

Fishlake National Forest

OHV Route Designation Project – Soils Report

Introduction. The Fishlake National Forest decided to update its existing motorized travel plan in 2003 with new information about road additions, closures and system authorization changes. In order to initiate and allow this type of action to occur on NFS lands, the Washington Office required a Forest - Wide / Roads Analysis to be completed by the Engineering Staff of each Forest on its Maintenance Level 3, 4 and 5 road surfaces. Since our recreation / travel map for the Fishlake Forest contained several omissions and numerous errors dating all the way back to 1997 ... the Forest Leadership Team decided to correct the recreation map in 2004 – and, include an adaptive management strategy that would facilitate keeping the travel plan both correct and current. Some of the updates and changes being proposed to the Forest travel plan would include 1) showing areas of motorized and non-motorized trails, 2) designating certain areas with specific restrictions for seasonal use, 3) posting the locations of physical barriers and metal gates – which would effectively close some roads and trails to the general public, 4) marking transportation surfaces scheduled for obliteration, 5) identifying managed, open - use areas for OHVs, 6) indicating specific routes and corridors that will remain open for dispersed camping, firewood gathering, administrative uses and emergency purposes and 7) displaying closures for oversnow travel by snowmobiles in order to protect critical habitat for mule deer. The most profound change currently under consideration within all the action alternatives is that ... cross-country travel would no longer be allowed to occur on NFS lands by OHVs.

Proposed Action. Due to a rapid growth in the use of OHVs here in south-central Utah during the past few years – along with, the development of both the Paiute and Great Western Trail systems ... it is no longer practical to allow seasonal or yearlong motorized cross-country travel on 62 percent of the Fishlake National Forest. The current concept used on our recreation / travel map indicates ... areas are open for travel – unless, signed or mapped as being closed. This policy is viewed as being somewhat complicated to interpret and very difficult to enforce on NFS lands. **The goal of the Fishlake National Forest is to effectively manage the use of OHVs in partnership with other federal, state and local units of government – including, nearby communities and special interest groups in order to protect our public lands and valuable resources while providing opportunities for the safe operation and enjoyment of OHVs on designated roads, trails and within managed-use areas.** Taking this approach will allow the Forest to focus on improving both its motorized and non-motorized recreation opportunities along with establishing a budget for road and trail maintenance work. Having an updated travel plan should improve the overall understanding of the public to the new travel rules – reducing the development of unauthorized, user-created routes on NFS lands.

Purpose and Need. The rationale that best supports our proposed action of improving upon the existing management of OHVs by creating an updated travel plan is simply ... we understand a better job can be done with respect to regulating motorized cross-country travel on our roads and trails. A revised plan would be much easier for the public to

understand; secondly, this new version of the travel plan would be supported by a policy which allowed for improved administration by the Forest Service – especially, in the area of law enforcement. Our new approach to managing OHVs would be consistent with the overall management strategy of other nearby and adjacent public lands. It should be noted, one significant benefit of updating our Forest travel plan would be ... to reduce potential conflicts between OHVs and other resources – such as soils and watershed. By implementing the proposed action, we would actually increase the certainty as to which transportation surfaces should be managed as motorized vs. non-motorized routes here on the Forest. And ... since the plan would include an adaptive management strategy, the updated travel map would accommodate current OHV uses – and, address issues related to the future growth of this sport and transportation industry.

Issue Identification. There are several issues related to geology and the soil resource that can be associated with allowing OHVs to travel cross-country using our roads, trails and public lands. Most of the issues are connected with the current Forest travel plan that keeps 62 percent of our NFS lands open for motorized vehicles. Our existing management of OHVs has resulted in some areas having accelerated rates of erosion, soil deformation and a loss of water control in locations where the hydrologic function of the ground has been compromised by vehicular traffic. A brief listing of the six land issues and concerns is as follows:

- **GEOLOGIC HAZARDS** ... most of the inherent problems commonly observed on the Fishlake National Forest include soil creep, slumps and rotational landslides occurring on unstable terrain derived from calcareous sediments of the North Horn Geologic Formation. These clayey soils were formed from both mudstone and siltstone deposits; North Horn landscapes occur on both the Fillmore and Richfield Ranger Districts. There are 108,000 acres of upland soils derived from North Horn sediments located here on the Fishlake Forest. Most of our North Horn areas occur in Management Area 9F – which places an emphasis on improved watershed condition.
- **DISPLACEMENT** ... involves the detachment and transport of geologic sediments or soil particles by a force of energy such as wind, water or gravity. Quite often, eroded material is the richest part of the soil profile – usually, its surface horizon containing most of the fertility in the form of plant nutrients and humified organic matter. Detrimental conditions occur when displacement amounts to the loss of either 2 inches or ½ of the humus enriched topsoil – whichever is less. (FSH 2509.18, R4 / SQS, revised ... 01-2003).
- **PUDDLING** ... is defined as the act of destroying the natural structure of a mineral soil when the ground is wet or saturated. Puddling is generally evaluated right at the ground surface. Visual indicators of detrimental puddling include ... clearly identifiable tire ruts with berms or hoof prints left in the topsoil. Fine-textured soils containing appreciable amounts of clay are the sites considered to be most susceptible to puddling type disturbances. Often times, puddling will result in the reduction of macropore space by 50 percent or more in severely damaged areas; this condition may restrict or even prevent the infiltration of water at the ground surface – causing erosion by surface runoff conditions.
- **COMPACTION** ... this disturbance is generally evaluated just below the ground surface; it usually occurs between the depths of 2 to 12 inches in a mineral soil. A common cause of compacted layers in the solum (meaning ... the A and B Horizons of a soil profile) is operating motorized vehicles or heavy equipment over the ground during moist conditions ... this often results in a subsurface or subsoil condition called a traffic pan. Compacted sites restrict root penetration, limit water movement and behave shallow in depth – all 3 of these acquired conditions hinder soil productivity and indicate changes in

hydrologic function. Threshold values for detrimental impacts to soil porosity are provided in FSH 2509.18 (R4 / SQS, revised ... 01-2003), Table 2.

- **GROUND COVER – INSUFFICIENT PROTECTION** ... wildland soils are considered to be detrimentally exposed to potential erosion losses when excessive amounts of ground cover are removed from a treatment unit or management area. In this particular instance, the term ground cover is being used to represent vegetation, litter and rock fragments occurring in direct contact with the soil surface – if, the material is larger than ¾ inch in size; in addition, the ground cover concept has been expanded to include any perennial canopy cover located within 3 feet of the soil surface. Insufficient protection of the topsoil commonly results in accelerated rates of erosion – which adversely affects long-term soil productivity.
- **BIOLOGICAL SOIL CRUSTS** ... ground disturbances often result in a variety of adverse impacts to soil crust populations from activities such as cross-country travel by motorized vehicles, trampling by domestic livestock or wildlife and land-clearing activities – especially, the mechanical thinning of pinyon - juniper plant communities within semidesert environments. Most of these disturbances will puddle and compact the upper soil profile (top 12 inches) during moist or wet ground conditions. The deformation of soil structure influences soil – plant water relationships and can accelerate rates of erosion by wind and overland flows. Our existing populations of biological soil crust should be managed to provide for 1) soil stabilization, 2) improved water retention properties and 3) nitrogen fixation within semiarid ecosystems. It should be noted, cyanobacteria are the most resistant crusts to ground disturbances; the organism is highly mobile and can re-colonize quite rapidly in disturbed areas. (USDI – BLM and USGS, Technical Reference 1730-2, 2001)

Most of the resource damage observed on the Fishlake National Forest from the unauthorized use of OHVs on NFS lands occurs in both semidesert and upland areas – semiarid landscapes measuring < 7,800 feet in elevation. Generally speaking, these areas do not have enough ground cover to protect the site from disturbances that cause soil deformation and erosion problems from uncontrolled flows of water. To a lesser extent, some of our mountain and high mountain landscapes were having stream crossings, riparian zones and fragile meadow areas damaged by motorized traffic. Some of the impacts are connected with dispersed recreation activities; other disturbances involving ATVs and dirt bikes have been attributed to isolated incidents involving youngsters, seasonal hunters of upland big game animals and a small group of local residents who choose to violate the BLM and FS travel map restrictions.

Affected Environment. Since 1984, the Fishlake National Forest (FNF) has signed two Memorandums of Understanding (MOUs) with both the USDA - Natural Resources Conservation Service (NRCS) and Utah Agricultural Experiment Station that allows us to conduct soil survey investigations on approximately 1.43 million acres of public lands located within south-central Utah. Currently the Forest is involved in managing two major soil survey areas; these projects list as follows:

- ❶ **Tushar - Pahvant - Canyon / Soil Survey Area # 649** ... includes 671,574 acres of NFS lands located on the Fillmore and Beaver Ranger Districts. This survey project was completed by the Fishlake National Forest during the spring of 1990. A final correlation session (meaning ... quality control review) has been conducted in cooperation with the NRCS / Utah State Office – Soils Staff and members from their NRCS / South National Technical Center. The soil survey report is currently in a draft format; however, there are no plans for its publication at this time. Land resource information obtained from the field mapping activities and acquired during the data

collection phase of this project has been used to develop GIS interpretive displays using the new ArcView (3.3) software package.

- ② **Fremont - Monroe - Salina / Soil Survey Area # 651** ... includes 760,416 acres of NFS lands located on the Loa and Richfield Ranger Districts. This survey is considered to be an on-going project at this time. Currently, the Forest has awarded a Service Contract to Soils Contractor / Mr. Bruce Chesler of Escalante, Utah for the purpose of collecting additional soils documentation within the project area; the contract is scheduled to be completed by June of 2005. Currently, all the field mapping has been completed – and, about 95 percent of the supporting documentation (i.e. profile descriptions, transects and field notes) has been collected by professional Soil Scientists. Once again, land resource information obtained from the field mapping activities and acquired during the data collection phase of this project has been used to develop GIS interpretive displays for timber, range, recreation, minerals, wildlife and prescribed fire type projects.

Generally speaking ... the soil resource consists of a relatively thin, unconsolidated layer of mineral type horizons that are located upon the earth's crust. Some soils have distinct accumulations of humified organic matter occurring at the ground surface. The soil profile usually acquires its unique properties as a direct result of physical and chemical weathering along with the biological alteration of its geologic source materials; in addition, the actual process of soil formation includes a contribution by factors such as climate and topography along with the simple recognition – that, all soils continue to form over time.

Most of the wildland soils occurring within the perimeter of the Fishlake National Forest were formed in mixed alluvium, colluvium and residuum derived from igneous, sedimentary or metamorphic type rocks. It should be noted, a large Pre-Cambrian formation of about 27,000 acres has been found within our Canyon Mountain Range; these ancient rocks are in excess of 500 million years old and make-up about ¼ of the entire subsection. A few unique areas of the Forest were derived from either 1) eolian sediments – which are wind-blown deposits of sand, 2) glacial till material or 3) gravitational debris. And ... several small areas observed on the Fillmore Ranger District were actually produced from secondary deposits of the mineral dolomite. The Geologic Map of the Fishlake National Forest displays a large group of polygons that represent 30 different types of parent rocks (i.e. basalt, rhyolite, limestone, conglomerate, shale, quartzite etc.) along with another 9 kinds of surficial deposits – areas having soils derived from transported materials ([see GIS Attachment # 1 – Geologic Map of the Fishlake National Forest, page # 33 in this Specialist Report](#)). Finally, a few locations consist of miscellaneous land types with rock outcrops, rubblelands, landslides, talus slopes, badlands or riverwash materials. Typically, these areas support less than 10 % vegetative cover; for this reason they are **NOT** considered to be soil material according to the current Soil Survey Manual (Agriculture Handbook # 18).

Currently, about 325 different map symbols are being used to represent over 450 types of contrasting soil resources mapped on NFS lands within our two survey areas; another 30 symbols have been added to the Fremont – Monroe - Salina legend in order to track and display the different soil types found within our large in-holdings of private land located throughout Salina Canyon. While the soil surveys being conducted by the Fishlake National Forest are termed Order 3 projects (inventories of moderate scale and complexity) ... just the fact we have such varied terrain, climate, geology, vegetation and age when it comes to our different landscapes allows us to sample and map so many different soil types. Land resources have been identified, mapped and documented within semidesert, upland, mountain, high mountain and subalpine types of ecological areas. According to the Utah State University / Climatological Center, during the past 30 years, the mean annual precipitation for this Forest has varied from a low of approximately 10 " / year in four

semidesert locations occurring along the Forest boundary to a high of over 36 “ / year in several high-elevation / subalpine areas; a brief summary of the extremes in our climatic conditions is shown in the following lists:

SEMIDESERT SITES (4)

Flat Canyon on the Fillmore Ranger District

Velvet Ridges on the Loa Ranger District

Sulphur Creek on the Loa Ranger District

Cottonwood Creek on the Beaver Ranger District

According to the NRCS / State of Utah – Soil Staff, these four droughty areas would have a freeze-free season of approximately 120 to 135 days / year.

