sensitivity analysis.

Table 279. Average annual projected timber and wood sale quantities by alternative – decades 1 and 2, without a budget constraint, Spectrum model

Category	Decade	Alternative A		Alternatives B/C		Alternative D		Alternative E	
		mmcf	mmbf	mmcf	mmbf	mmcf	mmbf	mmcf	mmbf
	1	5.28	24.68	5.64	26.33	5.50	25.68	12.03	56.55

Category	Decade	Alternative A		Alternatives B/C		Alternative D		Alternative E	
		mmcf	mmbf	mmcf	mmbf	mmcf	mmbf	mmcf	mmbf
Timber Products ¹ A1. Lands suitable for timber production	2	3.64	17.19	3.80	18.02	3.62	17.18	8.58	41.22
Timber Products ¹ A2. Lands not suitable for timber production	1	1.30	5.33	1.69	7.02	1.75	7.32	6.89	31.79
	2	2.94	13.77	3.53	16.52	3.63	16.98	10.33	48.91
PTSQ (A1 + A2)	1	6.57	30.01	7.33	33.36	7.25	32.99	18.92	88.34
	2	6.57	30.96	7.33	34.53	7.25	34.16	18.92	90.13
Other Wood Products ² B. All lands	1	2.34	4.50	2.45	5.00	2.44	4.95	4.18	13.25
	2	2.34	4.64	2.45	5.18	2.44	5.13	4.18	13.52
PWSQ (A1+A2+B)	1	8.91	34.51	9.78	38.36	9.69	37.95	23.10	101.6
	2	8.91	35.60	9.78	39.71	9.69	39.29	23.10	103.7
Amount annual budget would need to increase ³	1	\$3.6 million		\$4.1 million		\$4.1 million		\$11.9 million	
	2	\$1.0 million		\$1.3 million		\$1.4 million		\$9.2 million	

1. Timber Products and PTSQ include volumes from harvested material (other than salvage or sanitation) that meet timber product utilization standards.
2. Other Wood Products - Fuelwood, biomass, and other volumes that do not meet timber product utilization standards (small diameter 3 -7 inches).
3. The amount of money needed per year above the current budget constraint of \$5.322 million to achieve the projected volume outputs.

The effects on timber production are related to objective functions of the model. Because of this, alternative E has the highest projected timber and wood sale quantities. However, because the attainment of desired conditions was limited by a constraint to achieve volume production, alternative E also does less to meet the desired future vegetation conditions, as described in subsequent sections of this section.

The sustained yield limit is constant (9.05 million cubic feet or 47.98 mmbf); and the PTSQ must be below this level. However, in alternative E, without a budget constraint, emphasizing timber production resulted in a scenario in which PTSQ could exceed the sustained yield limit due to two interrelated factors. First, there is a difference in the landbase considered for the sustained yield limit versus lands where volume can be removed to contribute to the PTSQ. Second, the application of non-declining even flow was different between the sustained yield limit run and the projected alternatives. Non-declining even flow means that the volume from a certain area is steady or increasing into the future. Refer to appendix B.

The modeling of alternative E, unconstrained by budget, provides insight into the potential level of volumes that could be achieved with more flexibility in scheduling where harvest occurs. However, the directives require that the Forest Plan display levels of harvest and volume removal that are within the fiscal capability and organizational capacity of the HLC NF. Further, the selected PTSQ cannot exceed the sustained yield limit unless a departure analysis is done, and the increased volume could only occur for the first two decades. Because alternative E with an unconstrained budget is not within fiscal capability of the HLC NF, it is not anticipated that such a departure analysis would be conducted.

Timber demand

National and international market forces as well as trade policies have decreased demand for regional timber. According to the Bureau of Business and Economic Research annual outlook in 2017, primary wood product sales, labor income, and employment levels are all down from previous years and historic

averages. In 2017, two large mill closures occurred in Montana and surveyed, unused mill capacity remains proportionally high.

Alternative selection for the HLC NF plan would not directly affect timber demand, but may have some impact on timber supply elasticity and solvency for regional or state firms. Flexible timber supply chains are important for mills remaining in Montana to compete and scale to meet national and international lumber demand. Remaining mills in the region have an estimated additional capacity of 200 mmbf. Across alternatives a net wood quantity difference of 16.88 mmbf (alternative E compared to alternatives B/C) exists in the first decade of the plan period, which represents 8% of remaining capacity, statewide. Generally, substitution occurs where there is a mix of public and private land forests available to a mill. However, in counties such as Broadwater, or Deerlodge, and for a few of the most dependent of plan area firms, the HLC NF alternative selection may have a direct impact on supply availability and subsequently sawlog prices.

The influence over timber supply also directly relates to area employment. Timber industry employment, statewide, has dropped to approximately 7,300 jobs. In the HLC NF planning area, approximately 804 jobs exist within these industries. A difference of approximately 320 direct, indirect, and induced jobs are estimated between alternative E, and the other alternatives.

Timber harvest

Table 280 displays the projected acres of harvest that may occur to achieve the volumes shown in the previous section, both with and without a reasonably foreseeable budget constraint. Acres harvested are a mix of silvicultural prescriptions, including even-aged regeneration (clearcut, seedtree, shelterwood) and non-regeneration harvest (uneven-aged harvest or commercial thin).

With a reasonably foreseeable budget constraint, alternatives A, B/C, and D treat a similar amount acres; alternative E treats less. Alternative E achieves greater volume outputs because the stands selected for harvest contain more volume. Without a budget constraint, alternatives A, B/C, and D initially harvest nearly double the acres in the first period, but over time the amount declines to be similar to the levels achieved with a budget constraint. With alternative E, because of the objective function to maximize timber volume, the unconstrained budget run shows greater acres harvested in all periods. To achieve these acres, budgets would have to increase by the magnitude described in the timber supply section.

