Soils Specialist Report

Motorized Travel Plan
Dixie National Forest

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I. Scope of the Analysis

The geographic scope for the assessment of the soil resource conditions and potential effects is the entire Dixie National Forest. For organizational reasons, the Dixie National Forest is divided into five districts. The analysis for the soil resource is organized, analyzed, and discussed for each of the districts.

The analysis for the soil resource is limited to snow-free use only. This analysis addresses changes in the type, extent, and location of designated areas open to cross-country motor vehicle use and/or limited motorized access, designated roads, and designated motorized trails by alternative. Non-motorized travel is not addressed as a soil issue because it is allowed on all roads, trails, and cross-country in all alternatives. Winter access is not addressed as a soil issue because over-snow vehicle use (snowmobiles) does not degrade soil productivity or accelerate erosion.

Issues and Indicators

Issue

The type, extent, and location of roads, trails, and motorized areas in the Travel Plan may result in degraded soil productivity and accelerated erosion.

Indicators

1. Percent of the districts designated open to cross-country motor vehicle use.
2. Miles of roads that intercept slopes of 35 percent or more.
3. Miles of roads that are on high erosion potential soils.
4. Miles of road surface.
5. Miles of designated all-terrain vehicles (ATV) trails.

Background

Motorized vehicle use off roads and trails can degrade soil productivity. Direct mechanical impacts have several components: abrasion, compaction, shearing, and displacement. Indirect impacts include hydraulic modification, such as the disruption of surface water flow, reduction in infiltration and percolation, surface ponding, and the loss of water-holding capacity. Unauthorized roads and trails have the potential to accelerate erosion and sediment delivered to streams due to lack of design and poor location (Luce and Black 2001).

Disturbances from roads and trails can increase erosion and sediment delivery. Existing roads and trails are a primary source of long-term management-related sediment. The type, extent, and location of a designated motorized system of roads, trails, and areas will contribute to the amount of accelerated erosion. Accelerated erosion and sediment delivery have been identified as a primary source of water quality pollution in many Dixie National Forest watersheds.

The following text provides a summary of how and why each Soil Indicator is used to evaluate effects on the soil resource.

Soil Indicator 1: Percent of the districts designated open to cross-country motor vehicle use

The area designated open to cross-country motor vehicle use is used as a general measure of potential effects to soil productivity. Motorized cross-country travel can pioneer new trails across alpine areas, wetlands, steep slopes, and other areas with sensitive soils. Degraded areas become a major environmental problem because of their direct effects on vegetation, soils, and site hydrology.

Soil Indicator 2: Miles of road that intercept slopes of 35 percent or more

Accelerated erosion and sediment from roads continue over the long-term as a result of traffic use, compaction, high runoff, and concentrated water on the road surface, ditch lines and from relief culverts. Cut and fill slopes can also be a chronic source of surface erosion and mass failures (Satterlund 1972).

Soil Indicator 3: Miles of roads that are on high erosion potential soils

Erosion potential ratings characterize the natural inherent sensitivity of soil types to detach and erode. In high potential areas, disturbance poses a higher risk of accelerated erosion and sediment delivery (Switalski et. al 2004). Soils with low or moderate erosion potential were not considered as an issue due to low risk of accelerated erosion.

Soil Indicator 4: Miles of road surface

Roads represent a long-term commitment of the soil to a non-productive condition. This is a total resource commitment of the soil resource.

Soil Indicator 5: Miles of designated ATV trails

ATV trails can have similar effects to soil productivity as roads but the effects differ based on the width of the travel way. As with two-wheel motorized trails, ATV trails create additional problems due to steep grades, lack of designed stream crossings, and difficulty of maintaining water management features. In addition, cross-country motor vehicle use can cause additional damage to the soil resource.

II. Forest Plan Direction

The 1986 Land and Resource Management Plan for the Dixie National Forest, referred to as the Forest Plan, provides general direction for all Forest resources and the foundation for more specific direction at the management area level (USDA 1986).

In general, the following Forest Plan goals, objectives, standards, and guidelines for the soil resource are related to travel planning:

Goals and Objectives

- Goal No. 29 – Provide soil guidance to other resource activities to protect or improve soil productivity. Objectives a. & c.: Identify and adopt best management practices applicable to the forest and monitor effects on soil erosion in accordance with Public Law 92-500 and manage riparian areas according to the Riparian Management Standards and Guidelines. And protect or improve riparian dependant resources during management activities within or affecting riparian areas (page IV-8).
- Goal No. 32 – Design and implement practices on the ground that will reestablish acceptable soil conditions that are sufficient to secure and maintain a favorable water flow. Objective b.: Give priority to problem areas in high value watersheds and where accelerated erosion exists or is rapidly increasing (page IV-9).

