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3.08 SOIL RESOURCE

A healthy and functional watershed relies on an equilibrium, or balance, in the soil productivity, soil quality, water quantity, and water quality. The soil resource provides many essential functions for National Forest lands. It sustains plant growth that provides forage, fiber, wildlife habitat, and watershed protection. It absorbs precipitation, stores water for plant growth, and gradually releases surplus water which attenuates runoff rates. It sustains microorganisms which recycle nutrients for continued plant growth. The National Forest Management Act of 1976 and other acts recognized the fundamental need to protect, and where appropriate improve, the quality of soil.

Protection of soil resource is an important part of the mission of the Forest Service. Management activities on National Forest lands must be planned and implemented to protect soil quality and the hydrologic functions of forest watersheds. The use of roads, trails, and other areas on National Forests for public operation of motor vehicles has potential to affect the soil resource through interception of runoff, compaction of soils, and detachment of sediment (Foltz, 2006). Management decisions to eliminate cross-county motorized travel, add new routes to the NFTS, and make changes to the existing NFTS must consider effects on soils and watersheds.

Analysis Framework: Statute, Regulation, Forest Plan and Other Direction

Direction relevant to the proposed action as it affects the soil resource includes the following:

National Forest Management Act of 1976: Renewable Resource Program. "*(c) Recognize the fundamental need to protect and where appropriate, improve the quality of soil, water, and air resources.*"

National Soil Management Handbook: The Soil Management Handbook (USDA 1991a) is a national soils handbook that defines soil productivity and components of soil productivity, establishes guidance for measuring soil productivity, and establishes thresholds to assist in forest planning.

Region 5 Soil Management Handbook Supplement: The Forest Service Region 5 Soil Management Handbook Supplement (R5 FSH Supplement 2509.18-95-1) establishes regional soil quality analysis standards. The analysis standards address three basic elements for the soil resource: (1) soil productivity (including soil loss, porosity and organic matter), (2) soil hydrologic function, and (3) soil buffering capacity. The analysis standards are used for areas dedicated to growing vegetation. They are not applied to lands with other dedicated uses, such as developed campgrounds, administrative facilities, or in this case, the actual land surface authorized for travel by the public using various kinds of vehicles.

Regional Forester's Letter (February 5, 2007): This letter provided clarification to Forest Supervisors on the appropriate use of the R5 Soil Management Handbook Supplement (R5 FSH Supplement 2509.18-95-1). It states in part:

Analysis or evaluation of soil condition is the intended use of the thresholds and indicators in R5 FSH Supplement 2509.18-95-1.They are not a set of mandatory standards or requirements. They should not be referred to as binding or mandatory requirements in NEPA documents. Forest Plan S&Gs provide the relevant substantive standards to comply with NFMA. The thresholds and indicators represent desired conditions for the soil resource. Use of the thresholds and indicators provides a consistent method to analyze, describe, and report on soil condition throughout the region.

The Forest Plan provides S&Gs for management areas (USDA 2005a) that include:

1. Maintain soil productivity by applying guidelines to areas where management prescriptions are applied.
2. Monitor for implementation and effectiveness. Areas not meeting guidelines will be rehabilitated. As a minimum, 85 percent of areas affected by soil disturbing activities will not exceed soil property thresholds.
3. Soil porosity is at least 90 percent of its natural conditions.
4. The organic matter in the upper 12 inches of soil should be at least 85 percent of its natural conditions.
5. Design management activities not to exceed an R5 Erosion Hazard Rating of moderate.
6. During project planning, verify areas where soil productivity has been degraded.
7. Field verify the Order 3 SRI during the planning phase of each site disturbing or vegetation manipulating project. (SRI order describes the level of intensity of a soil survey). Develop specific soil mitigation measures and soil conservation management practice for each project site as needed.

Effects Analysis Methodology

Soil quality effects analysis was based on identifying areas of risk on the Stanislaus National Forest. This analysis used GIS and the published Order 3 SRI to rank proposed routes by erosion potential. Overlaying the proposed routes from the Alternatives 1 through 5 over GIS coverage layers, a general soil erosion risk assessment was completed. The risk assessment was used to prioritize field review. The following is a description of the methodology:

1. From the Order 3 SRI the Maximum Erosion Hazard Rating (MEHR) was tabulated. When the MEHR for a soil was low or moderate only minimal field checking was completed.
2. When the MEHR was high or very high, then the route was screened by GIS to determine the gradient of the proposed route. From the Digital Elevation Model (DEM), GIS calculated the gradient of proposed routes. The methodology applies to additions to the NFTS which are unauthorized routes proposed for public use as a motorized trail under one of the alternatives.
3. Steep routes (>15% grade) were systematically field checked to develop a correlation between soil type, gradient, and condition. The green/yellow/red monitoring criteria was used to judge the observed trail condition and to validate the initial office GIS risk assessment.
4. Routes with lower gradients and moderate MEHR were considered low risk, assuming routine maintenance. These routes were randomly checked in the field to observe trail condition and validate the assumption.
5. Routes with higher gradients and high or very high MEHR were considered high risk. These routes were further evaluated by GIS and field work to determine potential for adverse effects such as loss of water control on roads and trails. A secondary indicator, Hydrologic Function Class (HFC) was used to predict where some roads may be sensitive to damage and loss of hydrologic function. HFC was used as a tool for prioritizing field work and as an indicator to compare alternatives.
6. Trails that were found to be in poor condition during field work or having a high potential for adverse effects (surface erosion and loss of water control) were considered for mitigation or closure. Mitigation was documented by route. Recommendations for closure were based on field review of trail condition, soil type, and gradient of the route.

Assumptions Specific to the Soil Resource

Four assumptions are specific to the soil resource analysis:

1. Route Proliferation: Routes will continue to increase without prohibition of cross country motorized travel. This applies only to Alternative 2 (No Action) since cross country travel would continue. The rate of proliferation is estimated to be 2.25 miles per year across the forest based on utilizing the same proliferation rate that has occurred during the past 20 years. For purposes of the water resources analysis the route proliferation in Alternative 2 was assumed to occur in the concentrated use watersheds since these are expected to continue to be the locations of demand for off-highway motorized travel.
2. New Construction: While no new route construction occurs in the proposed action or alternatives, about five miles are expected to be built in the next 10 years. These are primarily segments that would connect existing routes to enhance motorized travel opportunities. These routes exist in, and the effects are accounted for, in the CWE analysis of concentrated use watersheds.
3. Passive Recovery: Existing routes not added to the NFTS are assumed to passively recover; that is, heal over in time as forest litter (e.g., pine needles, twigs, branches) and vegetation re-occupies the route surface. The rate of recovery will vary by location, type of route (i.e., motorcycle or ATV trail, road), and by soil type and route gradient. The range of time is expected to be from about two to ten years; trails in forested areas that have been closed have been observed to accumulate an acceptable amount of ground cover within two years while trail segments in forest openings may take up to a decade to recover.
4. Wheeled Over Snow (WOS) use does not affect the soil resource since the use is on existing NFTS routes that are open to public motorized use during the normal summer driving season.

Data Sources

1. Route-specific data collected in the field using established protocols for road erosion inventories and OHV green/yellow/red inventories.
2. Route inventories collected as a part of Step 1 of R5 Route Designation Guidebook (2004) and associated tabular data sets.
3. Forest soil survey and associated GIS layers.
4. Field observations or anecdotal information documenting the time required for passive recovery of routes closed to motor vehicle traffic.

Soil Resource Indicators

1. Miles of authorized and unauthorized routes displayed by MEHR (as defined by the R-5 Maximum Erosion Hazard Rating).
2. Miles of authorized and unauthorized routes displayed by Hydrologic Function Class (HFC).