SUBALPINE SITES (3)

White Pine Peak on the Fillmore Ranger District

Sunset Peak on the Fillmore Ranger District

Mt. Terrill on the Richfield Ranger District

Once again, according to the NRCS, these three subalpine areas would have a limited freeze-free season of only 20 to 30 days / year.

The State of Utah / Automated Geographic Reference Center (AGRC) has developed an informational database of Digital Elevation Models (DEMs) using 5 ' contour intervals which indicate our elevations vary from a low of approximately 4,760 feet on the alluvial fan terraces surrounding the western Pahvant Range to a high of over 12,170 feet up on Delano Peak in the Tushar Mountains. Our terrain ranges from 0 to 2 % slopes on nearly level alluvial plains up to 90 + % slopes on very steep canyon walls near ridgetop areas. Soils have been sampled and studied within wetland areas, riparian zones and on the surrounding hillsides under the following types of major biological plant communities:

Wyoming big sagebrush	Subalpine
mountain big sagebrush	spruce / fir
black & low sagebrush	seral aspen
basin big sagebrush	stable aspen
mountain brush / gambel oak	mixed conifers
pinyon - juniper	perennial grasses
riparian / aquatic	semidesert & upland shrubs
tall forbs	greasewood / 4-wing saltbush

Detailed information about our two survey projects has been recorded on both 1:40,000 scale (1.58 inches = 1 mile) and 1:24,000 scale (2.64 inches = 1 mile) black and white aerial

photographs; subsequently, these survey photos were hand-digitized and entered into our Fishlake / GIS for project assessment, planning, implementation and monitoring purposes. Profile descriptions, 6-point transects and survey field notes have been collected as documentation in support of this reconnaissance type of soils mapping project. Overall, this data has been used to develop interpretative ratings and GIS displays suggesting the suitability and limitations of conducting land management activities on wildland type soils.

R4 / Soil Quality Standards. Here in the Intermountain Region of the USDA - Forest Service, our Regional Forester / Mr. Jack Troyer has accepted the responsibility for developing Soil Quality Standards and Guidelines (R4 / SQS) along with selecting the suitable methods for monitoring any type of site disturbance. The Forest Supervisor's understand the important need to incorporate the current standard and guidelines into their Forest Monitoring Plans. Secondly, the Forest / Leadership Teams along with the District Rangers and their staff groups have acted to ensure that management prescriptions are consistent with the R4 / SQS in both the planning and implementation of land management activities.

Ultimately, the overall goal of our management should be ... to cause as little soil resource damage as possible on public lands administered by the Forest Service – not, just keeping treatment areas from site disturbances which exceed the maximum thresholds listed in the R4 / Soil Quality Standards and Guidelines.

The present concept about soil quality as it pertains to 1) the overall management of NFS lands and 2) the current policy and direction for allowing motorized OHV travel to occur on the Forest are effectively communicated to us in the following two statements taken from the Forest Service Handbook (FSH 2509.18) during January of 2003:

" Soil resource management must be consistent with the Forest Service goal of maintaining or improving long-term soil productivity and site hydrologic function. "

" ... presently, at least 85 % of the total acreage occurring within an activity area must have soil properties that remain in satisfactory condition. Plans for projects where treatments are expected to cause resource damage, exceeding the maximum thresholds listed under the R4 / Soil Quality Standards and Guidelines, must include provisions for mitigation of the ground disturbances. "

(**Note**) -- in this particular instance, the term **ACTIVITY AREA** is not to be confused with all NFS lands currently being administered by the Fishlake National Forest; each alternative has its own specific recommendations for motorized travel ... this information has been displayed on a detailed set of GIS maps which show all the different activity areas that would remain open to motorized cross-country use according to the various alternatives being presented by the proposed travel plans. An activity area is an area impacted by a land management activity, excluding specified transportation facilities, dedicated trails, and mining excavations and dumps. Activity areas include such areas as: harvest units within timber sale areas and prescribed burn areas. Riparian and other environmentally sensitive areas may be monitored and evaluated as individual activity areas within larger management areas.

Some of the R4 / Soil Quality Guidelines that should be **MONITORED** if the motorized travel plan for the Fishlake National Forest includes 1) displacement – the movement of topsoil material at the ground surface, 2) puddling – the deformation of soil structure, 3) compaction – soil material occurring in a massive type of structureless condition and 4)

issues related to ground cover and insufficient protection of the soil surface resulting in accelerated rates of erosion.

National Strategic Plan – Soil Management Program. In short, this final strategic plan defines the purpose of the Soils Program within the framework of the Forest Service; it articulates the overall mission, vision and goals of the program along with describing the desired outcomes necessary to achieve its program objectives.

Beyond the laws and regulatory mandates, soil and water are the basis from which all life on earth derives its sustenance. The Forest Service mission is to sustain the health, diversity and productivity of the Nation's Forests and Grasslands in order to meet the needs of present and future generations. The Forest Service – Soil Management Program identifies the necessity for improving and protecting watersheds to provide healthy soil resources in support of ecological functions -- an agency objective. Simply stated, ecological diversity and watershed function are both dependent upon having well - managed, highly productive soils. (USDA – Forest Service, National Strategic Plan – Soil Management, February, 2004)

The seven program objectives of Soil Management are identified as follows:

- Soil Quality Maintenance
- Ecosystem / Watershed Restoration
- Inventory Program Evaluation and Update
- Soil Quality Monitoring / Administrative Studies / Research
- Soil Information Management
- Partnership Development
- Organizational Capacity Maintenance and Enhancement

A clearly defined soil conservation and protection program is required if the Forest Service is to effectively maintain soil productivity, ensure sustainable ecosystems and improve - or protect, watershed conditions. FS / Soil Scientists must provide leadership in formulating this program and integrating the research and development needed to support it.

Geologic Hazards and Special Considerations for OHV Travel. Many of the soils mapped on the Fishlake National Forest have inherited their unique properties directly from the surrounding geologic source materials. For instance, soils derived from eolian deposits along with the Diamond Creek, Navajo, Nugget and Price River Geologic Formations are all sandy locations that can be quite susceptible to blowing hazards – especially, on unprotected sites having little ground cover. Likewise, soils formed in organic marshes, near landslide debris or upon shaly deposits from the Ankareh, Arapien, North Horn and Woodside Geologic Formations are problematic when it comes to puddling, compaction and their affects to hydrologic function. Some of these fine-textured areas and shaly landscapes can become susceptible to soil creep, slumps and landslides if their toe-slopes are damaged during road and trail construction – especially, if the transportation surface interferes with the lateral movement and subsurface flows of ground water.

In the analysis section of this report, a group of summary tables will be shown in order to quantify the amount of acres or miles considered to be at-risk according to the different geologic hazards. Simply stated ... it's important to understand the different units-of-measure associated with these tables. The table that shows acres of land affected by the existing or proposed travel plans was really intended to display the huge difference in the amount of NFS lands that would be open for motorized cross-country travel according to the different alternatives. This table would suggest there are few geologic hazards

associated with alternatives 2, 3, 4 and 5 – not true. In comparison, the table that shows miles of existing trail and motorized trail surfaces is an entirely different display – because, it acknowledges some of our existing transportation surfaces were actually constructed on fragile terrain. Most of our known geologic hazards have already been mitigated by 1) using drains and waterbars to create water dispersal systems, 2) hardening the ground surface with gravels or $MgCl_2$ to limit the detachment and transport of soil particles and 3) re-vegetating fragile sites not having enough protective ground cover due to repeated ground disturbances. In a few instances, areas of excess moisture were temporarily closed to protect the local geology and soil resource using a metal gate. In extreme circumstances, segments of road or trail surfaces were either permanently closed or re-located to avoid wet meadows, fragile riparian zones, natural spring sites, very steep – erosive terrain or inherently unstable slopes.

Potential for Soil Displacement. The specific purpose of including this section with my report is simply to show the users of soil survey information just how little topsoil we actually have in certain parts of this Forest ([see GIS Attachment # 2 – Topsoil Thickness of the Fishlake National Forest, page # 34 in this Specialist Report](#)). Most of the soils mapped near our Forest boundary and many of the soils occurring within our semidesert and upland ecological areas (meaning ... precipitation ranges from 10 to 16 inches / year) are classified as being either Entisols or Aridisols – meaning, young soils evolving within semi-arid areas which results in limited topsoil development. In fact, here on the Fishlake National Forest we have approximately 634,366 acres of alluvial fan terraces, sand dunes, structural benches, shaly foothills and upland hillsides with less than 4 inches of topsoil development; that calculates out to about 41 percent of our total acreage. Some areas of this Forest are especially fragile when it comes to allowing motorized, cross-country traffic to occur – because, the amount of existing ground cover is not adequate enough to prevent accelerated rates of erosion. And ... the damaged areas commonly occur on relatively dry landscapes – areas not easily rehabilitated and restored to natural type conditions.

Erosion is defined as the detachment, transport and deposition of soil particles by a natural force of energy such as water, wind or gravity; sometimes, highly erosive ground conditions can be the direct result of management - induced site disturbances. For example, topsoil horizons can become truncated (meaning ... scalped by wind or water erosion) by the continued action of allowing motorized vehicles to traverse across the landscape. The displacement of soil material can leave a management area with insufficient amounts of ground cover ... making the site susceptible to erosional events. Once the topsoil resource(s) have been removed from a site by a disturbance such as cross-country motorized travel ... the exposed subsurface and subsoil layers can become easily compacted by allowing the recreational activity to continue – resulting in surface runoff conditions.

Soil erosion rates are dependent on the inherent erodibility of the land resource; overall, the erosivity of a site is based upon rainfall factors such as intensity and duration, wind velocity along with topographical position – including slope length and its gradient.

- **WIND EROSION** ... is considered a basic geomorphological process; it can be responsible for creating an assortment of shapes including dunes, blowouts, desert pavements and rock pedestals. While the overall transport capacity of the wind is much less than that of flowing water ... the process of wind erosion is capable of removing nutrient rich soil material from disturbed sites – including roads, trails and unprotected ground surfaces. The resulting dust clouds may contaminate the atmosphere within the immediate transport area and occasionally impact residents living within its depositional locations. ([see GIS Attachment # 3 – Potential for Wind Erosion on the Fishlake National Forest, page # 35 in this Specialist Report](#))

- **WATER EROSION** ... is a series of processes leading to the depletion of soil material from upland hillside locations; simply stated, topsoil is detached and transported as sediment into surrounding streams and bodies of water. These processes include 1) diffuse surface erosion from the dynamic splash associated with raindrop impact, 2) linear erosion in the form of rills and gullies, 3) subsurface erosion ... seen as piping and 4) shallow mass movements. (see GIS Attachment # 4 – Potential for Water Erosion on the Fishlake National Forest, page # 36 in this Specialist Report)

Mitigation is defined as measures added to a project that reduce, prevent or correct its adverse impacts upon the land; it includes, rectifying the overall affects by repairing, rehabilitating or restoring disturbed areas; it may compensate for the action by providing substitute resources.

Table # 1 – Mitigation Measures commonly used to Trap Sediment and Stabilize Soil Conditions on Highly Erosive Sites

Mitigation Measures	Brief Description of the Treatments
<p>Broadcast Seeding</p>	<p>This treatment may consist of spreading native and introduced grasses along with non-persistent cereal grains on the damaged site at a rate of about 60 to 80 seeds / ft². The seed mix may include forbs or shrubs for erosion control. The mix is applied to the ground using a Type III helicopter, fixed-wing aircraft or rangeland drill. Seeding often occurs during the late fall and early winter season. The seed mix must be certified to be free of noxious weeds. The mixes are specifically designed for a variety of locations depending upon soil type, climate, aspect, elevation and temperature. The cost of this treatment can range from about \$ 35 to 185 / acre depending upon the type of seed mix, method of implementation (aircraft vs. drill) and the amount of ground support needed to complete the project. Under ideal conditions, project accomplishments will be about 600 to 850 acres / day if using aircraft to apply the seed mix – it depends on the terrain and overall distance from the Helispot or Landing Strip to the damaged-areas.</p>
<p>Aerial Mulching</p>	<p>This treatment is commonly used to protect communities from flooding, mud slides and debris flows. In order to justify using this type of treatment, the values-at-risk must be SIGNIFICANT and involve either threats to human life and property or genuine concerns about transportation surfaces, irrigated croplands, municipal water supplies, domestic water supplies, recreational developments, abandoned mine sites, power lines, utility lines etc. Aerial mulching with weed-free</p>