Desired Condition

The following desired conditions listed in the Forest Plan are pertinent to this analysis:

- Soil productivity will be maintained. Condition of riparian areas will be maintained, or if necessary improved (page IV-22)

Forest-wide Standard and Guidelines

The following forest-wide standards and guidelines (general direction) listed in the Forest Plan are pertinent to this analysis:

- Maintain soil productivity, minimize man-caused soil erosion, and maintain the integrity of associated ecosystem (page IV-48)

III. Existing Condition

Soil productivity on the Dixie National Forest has been directly impacted by the type, extent, and location of designated roads, motorized trails, and cross-country motor vehicle use. These impacts have affected the existing condition of all districts to varying degrees.

Soil Productivity

Soil productivity includes the inherent capacity of a soil under management to support the growth of specified plants, plant communities, or a sequence of plant communities.
The following text describes loss or degradation of soil productivity in two aspects:

- Total Soil Resource Commitment (TSRC) is defined as the conversion of a productive site to an essentially non-productive site for a period of more than 50 years. In this analysis, quantifiable TSRC is associated with roads and trails. These areas are dedicated to a specific management use that precludes other uses of the land and removes the majority of the productive capability of the land. These TSRC types of disturbances also affect water quality because they often create the greatest amount of accelerated soil erosion and thus sedimentation.
- Detrimental soil disturbance (DD) is the alteration of natural soil characteristics that results in immediate or prolonged loss of soil productivity and soil-hydrologic conditions.

DD can result from off-road motorized activities and can produce unacceptable levels of soil degradation by compacting, moving, eroding, or pudding the soil. Motorized vehicles can damage soils directly from impact from surface traffic and indirectly by hydrologic modifications, soil transport, and deposition. Direct mechanical impact has several components – abrasion, compaction, shearing, and deposition – that can affect the soil resource. Abrasion strips surface vegetation and roots. Compaction reduces soil voids and causes surface subsidence. Shearing is the destructive transfer of force through the soil. Displacement results in the mechanical movement of soil particles. Indirect impacts include hydraulic modifications such as the disruption of surface water flow, reductions in infiltration and percolation, surface ponding, and the loss of water-holding capacity. Other indirect impacts include those associated with erosion and the deposition of transported particles. Water quality can be degraded by erosion through sediment being delivered to lakes and streams.

Asbestos Influenced Soils

There are no known locations of asbestos influenced soils on the Dixie National Forest (Van Gosen 2008).

Current Conditions Described by District

Current Travel Access Effects on Soil Productivity

Table 1. Existing Condition of Soil Indicators – Cedar City Ranger District

Soil Indicators	Existing Condition
1. Percent of the district designated open to cross-country motor vehicle use	36.49%
2. Miles of roads that intercept slopes of 35% or more	29.80 miles
3. Miles of roads that are on high erosion potential soils	16.59 miles
4. Miles of road surface	1,362.90 miles
5. Miles of designated ATV trails	46.19 miles

- Currently 36% of the district is designated as open for cross-county travel. Cross-country travel can lead to detrimental soil disturbance. Many of the off-road uses occur in meadows or riparian areas where non-forested vegetation allows for easier progression in motor vehicles; these areas are not conducive to vehicle traffic due to variable soil moisture contents throughout the year and the subsequent compaction and puddling that occurs.
- Of the total 1,362 miles of roads found on the district, only 2 percent of the roads intercept slopes of more than 35 percent and only 1 percent of the roads are on high erosion potential soils. These areas are much more susceptible to sediment movement but are only found on a small amount of the district. All the roads currently on the district represent a total resource commitment of the soil resource.
- Designated ATV trails represent about 3.5 percent of the total resource commitment of roads and trails on the district. High ATV use on designated ATV trails has created

defined rutting and puddling within many areas of the defined ATV travel system (Glidden 2007).

Table 2. Existing Condition of Soil Indicators – Escalante Ranger District

Soil Indicators	Existing Condition
1. Percent of the district designated open to cross-country motor vehicle use	58%
2. Miles of roads that intercept slopes of 35% or more	26.12 miles
3. Miles of roads that are on high erosion potential soils	8.81 miles
4. Miles of road surface	1,033.19 miles
5. Miles of designated ATV trails	21.46 miles

- Currently 58% of the district is designated as open for cross-county travel. Cross-country travel can lead to detrimental soil disturbance. Many of the off-road uses occur in meadows or riparian areas where non-forested vegetation allows for easier progression in motor vehicles; these areas are not conducive to vehicle traffic due to variable soil moisture contents throughout the year and the subsequent compaction and puddling that occurs.
- Of the total 1,033 miles of roads found on the district, only 2.5 percent of the roads intercept slopes of more than 35 percent and less than 1 percent of the roads are on high erosion potential soils. These areas are much more susceptible to sediment movement but are only are found on a small amount of the district. All the roads currently on the district represent a total resource commitment of the soil resource.
- Designated ATV trails represent about 2 percent of the total resource commitment of roads/trails on the district. High ATV use on designated ATV trails has created defined rutting and puddling within many areas of the defined ATV travel system (Glidden 2007).