HFC is a soil hazard interpretation that predicts where roads and trails are prone to failure of drainage structures and loss of water control. Some roads are more sensitive to damage and loss of hydrologic function. In extreme cases a loss of the facility is possible. HFC is based on soil properties that determine how a native surface road or trail will mechanically rut and erode with traffic. Hydrologic Function Classes are adapted from R5 Soil Interpretations (USDA 1999). HFC is a filter or method to predict weak areas in the trail system that may require a higher level of maintenance, mitigation, and in some cases a recommendation to close the trail.

Classes and soils are described below:

- Mechanical Rutting and High Erosion - Granitic Holland soil is an example of a soil type in this risk category that is known to rut and erode easily. Holland and Holland-like soils have clay loam subsoils that rut deeply when wet and once rutted have a tendency to form gullies.

- Mechanical Rutting (wet) - Metamorphic soil types such as Jocal (Josephine) and Sites are examples of soils that have clay or clay loam subsoils that are prone to mechanical rutting under wet conditions.
- Mechanical Rutting (dry) - Volcanic McCarthy soil is an example of a soil type prone to mechanical rutting under dry summer conditions, although this is not a problem on strongly compacted surfaces such as a designed road. McCarthy soils lose their natural structure and the motorcycle and ATV trail turns to powder, hence they are rated as having a high mechanical rutting potential. This is particularly noticeable on steep and very steep grades. GIS assessed the gradient of routes (unauthorized and additions to NFTS) and grouped routes into gradient classes. Gradients were field checked and found accurate. Where the R/Y/G trail condition rating was completed, a rating of red or yellow matched up well with soil types and steeper gradients. Steep gradients are 16-25% and very steep gradients are 26% and higher. Gradients of 20% are difficult to hold on McCarthy soils because of the dry rutting problem.

Soil types (or soil map units) across the Forest were rated based upon the above general risk categories and then GIS was used to sort route segments that have mechanical rutting and erosion concerns based on the above hazard classes. The hazard classes were verified by field observation.

Soil Resource Methodology by Action

1. Direct and indirect effects of the prohibition of cross country motorized vehicle travel

The prohibition of cross-country travel is focused on the effects from unauthorized use. Considerations and the indicators of effects are given below:

Indicator(s): Miles of unauthorized routes displayed by (1) MEHR and (2) Hydrologic Function Class. Both indicators are a soil hazard interpretation that ranks miles of route by potential for erosion and loss of water control. The assumption is that effects are related to the miles of unauthorized routes to remain open under current use with no maintenance.

Direct Effects from unauthorized use: Generally for the existing unauthorized routes, direct effects have already occurred. The direct effects were: physical displacement of soil caused by unauthorized motorized vehicle traffic; loss of soil productivity from the displacement and loss of soil depth; loss in soil hydrologic function due to loss of soil and loss of soil cover.

Indirect Effects from unauthorized use: The removal of vegetation and exposure of soil in unauthorized routes will result in erosion. These unauthorized use areas were not designed and have no runoff water control to protect the soil resource. Further loss of productivity will occur and diminished hydrologic function. A loss of water control on and off of the un-maintained trail is an indirect effect.

Methodology: Unauthorized routes open for motor vehicle use are compared to GIS layers displaying MEHR and HFC.

Short-term time frame: The 1 year time frame looks at routes over the short-term. It does not provide time for passive recovery on closed routes.

Long-term time frame: The 10 year time frame looks at routes over the longer term. It provides time for passive recovery on closed routes. Passive recovery is an assumed benefit. Factors such as soil type, precipitation and temperature affect rates of vegetative recovery. An addition of 2.2 miles of route proliferation per year is assumed for the “no action” alternative. The same time frame is used for Cumulative Watershed Effects.

Spatial boundary: Forest.

Rationale: General guidelines in the National Soil Management Handbook and Region 5 Soil Management Handbook Supplement.

2. *Direct and indirect effects of adding facilities to the NFTS including identifying seasons of use and vehicle class*

The effects of adding facilities are focused on presently unauthorized roads and trails that would be added to the system routes. This is a change from unauthorized and un-maintained to NFTS status. Considerations and the indicators of effects are given below:

Indicators: Miles of unauthorized routes added to the system displayed by MEHR and Hydrologic Function Class.

Direct Effects: Generally direct affects have already occurred from the soil displacement caused by the unauthorized use. The effects were a loss of soil productivity from the displacement and loss of soil depth and a loss in soil hydrologic function due to loss of soil and loss of soil cover. The assumption is that effects are related to total miles of route converted from unauthorized to authorized status.

Indirect Effects: The indirect effects that will occur from the addition of a previously unauthorized use route to the designated system will be dependent upon a number of factors: (1) what soil type it is located on; (2) its erosion potential; (3) slope or gradient of the route; and (4) the assumption that necessary runoff water control work will be accomplished before the previously unauthorized route will be open for legitimate use.

Methodology: Unauthorized routes added to the system are compared to GIS layers displaying MEHR and Hydrologic Function Class. Routes are compared with zones of varying erosion potential risk. Field observations of soil type response are used to formulate the expected direct, indirect and cumulative soil effects for each alternative.

Short-term timeframe: 1 year.

Long-term timeframe: 10 years

Spatial boundary: Forest.

Rationale: Analysis guidelines in the National Soil Management Handbook and Region 5 Soil Management Handbook Supplement.

3. *Direct and indirect effects of changes to the existing NFTS including identifying seasons of use and vehicle class*

Changes to existing NFTS include (1) roads closed to roads open; (2) roads open to roads closed; (3) changes in vehicle class and season of use. Considerations and the indicators of effects are given below:

Indicator(s): Miles of NFTS routes (closed to open/open to closed) displayed by (1) MEHR and (2) Hydrologic Function Class. The indicators are a soil hazard interpretation that ranks miles of route by potential for erosion and loss of water control.

Direct Effects: Opening level 1 roads is considered as having the larger soil impact compared with the effects of closing routes or the effects of changing vehicle class. Routes that are closed and put to bed produce less sediment and require less maintenance than high use routes, particularly on soil types that are prone to erosion or loss of hydrologic function. The effects of changing vehicle class are mostly a road width issue. The assumption is that a change in vehicle class will either keep the existing road width the same or the road will eventually narrow if used by ATVs or motorcycles. A change in vehicle class only would represent no increase of soil or land area for routes.

Indirect Effects: An action alternative may place control on the season of use for an area. This will generally have a positive indirect effect because it will reduce damage to the facility tread and its erosion control structures and therefore reduce the risk of erosion to soil downslope.

Methodology: GIS analysis is done to compare the location of the trail/roads in each alternative with the zones of varying erosion potential risk. Field observations of soil type response formulate the discussion of expected effects for each alternative.

Short-term timeframe: 1 year

Long-term timeframe: 10 years

Spatial boundary: Forest.

Rationale: Analysis guidelines in the National Soil Management Handbook and Region 5 Soil Management Handbook Supplement.

4. Cumulative Effects

Soil cumulative effects parallel the water cumulative effects. The common ground is the Equivalent Roaded Acre (ERA) concept. All ground disturbances in the watershed is given a coefficient value. Roads, mechanical thinning operations, prescribed fire, wildfire, etc. are accounted for relative to past, present and expected future management activity levels. The USDA Forest Service Region 5 methodology is used to determine the overall disturbed footprint. The disturbed footprint is a semi-quantitative measure of acres of detrimental soil disturbance and hence an approximation of change in Soil Quality as defined by the R5 Soil Quality Standards (USDA 1995c).

Short-term timeframe: not applicable; cumulative effects analysis will be done only for the long-term time frame.

Long-term timeframe: The period used for long-term effects analysis is 20 years. It is the same recovery period as for the Cumulative Watershed Effects analysis.

Spatial boundary: The analysis area is the National Forest.

Indicator(s): (1) Cumulative effects on soil productivity from unauthorized use (No Action); (2) Cumulative effects on soil productivity in unauthorized areas that are expected to recovery (in the given long term analysis time period) after a cross country closure is implemented; (3) Cumulative effects on soil productivity in areas that are not expected to recover passively (in the given long term analysis period) after a cross country closure is implemented; (4) Cumulative effects on soil productivity from implementation of the particular travel system for each alternative.