Mitigation Measures	Brief Description of the Treatments
<p data-bbox="363 982 646 1012">Mulching-by-Hand</p> <p data-bbox="399 1285 610 1314">Straw Wattles</p>	<p data-bbox="756 247 1354 310">straw should be applied to problem landscapes at a rate of 1 to 1½ tons / acre using a Type III</p> <p data-bbox="756 382 1354 949">helicopter. This emergency treatment provides for a protective layer of ground cover to become re-established on a damaged site; it should be noted, mulching is still considered as the “ MOST EFFECTIVE ” land treatment in controlling soil erosion. As expected, this treatment is quite useful on steep to very steep terrain. The cost of this expensive treatment varies from about \$ 900 to \$ 2,500 / acre -- depending on the availability of straw, the contract price on the aircraft, any transportation costs that might be incurred to acquire the straw bales along with daily expenditures for the supporting helitack personnel. When 2 helicopters are involved with stabilizing the same damaged area, the crews can drop straw at a rate of about 50 to 60 tons / day on the site.</p> <p data-bbox="756 982 1354 1255">Mulching-by-hand can be easily accomplished on most gently sloping to moderately steep terrain at a cost of about \$ 750 to \$ 1,250 / acre – but, the process is much slower when compared with the previously described aerial mulching methods. Normal accomplishments for a Type II / Fire Crew would be treating about 8 to 10 acres / day when the application rate is at 1 ton / acre.</p> <p data-bbox="756 1285 1354 1948">Straw wattles are artificial barriers used to trap sediment on erosive hillsides. The barriers are about 9 inches in outside diameter, filled with weed-free straw and clipped into wattles having lengths of about 10 to 25 feet. The wattles are anchored upon the hillsides using 24 inch wood stakes positioned every 4 feet along the wattle. The wattles are placed along the contour in parallel rows spaced about 10 to 40 feet apart – depending on the slope of the landscape. The wattles usually decompose in place about 24 to 48 months after their initial installation – depending upon the climate. The barriers must be flush with the surface of the ground to be effective. Forest Service / BAER Teams have commonly recommended straw wattles in order to protect fragile riparian zones and wetland areas from the detrimental impacts of wildfire. The cost of this particular treatment ranges from about \$ 2.65 to \$ 4.50 / linear foot – depending upon how much</p>

Mitigation Measures	Brief Description of the Treatments
<p>Straw-Bale Check Dams</p> <p>Erosion Blankets</p>	<p>order to place the fabric in a folded position below the ground surface; this action allows for the</p> <p>effective trapping of sediment during storm events. The cost associated with building a silt fence is quite variable – just depends on the method of construction and how many rock fragments (cobbles, stones and boulders) are located within the topsoil; actual expenditures can range from about \$ 1.50 to \$ 4.95 / linear foot. Frequently, silt fences are constructed in discontinuous segments on alluvial plains or fan terraces ... or, are placed in parallel rows if heavy runoff conditions are expected from an OHV damaged landscape. Accomplishments will be variable ... as a general rule of thumb, a Type II / Fire Crew can build about ¼ mile or 1,320 feet of silt fence / day.</p> <p>These temporary structures are used in ephemeral and small intermittent stream channels to prevent sediment from entering into perennial streams. Straw-bale dams work very well in areas that do not have native rocks or logs to make natural type dams. Most often ... the straw-bale dams are built on gently sloping to strongly sloping terrain (3 to 15 % slopes) – but, closely spaced structures can be somewhat effective on moderately steep landscapes measuring 15 to 25 % slopes too. The purpose of the dams is to initially trap and slowly meter sediment through a drainage system – minimizing impacts to the fisheries resource. As expected, the cost associated with building the dams varies between \$ 150 to \$ 400 / each – depending upon how much time and work it takes to mobilize the bales prior to usage. Under normal conditions, a Type II / Fire Crew can construct about 40 to 50 straw-bale check dams / day.</p> <p>These mats are used when immediate ground cover and maximum protection is needed to shelter a sensitive (i.e. archeological) or high value site like a developed spring location. Simply stated ... the cost of using either fiber or jute-netting mats is the highest of all the erosion control treatments at about \$ 8,500 to \$ 10,000 / acre. The purpose of these mats is to prevent the detachment and transport of soil material from the dynamic splash associated with raindrop impact.</p>

Mitigation Measures	Brief Description of the Treatments
<p>Hydromulching & Seeding</p>	<p>The blankets come in different sizes, thickness, flexibility, tear resistance and absorptive capacities. Most of the erosion mats are 100 % biodegradable in a period of about 2 to 5 years after installation. If the terrain is not too steep ... a Type II / Fire Crew can use 6 inch metal stakes to anchor about 5 acres of blanket / day.</p> <p>The purpose of this treatment is to protect the soil from surface erosion; it provides both a temporary ground cover along with establishing a root mass to bind the soil particles together. For the most part, this treatment is limited to areas that have existing road access. Overall, this treatment is very effective ... because, even if the weather does not cooperate to germinate the seed as expected – the mulch will continue to protect the soil for a year until the vegetation grows and provides its new cover. Generally speaking ... hydromulching is used to protect transportation surfaces from potential damages associated with highly erosive sites. The cost of this particular treatment can range from about \$ 750 to \$ 1,500 / acre – depending on the seed mix, type of terrain, contract price on the spraying equipment and the amount of ground support necessary to complete the seeding project. Project accomplishments are commonly about 4 to 6 acres of spraying / day; usually, a strip about 100 to 200 feet in width is mulched on both sides of the road surface.</p>

In addition to the land, channel and road treatments listed in the previous discussion ... other mitigation measures that might be considered in the event our existing recreation / travel plan continues to cause highly erosive ground conditions on NFS lands would be as follows:

- | | | |
|--------------------|----------------------------|-------------------|
| Strip Mulching | Hand Seeding | Rock Check Dams |
| Log Check Dams | Channel / Culvert Clearing | Temporary Fencing |
| Upgrading Culverts | Armoring Roads | Sand Bags |

(**Note**) -- any soil can become susceptible to displacement; large or coarse woody debris is considered to be any organic materials measuring > 3 inches in diameter. Retaining nutrient-rich organic matter within disturbed areas limits erosion by protecting the ground surface from the dynamic splash associated with raindrop impact.

Potential for Puddling and Compaction Type Disturbances. Puddling or rutting is the creation of depressions in the soil made by the tires of wheeled vehicles during moist or wet ground conditions (see GIS Attachment # 5 – Potential for Puddling and Compaction on the Fishlake National Forest, page # 37 in this Specialist Report). Rutting occurs when the soil strength is not sufficient enough to support the applied load associated with vehicular traffic. Rutting directly affects the root zone characteristics – because, it severs the roots, compacts the soil, causes displacement by erosion, limits aeration, prevents infiltration ... thereby, degrading the surrounding environment. Poorly and very poorly drained soils of any texture are quite susceptible to rutting disturbances during most years when the site is not adequately frozen. Keep in mind, the preferred operating season for any one site may vary depending upon local climatic conditions.

When a puddled site becomes dry, the soil material is hard, dense and exists in a cloddy type of structureless condition. Puddled areas are almost impervious to the movement of air and water within the soil profile due to a significant reduction in overall pore space. This type of condition commonly results in accelerated erosion losses. Frequently ... puddling occurs in conjunction with detrimental compaction disturbances.

Soil physical properties are very important in determining both species composition and the rate of growth by grass-forb, shrub and tree types of vegetation. These properties directly affect the ease of root penetration, overall rooting depth, the availability of water and oxygen within the soil – and, the degree to which water moves laterally and vertically through the soil.

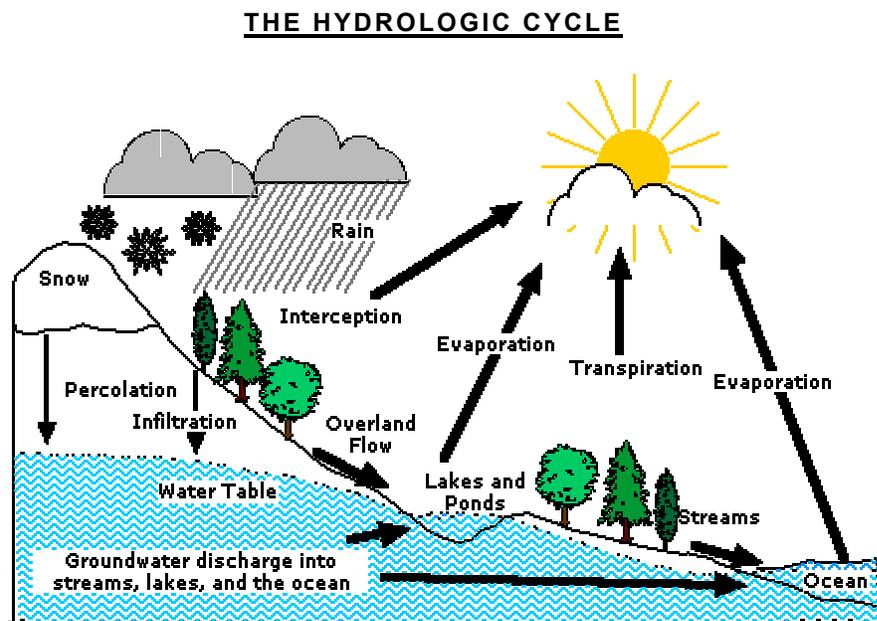
The persistence of soil compaction is determined by climate, the shrink – swell potential of the soil along with the overall depth to the massive condition. Freeze / thaw cycles can help to offset soil compaction occurring near the ground surface. Dry soils are certainly less susceptible to compacted conditions. Limiting equipment traffic to the drier seasons of the year is one way to reduce potential compaction problems in the soil.

Table # 2 – Mitigation Measures commonly used to offset Detrimental Puddling and Compacted Soil Conditions

Mitigation Measures	Brief Description of the Treatments
<p style="text-align: center;">Contour Raking</p>	<p>This treatment involves mixing the top 6 inches of the mineral soil using a McLeod (hand tool) in order to break-up puddled and compacted ground conditions caused by cross-country motorized travel using OHVs. The action is intended to promote the infiltration and percolation of water and snowmelt into the ground and minimize surface runoff conditions. The raking is not effective on sites having 1) very steep terrain, 2) a high percentage of rock fragments or 3) much coarse woody debris located at the ground surface; in addition, it is not considered practical in remote locations. The cost of a McLeod is currently about \$ 65 / each. The cost of implementing this type of emergency treatment usually ranges from about \$ 175 to \$ 350 / acre for labor. Project</p>

Protective Ground Cover. The role of coarse woody debris in a shrub or forested environment is one of economy: if allowed to remain on-the-ground ... very little will go to waste – and, the soil will be protected from erosive conditions. As the woody material eventually decays, increasing amounts of nitrogen become available to the microbes and surrounding plants which anchor the soil in place with their expanding root systems. In some instances, coarse woody debris will act as a physical barrier on the landscape trapping sediment and preventing soil material from entering into our natural spring sites, organic marshes, riparian zones and wetland areas.

Surface litter reduces ground temperature extremes (both hot and cold conditions) and aids with the infiltration of water at the soil surface. Secondly, the litter material (i.e. pine needles, aspen leaves etc.) actually reduces evapotranspiration losses – so, the net effect of having the soil covered is that ... it stays moist for longer periods of time.



Several factors influence whether or not soil particles are likely to become picked-up and transported away by flowing waters. These soil properties and site characteristics include the following three topics:

- precipitation patterns
- soil litter layers
- slope steepness and length

PRECIPITATION PATTERNS – the pattern and overall intensity of rainfall determines how much power it will have to detach and transport soil particles. Intense rainstorms have more power to move soil horizons off-site compared with a more gentle rain. The seasonal distribution of rainfall is also an important factor. Heavy rains that fall in the winter, when the ground is frozen, will not find much loose soil available for transport. Those same rains falling in the summer can detach and transport quite a bit of loose soil material.

SOIL LITTER LAYERS – the top layer of dead, organic matter covering the ground surface is commonly known as litter; it acts to slow and hold the falling rains. With a thick litter

layer, more water will be able to infiltrate into the soil and percolate down into the ground. There will be a smaller volume of water to cause runoff which erodes away soil particles.

SLOPE STEEPNESS and LENGTH – the steeper the slope, the more likely it is that rain water will actually flush over a hillside rather than infiltrate into the topsoil. In addition, the steeper the slope ... the faster the flowing water will travel over it. Water with more speed has more power – and, a greater potential to remove soil material. The longer the slope, before there is a change in the existing gradient or a physical barrier occurs at the ground surface, the more ability the runoff has to gather speed and erode soil horizons.

In order to assure that erosion rates will not exceed the natural soil-forming processes or the maximum thresholds listed by the R4 / SQS for soil-loss tolerance ... our Forest needs to establish a local guideline which states a minimum amount of ground cover that's needed on damaged terrain – especially, if motorized cross-country travel is allowed to continue on NFS lands. One of the mitigation measures that might be considered in the event ground cover is deemed as being insufficient to protect the soil resource would be ... using mulching-by-hand ([please see Table # 1 – Stabilizing Conditions on Highly Erosive Sites, pages 9 to 13 in this Specialist Report](#)) as a treatment to add straw to tire damaged areas at a rate of about 1 ton / acre.