Table 3. Existing Condition of Soil Indicators – Pine Valley Ranger District

Soil Indicators	Existing Condition
1. Percent of the district designated open to cross-country motor vehicle use	75.39%
2. Miles of roads that intercept slopes of 35% or more	18.52 miles
3. Miles of roads that are on high erosion potential soils	20.16 miles
4. Miles of road surface	718.19 miles
5. Miles of designated ATV trails	0 miles

- Currently 75% of the district is designated as open for cross-county travel. Cross-country travel can lead to detrimental soil disturbance. Many of the off-road uses occur in meadows or riparian areas where non-forested vegetation allows for easier progression in motor vehicles; these areas are not conducive to vehicle traffic due to variable soil moisture contents throughout the year and the subsequent compaction and puddling that occurs.
- Of the total 718 miles of roads found on the district, only 2.5 percent of the roads intercept slopes of more than 35 percent and only 3 percent of the roads are on high erosion potential soils. These areas are much more susceptible to sediment movement

but are only are found on a small amount of the district. All the roads currently on the district represent a total resource commitment of the soil resource.

Table 4. Existing Condition of Soil Indicators – Powell Ranger District

Soil Indicators	Existing Condition
1. Percent of the district designated open to cross-country motor vehicle use	62.30%
2. Miles of roads that intercept slopes of 35% or more	26.74 miles
3. Miles of roads that are on high erosion potential soils	16.66 miles
4. Miles of road surface	1,187.77 miles
5. Miles of designated ATV trails	8.58 miles

- Currently 62% of the district is designated as open for cross-county travel. Cross-country travel can lead to detrimental soil disturbance. Many of the off-road uses occur in meadows or riparian areas where non-forested vegetation allows for easier progression in motor vehicles; these areas are not conducive to vehicle traffic due to variable soil moisture contents throughout the year and the subsequent compaction and puddling that occurs.
- Of the total 1,187 miles of roads found on the district, only 2.5 percent of the roads intercept slopes of more than 35 percent and only 1.5 percent of the roads are on high erosion potential soils. These areas are much more susceptible to sediment movement but are only are found on a small amount of the district. All the roads currently on the district represent a total resource commitment of the soil resource.
- Designated ATV trails represent less than 1 percent of the total resource commitment of roads and trails on the district. High ATV use on designated ATV trails has created defined rutting and puddling within many areas of the defined ATV travel system (Glidden 2007).

Table 5. Existing Condition of Soil Indicators – Teasdale Ranger District

Soil Indicators	Existing Condition
1. Percent of the district designated open to cross-country motor vehicle use	56.92%
2. Miles of roads that intercept slopes of 35% or more	7.06 miles
3. Miles of roads that are on high erosion potential soils	1.52 miles
4. Miles of road surface	501.35 miles
5. Miles of designated ATV trails	17.38 miles

- Currently 56% of the district is designated as open for cross-county travel. Cross-country travel can lead to detrimental soil disturbance. Many of the off-road uses occur in meadows or riparian areas where non-forested vegetation allows for easier progression in motor vehicles; these areas are not conducive to vehicle traffic due to variable soil moisture contents throughout the year and the subsequent compaction and puddling that occurs.
- Of the total 501 miles of roads found on the district, only 1.5 percent of the roads intercept slopes of more than 35 percent and less than 0.5 percent of the roads are on high erosion potential soils. These areas are much more susceptible to sediment

movement but are only are found on a small amount of the district. All the roads currently on the district represent a total resource commitment of the soil resource.

- Designated ATV trails represent 3.5 percent of the total resource commitment of roads and trails on the district. High ATV use on designated ATV trails has created defined rutting and puddling within many areas of the defined ATV travel system (Glidden 2007).

New Motorized Trail Construction

Two new motorized (ATV) trails are proposed for construction in Alternative D (totaling 1.26 miles), and two new motorized trails are proposed for construction in Alternative E (totaling 1.26 miles). More information on the location of these routes can be found in the Recreation and Scenery Specialist Report. Additional information on the soils in the affected areas can be found in the Soil Survey of the Dixie National Forest (USDA 1999).

Table 6. New Motorized Trails Proposed for Construction in Alternatives D and E

Proposed Route #	Applicable Alternative	Mileage	Soil Types and Characteristics*	Existing Condition of Area Proposed for New Motorized Trail
T34070	D & E	0.65	Four soil types (223, 237, 242A, and 242) would be affected from this proposed route. These soil types are found on slump-land topography to the south of Brian Head Peak. These soils are located at very high elevation (10,000 feet or higher) and are formed from tertiary volcanic rocks of the Brianhead Formation. They are well-drained.	Active gully erosion is occurring down slope of the proposed motorized trail. The vegetation in the area is a sparse cover of low shrubs and forbs. The proposed new route traverses slopes that are 10-45 percent.
U24028A	D&E	0.61	Soil Type 239 is located at very high elevation (10,000 feet or higher) and on mountain sideslopes with soils that are shallow (less than 20 inches) to bedrock.	Slopes affected by the proposed route construction are less than 15 percent with sparse Engelmann spruce and subalpine fir trees.

* Source: Soil Survey of the Dixie National Forest (USDA 1999).