Methodology: Utilize observations and understanding of short term effects to soil productivity to estimate long term expected cumulative effects on soil productivity. Utilize the ERA analysis as a semi-quantitative measure of acres of detrimental soil disturbance and hence an approximation of change in Soil Quality.

Rationale: Analysis guidelines in the National Soil Management Handbook and Region 5 Soil Management Handbook Supplement.

Affected Environment

The Stanislaus National Forest has a high diversity of soil types. Soils are broadly zoned based on differences in geology and elevation. Four zones or subsections (USDA 1997) are present in the analysis area: Lower Foothills Metamorphic Belt; Batholith and Flows; Upper Batholith and Flows; and the Glaciated Batholith and Flows. Elevations range from below 3,000 feet to over 8,000 feet within the footprint of the proposed actions. Soils are formed from granitic, volcanic, and meta-sedimentary parent materials.

At the lowest elevation are soils of the Lower Foothills Metamorphic Belt. The Groveland District south of highway 120 is the type location for this area. The general landform is that of a highly dissected block of land that is crossed by major river canyons such as the Tuolumne and Merced Rivers. The upland surface generally slopes to the west. Major rivers have downcut their channels as much as 2,000 feet. Rocky, thin soils are found on the canyon slopes. Weathered red colored soils with high clay content are found on the more stable upland surface. Mariposa and Jocal soils are the most common. Soils are weathered from very old metamorphic rock and support chaparral, hardwoods, hardwood-conifer, and conifer vegetation. Coniferous forests are dominated by ponderosa pine.

At somewhat higher elevations are soils of the Batholith and Flows subsection. These soils are derived from granitic and volcanic rock within an elevation range of 3,500 feet to 6,000 feet. The Deer Creek area north of Twain Harte is in this zone. This land is a tilted, uplifted block with major river channels dissecting the block into long ridges and sideslopes. Ridges trend in a westerly direction. The volcanic Mehrton formation caps the ridge tops and upper sideslopes. Lower sideslopes, canyons and basins are often granitic lands. Soils are generally medium textured productive soils. Holland soils are common on granite lands and McCarthy and Holland, dark surface soils are common on the upper sideslopes of volcanic lands. Shallow unproductive soils are found on the lava caps. Soils within this broad zone support forests of mixed coniferous species known as the Sierra Nevada mixed conifer type.

The Upper Batholith and Flows subsection is a higher elevation version of the Batholith and Flows. The transition to "Upper" Batholith and Flows occurs at about 6,000 feet as white fir becomes a significant component of mixed conifer forests. Most of the soils in this zone have a frigid temperature regime, range in elevation from 6,000 to 8,000 feet and are covered with snow through-out the winter. Soils in the Pinecrest area and Dodge Ridge are typical of the zone. Windy soils are common on volcanic flows and Gerle, Tallac, and Wintoner soils occur on granitic lands. These soils support upper montane forests generally characterized by the presence of red fir, lodgepole pine, and Jeffery pine. Jeffery pine types are common on rocky or droughty soils, often on ridges or south facing slopes.

Soils of the Glaciated Batholith and Flows subsection occur at elevations of 8,000 feet to over 11,000 feet at the top of the Sierras. The Carson Iceberg wilderness (although outside the analysis area) and Bear Valley are examples of this landscape. The transition from "Upper" to "Glaciated" Batholith and Flows occurs when a combination of factors change. Soil temperatures are colder. Most of the soils have a cryic temperature regime and snow persists into June in most years. Mountain Hemlock or Western White Pine becomes a component in red fir stands on north facing slopes. Glacial eroded landforms become more prominent, hence shallow soils and rock outcrop can dominate the landscape. Soils are weakly developed (sandy soils, rocky, with little clay). In general the soils support a sparsely vegetated landscape of open red fir and mixed subalpine forests. Wet meadow soils are relatively common. A dry forb habitat known as dry volcanic meadow is extensive on high elevation volcanic soils. Few routes are found in this zone.

Many soils exist on the Forest; however key soils can be used as examples. In fact, the soil affected environment can be simplified by rating soils (or soil map units) across the Forest based upon engineering properties important to roads and trails. Soils were grouped into general risk categories known as HFC. HFC or Hydrologic Function Class is a soil hazard interpretation that predicts where roads and trails are prone to failure of drainage structures and loss of water control. HFC organizes the soil environment into useful information; and it is an indicator to compare the five alternatives in the Environmental Consequences section.

GIS was used to sort routes based on the following classes:

- High rut and erosion potential. The granitic Holland soil is an example of a soil type in the high rut and erosion potential category that is known to rut and erode easily.
- Mechanical rutting potential (dry). The volcanic McCarthy soil is an example of soils prone to mechanical rutting under dry summer conditions, although it is not a problem on strongly compacted surfaces such as a designed road.
- Mechanical rutting potential (wet). Metamorphic soil types such as Jocal and Sites are examples of soils that have clay or clay loam subsoils that are prone to mechanical rutting under wet conditions.
- Other soils - Lava cap soils and other shallow soils.

Existing Condition Methodology: GIS analysis of steep gradients, soil hazard classification (HFC), and R/Y/G survey results were used to construct the existing soil condition. The same tools were used to determine problem areas and prescribe mitigation.

Figure 3.08-1 shows 252 miles of unauthorized routes displayed by soil hazard classification or HFC. As such, it is an approximation of the existing condition and the No Action, Alternative 2. About 35% of the existing unauthorized routes occur on soils with high rutting and erosion potential. About 12% of existing unauthorized routes occur on steep grades (>15%).

The concentrated use areas of Deer Creek, Hull Creek, and Trout Creek (note routes located south of Strawberry) have a concentration of lava cap soils and soils with a potential for rutting and high erosion. Thin, rocky lava cap soils can be difficult to re-vegetate once disturbed, although they will provide a hard stable running surface once eroded down to bedrock. Routes in the Groveland area south of highway 120, generally have clay subsoils that rut easily when wet. Soils in the Bear Valley area are rocky and are generally more stable relative to rutting and erosion.

Red/Yellow/Green Condition Survey (see project record): Approximately 245 miles of routes were surveyed in 2008. Most of the routes were motorcycle and ATV routes. The survey showed 55 miles of red or yellow routes, and 190 miles of green routes. The red and yellow routes were commonly found on steep grades or on soils susceptible to mechanical rutting and erosion (as predicted by HFC).

Environmental Consequences

Alternative 1 (Proposed Action)