Biological Soil Crusts. Soil texture and pH have a pronounced influence on the species composition of any biological crust (USDI – BLM and USGS, Technical Reference 1730-2, 2001) occurring at the ground surface. For instance, a fine-textured soil located on a stable site will support a greater abundance and more varied population of cyanobacteria, lichens and mosses compared to ... a less stable site having a droughty, coarse-textured soil. Calcareous and gypsiferous type soils usually support a very high composition of species rich crust – with some taxa being excellent indicators of soil chemistry. Embedded rocks at the soil surface can increase the overall percentage of crust cover by 1) perching water and 2) armoring the surface against the impacts of physical disturbances. Shallow sites often support a wide variety of crusts ... especially within the Ustic Moisture Regime areas – because, the sites are frequently recharged with water during the summer growing season; in addition, shallow soils can be re-moistened by the capillary rise of water during the spring, summer and fall seasons.

Yes, crusts are well adapted to severe growing conditions – but, poorly adapted to many site disturbances. Grazing by domestic livestock along with allowing recreational activities (hiking, biking and OHVs) to occur on public lands places a heavy toll on the integrity of soil crusts. Compressional disturbances really reduce the capability of the soil organisms to function – particularly, in terms of providing nitrogen and site stability. Changes in plant composition are often used as indicators of rangeland health. However, this indicator may not be sensitive enough to warn of pending doom and damage to our microbiotic crusts. Studies of trampling type disturbances have noted that ... a significant loss of moss, lichens and a reduction in the presence of cyanobacteria can be profound. Surface runoff can increase by half – and, the rate of soil loss can increase six times without apparent damage to the existing vegetation. Simply stated ... disturbance to ground surfaces in semiarid regions can lead to large-scale erosional events.

A full recovery of the crusts from any disturbance is a slow process – particularly, for the mosses and lichens. There are means to facilitate a crust recovery. Allowing the cyanobacterial and green algae component to recover will give the appearance of a healthy crust. This visual recovery can be complete in as little as 1 to 5 years under normal climatic conditions. However, crust thickness can take up to 50 years, and mosses and lichens can

take up to 250 years to recover. Limiting the size of the disturbed area also increases the rate of recovery, provided that there is a nearby source of inoculum.

Table # 3 – Management Strategies commonly applied to Semiarid Lands for the Protection of Biological Soil Crusts in areas used for Recreational Activities

Management Strategies	Brief Description of the Strategies
Season-of-Use	Defer recreational use during specific periods when biological crusts are considered to be most susceptible to physical disturbances.
Ground Cover / Soil Structure	Maintain an optimum amount of live vegetation, surface litter and biological soil crusts in relation to the overall potential of the site; this action will help to maintain a thin layer of organic matter blanketed across the ground surface. The slowly decomposing organic matter will actually bind and aggregate the mineral soil into small structural units called granular peds – which serve to limit erosion losses.
Annual Plants	Control the establishment and spread of invasive plant species that can carry a moderate to severe ground fire – killing off the crusts.
Soil Moisture Content	Biological crusts occurring on all soil types are least susceptible to disturbance when the ground is frozen or the site is covered with snow. Crusts located on sandy textured soils are least susceptible to damage when the ground is moist or wet. And ... crusts occurring on clayey sites resist trampling, grazing pressure and recreational uses when the area is quite dry.

Under no circumstances should semiarid locations remain open or become opened for OHV use if the action will result in significant damage to the soil crusts followed by a permanent conversion of the existing vegetative community. Meaning, the area is changed by the vehicles to-the-point ... it loses its component of perennial grasses and upland shrubs and becomes a disturbed site consisting of invasive plant species and noxious weeds.

Some of the areas we should consider monitoring here on the Fishlake National Forest for potential impacts to both physical and biological crusts from cross-country / motorized travel with OHVs would include the lower Corn Creek drainage, Dog Valley Mountain and the NFS lands located adjacent to Round Valley on the Fillmore Ranger District. Likewise, the alluvial fan terraces, structural benches, eolian deposits and upland hillsides in the areas surrounding Sand Creek, Sulphur Creek, Chimney Rock Canyon and Solomon Basin should be studied on the Loa Ranger District. Finally, much of the Old Woman Plateau, Red Creek, Clear Creek and the sandy ground located directly adjacent to Salina Creek along the

Interstate – 70 transportation corridor of the Richfield District are areas having a genuine potential for resource damage.

The following map symbols represent soils having sandy textured surface horizons; these fragile areas can be disturbed by OHVs resulting in damage to, or the elimination of, biological crusts:

TUSHAR - PAHVANT - CANYON / SOIL SURVEY AREA # 649

101, 121, 156, 162, 185, 188, 190 and 201

FREMONT - MONROE - SALINA / SOIL SURVEY AREA # 651

5A, 6A, 6B, 20B, 30D, 63, 75, 84, 92, 222, 226, 237, 239, 240B and 271

(**Note**) – in this instance, we used our GIS to query the Forest coverage's for geology, soils and mean annual precipitation. We selected all the soils derived from geologic formations associated with sandstone parent rocks in areas having < 18 inches mean annual precipitation. Then ... we eliminated all the cryic temperature sites (too cold for crusts) along with any site (i.e. oakbrush, ponderosa pine etc.) known to have organic horizons occurring at the ground surface. Finally, we eliminated all areas measuring < 40 acres in size from our analysis. Certainly, these lists will need to be modified in the future – but, for right now, it's a good starting point in terms of reviewing the impacts of OHVs upon biological soil crusts.

➔ **ALTERNATIVE # 1** ... (no action – our Forest continues to use the 1997 version of its recreation / travel map with all the errors and omissions of important information. Motorized cross-country travel continues to occur on about 62 percent of the Forest)

The Forest Service will continue to work in cooperation with its District Offices and local units of government in order to schedule and implement normal maintenance operations on Class 2 and 3 type road surfaces. This action will be accomplished according to existing budgets, available staffing and the annual priorities being established by the federal agency. For instance ... the Fishlake National Forest will continue to maintain approximately 200 to 250 miles / year -- with an emphasis placed upon treating its Class 3 transportation system. In addition, the Recreation staff group will continue to work in cooperation with the District personnel to apply heavy maintenance or re-conditioning to its existing trail surfaces. The Forest can be expected to accomplish approximately 30 to 50 miles of treatments / year using a Sweco brand trail-cat to accomplish the work. Otherwise, the seasonal Trail Ranger's will continue to observe ATV and dirt bike use on the Forest repairing trails as needed – and, if necessary, issuing citations to any violator's of our Forest travel maps.

Now ... the indirect effect of selecting this particular alternative is that taking the **NO ACTION** approach towards the management of OHVs combined with a decision not to correct the Forest travel map could very well result in significant damage to the soil resource on NFS lands from displacement, puddling and compaction. **Simply stated ... selecting this alternative would eventually violate the Regional / Soil Quality Standards and our Forest Plan direction – because, long-term soil productivity would be impaired.** In addition, our lack-of-action would not be consistent with the management of other public lands located here in the State of Utah. Currently, the Bureau of Land

Management is in the process of revising their Resource Management Plan for south-central Utah – meaning, new updates to their travel plan which include closing most of the BLM administered lands to OHVs and designating specific routes that will remain open for recreational activities. Once again, it should be stated: **the goal of the Fishlake National Forest is to effectively manage the use of OHVs in partnership with other federal, state and local units of government – including, nearby communities and special interest groups in order to protect our public lands and valuable resources while providing opportunities for the safe operation and enjoyment of OHVs on designated roads, trails and within managed-use areas.**

➔ **ALTERNATIVES # 2, 3, 4 and 5** ... (includes the original proposed action that was released with the Notice of Intent along with ... modified versions of our proposed action based upon public comments, internal reviews, suggestions from advocacy groups and additional inventories of our Forest travel routes)

Alternative # 2 ... responds to the Purpose and Need for Action previously identified in Chapter 1 of the Draft Environmental Impact Statement (DEIS) and public requests for improved management of OHVs on NFS lands. In this instance, unrestricted travel will be limited to 973 acres on the entire Forest; specifically, this alternative designates 780 acres in three open-use areas west of Richfield, UT and 193 acres at Velvet Ridges above Torrey, UT where motorized cross-country travel would be permitted. The existing configuration of the Paiute and Great Western Trail systems would be retained. Motorized cross-country travel would be prohibited except as specified for access and egress to dispersed camping sites, firewood gathering areas, emergency fire suppression activities, search and rescue operations, law enforcement duties, military operations and Forest Service administrative uses.

This alternative adds 450 miles of unauthorized routes to and would remove 47 miles of authorized routes from the Forest's existing motorized system. About 775 miles of unauthorized motorized routes would be obliterated and 18 miles converted to non-motorized trail. This action would result in a system of roughly 2,139 miles of road and 552 miles of trail for a combined total of 2,691 miles of motorized routes. Of the latter total, 2,634 of these miles would be open to the public. The amount of seasonally restricted routes would increase from 329 miles to 390 miles. In addition, the ending date for the seasonal closure period for nearly all of these routes would be lengthened from March 31 to April 15th.

Alternative # 3 ... the Modified Proposed Action changes specific route and area designations previously shown under Alternative 2 in order to respond to public comments, internal reviews and to account for the additional route inventory from 2004. This alternative represents incremental progress towards identifying a preferred solution. The preferred alternative designates 780 acres in three open-use areas west of Richfield, UT and 189 acres at Velvet Ridges above Torrey, UT where motorized cross-country travel would be permitted. Some changes in area restrictions for oversnow travel by snowmobiles are proposed to protect critical mule deer winter ranges

This alternative adds 465 miles of unauthorized routes to and would remove 50 miles of authorized routes from the Forest's existing motorized system. About 756 miles of unauthorized motorized routes would be obliterated and 24 miles converted to non-motorized trail. This action would result in a system of roughly 2,132 miles of road and 582 miles of trail for a combined total of 2,714 miles of motorized routes. Of the latter total, 2,667 of these miles would be open to the public. The amount of seasonally restricted routes would increase from 329 miles to 381 miles. In addition, the ending date for the seasonal closure period for nearly all of these routes would be lengthened from March 31 to

April 15th. The existing configuration of the Paiute and Great Western Trail systems would be retained. Motorized cross-country travel would be prohibited except as specified for access and egress to dispersed camping sites, firewood-gathering areas, emergency fire suppression activities, search and rescue operations, law enforcement duties, military operations and Forest Service administrative uses.

Alternative # 4 ... the Non-Motorized Emphasis alternative combines suggestions from public comments and advocacy groups such as Utah Forest Network, Three Forests Coalition and the Utah Environmental Congress to add greater emphasis to protection of wilderness characteristics along with biological and physical resources.

This alternative adds 44 miles of unauthorized routes to and would remove 61 miles of authorized routes from the Forest's existing motorized system. About 1,113 miles of unauthorized motorized routes would be obliterated and 84 miles converted to non-motorized trail. This action would result in a system of roughly 1,926 miles of road and 196 miles of trail for a combined total of 2,122 miles of motorized routes. Of the latter total, 2,066 of these miles would be open to the public. The amount of seasonally restricted routes would decrease from 329 miles to 231 miles. In addition, the ending date for the seasonal closure period for nearly all of these routes would be lengthened from March 31 to April 15th. Removing side-trails that are located in the current inventory of unroaded and undeveloped areas would modify the existing configuration of the Paiute and Great Western Trail systems. Motorized cross-country travel would be prohibited except as specified for access and egress to dispersed camping sites, firewood gathering areas, emergency fire suppression activities, search and rescue operations, law enforcement duties, military operations and Forest Service administrative uses. Some changes in area restrictions for oversnow travel by snowmobiles are proposed to protect critical mule deer winter ranges. This particular alternative designates 0 acres in three open use areas west of Richfield, UT and 0 acres at Velvet Ridges above Torrey, UT where motorized cross-country travel would be permitted.

Alternative # 5 ... the Final, Preferred Alternative blends elements from each of the other action alternatives in response to route and area specific concerns identified by the public and through our own internal reviews. Alternative 5 fixes errors in Alternative 2, 3, and 4 that were discovered after release of the DEIS.

Alternative 5 adds 580 miles of unauthorized routes to and would remove 73 miles of authorized routes from the Forest's existing motorized system. About 635 miles of unauthorized motorized routes would be obliterated and 23 miles converted to non-motorized trail. This action would result in a system of roughly 2,181 miles of road and 639 miles of trail for a combined total of 2,820 miles of motorized routes. Of the latter total, 2,742 of these miles would be open to the public. The amount of seasonally restricted routes would increase from 329 miles to 424 miles. The ending date for the seasonal closure period that starts on January 1st would be lengthened from March 31 to April 15th. The existing configuration of the Paiute and Great Western Trail systems would be retained. Motorized travel off designated routes would be prohibited except for open - use areas, over - snow vehicles, or as specified for access to dispersed camping, firewood gathering, emergency fire suppression, search and rescue, law enforcement, military operations, and Forest Service administrative use. Some changes in area restrictions for winter travel by over - snow vehicles are proposed to protect critical mule deer winter ranges. The preferred alternative designates 690 acres in two open use areas west of Richfield, UT and 189 acres at Velvet Ridges above Torrey, UT where motorized cross - country travel would be permitted. Much like Alternative 3, Alternative 5 proposes changes to the open - use area boundary at Velvet Ridges to reduce potential for impacting sensitive plants and to make the boundary more manageable. Contrary to Alternatives 2 and 3, the most northern open

use area on the Fillmore District would be dropped in Alternative 5. The open - use areas remaining are open to motorized cross-country travel in the current travel plan.