IV. Environmental Consequences

Introduction

The type, extent, and location of designated areas open to cross-country motor vehicle use access and designated roads and motorized trails have an effect on soil productivity. Soil productivity is generally assessed by Total Soil Resource Commitment (TSRC) and Detrimental soil Disturbance (DD). The following is a general discussion of the five soil indicators and how they are used to evaluate the differences between alternatives on the soil resources.

Table 7. Soil Indicator 1: Percent of the Districts Designated Open to Cross-country Motor Vehicle Use

District	No Action	Alt B	Alt C	Alt D	Alt E
Cedar City	36.49%	0%	0%	0%	0%
Escalante	58.00%	0%	0%	0%	0%
Pine Valley	75.39%	0%	0%	0%	0%
Powell	62.30%	0%	0%	0%	0%
Teasdale	56.92%	0%	0%	0%	0%

The area designated open to cross-country motor vehicle use is used as a general measure of potential effects to soil productivity. Motorized cross-country travel can pioneer new trails across alpine areas, wetlands, steep slopes, and other areas with sensitive soils. Degraded areas become a major environmental problem because of their direct effects on vegetation, soils, and site hydrology.

In all alternatives, limited access for parking would be allowed within 150 feet of a designated road and within 150 feet of a designated motorized trail. The exception is in the designated dispersed camping areas, where travel off of designated routes would not be allowed. In these areas, short road sections leading to designated parking and camping sites would be identified and designated.

TSRC would vary in all alternatives because this project does propose to remove any roads and motorized trails from the landscape. This project will increase opportunities to implement watershed restoration activities to reduce TSRC during future Forest projects. With proper education and enforcement, unauthorized TSRC should only occur in limited portions of the districts closed to motorized cross-country travel.

DD should be reduced with implementation of any of the action alternatives with the reduction of areas open to motorized cross-country vehicle use. DD would continue to occur along designated roads and motorized trails due to permitted limited access for parking in those areas. With proper education and enforcement, unauthorized DD should be limited in areas closed to motorized cross-country vehicle use.

Soil quality is expected to improve with the reduction of areas open to cross-country motor vehicle use access. There would be an improvement due to the elimination of motorized use on and adjacent to the open unauthorized roads. However, accelerated erosion and sediment delivery would continue from these unauthorized roads until such time as restoration plans are made and implemented. Adverse effects to soil quality are expected to continue on areas open to limited motorized access along the designated roads and motorized trails. This indicator is best used to evaluate the differences between the No Action and the action alternatives from the effects of reducing the area open to cross-country motor vehicle use access.

Table 8. Soil Indicator 2: Miles of Road That Intercept Slopes of 35 Percent or More

District	No Action	Alt B	Alt C	Alt D	Alt E
Cedar City	29.80	25.72	26.70	28.43	30.73
Escalante	26.12	16.56	18.20	22.91	27.29
Pine Valley	18.52	11.16	14.05	14.51	18.73
Powell	26.74	14.68	19.42	23.27	27.64
Teasdale	7.06	4.61	5.29	5.91	7.76

The miles of roads that intercept slopes of 35 percent or more are used as a relative measure of DD in areas that are highly susceptible to accelerated erosion and where sediment from roads continues over the long-term as a result of traffic use, compaction, high runoff, and concentrated water on the road surface, ditch lines, and from relief culverts. Cut and fill slopes can also be a chronic source of surface erosion and mass failures (Satterlund 1972).

Table 9. Soil Indicator 3: Miles of Road That Are on High Erosion Potential Soils

District	No Action	Alt B	Alt C	Alt D	Alt E
Cedar City	16.59	9.39	14.40	16.14	20.87
Escalante	8.81	7.38	7.70	10.55	11.93
Pine Valley	20.16	13.00	13.11	14.93	20.16
Powell	16.66	8.06	9.98	10.67	16.67
Teasdale	1.52	1.52	1.52	1.52	2.35

The miles of roads that are on high erosion potential soils is used as a relative measure of DD for soil that can be easily detached and eroded. In high potential areas, disturbance poses a higher risk of accelerated erosion and sediment delivery. Soils with low or moderate erosion potential were not considered as an issue due to low risk of accelerated erosion.

Table 10. Soil Indicator 5: Miles of Road Surface

District	No Action	Alt B	Alt C	Alt D	Alt E
Cedar City	1,362.90	918.18	968.89	1,046.41	1,357.46
Escalante	1,033.19	610.61	649.62	834.63	1,097.46
Pine Valley	518.35	438.47	508.09	537.19	718.74
Powell	1,187.77	500.26	621.38	744.87	1,199.57
Teasdale	501.35	287.56	313.77	381.51	501.87

The miles of designated roads are used as a relative measure of TSRC and DD. Accelerated erosion and sediment from roads continue over the long-term as a result of traffic use, compaction, high runoff, concentrated water on the road surface, ditch lines, and from relief culverts. Cut and fill slopes can also be a chronic source of surface erosion and mass failures (Satterlund). In addition, off-road motorized vehicle can damage soil and water resources. For this indicator, TSRC is determined by the extent of roads on the landscape. TSRC can affect water quality because it often creates the greatest extent of accelerated erosion and sediment delivery. DD can result from off-route motorized activities and can produce unacceptable levels of soil degradation by compacting, moving, eroding, or puddling the soil. This indicator is best

used to evaluate the relative difference between the alternatives on the extent of designated roads.