Table 280. Average annual acres treated by treatment type by alternative, decades 1 and 2, with and without a reasonably foreseeable budget constraint

Type and Decade of Harvest		Alternative A	Alternative B/C	Alternative D	Alternative E
Even-aged Regeneration Harvest	Decade 1 Constrained	3,414	3,326	3,199	1,955
	Decade 1 Unconstrained	4,709	5,821	5,579	9,384
	Decade 2 Constrained	2,007	1,747	1,771	1,759
	Decade 2 Unconstrained	2,099	2,745	2,662	6,198
Other Harvest	Decade 1 Constrained	694	766	876	381
	Decade 1 Unconstrained	2,390	2,500	2,500	2,500
	Decade 2 Constrained	2,500	2,500	2,500	1,000
	Decade 2 Unconstrained	2,500	2,500	2,500	2,500
Total Harvest	Decade 1 Constrained	4,108	4,091	4,075	2,336
	Decade 1 Unconstrained	7,099	8,321	8,079	11,884
	Decade 2 Constrained	4,507	4,247	4,271	2,759
	Decade 2 Unconstrained	4,599	5,245	5,162	8,698

The differences in the alternatives with respect to acres of projected harvest can also be demonstrated by the vegetation types of the stands the model chose to harvest to meet the objective functions, as shown in appendix B. In alternatives A, B/C, and D, the model selected primarily Douglas-fir and ponderosa pine cover types growing on warm dry broad PVTs for harvest. The model was driven to do this based on the desired conditions it was given (such as looking for opportunities to increase the amount of ponderosa pine and the large size classes). In alternative E, the model selected more lodgepole pine and spruce/fir and forests; these types tend to be more productive and therefore more volume removal could be achieved.

Spectrum made choices to maximize desired condition attainment using only desired conditions for cover type, size class, and density class. These are very broad depictions of the desired condition at the forestwide scale, and while the model chose to optimize this by focusing treatments in warm dry types in alternatives A, B/C, and D the results should not be misinterpreted to indicate that harvest treatments would not also be appropriate in cool moist forests to contribute to other desired conditions, such as individual tree species presence, vertical structure, and/or landscape pattern (patch size).

Other forest products

Commercial use of other forest products is not allowed in designated wilderness, RWAs, WSAs, RNAs, or the Tenderfoot Creek Experimental Forest. The differences between alternatives is driven primarily by the acres included as RWAs. Table 281 displays the acres by alternative where commercial use of special forest products is not allowed. Commercial use of special forest products is allowed to the greatest degree in alternative E, and to the least in alternative D.

Table 281. Acres where commercial use of special forest products is not allowed by alternative

Alternative A	Alternatives B and C	Alternative D	Alternative E
793,455	972,298	1,233,811	759,223

Effects from forest plan components associated with:

Terrestrial vegetation

The revised plan for the action alternatives contains detailed desired conditions for terrestrial vegetation, and timber harvest is one of the tools available to help move the forest toward those conditions. Although these desired conditions are not enumerated in the existing 1986 forest plans, in practice HLC NF would likely be managed in the spirit of these desired conditions. The desired conditions translated into the Spectrum model included the desired distribution of vegetation types (species composition), size, and density classes. The most substantial desired shifts include an increase in ponderosa pine cover types, and an increase in large and very large size classes. The potential types, locations, and frequency of future harvest were influenced by these desired conditions.

The desired conditions for vegetation were a key component in the Spectrum modeling to ensure the future projected harvest types and volumes would be consistent with the plan components for terrestrial vegetation. Appendix B contains the results for the “desired condition penalty points” from the Spectrum model for each alternative over 5 decades. Fewer penalty points means that vegetation conditions were closer to the desired condition. Alternative A would be the best at moving the forest toward the desired condition, although B/C and D are also very similar. Alternative E incurs the most penalty points, indicating it does not achieve the desired conditions as well as the other alternatives. For alternatives A, B/C, and D, an unconstrained budget would improve the desired condition score, whereas with alternative E it does worse because of its objective to maximize timber volume outputs.

The desired condition penalty points provide a relative comparison of how well treatments in Spectrum contribute to terrestrial vegetation desired conditions. However, these results do not include dynamic interactions between treatments and ecological processes over time.

Fire, fuels, insects and disease

Plan components related to the management of natural disturbances and prescribed fire would have effects to timber. Insects, disease, prescribed fire, and wildfire can affect the production of timber by killing and damaging trees. Conversely, these events can also thin the forest and, while economic loss of specific trees may occur, can contribute to the long term forest health and timber productivity depending on the site and severity of disturbance.

Under all action alternatives, plan components associated with prescribed burning and other fuels management would generally complement timber management and vice versa, because all treatments would be designed to move towards desired vegetation conditions. Plan components in alternative A would also ensure that burning on lands suitable for timber production would complement timber production; less specificity is provided for lands unsuitable for timber production.

The Spectrum model included prescribed burning to move the forest toward desired future conditions. Burning treatments were applied both as maintenance treatments within harvested stands, as well as stand-alone burning prescriptions. Table 282 displays the acres of projected prescribed burning by alternative for the first two decades of the planning horizon. The ability to actually achieve burning is highly uncertain and dependent upon many factors including weather windows. Alternatives B/C and D are very similar, while alternative E projects less burning.

Table 282. Average annual acres burned¹ by alternative, reasonably foreseeable budget

	Alternative A	Alternative B/C	Alternative D	Alternative E
Decade 1	6,479	6,358	6,419	2,777
Decade 2	3,757	3,711	3,714	2,173

1. Spectrum model. Burning in forested vegetation. Additional burning would occur in nonforested vegetation.

The SIMPPLLE model included a predicted amount of wildfire on the Forest based on current fire suppression success and fire starts, as well as potential insect and disease activity. Refer to the terrestrial vegetation section for a summary of the acres affected. Under the action alternatives, plan components recognize the importance of these processes on the landscape. The no-action alternative emphasizes the control of these disturbances on lands suitable for timber production.

Under all alternatives, there exists potential for salvage or sanitation to harvest dead and damaged timber after natural disturbances and/or to attempt to slow or impede insect infestations. The degree to which these harvests are undertaken would depend upon the risks associated with wildfire, infestation spread into healthy stands, public safety, the presence of high value resources, and the management emphasis of the area. These would all be determined at the site-specific project level of analysis and decision. Sanitation and salvage treatments are not part of the estimated timber volume outputs over time. In the past, fire salvage has occurred on a fairly small proportion of burned acres on the HLC NF (about 2%). In general it would not be expected that future salvage would occur to a much greater degree than has been done in the past; however, the potential for future salvage would depend on the type and location of future fire events. It is possible that increasing large fires in lands suitable for timber production could result in an increased amount of salvage harvest, as permitted by plan components. This activity could result in additional volume outputs beyond what is predicted by the protected timber sale and wood sale quantities.