Table # 4A – Acres of NFS lands already in Alternative 1 – or, occurring within the various Open - Use Areas being recommended by the Fishlake National Forest that would be subject to the impacts of OHVs according to the intent of the Proposed Action Alternatives

Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
910,371.5	972.5	968.9	-0-	878.7

Table # 4B – Acres of NFS lands already in Alternative 1 – or, occurring within Managed Open - Use Areas and Dispersed Camping Corridors on the Fishlake National Forest that could be affected by Designated Roads and Motorized Trails according to the intent of the Proposed Action Alternatives

Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
934,433.2	161,504.6	84,979.2	64,838.6	85,174.0

(Note) - Alternative # 1 has up to 62 percent of the Fishlake National Forest remaining open with seasonal restrictions for motorized cross-country travel from January 1st until March 31st; a few specific areas would be restricted yearlong to the routes shown under Reference Number B on the 1997 travel map to protect soils, watershed and wildlife. About 38 percent of the Forest would remain closed to all motorized vehicles. Alternatives 2, 3 and 5 would only have the two managed-use areas located at the Velvet Ridges of the Loa District and lower Flat Canyon of the Fillmore District open to OHVs for recreational purposes. All other cross-country locations would be closed to motorized traffic.

Table # 5 – Miles of Existing Roads and Trails occurring within the overall perimeter of the Fishlake National Forest which would be used for Motorized Travel according to the Various Alternatives

Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
3,539.4	2,689.9	2,713.6	2,121.6	2,819.6

(Note) - all of the numbers being presented in these interpretive tables were quantified by the FNF / GIS Staff using the new ArcView 3.3 software package; in each instance, the existing or proposed travel plans were referenced with our available GIS interpretive plots for recreation, geology and soils in order to determine the potential impacts to site productivity and hydrologic function. All of the Forest-wide / GIS coverage's used in the preparation of this report (six different themes) were subsequently made into .jpg files and printed on 8 ½ x 11 inch paper and attached to this document. The larger GIS displays that were referenced with the various alternatives of the Forest travel plan were printed on 36 x 60 inch paper and are currently being stored in the project file – a total of 24 maps.

Table # 6A – Acres of NFS lands already in Alternative 1 – or, occurring within the various Open - Use Areas being recommended by the Fishlake National Forest that would be subject to the impacts of OHVs according to

**the intent of the Proposed Action Alternatives ... these locations have a
Genuine Potential for Geologic Hazards**

Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
191,600.4	299.2	249.6	-0-	213.4

**Table # 6B – Acres of NFS lands already in Alternative 1 – or, occurring
within Managed Open - Use Areas and Dispersed Camping Corridors on the
Fishlake National Forest that could be affected by Designated Roads and
Motorized Trails according to the intent of the Proposed Action Alternatives
... these locations have a Genuine Potential for Geologic Hazards**

Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
207,517.9	44,187.5	23,035.7	17,098.0	22,632.5

(Note) – once again, 30 different geologic formations and another 9 surficial deposits were reviewed during this analysis to determine the scope of the hazard that could be associated with our existing and proposed travel plans. In some unique instances, the soil resource will directly **INHERIT** properties related to erosive conditions, deformation, salt content and percent organic matter from the surrounding rocks and geologic parent materials. While preparing this report, the following geologic formations and surficial deposits were evaluated for their potential to impact and affect the overall trafficability of motorized vehicles on cross-country terrain:

Ankareh Shale	Organic Marshes
Arapien Shale	Navajo Sandstone
Diamond Creek Sandstone	Nugget Sandstone
Eolian Deposits	North Horn Formation
Glacial Deposits	Price River Sandstone
Green River Formation	Salt Lake Sediments
Landslide Debris	Woodside Shale

The most problematic of these geologic formations is the North Horn sediments which occur on both the Fillmore and Richfield Ranger Districts. These fragile sites are subject to soil creep, slumps and rotational landslides when ground disturbances occur upon steep to very steep terrain – meaning, areas measuring > 25 percent slope.

**Table # 7 – Miles of Existing Roads and Motorized Trails occurring
on NFS lands having a potential for Geologic Hazards**

Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
915.7	718.1	719.7	548.8	732.4

(**Note**) – keep in mind, the numbers being shown in this summary table reflect 1) the existing conditions currently occurring on-the-ground and 2) all of the changes being proposed to our Forest travel plan. In this particular instance, the alternatives are being studied in relation to our **GEOLOGY** coverage in GIS. Many of the locations having concerns or actual problems for erosive conditions, puddling and compaction have already been treated with mitigation measures in order to protect the integrity of the site for vehicular traffic. Alternatives 2, 3, 4 or 5 close some of the remaining areas. Some of the information presented in this table will actually overlap with Tables 8A through 12B when the different alternatives are reviewed in comparison to our **SOIL SURVEY** coverage.

Table # 8A – Acres of NFS lands already in Alternative 1 – or, occurring within the various Open - Use Areas being recommended by the Fishlake National Forest that would be subject to the impacts of OHVs according to the intent of the Proposed Action Alternatives ... fragile areas having < 4 inches of Topsoil Development

Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
380,953.7	925.4	921.9	-0-	826.1

Table # 8B – Acres of NFS lands already in Alternative 1 – or, occurring within Managed Open - Use Areas and Dispersed Camping Corridors on the Fishlake National Forest that could be affected by Designated Roads and Motorized Trails according to the intent of the Proposed Action Alternatives ... fragile areas having < 4 inches of Topsoil Development

Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
384,778.2	49,645.7	25,025.6	18,053.8	24,375.1

(**Note**) – some of the fragile landscapes occurring on the Forest that remain susceptible under Alternative # 1 to potential resource damage in the form of topsoil displacement from motorized cross-country travel are located in the following general areas:

D1 - Fillmore District ... Church Hills, Eightmile Creek and Whisky Creek within the Canyon Mountains along with most of the eastern ½ of the Pahvant Range – especially, in areas located due west of Richfield, Utah

D2 - Loa District ... Sand Creek and Sulphur Creek located north of Torrey, Utah along with Cedarless Flats and Post Hollow located near the Mill Meadow Reservoir and most of the terrain found east of Paradise Valley

D3 - Beaver District ... some of the high mountain areas located east of Anderson Meadow, within Buck Pasture and continuing NE towards LaBaron Lake

D4 - Richfield District ... various areas located east of Salina, Utah along the Interstate – 70 transportation corridor including Cedar Mountain, Soldier Canyon, the Rocks and Little Lost Creek

Table # 9 – Miles of Existing Roads and Motorized Trails occurring on NFS lands in areas having < 4 inches of Topsoil Development

Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
1041.3	765.6	766.0	575.2	782.2

(Note) – most of our roads and trails that have been constructed in these fragile areas have had mitigation in the form of vegetative and physical measures to limit the detachment and transport of topsoil material into nearby streams and bodies of water. The vegetative measures include broadcast seeding on temporary road surfaces followed by fertilizer applications to promote new plant growth. Some of the physical measures used by our Forest to minimize soil displacement include using a limited amount of MgCl₂ treatments (i.e. Maple Hollow on the Fillmore Ranger District), out-sloping of road surfaces during maintenance operations to control water flows, using rip-rap to stabilize steep cut-slope areas, keeping road grades at < 5 percent slopes, using buffer strips to protect riparian zones and fragile wetland areas along with closing roads and trails built in areas unsuited for vehicular traffic.

Table # 10A – Acres of NFS lands already in Alternative 1 – or, occurring within the various Open – Use Areas being recommended by the Fishlake National Forest that would be subject to the impacts of OHVs according to the intent of the Proposed Action Alternatives ... upland sites having a High Potential for Erosive Ground Conditions

Erosion By	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Wind	6,365.8	1.1	0.4	-0-	0.4
Water	7,868.4	184.4	164.1	-0-	164.1

Table # 10B – Acres of NFS lands already in Alternative 1 – or, occurring within Managed Open – Use Areas and Dispersed Camping Corridors on the Fishlake National Forest that could be affected by Designated Roads and Motorized Trails according to the intent of the Proposed Action Alternatives ... upland sites having a High Potential for Erosive Ground Conditions

Erosion By	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Wind	6,621.6	2,248.7	1,168.4	919.3	1190.2
Water	2,359.0	1,069.6	686.5	407.2	679.9

(Note) – some of the fragile landscapes occurring on the Forest that remain susceptible under Alternative # 1 to potential resource damage in the form of wind and water erosion from motorized cross-country travel are located in the following general areas:

D1 - Fillmore District ... wind erosion can be a serious problem near Sixmile Wash and Whisky Creek in the Canyon Mountains; water erosion occurs on unprotected soils in Dry Wash, The Narrows, upper Goose Canyon, south of Meadow Bench and within Wide Canyon

D2 - Loa District ... wind erosion has been observed along Sand Creek, within Sulphur Hollow Draw and west of Saddle Pass near Horse Pasture; some of the sandstone benches

located east of Paradise Valley can be highly erosive during windy conditions; water can erode the shaly geologic deposits of the Velvet Ridges and the slopes located east of the Frying Pan

D3 - Beaver District ... no significant – high hazard wind and water erosion hazards occur on this Ranger District

D4 - Richfield District ... all of the problems associated with motorized vehicles and wind erosion are taking place along the eastern edge of the Old Woman Plateau in areas having soils derived from the Price River Sandstone Formation; water erosion can be a problem on unprotected soils located near Gooseberry Peak

Table # 11 – Miles of Existing Roads and Motorized Trails occurring on NFS lands having a High Potential for Erosive Conditions

Erosion By	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Wind	81.4	33.3	33.7	25.5	35.3
Water	30.3	23.6	24.3	17.7	26.6

(Note) – our Forest will continue to monitor these areas for erosive ground conditions – most are Class II transportation surfaces. If necessary, some of these roads and trails may be re-conditioned, or closed if necessary, to limit maintenance costs and prevent soil erosion losses.

Table # 12A – Acres of NFS lands already in Alternative 1 – or, occurring within the various Open – Use Areas being recommended by the Fishlake National Forest that would be subject to the impacts of OHVs according to the intent of the Proposed Action Alternatives ... areas having a High Potential for Puddling & Compaction Disturbances

Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
47,062.5	479.3	479.3	-0-	474.3

Table # 12B – Acres of NFS lands already in Alternative 1 – or, occurring within Managed Open – Use Areas and Dispersed Camping Corridors on the Fishlake National Forest that could be affected by Designated Roads and Motorized Trails according to the intent of the Proposed Action Alternatives ... areas having a High Potential for Puddling & Compaction Disturbances

Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
52,247.5	18,270.2	10,496.5	7,862.8	10,555.1

(Note) – some of the fragile landscapes occurring on the Forest that remain susceptible under Alternative # 1 to potential resource damage in the form of puddling and compaction from motorized cross-country travel are located in the following general areas:

D1 - Fillmore District ... from the Pahvant Guard Station going north across the entire ridgetop portion of the Pahvant Range – especially, in areas where the soils are derived from North Horn sediments; includes some of the terrain located within the Corn Creek drainage and near Middle Mountain along with the Flat Canyon area located west of Richfield, Utah

D2 - Loa District ... some areas located within the Solomon Basin on shaly soils or gypsiferous sites along with meadow areas located along Highway 72 near Forsyth Reservoir

D3 - Beaver District ... parts of the Clear Creek drainage located west of the Fremont Indian State Park

D4 - Richfield District ... Big Flat, Big Lake and near Koosharem Guard Station on Monroe Mountain along with Water Hollow, upper Salina Creek and parts of the Gooseberry Valley – when the soils are formed in clayey, calcareous sediments of the North Horn Formation

Table # 13 - Miles of Existing Roads and Motorized Trails occurring on NFS lands having a High Potential for Puddling & Compaction

Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
458.0	376.9	383.8	308.1	391.2

(Note) – our Forest will continue to monitor these loamy / clayey areas for any problems associated with site hydrologic function. If necessary, some of these roads and trails may be re-conditioned to promote the infiltration and subsequent percolation of water. In some instances, the damaged areas may be closed, re-shaped and re-seeded in order to limit maintenance costs and prevent a loss of water control.