Table 11. Soil Indicator 5: Miles of Designated ATV Trails

District	No Action	Alt B	Alt C	Alt D	Alt E
Cedar City	46.19	77.58	72.04	55.11	47.37
Escalante	21.46	43.57	38.84	34.81	20.04
Pine Valley	0	0	12.74	9.35	1.84
Powell	8.58	14.51	21.38	23.55	8.92
Teasdale	17.38	18.35	19.75	28.17	19.44

The miles of designated ATV trails are used as a relative measure of TSRC and DD. ATV trails can have similar effects to soil productivity as roads but the effects differ based on the width of the travel way. ATV trails create additional problems due to steep grades, lack of designed stream crossings, and difficulty of maintaining water management features. In addition, motorized vehicle use off the trail can occur, resulting in additional damage to the soil resource. This indicator is best used to evaluate the relative difference between the alternatives on the extent of designated ATV trails.

Effects of New Motorized Trail Construction

New motorized trails represent a total soil resource commitment and detrimental soil disturbance. ATV trails can have effects to soil productivity similar to those of roads but the effects differ based on the width of the travelway. Typically the proposed routes would be 60 inches wide, and would include the removal of all vegetation. The proposed motorized trails can create additional problems due to steep grades, lack of designed stream crossings, and difficulty of maintaining water management features, such as rolling dips that are used to limit water/sediment movement. In addition, motorized vehicle use off the trail can occur, resulting in additional damage to the soil resource. Specific effects from each new route are disclosed in the table below.

Table 12. Effects of New Motorized Trail Construction – Alternatives D and E

Proposed Route #	Applicable Alternative	Mileage	Effects to Soil Resources from the Proposed New Motorized Trail
T34070	D & E	0.65	By constructing a motorized trail mid slope across this soil, additional gullies would likely develop from the interruption of the natural surface flow, causing the runoff to be accumulated and released along varying sections of this trail and increasing the water erosion potential on these high elevation sideslopes with little vegetative cover.
U24028A	D & E	0.61	The soils are suitable for motorized trail development. Additional design practices would need to be utilized to prevent water erosion.

Indirect Effects Common to Alternative B, C, and D

Motorized users may be displaced to other areas within Utah, Arizona, and Nevada with implementation of Alternative B, C, or D. This may increase motorized vehicle use in these areas and could cause additional effects to the soils off of the Dixie National Forest..

Summary

All proposed motorized trails represent a total resource commitment; the total commitment for Alternatives D and E is 0.8 acres. Route T34070 is not suited for new motorized trails. Route U24028A is suitable for new construction with proper design features to minimize effects to the soil resource.

Cumulative Effects Common to All Alternatives and Districts

The cumulative effects analysis is grouped into eight categories: Utilities, Oil and Gas, Transportation, Recreation, Vegetation Treatments, Land Exchange and Easements, Special Use Permits, and Grazing. Details of each project associated with these groups can be found in the project record (USDA 2008).

Utilities

Proposals for new power lines, telecommunication facilities, and water lines and tanks to be located on the Forest are received annually. All these projects result in additional disturbance to the soil resource through the removal of vegetation and long-term commitments for access to these improvements. Detrimental cumulative effects to the soil resource from future utility developments would increase at the forest-level in all alternatives.

Oil and Gas

Analysis for new oil and gas development in currently ongoing. Oil and gas exploration and development cause additional disturbance to the soil resource with new roads and drill pad development, and through the long-term commitments for access to these improvements. Detrimental cumulative effects to the soil resource from future oil and gas development would increase at the forest-level in all alternatives.

Transportation

Closed NFS (Level 1 Maintenance) Roads

These roads are designated National Forest System (NFS) roads that have been closed to use but that may actually be operationally open. In recent years these roads have been physically

closed, waterbars have been installed, and roadbeds and cut and fill slopes have been scarified and seeded. However, many of these roads still need to be physically closed and stabilized to keep them from contributing sediment.

Unauthorized Motor Vehicle Use and Unauthorized Roads

Unauthorized motorized use would continue to be a problem that adversely affects soil productivity. The major problems occur on unauthorized roads and in meadows adjacent to roads and motorized trails. Unauthorized roads may or may not be open or drivable. Access may be physically blocked by down or live trees. These roads receive no maintenance so drainage and erosion problems do occur in areas. Drainage structures such as ditches, crossdrains, waterbars, or dips may never have been constructed or are no longer functioning.

The majority of routes that are being considered for designation across the alternatives of this project currently exist and are receiving some amount of use. If Alternative B, C, or D is selected, detrimental effects to the soil resource from the motorized route network would be reduced from the current condition.

Cross-country Travel

All action alternatives would result in the elimination of cross-country travel. This action would reduce current and potential future interaction between cross-country travel and other forest actions, thereby reducing the threat of detrimental effects to the soil resource. The No Action Alternative has the highest potential to result in adverse cumulative impacts to aquatic resources. This is primarily related to the continuation of cross-country travel on the 61 percent of the Forest where it is currently allowed, including sensitive riparian areas, stream corridors, and lake basins.