Recreation opportunity settings

Recreation opportunity settings are land allocations that influence access for harvest and/or how much timber harvest can occur on the landscape for alternatives B/C, D, and E. The existing 1986 forest plans (alternative A) did not include any system analogous to ROS; but these settings were modeled for this alternative to provide for a comparison to the action alternatives. For action alternatives, the mapped ROS classes were blended with other designations such as SIOs and timber suitability to reflect the theme of

the alternative. These land allocations are underpinnings within the Spectrum model, and therefore their influence on expected timber outputs and harvest acres are expressed in the outputs shown in this section.

The acres allocated to summer recreation opportunity settings by action alternative are shown in Table 283 for lands suitable and unsuitable for timber production. Alternative D is the most limiting to timber harvest because it has the least lands suitable for timber production, and the most primitive recreation settings. In all alternatives, the bulk of lands suitable for timber production have a roaded natural recreation opportunity setting. However, alternatives A, B/C and D also have a substantial portion of suitable lands within semi-primitive motorized, whereas alternative E has very little. Alternative E has both the most acres overall of lands suitable for timber production, and those lands lie within the recreation opportunity settings most permissive to vegetation management.

Table 283. Acres of summer ROS classes by action alternative, by suitability for timber production

ROS Class	Alternative A		Alternative B/C ¹		Alternative D		Alternative E	
	Suitable	Unsuitable	Suitable	Unsuitable	Suitable	Unsuitable	Suitable	Unsuitable
Primitive	1.26 ²	758,130	0	846,121	0	1,231,795	0	723,945
Semi-Primitive Non-Motorized	73,986	957,149	0	955,564	0	617,040	0	1,058,026
Semi-Primitive Motorized	64,284	301,669	81,892	285,486	79,007	262,320	2,168	241,872
Roaded Natural	286,240	413,746	354,082	331,916	349,234	317,394	462,202	368,007
Rural	5,977	22,041	6,612	21,527	6,474	19,935	9,799	17,181

1. Alternative C varies slightly from alternative B in terms of ROS classes in unsuitable lands, and are within a few hundred acres for all classes. These differences are negligible in the context of the timber analysis, and the relative amounts and trends are the same. The acres for suitable lands are the same.

2. The small inclusion of primitive in suitable lands for alternative is likely the sum of tiny mapping errors.

- Primitive settings are not suitable for timber production, and no harvest is allowed. Plan components ensure that no vegetation management occurs. This setting often corresponds to designated and recommended wilderness. Natural processes are the drivers of vegetation change.
- Semi-primitive non-motorized areas are not suitable for timber production, although limited amounts of harvest can occur to maintain natural vegetation. These areas are often but not always associated with IRAs, and limitations on harvest from the Roadless Area Conservation Rule may also apply. These areas typically have poor access and either natural processes or prescribed fire would be drivers of vegetation change more often than timber harvest.
- Semi-primitive motorized settings may or may not be suitable for timber production based on other factors, and harvest for other purposes is generally allowed, although the plan specifies that vegetation management should create limited, widely dispersed treatment areas consistent with natural vegetation patterns. Harvest would be expected to occur at low to moderate levels.
- Roaded natural and rural areas may often be suitable for timber production, and where unsuitable for timber production harvest is generally allowed for other purposes. Typically there is good road access, and vegetation management may be evident while in harmony with the scenic character of the area. Harvest may be a commonly used tool in these areas.

Scenery management

SIOs are also land allocations that influence how much timber harvest can occur on the landscape for Alternatives B/C, D, and E. Scenic objectives are consistent with ROS classes and timber suitability, and

therefore are reflected in timber projections. In all alternatives, a SIO of High makes up a substantial portion of lands unsuitable for timber production, which is largely driven by IRAs. This objective is also common on suitable lands, based on viewpoints and other criteria. Alternative D is generally the most limiting to timber harvest because it has the highest proportion of the very high SIO. All alternatives are similar with respect to the proportions of SIOs identified as high, moderate, and low across lands suitable for timber production. The acres allocated to SIOs by alternative are shown in Table 284.

Table 284. SIO, percent by lands suitable and unsuitable for timber production, by action alternatives B/C, D, and E

SIO	Alternative B/C		Alternative D		Alternative E	
	Suitable	Unsuitable	Suitable	Unsuitable	Suitable	Unsuitable
Very High	0%	36%	0%	51%	0%	31%
High	32%	58%	32%	43%	32%	63%
Moderate	36%	3%	36%	3%	35%	3%
Low	32%	3%	32%	3%	33%	3%
Very Low	0%	0%	0%	0%	0%	0%

- Harvest is precluded in areas with a very high scenic quality objective, where the valued landscape character should be intact and landscapes generally provide for ecological change only. Such areas typically correspond to primitive recreation opportunity settings, including wilderness, RWAs, WSAs, and RNAs.
- Areas with a high SIO primarily correspond to IRAs, WSR corridors, the King’s Hill Scenic Byway corridor, and the Continental Divide National Scenic Trail corridor. Timber production and/or harvest may be allowed on limited areas in some of these areas, but scenery (and other regulatory limitations) would result in low to moderate amounts of harvest. This SIO requires that landscape character appear intact, and management activities do not dominate the landscape.
- Areas with a moderate SIO are often suitable for timber production, or harvest for other purposes, depending on the other factors. These landscapes may appear slightly altered although management activities remain visually subordinate to the overall landscape character.
- Areas with low SIOs are also often suitable for timber production, or harvest for other purposes is allowed. These landscapes may appear altered, and management activities are visible. There are no lands with a very low SIO on the HLC NF.

The existing 1986 forest plans (alternative A) do not include the scenic management system or associated SIOs. However, visual quality objectives as described for the visual management system were specified by management area, as shown in Table 285.

Table 285. Acres of visual quality objective, by suitability for timber production, alternative A

Visual Quality Objective	Lands Suitable for Timber Production	Lands Unsuitable for Timber Production
Preservation	1	598,473
Retention	40,217	224,993
Partial Retention	121,283	526,454
Modification	268,987	1,103,300

- In areas with a preservation visual quality objective, only ecological changes are allowed; no timber harvest would occur. Primarily wilderness and RWAs have this objective. No lands suitable for

timber production have a visual quality objective of preservation; the 1 acre inclusion in Table 285 is a result of the sum of very small mapping discrepancies.