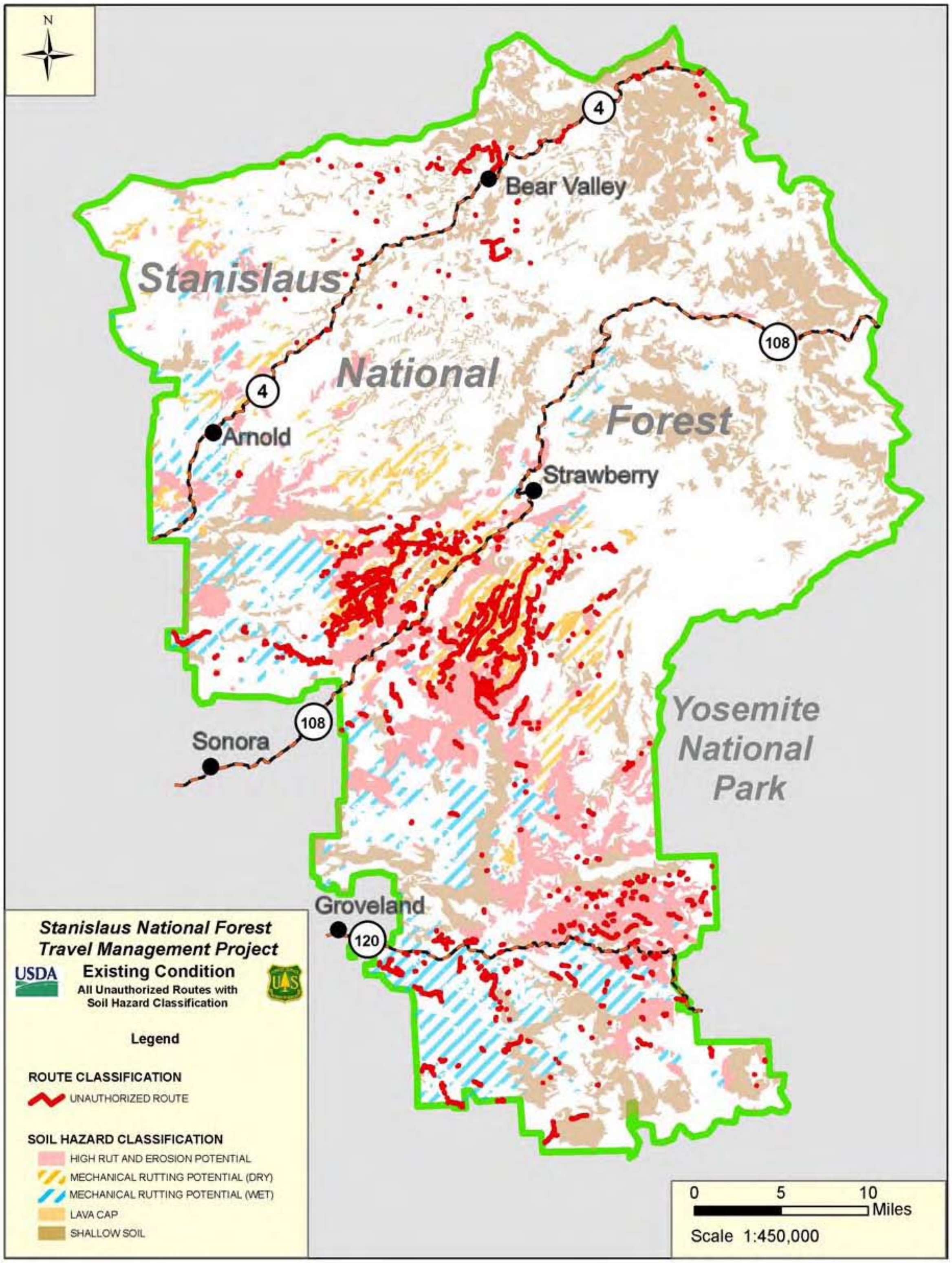
Direct and Indirect Effects

Cross Country Travel: Cross-Country travel is prohibited in Alternative 1. Unauthorized routes are converted to system routes or closed. Proliferation of unauthorized routes is assumed zero or minor. Use will be discontinued on 92 miles of unauthorized routes. The routes will be closed to use and allowed to passively recover. Passive recovery and re-vegetation is expected within a 10 year period. Disturbed areas on shallow soils, particularly above 8,000 feet elevation (cold temperature), will recover more slowly. These changes will have a positive effect on soil conditions as compared to the No-action Alternative.

Additions to the NFTS: Alternative 1 will add 157.4 miles of unauthorized roads and trails to the present NFTS. These routes already exist on the ground. An indicator of soil effects is the Maximum Erosion Hazard Rating (MEHR). GIS analysis was used to overlay routes and erosion hazard.

MEHR: About 128 miles of additions to the NFTS occur on high MEHR soils. This suggests that “off trail” accelerated erosion is more likely to occur where concentrated flow of water is directed off the trail. Mitigation will lower the actual EHR to low or moderate. Definitions of maintenance and mitigation treatments (see Appendix F, Mitigations) are described and the route cards specify site specific treatments.

Figure 3.08-1 Existing Condition: All Unauthorized Routes with Soil Hazard Classification



Approximately 17% of all additions to the NFTS included in Alternative 1 have steep segments (Table 3.08-4). About 26 miles of additions to the NFTS have steep gradients (>15% grade). This implies higher maintenance needs and costs for some segments. This does not imply that the routes should not be added to the system, only that the routes are prone to tread loss and need mitigation, particularly on steep grades. Soil condition is expected to improve compared to the Alternative 2 because 157.4 miles of unauthorized routes will now be subject to mitigation and brought up to standards before the routes are added to the NFTS

Changes to the Existing NFTS: Change would occur on a total of 623 miles of NFTS roads. All existing seasonal closures are replaced by winter closures of all routes based on elevation and wet weather closures on native surfaced routes. The alternative opens 68 miles of roads and closes 46 miles. Other changes in vehicle class (509 miles) includes converting 63 miles of road to trail, converting 5 miles of closed road to open to administrative use only, and minor changes to vehicle class.

Opening the 68 miles of closed roads is the larger change relative to soil effects. The change from closed to open status will increase use of the route; and erosion and sedimentation rates will increase on some route segments (prone to a loss of road hydrologic function and water control). The season of use requirements in zone 2 and 3 along with required maintenance and erosion control measures are expected to mitigate both on/off trail loss of water control concerns.

Minor changes in vehicle class on 509 miles of existing NFTS routes will have minimal effect relative to soil erosion, because these roads where constructed to traditional road standards of compaction and drainage control. For example, a change from Highway Legal Only (HLO) to All Vehicles is expected to have a minimal effect on surface erosion and life of the facility. The effect would be limited in scope, with winter and wet weather requirements.

Soil Effects: Soil effects are based on a GIS analysis of routes and HFC. The Hydrologic Function Class sorts route segments that are more prone to loss of water control and eventual loss of facility (the trail itself). *The rating is simply a soil hazard classification or method to predict weak areas in the trail system that rut and erode easily and may require a higher level of mitigation.*

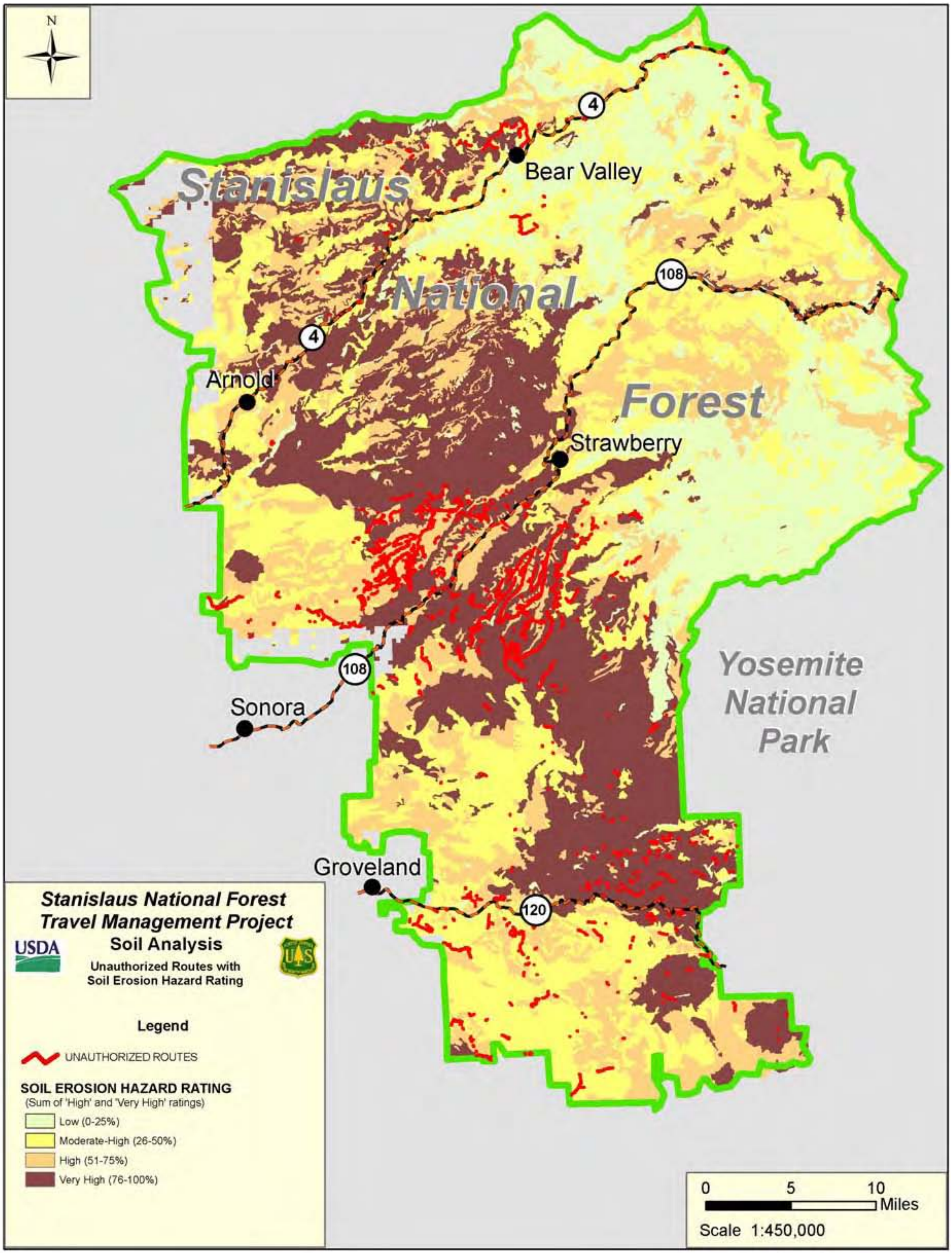
Table 3.08-3 summarizes miles of route or “footprint” occurring on soils that are sensitive to mechanical rutting and erosion. Alternative 1 proposes 157 miles of additions to the NFTS to NFTS; of which 55 miles are prone to failure of drainage structures and loss of water control. Alternative 1 will open 68 miles of NFTS routes that are presently closed to the public; of which 29 miles have a high rutting and erosion potential. The alternative proposes to close 92 miles of unauthorized routes, of which 31 miles are considered as sensitive to gully erosion as passive recovery slowly stabilizes the closed routes.