Table # 14A - Acres of NFS lands already in Alternative 1 – or, occurring within the various Open – Use Areas being recommended by the Fishlake National Forest that would be subject to the impacts of OHVs according to the intent of the Proposed Action Alternatives ... locations with steep to very steep terrain having Severe Limitations for building new OHV trails - or, areas considered to be Unsuitable for cross-country travel using Motorized Vehicles

Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
356,373.0	237.4	217.1	-0-	164.1

Table # 14B - Acres of NFS lands already in Alternative 1 – or, occurring within Managed Open – Use Areas and Dispersed Camping Corridors on the Fishlake National Forest that could be affected by Designated Roads and Motorized Trails according to the intent of the Proposed Action Alternatives ... locations with steep to very steep terrain having Severe Limitations for building new OHV trails - or, areas considered to be Unsuitable for cross-country travel using Motorized Vehicles

Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
360,256.1	39,496.5	19,292.5	13,613.4	18,947.2

(**Note**) – simply stated, the purpose of this GIS display was to show the users of soil survey information some of the rugged terrain located on NFS lands that would **NOT** be suited to motorized cross-country travel using OHVs. The numbers contained in this table show ratings for vehicles crossing upland terrain in a random manner – meaning, there are no roads or trails associated with motorized use and the difficulty of building new paths and trails for OHV use. Some of the soil properties and site characteristics that were evaluated in making this GIS display included 1) soil texture, 2) percentage of rock fragments occurring at the ground surface, 3) the location of water resources – especially, with respect to flooding hazards, surface ponding and riparian / wetlands habitat, 4) depth to bedrock and the location of rock outcrop exposures, 5) percent slope of the surrounding terrain, 6) K-Factors for potential water erosion hazards and 7) Engineering Classifications according to both the Unified and AASHTO systems. (see GIS Attachment # 6 – Interpretations for ATVs on the Fishlake National Forest, page # 38 in this Specialist Report)

(**Note**) – some of the fragile landscapes occurring on the Forest that have Severe Limitations or are considered to be Unsuitable for cross-country travel using OHVs are located in the following general areas:

D1 - Fillmore District ... all of the steep and very steep slopes located within the Canyon Mountain Subsection including Fool Creek Peak, Buck Peak and Blue Mountain; most of the terrain surrounding Beehive Peak in the eastern Pahvant Range is too steep, all of the canyon walls mapped in close proximity to Corn Creek are unsuitable for OHVs and the country located east of Dog Valley Peak in the lower Pahvant Range has landscapes that present extreme hazards to experienced riders

D2 - Loa District ... certainly all of the high mountain areas containing significant amounts of rubbleland (igneous rocks of assorted sizes with angular shapes) will be unsuitable; these areas exist near Mytoge Mountain, 1000 Lake Mountain, Mt. Marvine and the Fishlake Hightop

D3 - Beaver District ... most of the subalpine areas occurring within the high peaks of the Tushar Mountains are too steep for OHVs – and, some of the sagebrush country found adjacent to Interstate – 70 along the Clear Creek drainage consists of escarpments and very steep terrain with dry ravel hazards

D4 - Richfield District ... most of the problem areas occurring on Monroe Mountain are associated with the very steep slopes surrounding Monrovia Park, occur in the canyons located NW of Signal Peak and exist within Pole Canyon found at the southern end of the subsection; some of the mountainsides found within Salina Canyon along the Interstate – 70 transportation corridor are quite steep – and, much of the bedrock-controlled terrain surrounding Little Lost Creek Canyon is too hazardous for OHV riders

(**Note**) - there is no Table **13B** in this particular instance – because, we did not evaluate existing miles of roads and trail occurring in areas considered to have Severe Limitation towards OHVs or locations deemed Unsuitable for motorized travel. There are few, if any, transportation surfaces existing in these fragile areas.

Direct and Indirect Effects. From allowing motorized use to continue with their current mode of operation and tour across NFS lands according to the Forest travel map – Alternative 1. By authorizing OHVs to operate on and off designated roads and trails and within designated open – use areas – Alternatives 2, 3, 4, and 5.

Table # 15 – Summary of Direct and Indirect Effects to the Soil Resource

associated with allowing OHVs to Travel off Roads and Trails and upon public lands administered by the Fishlake National Forest

Direct Effects	Indirect Effects
<p align="center"> soil creep / minor slumping topsoil displacement surface rutting / puddling detrimental compaction insufficient ground cover damage to biological soil crusts </p>	<p align="center"> accelerates rates of erosion impacts to hydrologic function reduces microbial populations changes in plant nutrient reserves increases invasive plants & weeds limits soil water retention </p>

As shown in the analysis tables in this report, the action alternatives reduce actual and potential resource impacts on NFS lands relative to existing conditions and would be expected to meet regional soil quality standards. As long as motorized use continues off roads, trails within open-use areas, there will be some impacts related to long-term productivity of soil resources. However, under the action alternatives, there will be fewer concerns about the overall integrity of our soil and its hydrologic function compared with Alternative # 1.

Short-Term Uses and Long-Term Productivity. In this particular instance, the short-term, but widespread use commonly associated with Alternative 1 will cause the most damage to long – term soil productivity in the form of displacement, puddling, compaction, insufficient ground cover and physical damage to the biological soil crusts when compared with the remaining action alternatives. Since the annual OHV Jamborees are such well-managed local events, ... few if any, soil impacts actually occur to NFS lands during these festivities.

Unavoidable Adverse Effects. Travel routes that are poorly planned or that are improperly maintained over time can greatly accelerate the adverse affects of soil erosion and sediment transport. The unauthorized use of OHVs on NFS lands can result in detrimental soil conditions regardless of the alternative.

The Irreversible and Irretrievable Commitment of Land Resources. The Richfield Ranger District will be working in cooperation with Federal Highways to select several locations for Recreation parking near the new Gooseberry – Sevenmile Road. If these proposed parking areas become covered with asphalt during road construction activities ... this action will be an irreversible loss of land resources. Accelerated soil erosion lost from a site can be irreversible or reduced or lost productivity can be irreversible. However, adverse impacts from route prisms can be eliminated and sites can be returned to a productive status through route obliteration or rehabilitation.

Cumulative Effects. Cumulative effects consider the combined impacts of 1) past, 2) present, 3) reasonably foreseeable along with any 4) proposed management actions. In this particular assessment, most of the **PAST** and **PRESENT** impacts were actually associated with the initial development and related maintenance of the transportation surfaces. Road construction affects wildland soils by removing and displacing topsoil layers from the road

prism along with compacting both the road surface and its adjacent shoulder areas. Both road and trail surfaces disrupt the site hydrologic processes that occur within a soil profile by restricting infiltration -- which subsequently limits the percolation of water downward into the ground. If sufficient water accumulates at the soil surface, accelerated erosion rates will occur and cause soil material to be detached and subsequently transported as sediment into nearby streams. The surface of the road will not support trees and other types of vegetation for as long as the road is being used and routinely maintained as a transportation system. Impacts from roads and trails persist until the sites are totally reclaimed, subsurface drainage patterns restored and organic litter accumulates at the ground surface once again. Right now, most of the **REASONABLY FORESEEABLE** impacts to the existing roads and trails within the project area would be related to either maintenance operations, use of motorized routes, and perhaps a potential ground disturbance related to periods of wildfire or inclement weather (e.g. spring snowmelt conditions -- such as 1983 and 1984 which could cause small slumps and landslides). Any unauthorized use by the general public could result in the issuance of a citation -- if observed by the local Law Enforcement Officers (LEOs) or seasonal Trail Rangers. Any natural wildfire disturbance of significant size affecting the transportation system would result in a temporary closure order followed by a request for emergency funding (e.g. BAER Reports) in order to stabilize the disturbance. The OHV events involve allowing 200 to 300 riders on the Fillmore Jamboree and up to 800 riders during the Rocky Mountain ATV event. In both cases ... these rides are managed by knowledgeable guides, commonly include EMTs as participants, always start with a safety briefing and the sponsor's extend themselves to communicate the message of ... Tread Lightly upon the Land. Past monitoring efforts suggest very few, if any, disturbances are associated with these events. There is really nothing related to the proposed Jamboree experience (2 weeks / year) that adversely impacts our wildland soil resource or places the event(s) in contradiction with the General Direction listed in our Fishlake National Forest / Land and Resource Management Plan. Since the proposed actions occur on existing transportation surfaces ... very few additional impacts are anticipated. Potential for cumulative impacts off routes would be reduced in the areas where motorized cross-country travel would no longer be allowed. The reasonably foreseeable and proposed actions are within the stated goals of the R4 / Soil Quality Standards and Guidelines with respect to maintaining long - term soil productivity and site hydrologic function.

Additional actions to be considered as part of the cumulative effects analysis include proposed projects for 1) fuels reduction, 2) campground reconstruction, 3) developing and repairing water systems, 4) dam reconstruction, 5) vegetation management – timber, 6) broadcast seeding, 7) building sanitary facilities, 8) thinning – timber, 9) Dixie harrow treatments, 10) geothermal leasing – pad development, 11) grazing permit reauthorizations and 12) new road construction – just to name a few items being considered by the Forest at this time (see Appendix C in the FEIS for more detail). Certainly, there is a strong likelihood that some of these projects could cause some type of soil disturbance on NFS lands. Simply stated ... if approved, each project will contain a list of mitigation measures intended to protect the soil resource from detrimental conditions. For instance, in the case of fuels reduction ... we would avoid severe burning disturbances on fragile soils and landscapes during dry ground conditions. In order to limit soil displacement on the geothermal locations ... a seed mix consisting of native and introduced grass species would be recommended to limit soil erosion losses. Much of the new road construction that might be associated with the SUFCO Mine / Quitcupah Road Project would actually occur on BLM administered lands. Most of the anticipated uses connected with these projects would occur on established transportation surfaces; these actions will not adversely affect the management of NFS lands.

Information and Education. In my opinion, all the individuals and volunteer groups working in support of sponsoring the Fillmore ATV Jamboree and Rocky Mountain ATV

Jamboree have done a tremendous job in communicating a message about **RESPECT** to the riders and guides working these events. Specifically, the Paiute ATV Committee has prepared a **TRAIL GUIDING HANDBOOK** which reminds its participants to follow this important message:

“ ... it is a privilege to use the Paiute ATV Trail and it is the user’s responsibility to maintain that privilege. By obeying the following guidelines, we can continue to enjoy this unique trail system ”

- ◆ Please obtain a map, travel only where permitted ... resist the urge to pioneer a new trail.
- ◆ Avoid running over vegetation -- including young trees, shrubs and grasses.
- ◆ Improve the trails by staying off them when they’re soft and wet.
- ◆ Use your head. Wear a helmet and other protective gear.
- ◆ Treat others with respect. Motorized vehicles should yield to non-motorized.
- ◆ Tread Lightly! Leave no trace that you were there.
- ◆ Respect property. Leave gates as you found them. Obey all closures and trail signs.
- ◆ If you enjoy the trail ... contribute to its maintenance and upkeep.
- ◆ Leave it better than you found it!

Overall, the message to the many Jamboree participants is ... have a safe and enjoyable riding experience during the scheduled events. The objective of distributing the **TRAIL HANDBOOK** material during the Rocky Mountain ATV Jamboree is to have each ride conducted in adherence with the message of Safety, Tread Lightly and maintain respect for the Paiute Trail principles.

Specialist Report Revised By:



Michael D. Smith
Soil Scientist

Fishlake National Forest

OHV / Route Designation Project

Technical Soils Report

GIS Attachments

1 – Geologic Map of the Fishlake National Forest

2 – Topsoil Thickness

3 – Potential for Wind Erosion

4 – Potential for Water Erosion

5 – Potential for Puddling & Compaction

**# 6 – ATVs ... Interpretations for Building New Trails
and allowing Motorized Cross-Country Travel on NFS
lands**

(Note) – full size maps are included with the Project File

FNF, OHV Project - GIS Attachment # 1

Geologic Map of the Fishlake National Forest

- Forest Boundary
Geologic Types
 C1 - Tintic Quartzite (34,031 Acres)
 C2 - Maxfield Limestone (24,332 Acres)
 C3 - Ajax Dolomite (13,417 Acres)
 D - Devonian Dolomite / Limestone (5,682 Acres)
 J1 - Arapian Shale (4,246 Acres)
 J2 - Morrison Sandstone (63 Acres)
 JTR - Navajo / Nugget Sandstone (46,696 Acres)
 K1 - Dakota / Cedar Mountain Sandstones (1,312 Acres)
 K2 - Indianola Conglomerate (31,055 Acres)
 K3 - Price River Sandstone (117,664 Acres)
 O - Ordovician Dolomite / Limestone (4,301 Acres)
 P1 - Diamond Creek Sandstone (2,286 Acres)
 P2 - Park City Formation (6,219 Acres)
 PCs - Precambrian Rocks of the Canyon Mountains (26,891 Acres)
 PIP - Bridal Veil Limestone (3,375 Acres)
 OT - Mixed Alluvium (479 Acres)
 Qa - Alluvium and Colluvium (218,256 Acres)
 Qao - Older Alluvial deposits (11,775 Acres)
 Qe - Eolian deposits (1,453 Acres)
 Qg - Glacial deposits (11,504 Acres)
 Qls - Landslides (54,910 Acres)
 Qm - Marshes (219 Acres)
 Qs - Mud and Salt Flats (59 Acres)
 S - Bluebell Dolomite (3,266 Acres)
 T1 - Flagstaff Limestone (89,436 Acres)
 T2 - Green River Formation (22,127 Acres)
 T3 - Crazy Hollow Formation (9,666 Acres)
 T4 - Salt Lake Sediments (46,878 Acres)
 T5 - Sevier River Volcanics (35,990 Acres)
 TK - North Horn Formation (106,531 Acres)
 TR1 - Woodside Shale (7,545 Acres)
 TR2 - Ankareh Shale (6,351 Acres)
 T1 - Tertiary intrusive rocks (3,293 Acres)
 Tmb - Basalts (3,983 Acres)
 Tmr - Rhyolites (16 Acres)
 Tmv - Miocene volcanic rocks, undivided (566,286 Acres)
 Tov - Oligocene volcanic rocks, undivided (33,395 Acres)
 Tpb - Basalts (3,035 Acres)
 Tpr - Rhyolites (2,594 Acres)

(NOTE) -- The colors and fill patterns selected for display purposes on this GIS interpretive plot are similar to those actually shown on the Geologic Map of Utah.