Recreation

Dispersed Camping and ATV Use

These activities are widespread across the Forest. ATV use and cross-country travel are commonly related activities that occur within and near popular dispersed camping areas. Selection of Alternative A would result in cumulative detrimental impacts associated with dispersed camping and ATV use on the soil resource within areas open to cross-country travel. Additionally, routes included within all action alternatives that increase the designated ATV system would present the potential for adverse cumulative effects associated with dispersed camping. These effects may produce unacceptable levels of soil degradation by compacting, moving, eroding, or puddling the soil.

Vegetation Treatments

Proposals for new timber sales are an annual occurrence on the Forest. These projects typically result in 2 to 5 percent of each activity area resulting in detrimental soil disturbance (Jaros 2005, 2007a, 2007b). Detrimental cumulative effects to the soil resource from timber sale activity would remain at current levels in the future at the forest-level in all alternatives.

Land Exchange and Easements

Proposals for land exchanges do not directly affect detrimental soil disturbance.

Special Use Permits

Proposals for special use permits do not directly affect detrimental soil disturbance.

Grazing

Livestock grazing is a use that is managed under proper use guidelines. The actions proposed in this FEIS will not alter the grazing pattern or management of the livestock.

Summary

Alternatives B, C, and D (in the same order of preference) would result in beneficial cumulative effects to soil resource in response to past, present and future implementation of travel management actions on the Forest. Some of these actions are included in signed decisions that have yet to be implemented on the ground. All of these projects either reduced total motorized route mileage or reduced route encroachment on steep soils or highly erodible areas. These actions have been initiated primarily to improve watershed function and aquatic and terrestrial habitat conditions. Alternative A would have a continuance of negative cumulative effects as it would allow continued cross-country travel on 61 percent of the Forest. Alternative E would increase the number and miles of roads on the Forest and would also increase negative cumulative effects.

Effects of Snow-free Motorized Travel on Soil Productivity by District

The tables displayed for each district provide a numerical depiction of how the Soil Indicators change in each action alternative compared with the existing condition. Effects were determined to be an improvement, no change, or degradation. The extent of the effects is relative to each other. A negative change indicates an improvement to soil productivity, a positive number indicates degradation, and zero indicates no change. The larger the negative number, the greater relative improvement to the soil resources. The larger the positive number, the greater relative degradation to the soil resources.

In addition, the size of the increase or decrease was qualitatively described for each indicator. For the indicators, a rating of “major” was given when the difference was 20 percent or more. A rating of “moderate” was given when the change was 10-19 percent. A rating of “minor” was given to changes of 1-9 percent. If the change was less than 1 percent, a “no change” rating was applied.

Table 13. Effects Analysis – Cedar City Ranger District

Soil Indicator	Percent Change From Existing Condition									
	No Action		Alt B		Alt C		Alt D		Alt E	
1. Percent of the districts designated open to cross-country motor vehicle use.	Acres	% Change	Acres	% Change	Acres	% Change	Acres	% Change	Acres	% Change
	147,494	0	0	-100	0	-100	0	-100	0	-100
2. Miles of roads that intercept slopes of 35% or more.	Miles	% Change	Miles	% Change	Miles	% Change	Miles	% Change	Miles	% Change
	29.8	0	25.72	-14	26.70	-11	28.43	-5	30.73	3
3. Miles of roads that are on high erosion potential soils.	Miles	% Change	Miles	% Change	Miles	% Change	Miles	% Change	Miles	% Change
	16.59	0	9.39	-44	14.40	-14	16.14	-3	20.87	25
4. Miles of road surface.	Miles	% Change	Miles	% Change	Miles	% Change	Miles	% Change	Miles	% Change
	1,362.9	0	918.18	-33	968.89	-29	1,046.41	-24	1,357.46	-1
5. Miles of designated ATV trails.	Miles	% Change	Miles	% Change	Miles	% Change	Miles	% Change	Miles	% Change
	46.19	0	77.58	67	72.04	55	55.1	19	47.37	2

Cedar City Ranger District Effects Summary

- All action alternatives would have a major reduction in restricting cross-country travel by eliminating this effect to the soil resource.
- The miles of roads on slopes of more than 35 percent would be a moderate improvement for Alternatives B and C, and minor improvement for Alternative D. Alternative E would have a minor degradation from an increase in miles of roads on steep slopes.
- The miles of roads on high erosion potential soils would be a major improvement for Alternative B, moderate improvement for Alternative C, and minor improvement for Alternative D. Alternative E would have a major degradation from an increase in miles of roads on highly erodible soils.
- The miles of roads would be a major improvement for Alternatives B, C, and D. Alternative E would have a minor improvement from a decrease in roads.
- The miles of designated ATV trails would be a major degradation for Alternatives B and C, moderate degradation for Alternative D, and minor degradation for Alternative E. All action alternatives would have an increase in designated ATV trails and an increase in degradation to the soil resource.