The “net footprint” (see bottom of Table 3.08-3) considered the collective result of closing or opening routes looking at a time frame of 1 year and 10 years into the future. Some routes will continue to be sensitive to a loss of road hydrologic function by virtue of soil type, gradient, and amount of use. No proliferation of routes is assumed for Alternatives 1, 3, 4, and 5. Passive recovery is assumed to be gradual over 10 years. Erosion control on closed NFTS routes is assumed to be effective in year 1. The net footprint of routes on sensitive soils is estimated to be 84 miles after 10 years for Alternative 1.

Cumulative Effects

Soil cumulative effects parallel the water cumulative effects. The common ground is the Equivalent Roaded Acre (ERA) concept. All ground disturbances in the watershed is given a coefficient value. Roads, mechanical thinning operations, prescribed fire, wildfire, etc. are accounted for relative to past, present and expected future management activity levels. The USDA Forest Service Region 5 methodology is used to determine the overall disturbed footprint. The disturbed footprint is a semi-quantitative measure of acres of detrimental soil disturbance and hence an approximation of change in Soil Quality as defined by the R5 Soil Quality Standards (USDA 1995c).

Figure 3.08-2 Soil Analysis: Unauthorized Routes with Soil Erosion Hazard Rating



The CWE analysis considered the 88 HUC 7 watersheds on the forest that contain one or more proposed additions to the NFTS. Of these, the largest concentration of use occurs in the 10 watersheds that coincide with the three principal off-highway vehicle activity areas on the forest.

These are the watersheds for which detailed CWE analysis was conducted. The total ERA values in the 10 concentrated watersheds are summarized as follows:

The total ERA ranges from 2.75% to 8.10%. The additions to the NFTS account for less than 0.20% ERA in all of the watersheds, a very small fraction of the total ERA value.

The highest ERA was determined in Lyons Reservoir-Lower South Fork watershed. The ERA was 8.01%. This level of compaction and detrimental disturbance is substantially below the Stanislaus Forest Plan S&G to avoid compacting more than 15% of a treatment area (USDA 2005a).

The remaining watersheds outnumber the concentrated use watersheds but have substantially less motorized travel and generally less other use. For example, fifty eight of these dispersed use watersheds have less than 1 mile of route addition proposed, usually in scattered segments, in watersheds each averaging about 6,000 acres in size. The past, present and expected future management activity level (Appendix C) is not anticipated to exceed, and is likely less than, that in the concentrated use watersheds based upon review of the list of activities in the Cumulative Effects Analysis list (project record).

Alternative 2 (No Action)

Direct and Indirect Effects

Cross Country Travel: Cross-Country travel is allowed in Alternative 2. Continued use will occur on 252 miles of unauthorized routes.

MEHR: GIS was used to overlay existing unauthorized routes with classes of erosion hazard. Figure 3.08-2 displays the maximum soil erosion hazard rating (MEHR). Approximately 80% of the routes cross high or very high MEHR soils.

Routes occur on 204 miles of high MEHR soils. Proliferation is expected to add 22 miles onto similar high MEHR soils over 10 years. Assuming no maintenance and continued cross-country travel, a high erosion hazard condition could occur on 247 miles of unauthorized routes (Table 3.08-2).

Soil Productivity: The 252 miles of unauthorized routes plus 2.2 miles of assumed route proliferation annually represent a loss of soil productivity under Alternative 2. The 252 miles include some access routes to undeveloped campsites, but the bulk of the miles are ATV and motorcycle width trails (<50 inches wide). This is a loss of soil productivity on 158 acres, most of which has already occurred. About 101 miles are susceptible to rutting and gully erosion (Table 3.08-3), and the assumption is that these routes will continue to degrade without proper maintenance.

Additions to the NFTS: no additions to the NFTS.

Changes to the Existing NFTS: no changes to the vehicle class or season of use.

Cumulative Effects

Soil cumulative effects parallel the water cumulative effects determined during the CWE analysis. The CWE analysis considered the 88 HUC 7 watersheds on the forest that contain one or more unauthorized routes. Of these, the largest concentration of use occurs in the 10 watersheds that coincide with the three principal off-highway vehicle activity areas on the forest. These are the watersheds for which detailed CWE analysis was conducted. The total ERA values in the 10 concentrated watersheds are summarized by alternative as follows:

The total ERA ranges from 2.91% to 8.40%. Route proliferation raises the ERA in the alternatives less than 0.10%.

The highest ERA was determined in Lyons Reservoir-Lower South Fork watershed. The ERA was 8.40%. This level of compaction and detrimental disturbance is substantially below the Stanislaus

Forest Plan standard and guideline to avoid compacting more than 15% of a treatment area (USDA 2005).

The remaining watersheds outnumber the concentrated use watersheds but have substantially less motorized travel and generally less other use. For example, fifty eight of these dispersed use watersheds have less than 1 mile of route addition proposed, usually in scattered segments, in watersheds each averaging about 6,000 acres in size. The past, present and expected future management activity level is not anticipated to exceed, and is likely less than, that in the concentrated use watersheds based upon review of the list of activities in the Cumulative Effects Analysis list.

Alternative 3 (Cross Country Prohibited)

Direct and Indirect Effects

Cross Country Travel: Motorized vehicle travel off NFTS routes by the public would be prohibited except as allowed by permit or other authorization. Alternative 3 will not add 252 miles of unauthorized routes. The time frame of 10 years allows for most of the routes to grow vegetation and stabilize to background erosion rates. Recovery will be slower where soils are less productive (shallow, rocky soils) or where much of the original soil profile is lost to mechanical erosion.

Additions to the NFTS: No unauthorized routes are added to the NFTS.

Changes to the Existing NFTS: No changes are made to the NFTS or existing seasonal closures.