Prepared by Michael D. Smith and Robin I. Sorenson on 1-6-1998

5 0 5 10 15 20 Miles



Provided by the Utah Geological and Mineral Survey Using SGID Files

Compiled by Lehi F. Hintze 1980

FNF, OHV Project - GIS Attachment # 2

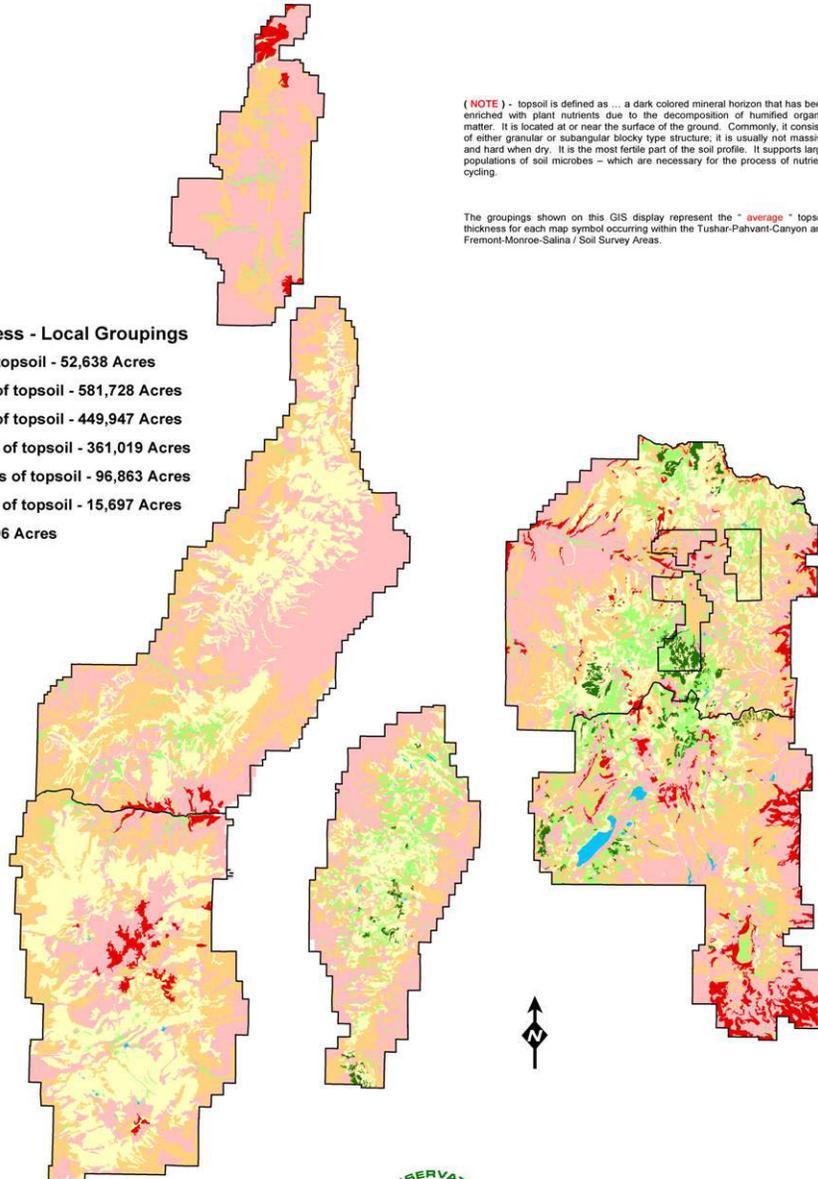
Fishlake National Forest Topsoil Thickness

Topsoil Thickness - Local Groupings

	< 1 inch of topsoil - 52,638 Acres
	1-4 inches of topsoil - 581,728 Acres
	4-7 inches of topsoil - 449,947 Acres
	7-10 inches of topsoil - 361,019 Acres
	10-16 inches of topsoil - 96,863 Acres
	> 16 inches of topsoil - 15,697 Acres
	Water - 4,696 Acres

(NOTE) - topsoil is defined as ... a dark colored mineral horizon that has been enriched with plant nutrients due to the decomposition of humified organic matter. It is located at or near the surface of the ground. Commonly, it consists of either granular or subangular blocky type structure; it is usually not massive and hard when dry. It is the most fertile part of the soil profile. It supports large populations of soil microbes - which are necessary for the process of nutrient cycling.

The groupings shown on this GIS display represent the "average" topsoil thickness for each map symbol occurring within the Tushar-Patvant-Canyon and Fremont-Monroe-Salina / Soil Survey Areas.



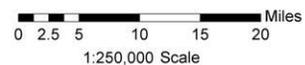
Prepared by Michael D. Smith, Wanda Bennett and Jenneka Jewkes 03/16/2004.

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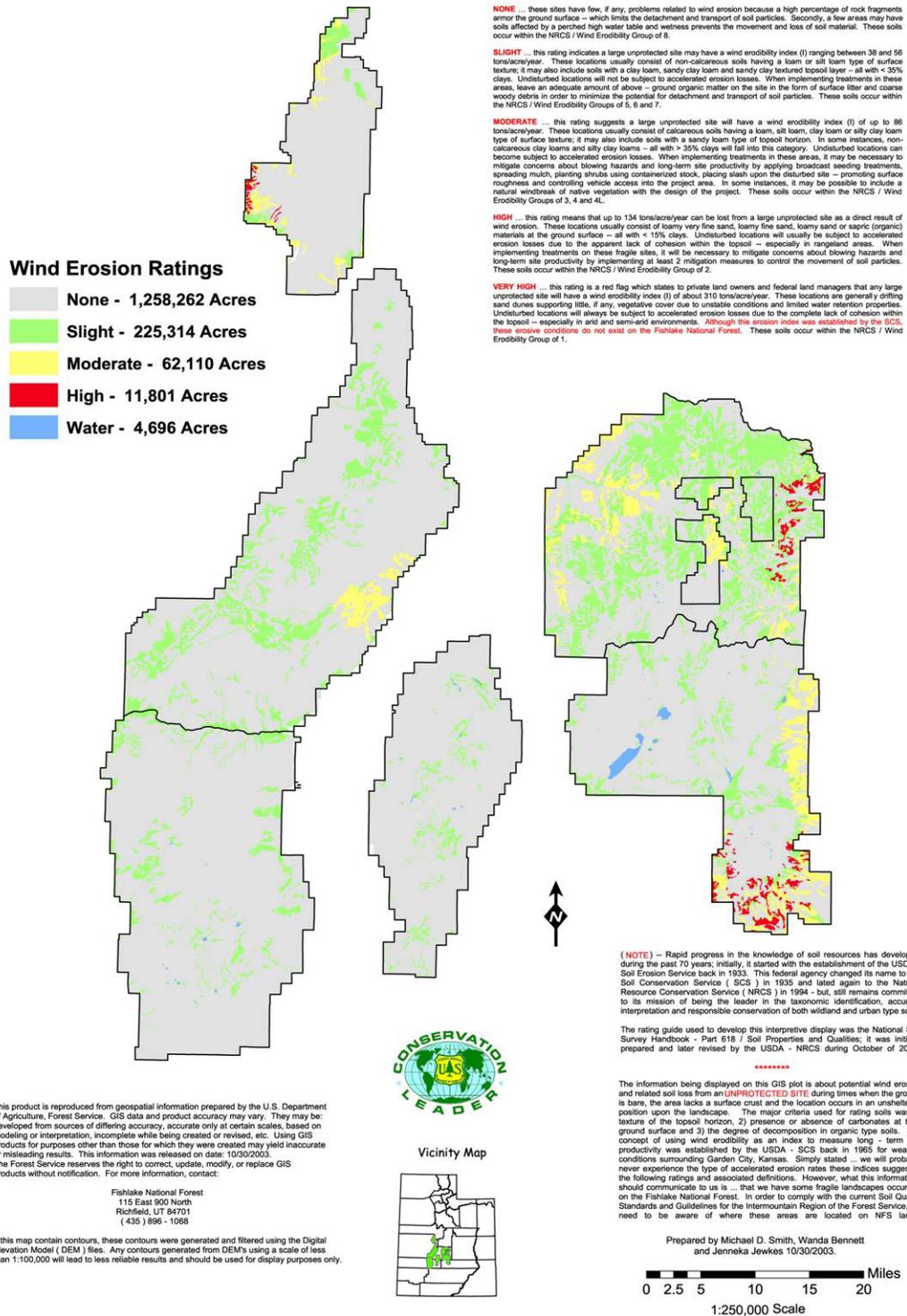
If this map contain contours, these contours were generated and filtered using the Digital Elevation Model (DEM) files. Any contours generated from DEM's using a scale of less than 1:100,000 will lead to less reliable results and should be used for display purposes only.