- A retention visual quality objective allows for management activities which are not visually evident. While some harvest could be allowed, these lands are generally not suitable for timber production, and may correspond to designations such as IRAs.
- A partial retention visual quality objective indicates that management activities must remain visually subordinate to the characteristic landscape. Some of these lands are suitable for timber production, and harvest on unsuitable lands may occur, although the type and rate of harvest would likely be less than lands with a modification or maximum modification objective.
- With a modification visual quality objective, management activities such as timber harvest may visually dominate the original characteristic landscape. This is the most common visual quality objective on the HLC NF, for both lands suitable and unsuitable for timber production.

Under all alternatives, additional site-specific scenery requirements (such as in sensitive viewsheds) would influence project design and potentially the amount, type, and/or location of harvest activities.

IRAs

IRAs are not suitable for timber production and do not vary by alternative. Timber harvest may be allowed, but is limited under the Roadless Area Conservation Rule (2001). The legal requirements for management of IRAs would influence timber harvest and outputs. RWAs tend to overlap with IRAs, and no harvest is allowed. Therefore, to the extent that RWAs vary by alternative, so too does the amount of IRAs where harvest could possibly occur.

Table 286 displays the acres of IRAs by alternative where harvest could potentially occur (that is, IRAs that are not also RWAs, primitive recreation settings, or where harvest is otherwise prohibited). Alternatives A and D have the least IRAs where limited harvest could occur. In the case of alternative A, this is due to additional management area guidance that prohibits timber harvest. In the case of alternative D, this is because it has the most RWAs. Alternative E has the most IRAs that could potentially have harvest because it has no RWAs.

Table 286. Lands where harvest may occur in IRAs

	Alternative A	Alternatives B and C	Alternative D	Alternative E
Acres	733,595	1,083,682	750,615	1,200,842
% of NFS lands	25%	38%	26%	42%

In IRAs where harvest could be allowed, the legal requirements of the 2001 Roadless Area Conservation rule (U.S. Department of Agriculture, Forest Service, 2001) would limit the purposes for which harvest could occur, and the types of prescriptions that could be applied. The possible purposes of harvesting “generally small diameter timber” would include improving at-risk species habitat, or maintaining or restoring ecosystem composition and structure within the NRV. Appendix C of the Draft Plan provides guidance for implementing activities in IRAs. The effect of this direction would be to limit the acres of harvest and volume outputs that occur. Timber harvest in IRAs also requires additional analysis, and receives a great deal of public and agency scrutiny.

The Spectrum model was formulated to allow limited harvest in IRAs not precluded by any other designations, as a possible option in the management solution to move towards desired conditions. The model was calibrated to recognize the limiting factors of recreation opportunity settings and scenery management objectives by blending these characteristics along with IRAs into management area groups. “management group 2” represents IRAs and other areas with a semi-primitive non-motorized area recreation setting or very high to high SIOs. Table 287 displays acres where timber harvest could occur in

this group, showing the percent of land that was allocated to harvest sometime over a 50-year modeling horizon, and the amount of harvest in the first two decades with a reasonably foreseeable budget.

Table 287. Total acres and first two decade average annual harvest acres in Spectrum management group 2¹

Alternative	Total area of MAG ¹ 2	Annual average acres of harvest, decade 1	Annual average acres of harvest, decade 2
Alternative A	999,281	205	291
Alternative B/C	815,085	206	293
Alternative D	530,933	204	275
Alternative E	910,764	117	176

1. Management group 2 includes IRAs, semi-primitive non-motorized recreation settings, and very high or high SIOs in lands unsuitable for timber production where harvest can occur.

Table 287 shows that while some limited harvest may be allowed in IRAs and other semi-primitive areas, very little is projected to occur as part of the modeled solution to move towards desired conditions. Alternative D has the fewest acres of management group 2 because it also has the most RWAs. Alternatives A and E have the most acres of IRA where timber harvest may be allowed. In all alternatives, management area group 2 would be influenced by natural disturbances and prescribed fire more so than timber harvest.

Recommended wilderness

RWA designations have little impact on potential timber outputs. This is because RWAs tend to be located in areas that do not contain lands that may be suitable for timber production as shown in Table 288, and further because they tend to be located in designated IRAs where harvest is limited by the 2001 Roadless Area Conservation Rule. Alternative D has the greatest acres of RWAs that could have been suitable for timber production, and represents the highest degree to which potential timber production would be forgone for RWAs.

Table 288. Acres and proportion of RWAs that may be suitable for timber production by alternative

Alternative	Total RWA Acres	Acres of RWAs that may be suitable for timber production	Percent of RWAs that may be suitable for timber production
Alternative A	34,226	60	0.2%
Alternative B/C	213,076	4,062	2%
Alternative D	474,563	26,773	6%
Alternative E	0	0	0%

Livestock grazing

In all alternatives, livestock grazing would occur both in lands suitable for timber production, and in unsuitable areas where harvest occurs for other purposes. The amount of lands suitable for timber production that are also within current livestock allotments are shown in Table 289 by alternative. Alternative E has the most lands where harvest could occur in livestock allotments because it has the most lands suitable for timber production and no RWAs.

Table 289. Acres of lands where harvest can occur within livestock allotments

Alternative	Acres of lands suitable for timber production - in livestock allotments	Acres of lands unsuitable for timber production where harvest can occur – in livestock allotments
Alternative A	293,969	653,103
Alternative B/C	295,300	951,134
Alternative D	288,505	780,609
Alternative E	319,544	959,657

Management direction that addresses livestock grazing and timber harvest and production would have similar results across all alternatives. While grazing and trampling from livestock can damage seedlings and saplings, plan components would ensure that grazing is managed to avoid impacting the regeneration of forests impacted by harvest, fire, or other disturbances. Plan components would also ensure that grazing is managed in a manner that would not lower site productivity (through damages such as compaction), and therefore would not preclude the production of timber or other forest products under any alternative. The action alternatives also contain plan components that would encourage grazing activities that complement timber stand tending goals and vice versa where appropriate, such as reducing fine fuels to lower fire risk, and/or utilizing forage stimulated by harvest.