Table 14. Effects Analysis – Escalante Ranger District

Soil Indicator	Percent Change From Existing Condition									
	No Action		Alt B		Alt C		Alt D		Alt E	
1. Percent of the districts designated open to cross-country motor vehicle use.	Acres	% Change	Acres	% Change	Acres	% Change	Acres	% Change	Acres	% Change
	253,231	0	0	-100	0	-100	0	-100	0	-100
2. Miles of roads that intercept slopes of 35% or more.	Miles	% Change	Miles	% Change	Miles	% Change	Miles	% Change	Miles	% Change
	26.12	0	16.56	-37	18.20	-31	22.91	-13	27.29	4
3. Miles of roads that are on high erosion potential soils.	Miles	% Change	Miles	% Change	Miles	% Change	Miles	% Change	Miles	% Change
	8.81	0	7.38	-17	7.70	-13	10.55	19	11.93	35
4. Miles of road surface.	Miles	% Change	Miles	% Change	Miles	% Change	Miles	% Change	Miles	% Change
	1,033.19	0	610.61	-41	649.62	-38	834.63	-20	1,097.46	6
5. Miles of designated ATV trails.	Miles	% Change	Miles	% Change	Miles	% Change	Miles	% Change	Miles	% Change
	21.46	0	43.57	103	38.84	80	34.81	62	20.24	-7

Escalante Ranger District Effects Summary

- All action alternatives would have a major reduction in restricting cross-country travel by eliminating this effect to the soil resource.
- The miles of roads on slopes of more than 35 percent would be a major improvement for Alternatives B and C, and moderate improvement for Alternative D. Alternative E would have a minor degradation from an increase in miles of roads on steep slopes.
- The miles of roads on high erosion potential soils would be a moderate improvement for Alternatives B and C. Alternatives D and E would have a moderate and major degradation, respectively, from an increase in miles of roads on highly erodible soils.
- The miles of roads would be a major improvement for Alternatives B, C, and D. Alternative E would have a minor degradation from an increase in roads.
- The miles of designated ATV trails would be a major degradation for Alternatives B, C, and D. Alternative E would have a minor improvement in not designating ATV-specific trails.

Table 15. Effects Analysis – Pine Valley Ranger District

Soil Indicator	Percent Change From Existing Condition									
	No Action		Alt B		Alt C		Alt D		Alt E	
1. Percent of the districts designated open to cross-country motor vehicle use.	Acres	% Change	Acres	% Change	Acres	% Change	Acres	% Change	Acres	% Change
	362,778	0	0	-100	0	-100	0	-100	0	-100
2. Miles of roads that intercept slopes of 35% or more.	Miles	% Change	Miles	% Change	Miles	% Change	Miles	% Change	Miles	% Change
	18.52	0	11.16	-40	14.05	-25	14.51	-22	18.73	1
3. Miles of roads that are on high erosion potential soils.	Miles	% Change	Miles	% Change	Miles	% Change	Miles	% Change	Miles	% Change
	20.16	0	13	-36	13.11	-35	14.93	-26	20.16	0
4. Miles of road surface.	Miles	% Change	Miles	% Change	Miles	% Change	Miles	% Change	Miles	% Change
	518.35	0	438.47	-16	508.09	-2	537.19	3	718.74	38
5. Miles of designated ATV trails.	Miles	% Change	Miles	% Change	Miles	% Change	Miles	% Change	Miles	% Change
	0	0	0	0	12.74	1274	9.35	935	1.84	184

Pine Valley Ranger District Effects Summary

- All action alternatives would have a major reduction in restricting cross-country travel by eliminating this effect to the soil resource.
- The miles of roads on slopes of more than 35 percent would be a major improvement for Alternatives B, C, and D. Alternative E would have a minor degradation from an increase in miles of roads on steep slopes.
- The miles of roads on high erosion potential soils would be a major improvement for Alternatives B, C, and D. Alternative E would have no change in miles of roads on highly erodible soils.
- The miles of roads would be a moderate improvement for Alternative B and minor improvement for Alternative C. Alternative D would have a minor degradation from an increase in miles of roads. Alternative E would have a major degradation from an increase in miles of roads.
- The miles of designated ATV trails would be a major degradation for Alternatives C, D, and E by designating ATV-specific trails. Alternative B would have no change in miles of designated ATV trails.

Table 16. Effects Analysis – Powell Ranger District

Soil Indicator	Percent Change From Existing Condition									
	No Action		Alt B		Alt C		Alt D		Alt E	
1. Percent of the districts designated open to cross-country motor vehicle use.	Acres	% Change	Acres	% Change	Acres	% Change	Acres	% Change	Acres	% Change
	388,598	0	0	-100	0	-100	0	-100	0	-100
2. Miles of roads that intercept slopes of 35% or more.	Miles	% Change	Miles	% Change	Miles	% Change	Miles	% Change	Miles	% Change
	26.74	0	14.68	-46	19.42	-28	23.27	-13	27.64	3
3. Miles of roads that are on high erosion potential soils.	Miles	% Change	Miles	% Change	Miles	% Change	Miles	% Change	Miles	% Change
	16.66	0	8.06	-52	9.98	-41	10.67	-36	16.67	0
4. Miles of road surface.	Miles	% Change	Miles	% Change	Miles	% Change	Miles	% Change	Miles	% Change
	1,187.77	0	500.26	-58	621.38	-48	744.87	-38	1,199.57	1
5. Miles of designated ATV trails.	Miles	% Change	Miles	% Change	Miles	% Change	Miles	% Change	Miles	% Change
	8.58	0	14.51	69	21.38	149	23.55	174	8.92	3