Cumulative Effects

Soil cumulative effects parallel the water cumulative effects determined during the CWE analysis. The largest concentration of use occurs in the 10 watersheds that coincide with the three principal off-highway vehicle activity areas on the forest. These are the watersheds for which detailed CWE analysis was conducted. The total ERA values in the 10 concentrated watersheds are summarized by alternative as follows:

The total ERA ranges from 2.59% to 7.93% with no additions to the NFTS.

The highest ERA was determined in Lyons Reservoir-Lower South Fork watershed. The ERA was 7.93%. This level of compaction and detrimental disturbance is substantially below the Stanislaus Forest Plan standard and guideline to avoid compacting more than 15% of a treatment area (USDA 2005).

The remaining watersheds outnumber the concentrated use watersheds but have substantially less motorized travel and generally less other use. For example, fifty eight of these dispersed use watersheds have less than 1 mile of route addition proposed, usually in scattered segments, in watersheds each averaging about 6,000 acres in size. The past, present and expected future management activity level is not anticipated to exceed, and is likely less than, that in the concentrated use watersheds based upon review of the list of activities in the Cumulative Effects Analysis list.

Alternative 4 (Recreation)

Direct and Indirect Effects

Cross Country Travel: Cross-Country travel is prohibited in Alternative 4. Unauthorized routes are converted to system routes or closed. Proliferation of unauthorized routes is assumed zero or minor. Use will be discontinued on 65 miles of unauthorized routes. The routes will be closed to use and allowed to passively recover. Passive recovery and re-vegetation is expected within a 10 year period. Disturbed areas on shallow soils, particularly above 8,000 feet elevation (cold temperature), will recover more slowly. These changes will have a positive effect on soil conditions as compared to the No-action Alternative.

Additions to the NFTS: Alternative 4 will add 181.7 miles of unauthorized roads and trails to the present NFTS. These already exist on the ground. Indicators for effects analysis are MEHR and Hydrologic Function Class, HFC

MEHR: About 151 miles of additions to the NFTS occur on high MEHR soils. This suggests that "off trail" accelerated erosion is more likely to occur where concentrated flow of water is directed off the trail. Mitigation will lower the actual EHR to low or moderate. Definitions of maintenance and mitigation treatments are described and the route cards specify site specific treatments.

About 31 miles of additions to the NFTS have steep gradients (Table 3.08-4). This implies higher maintenance needs and costs for some segments. This does not imply that the routes should not be added to the system, only that the routes are prone to tread loss and need mitigated.

Soil condition is expected to improve compared to Alternative 2 because 181.7 miles of unauthorized routes will now be subject to mitigation and brought up to standards before the routes are added to the NFTS.

Changes to the Existing NFTS: Change would occur on a total of 531 miles of NFTS roads. All existing seasonal closures are replaced by winter closures of all routes based on elevation and wet weather closures on native surfaced routes. The alternative opens 102 miles of roads and closes 11 miles. Other changes in vehicle class (259 miles) includes converting 100 miles of road to trail, converting 2.5 miles of closed road to open to administrative use only, and minor changes to vehicle class.

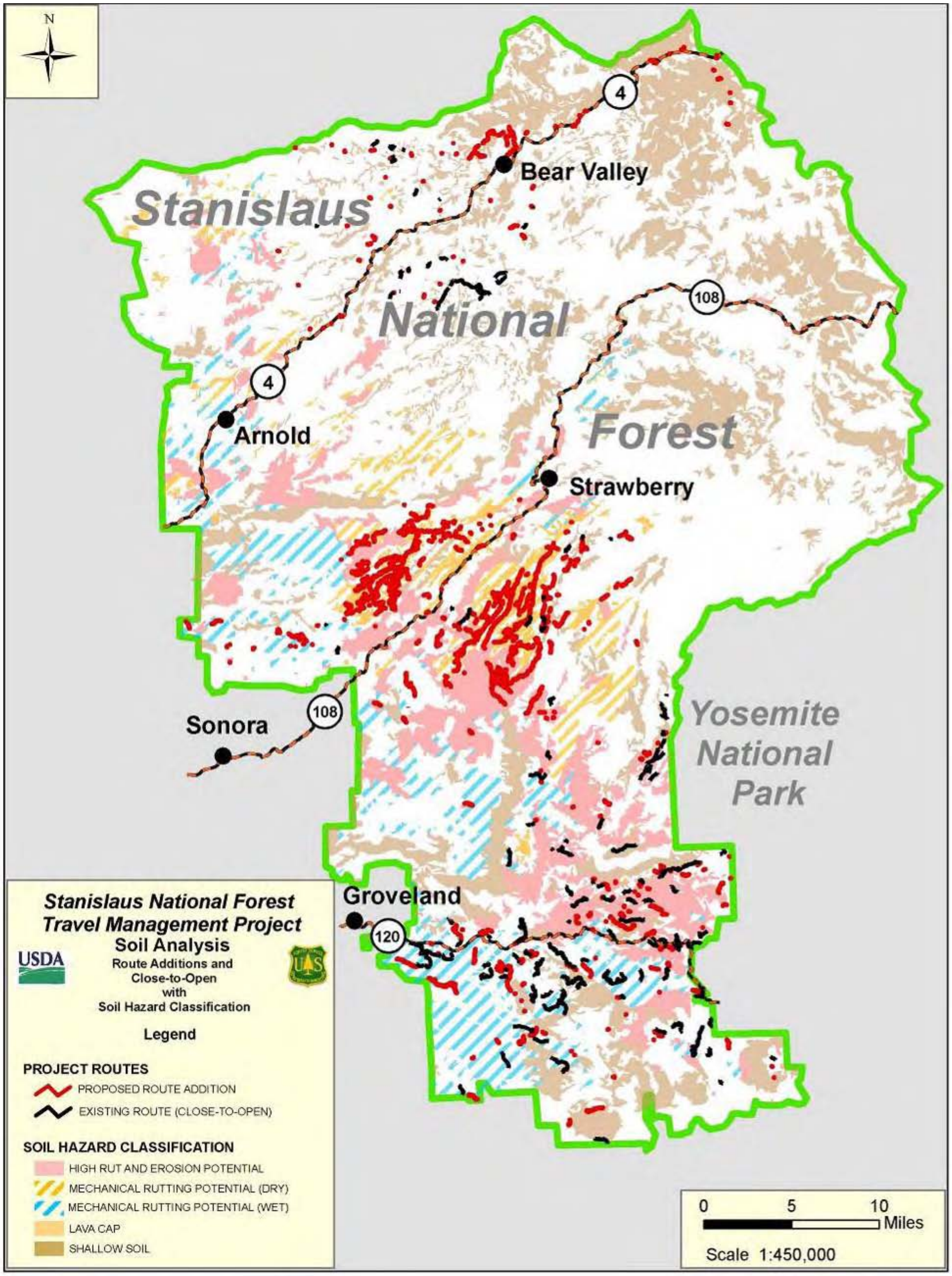
Opening the 102 miles of closed roads is the larger change relative to soil effects. The HFC shows that 45 miles of route segments are prone to loss of hydrologic function and water control. The season of use requirements in zone 2 and 3 along with required maintenance and mitigation are expected to mitigate both on/off trail loss of water control concerns. Appendix I lists mitigation measures by route.

Minor changes in vehicle class on 259 miles of existing NFTS routes will have minimal effect relative to soil erosion, because these roads where constructed to traditional road standards of compaction and drainage control. The effect would be limited in scope, with winter and wet weather requirements.

Soil Effects: Soil effects are based on a GIS analysis of routes and HFC. The Hydrologic Function Class sorts route segments that are more prone to loss of water control and eventual loss of facility (the trail itself). *The rating is simply a soil hazard classification or method to predict weak areas in the trail system that rut and erode easily and may require a higher level of mitigation.*

Table 3.08-3 summarizes miles of route or "footprint" occurring on soils that are sensitive to mechanical rutting and erosion. Alternative 4 proposes 181.7 miles of additions to the NFTS; of which 68 miles are prone to failure of drainage structures and loss of water control. Alternative 4 will open 102 miles of NFTS routes that are presently closed to the public; of which 45 miles have a high rutting and erosion potential. The alternative proposes to close 65 miles of unauthorized routes, of which 22 miles are considered as sensitive to gully erosion as passive recovery slowly stabilizes the closed routes. Alternative 4 adds the maximum miles of authorized routes, and the maximum miles of routes subject to rutting and erosion or loss of hydrologic function. Figure 3.08-3 illustrates the concept.