Watershed and conservation watershed network management

Watershed plan components exist for all alternatives, but are more specific in the action alternatives than alternative A. These components would affect timber management in that the scale and types of harvest would be influenced by the need to protect watershed function and water quality. This could result in limiting harvest in some cases, such as when forest cover needs to be retained to limit erosion; or increasing harvest, such as when vegetation modification or fuel reduction is needed to limit the effects of potential high severity wildfire. The management direction in the action alternatives recognizes more flexibility in these scenarios than the no-action alternative. The action alternatives also include components that specifically address conservation watershed network and restoration. In all alternatives, plan components related to reducing sediment by limiting or reducing road access may limit access for timber harvest, or reduce feasibility due to the cost of accessing some areas. Such limitations are more explicitly identified in the action alternatives than in the no-action alternative, but the impacts to future management would be similar for all alternatives.

Soils management

Under all alternatives, plan components related to soils would generally benefit the timber resource by ensuring that soil productivity (and thus, future timber growth) is maintained in the long term. Standards and guidelines related to soils would have the general impact of limiting timber production and harvest in some areas, to the extent that activities that may be detrimental to soils (such as repeated compaction, operating equipment on steep slopes, and the like) would be restricted. Such restrictions have been applied to recent timber management activities, and continuing these practices would help sustain future timber production and are generally the same for all alternatives. The action alternatives provide greater specificity in the standards and guides for soils than alternative A, particularly with respect to allowable detrimental disturbance and post-treatment ground cover requirements.

Aquatic habitat and riparian areas

Measures to protect aquatic habitat and riparian areas would apply under all alternatives. The desired conditions, management restrictions, and other regulations that apply to areas near streams, water bodies, and wetlands would limit the amount of timber that may be produced; affect the types of harvest that occur; and/or may reduce operational feasibility of harvest.

- Under alternative A, most of the HLC NF (east of the Continental Divide) would be directed by Montana SMZ laws and BMPs. The SMZs vary depending on the class of stream. Within these zones, no broadcast burning, clearcutting, or road construction would occur, and no ground-based equipment would be used. Various levels of green tree retention would be required depending on the type of stream present (Montana Department of Natural Resources and Conservation, 2006). Further, the 1986 Lewis and Clark forest plan included a riparian management area (R) that included specific plan components, including a description of specific harvests (uneven-aged management) that could occur within riparian areas. Under this alternative, riparian areas west of the Continental Divide are delineated as riparian habitat conservation areas with restrictions applied based on the INFISH (USDA, 1995c). This direction would apply to portions of the Divide GA and most of the Upper Blackfoot GA. The riparian habitat conservation area delineations and associated guidance are similar to the RMZs defined for the action alternatives.
- Under alternatives B, C, D, and E, RMZs would be established. The width of the zones depends on the class of stream, and both inner and outer management zones are defined. These zones are not exclusions zones, and vegetation management including harvest may occur. Limitations are more stringent in the inner riparian zones, where management must specifically benefit the aquatic resource. In the outer riparian zones, vegetation management may occur to achieve a wide range of desired conditions as long as it does not preclude achievement of desired conditions for riparian resources and wildlife in the inner zone. No salvage harvest could occur in the inner RMZ, and no clearcutting could occur in any part of the RMZ. Other standards and guidelines related to landing and road construction would also apply.

West of the Continental Divide, alternative A is similar to the action alternatives (B, C, D, and E) with respect to the sizes and management direction applied to riparian areas, although guidance for vegetation management in the outer RMZs is more flexible with the action alternatives. East of the Continental Divide (the majority of the HLC NF), the action alternatives would establish larger RMZs than alternative A. The inner zones for many streams, where vegetation management is most limited, would be fairly similar in width to SMZs under the no-action alternative. The outer zones would be larger in size than SMZs, but more flexibility to permit vegetation management may be applied in these areas.

Riparian areas as defined by any alternative are not suitable for timber production because management requirements and constraints preclude planning a scheduled flow of timber products. However, harvest may occur when consistent with management restrictions and desired conditions for the riparian resources. Under all alternatives, water features smaller than 120' wide were not excluded from the mapping of lands suitable for timber production due to the difficulty in mapping. Rather, riparian areas associated with water features are considered to be unsuitable inclusions.

Management zones associated with riparian areas would be identified during project design because it is not possible to accurately map all zones at the broad scale. However, for the purposes of a programmatic comparison, estimated riparian areas for one category of stream (fish-bearing perennial), were identified to compare the magnitude of their influence on timber harvest across alternatives. Table 290 displays the estimated acres of these zones for each alternative, in lands suitable for timber production and unsuitable lands where harvest may occur for other purposes. The overlap of RMZs in lands suitable for timber production is smallest for alternative A, because the zones are represented by smaller widths east of the Continental Divide. Although the RMZs are the same for all action alternatives, the overlap of these areas on lands suitable for timber production in alternative E represents a slightly smaller percentage than alternatives B/C and D because the total acres suitable for timber production is greater. Additional riparian zones for other stream classes (perennial non-fish bearing and intermittent streams) would also influence timber management.

Table 290. Acres of land where harvest may occur, within RMZs associated with fish-bearing perennial streams^{3, 4}

	Alternative A ¹	Alternative B/C ²	Alternative D ²	Alternative E ²
Acres of RMZs in lands suitable for timber production	8,765	24,496	24,249	25,782
% of lands suitable for timber production in RMZs	2%	6%	6%	5%
Acres of RMZs in lands unsuitable for timber production where harvest may occur	22,682	69,350	52,533	73,843
% of lands unsuitable for timber production where harvest may occur in RMZs	2%	4%	4%	4%

1. Riparian areas for alternative A are defined using INFISH west of the Continental Divide, with a maximum possible width of 300'. Riparian areas for alternative A east of the Continental Divide are based on Montana SMZ law, based on a maximum possible width of 100'.
2. Riparian areas for alternatives B/C, D, and E are based on RMZ definitions both east and west of the Continental Divide, based on a maximum possible width of 300' to encompass the outer zone.
3. For all alternatives, the stream mapping for areas west of the divide is based on the INFISH. For areas east of the divide, the stream mapping is based on fish distribution from Montana Fish Wildlife and Parks.
4. Additional riparian zones would be associated with stream classes other than fish-bearing perennial. Actual riparian zones on the ground could be smaller than the maximum widths based on slope and other factors.

RMZ guidance associated with fish-bearing perennial streams would have the potential to limit timber harvest on 2 to 6% of lands suitable for timber production or other lands where harvest could occur, depending on alternative. This influence is less for the no-action alternative as compared to the action alternatives. However, vegetation management could occur within the outer RMZs identified for the action alternatives. The most stringent guidance would apply to the inner RMZs, which would not differ substantially from the size of SMZs that apply to alternative A.