Powell Ranger District Effects Summary

- All action alternatives would have a major reduction in restricting cross-country travel by eliminating this effect to the soil resource.
- The miles of roads on slopes of more than 35 percent would be a major improvement for Alternatives B and C and moderate improvement for Alternative D. Alternative E would have a minor degradation from an increase in miles of roads on steep slopes.
- The miles of roads on high erosion potential soils would be a major improvement for Alternatives B, C and D. Alternative E would have no change in miles of roads on highly erodible soils.
- The miles of roads would be a major improvement for Alternatives B, C, and D. Alternative E would have a minor degradation from an increase in miles of roads.
- The miles of designated ATV trails would be a major degradation for Alternatives B, C, and D by designating ATV-specific trails. Alternative E would have a minor degradation in designating ATV-specific trails.

Table 17. Effects Analysis – Teasdale Ranger District

Soil Indicator	Percent Change From Existing Condition									
	No Action		Alt B		Alt C		Alt D		Alt E	
1. Percent of the districts designated open to cross-country motor vehicle use.	Acres	% Change	Acres	% Change	Acres	% Change	Acres	% Change	Acres	% Change
	253,704	0	0	-100	0	-100	0	-100	0	-100
2. Miles of roads that intercept slopes of 35% or more.	Miles	% Change	Miles	% Change	Miles	% Change	Miles	% Change	Miles	% Change
	7.06	0	4.61	-35	5.29	-26	5.91	-17	7.76	9
3. Miles of roads that are on high erosion potential soils.	Miles	% Change	Miles	% Change	Miles	% Change	Miles	% Change	Miles	% Change
	1.52	0	1.52	0	1.52	0	1.52	0	2.35	54
4. Miles of road surface.	Miles	% Change	Miles	% Change	Miles	% Change	Miles	% Change	Miles	% Change
	501.35	0	287.56	-43	313.77	-38	381.51	-24	501.87	0
5. Miles of designated ATV trails.	Miles	% Change	Miles	% Change	Miles	% Change	Miles	% Change	Miles	% Change
	17.38	0	18.35	5	19.75	13	28.17	62	19.44	11

Teasdale Ranger District Effects Summary

- All action alternatives would have a major reduction in restricting cross-country travel by eliminating this effect to the soil resource.
- The miles of roads on slopes of more than 35 percent would be a major improvement for Alternatives B and C, and moderate improvement for Alternative D. Alternative E would have a minor degradation from an increase in miles of roads on steep slopes.
- There would be no change in the miles of roads on high erosion potential soils for Alternatives B, C, and D. Alternative E would have a major degradation in miles of roads on highly erodible soils.
- The miles of roads would be a major improvement for Alternatives B, C, and D. There would be no change for Alternative E.
- The miles of designated ATV trails would be a major degradation for Alternative D, moderate degradation for Alternatives C and E, and minor degradation for Alternative B.

V. Forest Plan Consistency

Forest Plan direction for the Forest Plan goals, objectives, standards and guidelines are met by all alternatives. Alternatives B would provide the greatest improvement to the soil resource, followed, in order, by Alternatives C, D, and E. Alternative A, while still meeting Forest Plan direction, would provide the least benefit to the soil resource, though it would improve soil productivity through the elimination of user-created routes in those areas closed to cross-country travel.

Adherence to the Utah State Nonpoint Source Management Plan is accomplished by implementing Best Management Practices (BMPs) and Soil and Water Conservation Practices to minimize erosion and sediment delivered to stream and other water bodies. BMPs are primarily met by road and trail maintenance activities.

Project Design Features are listed in Chapter 2 of the FEIS. These features include an assessment process on all new and reconstructed roads and motorized trails, and a mechanism to identify and fix problem areas. Implementation and effectiveness monitoring plans for the soil and water resources are part of these features.

VI. Consideration of Available Science

The techniques and methodologies used in this analysis consider the best available science. The analysis includes a summary of the credible scientific evidence that is relevant to evaluating reasonably foreseeable impacts. The analysis also identifies methods used and references scientific sources relied on. The conclusions are based on the scientific analysis that shows a thorough review of relevant scientific information. For this analysis there was not any incomplete or unavailable information that would be necessary for this decision.

The determinations reached in this specialist report are based upon review of the literature that is cited in the specialist report. In my professional opinion, there are no significant scientific uncertainties or risks associated with this proposal. On the basis of the foregoing, it is my determination that I have considered the best available science relevant to the effect of this project on the soil resource of the Dixie National Forest.

VII. References

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