Figure 3.08-3 Soil Analysis: Route Additions and Close-to-Open with Soil Hazard Classification



The "net footprint" (see bottom of Table 3.08-3) considered the collective result of closing or opening routes looking at a time frame of 1 year and 10 years into the future. Some routes will continue to be sensitive to a loss of road hydrologic function by virtue of soil type, gradient, and amount of use. No proliferation of routes is assumed for Alternatives 1, 3, 4, and 5. Passive recovery is assumed to be gradual over 10 years. Erosion control on closed NFTS routes is assumed to be effective in year 1. The net footprint of routes on sensitive soils is estimated at 113 miles after 10 years for Alternative 4.

Cumulative Effects

Soil cumulative effects parallel the water cumulative effects determined during the CWE analysis. The largest concentration of use occurs in the 10 watersheds that coincide with the three principal off-highway vehicle activity areas on the forest. These are the watersheds for which detailed CWE analysis was conducted. The total ERA values in the 10 concentrated watersheds are summarized by alternative as follows:

The total ERA ranges from 2.77% to 8.13%. The additions to the NFTS account for less than 0.31% ERA in these watersheds, a very small fraction of the total ERA value.

The highest ERA was determined in Lyons Reservoir-Lower South Fork watershed. The ERA was 8.13%. This level of compaction and detrimental disturbance is substantially below the Stanislaus Forest Plan S&G to avoid compacting more than 15% of a treatment area (USDA 2005a).

The remaining watersheds outnumber the concentrated use watersheds but have substantially less motorized travel and generally less other use. For example, fifty eight of these dispersed use watersheds have less than 1 mile of route addition proposed, usually in scattered segments, in watersheds each averaging about 6,000 acres in size. The past, present and expected future management activity level is not anticipated to exceed, and is likely less than, that in the concentrated use watersheds based upon review of the list of activities in the Cumulative Effects Analysis list.

Alternative 5 (Resources)

Direct and Indirect Effects

Cross Country Travel: Cross-Country travel is prohibited in Alternative 5. Unauthorized routes are converted to system routes or closed. Proliferation of unauthorized routes is assumed zero or minor. Current use will be discontinued on 220 miles of unauthorized routes. The routes will not be added to the NFTS and allowed to passively recover. Passive recovery and re-vegetation is expected within a 10 year period. Disturbed areas on shallow soils, particularly above 8,000 feet elevation (cold temperature), will recover more slowly. These changes will have a positive effect on soil conditions as compared to the No-action Alternative.

Additions to the NFTS: Alternative 5 will add 32 miles of unauthorized roads and trails to the present NFTS. These already exist on the ground. Indicators for effects analysis are MEHR and Hydrologic Function Class, HFC

MEHR: About 24 miles of additions to the NFTS occur on high MEHR soils. This suggests that “off trail” accelerated erosion is more likely to occur where concentrated flow of water is directed off the trail. Mitigation will lower the actual EHR to low or moderate. Definitions of maintenance and mitigation treatments are described and the route cards specify site specific treatments.

HFC: Soils that rut and erode easily are prone to loss of hydrologic function. The hydrologic function class sorts route segments that are more prone to loss of water control and eventual loss of facility (the trail itself). About 8.6 miles of additions to the NFTS occur on soils with this concern. This implies higher maintenance needs and costs for some segments. This does not imply that the routes should not be added to the system, only that the routes are prone to tread loss and need mitigation.

Soil condition is expected to improve compared to the no- action Alternative because 187 miles of unauthorized routes will now be subject to mitigation and brought up to standards before the routes are added to the NFTS.

Changes to the Existing NFTS: Change would occur on a total of 531 miles of NFTS roads. All existing seasonal closures are replaced by winter closures of all routes based on elevation and wet weather closures on native surfaced routes. The alternative opens 12 miles of roads and closes 60 miles. Other changes in vehicle class (459 miles) includes converting 22 miles of road to trail, converting 5.4 miles of closed road to open to administrative use only, and minor changes to vehicle class. Opening the 12 miles of closed roads is the larger change relative to soil effects because the native surface road will be exposed to higher traffic use and soil loss (as compared to a closed road, put to bed and partially re-vegetated). The HFC shows that 1.8 miles of route segments are prone to loss of hydrologic function and water control. The season of use requirements in zone 2 and 3 along with required maintenance and mitigation are expected to mitigate both on/off trail loss of water control concerns. Appendix I lists mitigation measures by route.

Minor changes in vehicle class on 459 miles of existing NFTS routes will have minimal effect relative to soil erosion, because these roads where constructed to traditional road standards of compaction and drainage control. The effect would be limited in scope, with winter and wet weather requirements.

Soil Effects: The net footprint of routes on sensitive soils is estimated to be 11 miles after 10 years for Alternative 5.

Cumulative Effects

Soil cumulative effects parallel the water cumulative effects determined during the CWE analysis. The largest concentration of use occurs in the 10 watersheds that coincide with the three principal off-highway vehicle activity areas on the forest. These are the watersheds for which detailed CWE analysis was conducted. The total ERA values in the 10 concentrated watersheds are summarized by alternative as follows:

The total ERA ranges from 2.59% to 8.01%. The additions to the NFTS account for 0.04% of the ERA in these watersheds, a very small fraction of the total ERA value.

The highest ERA was determined in Lyons Reservoir-Lower South Fork watershed. The ERA was 8.01%. This level of compaction and detrimental disturbance is substantially below the Stanislaus Forest Plan standard and guideline to avoid compacting more than 15% of a treatment area (USDA 2005).

The remaining watersheds outnumber the concentrated use watersheds but have substantially less motorized travel and generally less other use. For example, fifty eight of these dispersed use watersheds have less than 1 mile of route addition proposed, usually in scattered segments, in watersheds each averaging about 6,000 acres in size. The past, present and expected future management activity level is not anticipated to exceed, and is likely less than, that in the concentrated use watersheds based upon review of the list of activities in the Cumulative Effects Analysis list.

Summary of Effects Analysis across All Alternatives

The following shows: (1) the miles of routes by action; (2) the miles of routes displayed by the indicator MEHR; and (3) the miles of routes displayed by the indicator HFC. The intent is to present a summary of data used to evaluate the alternatives, so the reader can quickly compare the alternatives. A brief discussion of soil productivity and season of use requirements is given to provide background for the effects analysis.

Soil Productivity

The erosion that may occur from the authorized trail or road surfaces is a concern regarding loss or degradation of the facility, but not a particular concern for the soil resource, because the route surface is a dedicated use and no longer dedicated to growing vegetation. An unauthorized route that is converted to a system route has already incurred a significant reduction in soil productivity from topsoil displacement, compaction and erosion. The closure of an unauthorized route is a long term improvement to soil productivity as it becomes naturally re-vegetated and stabilized. However, the original productivity, before disturbance, may not be recovered entirely.

Routes by Actions

Table 3.08-1 sorts the routes analyzed by three actions: (1) Adding Facilities (those routes that are proposed additions to the NFTS); (2) Unauthorized Use (trails that are not part of the NFTS; and (3) Changes to the Existing NFTS (mostly changes in vehicle class). Collectively, the routes establish a footprint to compare direct and indirect effects. Table 3.08-2 uses the MEHR to display miles of high erosion potential by alternative. Table 3.08-3 uses the indicator Hydrologic Function Class to display miles where road hydrologic function may be a concern.