Previous harvest has not been common in the riparian zones for perennial fish-bearing streams, but has occurred. Based on database queries of activities recorded from 1940 to 2013, harvest occurred in riparian zones as defined for alternative A on about 2,688 acres, and on 6,426 acres of riparian zones as they would be defined for the action alternatives. These figures represent 2% and 5%, respectively, of the 138,649 acres of total harvest recorded on the HLC NF.

Based on the extent of RMZs in potential harvest areas, and because harvest may occur to some degree, the potential impact of the management restrictions in riparian areas is not likely so great that the projected timber volumes and expected harvest treatments generated by the Spectrum model would be affected to a great degree with respect to the programmatic timber analysis.

Continental Divide National Scenic Trail

The Continental Divide National Scenic Trail runs through the HLC NF plan area in the Divide, Upper Blackfoot, and Rocky Mountain Range GAs. Many stretches of this trail lie within designated wilderness, where timber harvest is prohibited. Other stretches are in IRAs, where timber harvest is constrained. However, some stretches of this trail are also located in areas where harvest could occur, including both areas that are suitable for timber production and those unsuitable for timber production where harvest can occur for other purposes. In these areas, harvest may occur but would be constrained by plan components associated with the trail, which are designed to maintain a high or very high SIO within a half mile of either side of the trail (FW-CDNST-GDL-02, 03). Guidelines also limit harvest-related activities such as temporary roads, skidding, hauling, and log landings (FW-CDNST-GDL-08, 09).

The overlap of lands where harvest could be permitted within ½ mile of the Continental Divide National Scenic Trail is shown in Table 291. Alternative D would have the least amount of overlap with the trail corridor in both lands suitable for timber production and unsuitable lands where harvest could occur for other purposes, largely as a function of RWAs. Alternative A has the most overlap of lands suitable for

timber production, while alternative E has the most overlap of unsuitable lands where harvest may occur for other purposes. In these areas, the types of harvest and amount of volume removed may be limited, and/or harvest projects may be more complex to implement to meet the guidelines for the trail.

Table 291. Acres where harvest may occur within a half mile on either side the Continental Divide National Scenic Trail

	Alternative A	Alternative B/C	Alternative D	Alternative E
Lands Suitable for Timber Production	15,142	11,069	10,700	12,321
Lands Unsuitable for Timber Production where Harvest may Occur	42,248	49,141	28,851	59,505

Elk management

Under all alternatives, the management of elk would limit the location, timing and duration of harvest and in some cases lower the amount of harvest because of certain required vegetation conditions (such as hiding and thermal cover). These plan components vary by alternative and GA. The potential influences of these components cannot be explicitly modeled and quantified.

Plan components related to elk are detailed and specific in alternative A, and include requirements for the maintenance of certain vegetation conditions, such as hiding or thermal cover as defined by tree canopy density. The effect of these components would be to limit harvest in some areas. Other components, such as open road densities and elk security standards, may limit the feasibility of some harvest projects.

Under the action alternatives, plan components related to disturbance to ungulates (specifically on winter range) would also influence the potential timing and duration of harvest activities. Hiding and thermal cover would also be considerations for determining desired vegetation conditions at the project scale. Elk security guidelines may limit harvest, and are found in alternatives B and E but not C or D. For all of these aspects of elk management, the potential constraints to timber management would be based on site-specific information and the best available science to provide for the needs of elk.

The Elkhorns GA has unique plan components under all alternatives, based on its designation as a wildlife management unit. These components are similar across all alternatives, and would result in any harvest that occurs being designed to benefit desired wildlife and vegetation conditions, hazardous fuel reduction, or protection of values at risk. This GA is not suitable for timber production under any alternative because of these considerations.

Grizzly bear management

Under all alternatives, grizzly bear management would be guided based on the Draft Northern Continental Divide Ecosystem Grizzly Bear Conservation Strategy (U.S. Department of Agriculture, Forest Service, 2013c). Management direction from the Conservation Strategy would be amended to the existing plans for alternative A; or incorporated into all action alternatives (see appendix I of the Draft Plan).

Management for grizzly bears may affect to a relatively small degree the amount of timber that is feasible to remove, as an indirect result of limits on road access and duration of project activities. These restrictions would apply to the primary conservation area and to zone 1. Where grizzly habitat management applies, grizzly bear secure core habitat is calculated based on distance from motorized routes, and management direction would result in no increase in open motorized route density, and no decrease in core, as compared to a 2011 baseline.

On the HLC NF, the primary conservation area occurs only on portions of the Upper Blackfoot and Rocky Mountain Range GAs, and zone 1 occurs only on a portion of the Upper Blackfoot GA. In all alternatives, very little to no land suitable for timber production is identified in the Rocky Mountain

Range GA. Table 292 shows how much land suitable for timber production overlaps with the primary conservation area and grizzly bear secure core habitat as currently calculated. The remainder of the primary conservation area and secure core habitat is in IRAs, wilderness, or other lands unsuitable for timber production. The area where potential harvest would be the most restricted are the grizzly bear secure core habitat areas, which are present on a small proportion of land suitable for timber production.

Table 292. Lands suitable for timber production within the grizzly bear primary conservation area and secure core grizzly bear habitat

Alternative	Rocky Mountain Range GA		Upper Blackfoot GA	
	Primary conservation area	Secure Core	Primary conservation area	Secure Core
A	1,683	1,597	18,549	1,037
B/C	0	0	15,712	375
D	1,458	339	15,712	375
E	0	0	16,364	434

Due to the limited influence that habitat management for grizzly bears would have on timber management at the programmatic level, no constraints were applied in the Spectrum model. The general effects would be to possibly lower the feasibility of some timber projects, primarily within the Upper Blackfoot GA, by influencing the access and duration of projects. The Northern Continental Divide Ecosystem Grizzly Bear Conservation Strategy plan components would not have an impact on required reforestation or prescribed burning associated, because exceptions apply to allow access to perform these activities.

Grizzly bear management may influence other special forest products, but to a very minor degree. While limiting road access may inhibit firewood gathering in some areas, components allow for the temporary use of access roads in projects to be used for such activities. Special considerations would apply for special use permits for beehives to limit potential grizzly-human conflicts; this use does not currently occur on the HLC-NF. Finally, projects that increase food for grizzlies (i.e., huckleberries) would need to avoid certain locations such as recreation areas.

Canada lynx management

All alternatives would incorporate the NRLMD (USDA, 2007a). This direction would influence timber activities in potential lynx habitat, which is identified based on PVTs. Refer also to appendix H of the Draft Plan. For the timber resource, the impacts of lynx management would have the greatest effect on lands suitable for timber production, but would also influence harvest that occurs on unsuitable lands.

The management guidance that would influence timber production and harvest in potential lynx habitat includes not allowing harvest in multi-storied forest except in specified situations; possibly limiting the extent of regeneration harvest depending on how much stand initiation habitat is present in a given LAU; and not allowing pre-commercial thinning in stand initiation habitat. Some exceptions and considerations would apply, including but not limited to treating lands adjacent to administrative sites, treating lands in the WUI, and conducting treatments to restore whitebark pine. The lynx management direction also notes the potential for vegetation management to occur that would help develop desired habitat characteristics. This may influence the type of harvest conducted in some areas; for example, uneven-aged harvests may be used to help develop multi-storied forests.

Although the management constraints are only required in occupied lynx habitat, the guidance should be considered on all lands. Occupied lynx habitat has been identified by the USFWS, and currently includes only the Upper Blackfoot and Rocky Mountain Range GAs. However, because the guidance should be considered on all lands, and there is potential for occupied habitat to change, lynx constraints are analyzed

across the entire HLC NF. Lynx constraints were applied to the Spectrum model. The projected harvest quantities, types, and volume outputs shown in this section therefore reflect lynx management direction to the extent possible. These constraints included:

- Limiting the percent of areas that can have a regenerating harvest or prescribed burn
- Not allowing Precommercial thinning in certain vegetation types
- Not allowing treatment in multistoried habitat

Table 293 compares the lands suitable for timber production and the proportion of those lands that are also in potential lynx habitat. This shows that the magnitude of the potential influences of lynx habitat management in lands suitable for timber production are similar across all alternatives. In general, potential lynx habitat influences roughly half of lands suitable for timber production.

Table 293. Lands suitable for timber production within potential lynx habitat - acres

Alternative	Total lands suitable for timber production	Acres of land suitable for timber production in potential lynx habitat	Percent of land suitable for timber production in potential lynx habitat
A	430,489	243,730	57%
B/C	443,057	228,839	52%
D	435,014	223,902	51%
E	474,640	236,863	50%

Sensitivity analysis on the Spectrum model indicates that management constraints for lynx have a relatively minor effect on the timber analysis, causing an 8% reduction in PWSQ and 6% reduction in harvest acres in decade 1, as compared to an unconstrained baseline model scenario. This is only when looking at the sensitivity of the model to constraints; see appendix B for more information. Also see the terrestrial vegetation section for a description of effects from lynx management on vegetation management and desired conditions.

Cumulative Effects

The demand for timber products, supply from other sources, laws, and regulations all affect the amount of timber that may be harvested from the HLC NF. Budgets and court decisions also impact timber supply.

Changing human population

A stressor that may increase in the future is population level, locally and nationally, with resulting increasing demands and pressures on public lands. Locally, at present populations are increasing in the counties on the west side of the plan area, but are declining or stable in other areas. These changes may lead to increased tensions between the demand for timber and changing societal desires related to the mix of other uses public lands may provide. The sustainable use of other forest products may become increasingly vulnerable, requiring permitting and limitation of use.

Management of adjacent lands

Portions of the HLC NF adjoin other NFs, each having its own forest plan. The HLC NF is also intermixed with lands of other ownerships, including private lands, other federal lands, and state lands. Some GAs contain inholdings of such lands, while others are more unfragmented in terms of ownership. The GAs which are island mountain ranges are surrounded by private lands. Harvesting or conversion of forests on adjacent lands would affect vegetation conditions at the landscape level. State law applies to all harvest activities regardless of ownership; therefore, basic resource protections would be consistent. However, harvest practices on other lands would not necessarily be conducted to meet the same desired conditions as those outlined in the HLC NF Draft Plan.

Some adjacent lands are subject to their own resource management plans. The cumulative effects of these plans in conjunction with the HLC NF Draft Plan are summarized in Table 294, for those plans relevant to the timber resource.

Table 294. Summary of cumulative effects to timber from other resource management plans

Resource plan	Summary of effects
Forest Plans of Adjacent National Forests	The Flathead, Lolo, Beaverhead-Deerlodge, and Custer-Gallatin NFs are adjacent to the HLC-NF, and share boundaries on specific GAs (Rocky Mountain Range, Upper Blackfoot, Divide, Elkhorns, and Crazies). The Flathead and Custer-Gallatin are currently in forest plan revision under the 2012 Planning Rule. The Beaverhead-Deerlodge is guided by a recent forest plan (2009), under the 1982 rule. The Lolo is guided by a 1986 forest plan. All of the forest plans contain plan direction that meets the requirements of the NFMA, such as limitations on harvest, reforestation practices, and maximum sized openings. Generally speaking, management of the timber resource is consistent across NFs due to consistency in law, regulation, and policy. The management of the specific areas that are adjacent would be complementary across boundaries.
Montana Statewide Forest Resource Strategy	The forest action plan is complementary to the timber management on the HLC NF, by including strategies related to increased resilience, wildfire safety, and most especially providing forest products and biomass. The cumulative effect would likely be additive, in terms of the amount of timber harvest treatments that occur across the landscape and in a broad sense moving towards the vegetation desired conditions.
BLM Resource Management Plans	The Butte, Missoula, and Lewistown field offices manage lands that are intermixed with the HLC-NF. The Missoula and Lewistown areas are currently in revision. The Butte area is guided by a recent plan (2009). At a broad scale, the themes of the plans are similar to the HLC NF; timber management would have similar results.
County growth plans	Many of the county growth plans associated with the HLC NF plan area emphasize an interest in promoting the use wood products from NFS lands, as an economic contribution and to enhance the sustainability of forest landscapes. This would indicate that timber demand would remain an important feature in the local communities.
County wildfire protection plans	Some county wildfire protection plans map and/or define the WUI. The HLC NF notes that these areas may be a focus for hazardous fuels reduction, and other plan components have guidance specific to these areas. Treatments, including harvest, may be emphasized in these areas more so than others.