Table 3.08-1 Routes by Action

Route Type	Miles of Route by Action				
	ALT 1	ALT 2	ALT 3	ALT 4	ALT 5
Adding Facilities					
Additions to NFTS	157.4	0	0	181.7	32
Unauthorized Use					
Open Unauthorized	0	221	0	0	0
Closed Unauthorized (passive recovery)	92	0	252	65	220
Access to campsites		31			
Proliferation (10yrs)	0	22	0	0	0
Changes to Existing NFTS					
Roads Closed to Open	68	0	0	102	12
Roads Open to Closed	51.4	0	0	13	64.5
Other Changes in Vehicle class [1]	509	0	0	258	459

[1] Includes conversion from road to trail status, conversion to administrative use only, changes in type of vehicle.

Routes by MEHR

Table 3.08-2 is the product of a soil erosion assessment using the indicator MEHR. The MEHR values were taken from the Stanislaus Order 3 Soil Survey Report (USDA 1995b). The table displays miles of motorized route found on high and very high MEHR soils by alternative. The MEHR is the benchmark indicator used to rank soils by low, moderate, high, and very high erosion hazard. It is designed to appraise the relative risk of accelerated sheet and rill erosion. Although the MEHR is a good indicator of relative risk it will over estimate the actual erosion hazard.

The table is simplified in one respect: (1) Motorized routes where the only change is from one vehicle use to another vehicle use is excluded from this table. “Other Changes in Vehicle Class” is not considered part of the “net footprint” described below. Minor changes in vehicle class are not expected to result in a significant change in soil erosion or hydrologic function on most soils, assuming proper maintenance.

NFTS roads previously closed and now proposed opened under Alternatives 1, 4 and 5 have some additional considerations. The roads are engineered roads and the assumption is that they are compacted, have functioning drainage structures, and are not built on steep or very steep grades. This is not to say that NFTS roads contribute less sediment on a per mile basis than motorcycle and ATV routes. These roads need to be considered as part of the net foot print because an increase in on-off road erosion is expected to increase somewhat over the non-use condition.

Three of the five alternatives add unauthorized routes to the NFTS. The routes not added to the NFTS will passively re-vegetate. The time frame of 10 years allows for most of the routes to grow vegetation and stabilize to background erosion rates. Shallow soils such as lava caps and shallow soils at higher elevations above 8,000 feet will recover slowly and possibly to a lesser degree. The closed and re-vegetated routes are considered “out of play” after 10 years (not part of the Net Footprint).

Table 3.08-2 Routes by Action and MEHR

Route Type	Miles of high and very high MEHR				
	ALT 1	ALT 2	ALT 3	ALT 4	ALT 5
Adding Facilities					
Proposed Additions to NFTS	128	0	0	151	24
Unauthorized Use					
Open Unauthorized	0	204	0	0	0
Closed Unauthorized (passive recovery) [1]	75	0	204	53	180
Access to campsites		25			
Proliferation (10yrs)	0	18	0	0	0
Changes to Existing NFTS					
Road Closed to Open	60		0	82	2
Road Open to Closed	37	0	0	9	48
Other Changes in Vehicle Class [1]	Not Included [1]				
Net Footprint [2] (1yr)	226	231	204	277	158
Net Footprint [2] (10yr)	188	247	0	233	26

[1] Minor changes in vehicle class are not expected to result in a change in soil erosion or hydrologic function.

[2] Net Footprint is the net change of unauthorized use, changes in use, and adding facilities. The time frame is 10 years and 1 year. Assumes that closure of existing NFTS and unauthorized routes is a net benefit relative to soil erosion. The benefit is greater after 10 years of passive vegetative recovery.

Routes by HFC

The indicator, HFC is a soil hazard interpretation that predicts where roads and trails may be prone to failure of drainage structures and loss of water control without proper maintenance or mitigation. In extreme cases a loss of the facility is possible. Table 3.08-3 displays miles of routes with a higher potential for rutting and erosion based on the hazard interpretation, HFC.

Table 3.08-3 Routes with High Rutting and Erosion Potential (HFC)

Route Type	Miles of high rutting and erosion potential				
	ALT 1	ALT 2	ALT 3	ALT 4	ALT 5
Adding Facilities					
Proposed Additions to NFTS	54.7	0	0	67.9	8.6
Unauthorized Use					
Open Unauthorized	0	81	0	0	0
Closed Unauthorized (passive recovery) [1]	31	0	81	22	75
Access to campsites		11			
Proliferation (10yrs)	0	9	0	0	0
Changes to Existing NFTS					
Closed to Open	28.9	0	0	45	2.9
Open to Closed	16	0	0	3.7	20
Other Changes in Vehicle Class	Not Included [1]				
Net Footprint [2] (1yr)	99	92	81	131	66
Net Footprint [2] (10yr)	84	101	0[3]	113	11

[1] Minor changes in vehicle class are not expected to result in a change in soil erosion or hydrologic function.

[2] Net Footprint is the net change of unauthorized use, changes in use, and adding facilities. The time frame is 10 years and 1 year. Assumes that closure of existing NFTS and unauthorized routes is a net benefit relative to soil erosion. The benefit is greater after 10 years of passive vegetative recovery.

[3] Zero is equivalent to the existing NFTS.

Comparison of Alternatives

Initially the differences between the alternatives are not great. The net footprint (net impact) using a one year time frame is somewhat similar, with Alternative 5 ranking the best (most protective) relative to the soil resource and Alternative 4 the worst. The net footprint using a 10 year time frame shows a similar ranking, but Alternative 3 and Alternative 5 now have a much lower net impact. Alternative 3 and 5 are essentially back to the existing NFTS (maximum miles of closure and passive recovery). Note that over the longer time frame, Alternative 1 is a lower impact than Alternative 2 and 4 although the differences are not great.

Additions to the NFTS

Table 3.08-4 shows a comparison of the two indicators and gradient class by alternative for proposed additions to NFTS. The factor or indicator displays different ways of looking at routes and soil concerns related to the routes. The focus here is on additions to the NFTS because they represent the bulk of non-engineered facilities being added to the existing NFTS system.

Table 3.08-4 Additions to the NFTS: MEHR, Hydrologic Function Class and Gradient Class

Factor or Indicator	Route Addition Miles				
	ALT 1	ALT 2[1]	ALT 3[1]	ALT 4	ALT 5
MEHR-high and very high	128.2	0	0	151.0	24.0
HFC	54.7	0	0	68.0	8.6
Gradients-steep and very steep	26.1	0	0	31.4	5.9
Additions Forest-wide	160	0	0	187	32

[1]Alt 2 and Alt 3 have no additions to the NFTS proposed

Gradient class was not a formal indicator to weigh alternatives by, but it proved especially useful for 1) sorting routes to look at in the field; and 2) applying mitigation in a uniform manner.

Table 3.08-5 Summary of Effects: Soil Resource

Indicators	Ranking of Alternative for each Indicator [1]				
	ALT 1	ALT 2	ALT 3	ALT 4	ALT 5
Miles of unauthorized routes displayed by miles in each of the R5 HER ratings.	3	1	5	2	4
Miles of authorized roads and trails displayed by miles in each of the R5 HER ratings.	3	1	5	2	4
Average	**3**	**1**	**5**	**2**	**4**

[1] A score of 5 indicates the alternative is the least impact for this resource; a score of 1 indicates the alternative is the most impact.

Compared with the existing condition, represented by Alternative 2 (no action), all other alternatives result in a reduction of direct, indirect and cumulative soil effects. Table 3.08-5 gives a ranking of alternatives comparing authorized and unauthorized routes. A ranking of 5 is best (most protective) for the soil resource and 1 is the least. The ranking is based on the miles of analysis routes on high and very high MEHR soils shown in Table 3.08-2

Compliance with the Forest Plan and Other Direction

Alternatives 1, 3, 4 and 5 comply with applicable S&Gs (USDA 2005a). If any of those alternatives are implemented, or a combination thereof, applicable soil standards and guidelines would be followed. Alternative 2 would not comply with the intent of the plan standards because unregulated cross country motorized travel would continue to occur.