Timber demand

The demand for wood products allows for successful vegetation management and timber sales from the HLC NF. If demand for wood products increases, so too will demand for timber sales from the HLC NF. Alternatively, if demand decreases and mills close, there may be less desire for HLC NF timber. A decrease in demand may reduce the amount of timber sold regardless of the alternatives. Lower wood quantity may contribute to total public and private land timber supply chain elasticity, especially for mills isolated from other ownership and highly dependent on HLC NF forest ownership. If enough timber is collectively removed from markets, it would have the effect of increasing sawlog prices, decreasing operating profits for existing mills.

Conclusions

Managing lands suitable for timber production can provide a sustainable supply of timber products, which is important for local communities and provides other ecosystem benefits such as storing carbon in harvested wood products. Timber harvest, on lands suitable and unsuitable for timber production, is an important tool to achieve desired vegetation conditions and objectives for multiple resources.

All alternatives identify lands suitable for timber production and other lands where harvest can occur for purposes other than timber production. The magnitude of difference across alternatives is minor because the primary factors that influence these determinations do not vary by alternative, such as IRA

designations and the inherent capability of the land to grow trees. The primary difference is due to management emphasis of certain areas, primarily the South Hills Recreation Area and the Little Snowies portion of the Snowies GA. There is not a substantial trade off with RWAs and lands suitable for timber production, because most of these lands are IRAs and unavailable for timber production regardless of whether or not they are RWAs.

In all alternatives, a substantial proportion of lands unsuitable for timber production where harvest may occur are IRAs; while some harvest could be allowed, it would be constrained to a great degree by the 2001 Roadless Area Conservation Rule. While alternative E has the most unsuitable lands where harvest may occur, alternatives B/C have the most unsuitable lands where harvest may occur that are not in IRAs.

All alternatives would produce timber volume. Alternatives A, B/C, and D are similar with respect to expected timber outputs, acres harvested, and achievement of desired conditions. Alternative E produces higher timber outputs, although it harvests fewer acres and does less to achieve the desired vegetation conditions than the other alternatives. The difference with alternative E is a function of management emphasis to maximize timber production, which results in harvesting fewer acres more intensively, in the most productive vegetation types. Alternatives A, B/C, and D do more to achieve desired conditions by harvesting more acres less intensively, in less productive vegetation types.

All alternatives are projected to have the potential to harvest acres and produce timber volumes that exceed the levels the HLC NF has produced in recent decades. This is in part due to factors which are not under FS control and are not included in the modeled metrics. Another factor is the proportion of sawtimber to nonsawtimber volume. For example, in the last decade, an emphasis toward non-sawtimber volume sold (dead lodgepole pine) occurred in the wake of the mountain pine beetle outbreak. Regardless of alternative, actual timber outputs will be influenced by factors outside of the FS control, including actual budgets received and appeals/litigation processes.

Projected timber outputs are displayed both with and without a budget constraint. The levels of timber volume and acres treated in model scenarios unconstrained by budget represent the levels that could be achievable within the regulatory and ecological capacity of the HLC NF, if budgets were not a factor. The constrained budget scenarios represent the levels of timber production that are likely achievable with a reasonably foreseeable budget level.

Alternative E would have the potential to produce more timber jobs than the other alternatives based on projected volume outputs. However, alternatives A, B/C, and D would harvest more acres, and therefore job opportunities that are related to the magnitude of area treated could actually be greater with those alternatives. The trend for timber demand is independent of alternatives, but alternatives may offer different supply chain flexibility to planning area firms.

Other forest products such as Christmas trees would remain available into the future to a similar degree in all alternatives. Potential commercial use of other forest products varies as a function of RWAs.

Table 295 shows a simplified summary of the timber indicators across alternatives.

Table 295. Timber indicators comparison of alternatives

Indicator	Greatest to Least			
Acres suitable for timber production	E	BC	D	A
Acres unsuitable for timber production where harvest can occur	E	BC	D	A
PTSQ and wood sale quantity	E	ABCD		
Contribution to select desired vegetation conditions	ABCD	E		
Timber demand	ABCDE			

Indicator	Greatest to Least			
Acres harvested ¹	A	BCD	E	
Area where commercial use of other forest products is allowed	E	A	BC	D

3.30 Geology, Energy, and Minerals

3.30.1 Introduction

Minerals management of NFS lands requires interagency coordination and co-operation. Although the FS is responsible for the management of surface resources of NFS lands, the BLM is primarily responsible for management of government-owned minerals. Since it is not possible to separate mineral operations from surface management, the agencies have developed cooperative procedures to accommodate their respective responsibilities.

There are three types of mineral and energy resources:

- Locatable minerals include commodities such as gold, silver, copper, zinc, nickel, lead, platinum and some nonmetallic minerals such as asbestos, gypsum, and gemstones. Lands that are open to location under the Mining Law of 1872 guarantee U.S. citizens the right to prospect and explore lands reserved from the public domain and open to mineral entry. The right of reasonable and appropriate access for exploration and development of locatable mineral is guaranteed.
- Leasable minerals include commodities such as oil, gas, coal, geothermal, potassium, sodium phosphates, oil shale, sulfur, and solid leasable minerals on acquired lands. Areas of the Forest are open to leasable minerals exploration, development and production. A leasing decision will not be a part of this plan. The disposal of these leasable minerals is discretionary.
- Salable minerals include common varieties of sand, stone, gravel, cinders, clay, pumice and pumicite. The FS has the authority to dispose of these materials on public lands through a variety of methods. The disposal of these materials is discretionary.

Analysis area and indicators

The analysis area is the NFS lands within the Forest. The key indicators for minerals are:

- Locatable minerals – acres unavailable for mineral entry (not withdrawn);
- Leasable minerals – acres unavailable for leasing proposals and proposed no surface occupancy stipulation acreages;
- Salable minerals-acres unavailable for disposal of mineral materials; and
- Timing and access restrictions that could affect all mineral development.

3.30.2 Regulatory framework

Weeks Law Act of March 1, 1911 (P.L. 61-435, 72 Stat. 1571, as amended, 16 U.S.C. § 480 et seq):

This act authorized the federal government to purchase lands for stream-flow protection, and maintain the acquired lands as national forests.

Mineral Resources on Weeks Law Lands Act of March 4, 1917 (P.L. 64-390, 39 Stat. 1149, 16

U.S.C. § 520): This act authorizes the Secretary of Agriculture to issue permits and leases for prospecting, developing, and utilizing hard-rock minerals on lands acquired under the authority of the act. This authority was later transferred to the Secretary of the Interior.