Vicinity Map



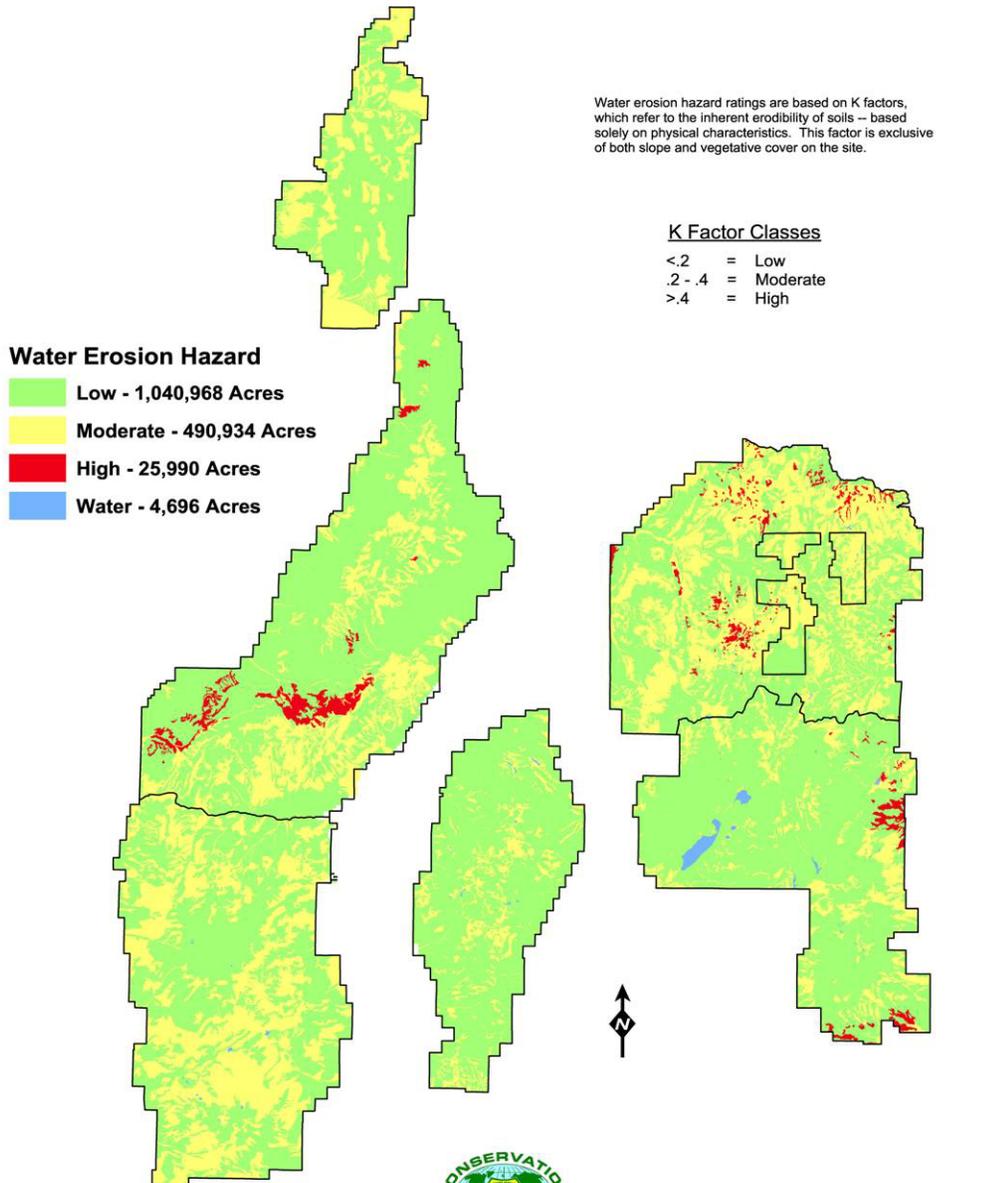
FNF, OHV Project - GIS Attachment # 3

Potential for Wind Erosion Fishlake National Forest



FNF, OHV Project - GIS Attachment # 4

Potential for Water Erosion Fishlake National Forest



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Vicinity Map

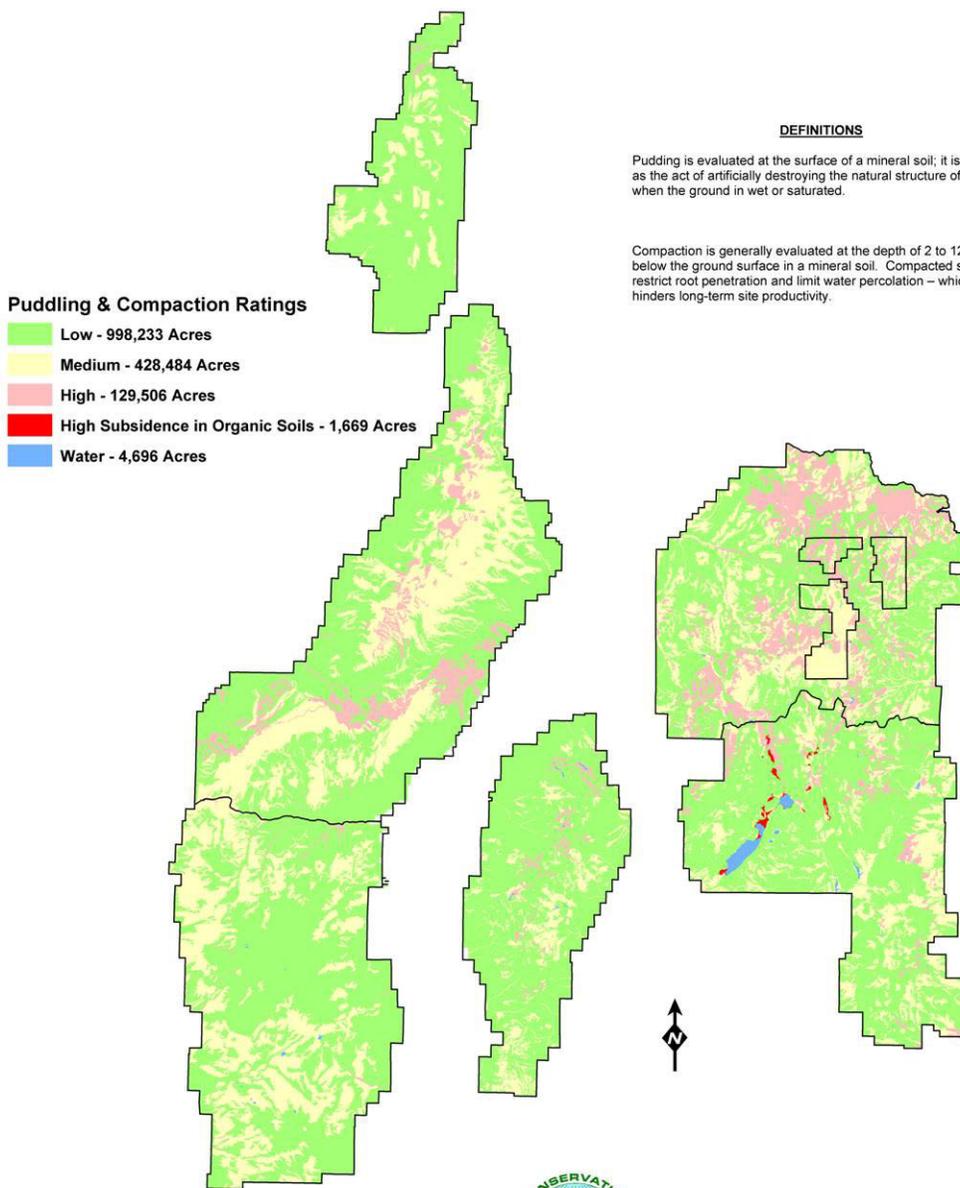


Prepared by Michael D. Smith, Wanda Bennett and Jenneka Jewkes 03/03/2005.

0 2.5 5 10 15 20 Miles
1:250,000 Scale

FNF, OHV Project - GIS Attachment # 5

Fishlake National Forest Potential for Puddling and Compaction



Puddling & Compaction Ratings

- Low - 998,233 Acres
- Medium - 428,484 Acres
- High - 129,506 Acres
- High Subsidence in Organic Soils - 1,669 Acres
- Water - 4,696 Acres

DEFINITIONS

Puddling is evaluated at the surface of a mineral soil; it is defined as the act of artificially destroying the natural structure of the soil when the ground is wet or saturated.

Compaction is generally evaluated at the depth of 2 to 12 inches below the ground surface in a mineral soil. Compacted sites restrict root penetration and limit water percolation – which hinders long-term site productivity.



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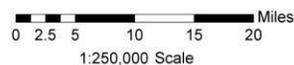
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Vicinity Map



Updated by Michael D. Smith, Wanda Bennett and Jenneka Jewkes on 03/30/2004.



FNF, OHV Project - GIS Attachment # 6

Fishlake National Forest

ATVs - Interpretations for building new trails and opportunities for operating vehicles in areas without established transportation surfaces

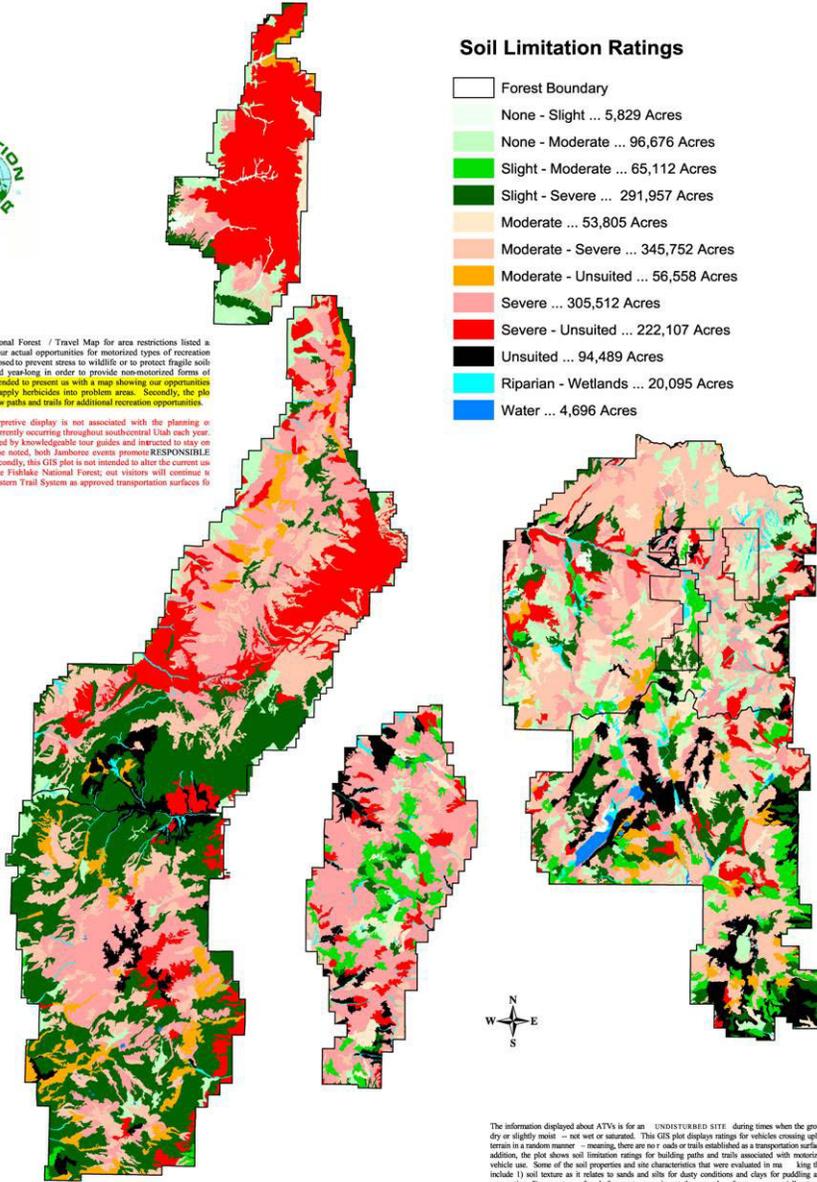


(NOTE) - Please refer to the Fishlake National Forest / Travel Map for area restrictions listed a reference numbers A, B and C to determine your actual opportunities for motorized types of recreation some areas of the Forest may be temporarily closed to prevent stress to wildlife or to protect fragile soils and watersheds. Parts of the Forest are closed yearlong in order to provide non-motorized forms of recreation for our visitors. This display was intended to present us with a map showing our opportunities for controlling noxious weeds using ATVs to apply herbicides into problem areas. Secondly, the map suggests areas that may be suited for building new paths and trails for additional recreation opportunities.

The information being presented at this interpretive display is not associated with the planning a management of the on-going ATV Jambores currently occurring throughout southcentral Utah each year. During the Jambores, visiting riders are managed by knowledgeable tour guides and instructed to stay on the existing road and trail surfaces; it should be noted, both Jambores events promote RESPONSIBLE RIDING ETHICS to their many participants. Secondly, this GIS plot is not intended to alter the current use of motorized routes previously identified by the Fishlake National Forest; our visitors will continue to utilize both the Future ATV Trail and Great Western Trail System as approved transportation surfaces for recreational travel.

Soil Limitation Ratings

- Forest Boundary
- None - Slight ... 5,829 Acres
- None - Moderate ... 96,676 Acres
- Slight - Moderate ... 65,112 Acres
- Slight - Severe ... 291,957 Acres
- Moderate ... 53,805 Acres
- Moderate - Severe ... 345,752 Acres
- Moderate - Unsuitable ... 56,558 Acres
- Severe ... 305,512 Acres
- Severe - Unsuitable ... 222,107 Acres
- Unsuitable ... 94,489 Acres
- Riparian - Wetlands ... 20,095 Acres
- Water ... 4,696 Acres



Vicinity Map

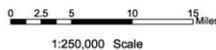


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Prepared by Michael D. Smith, Wanda Bennett,
Jenika Jenkins and Max Reed, 5/14/03



The information displayed about ATVs is for an UNDISTURBED SITE during times when the ground is dry or slightly moist - not wet or saturated. This GIS plot displays ratings for vehicles crossing upland terrain in a random manner - meaning, there are no roads or trails established as a transportation surface. In addition, the plot shows soil limitation ratings for building paths and trails associated with motorized vehicle use. Some of the soil properties and site characteristics that were evaluated in this plot include 1) soil texture as it relates to sands and silts for dusty conditions and clays for puddling and compaction, 2) percentage of rock fragments occurring at the ground surface - especially stones and boulders, 3) water resources with respect to flooding hazards, surface ponding and identifying both riparian zones and wetland habitats, 4) depth to bedrock along with the location of rock outcrop exposures, 5) percent slope of the surrounding terrain, 6) K_u - factors for water erosion on an unprotected soil surface and 7) engineering classifications according to the Unified and AASHTO Systems.

NONE ... these areas have few, if any, limitations towards using ATVs on NFS Lands or connected with building paths and trails for motorized vehicles. Most of the landscapes consist of nearly level to gently sloping terrain having few problems associated with dust, puddling, compaction, seasonal wetness, large stones, accelerated erosion, overall depth or percent slope.

SLIGHT ... this rating indicates the soil resource will not be damaged by the continued use of ATVs during dry or slightly moist ground conditions or during the building of paths and trails. These areas will maintain long-term soil productivity and site hydrologic function. Most of the terrain is moderately sloping to strongly sloping and considered to be relatively safe for a rider of normal skills and abilities.

MODERATE ... this rating suggests that soil resources may be damaged by displacement, puddling or compaction from the continued use or intensive use of ATVs. In some instances, the current standard for Soil Quality as it relates to site productivity and soil-water relationships may be violated - indicating mitigation measures would be necessary to protect the resource. Terrain can include moderately steep landscapes. Several areas will have obvious limitations for building paths and trails caused by abundant cobbles and stones, dusty conditions or eroded slopes. In some areas, the hillsides may exceed 25 percent slopes - presenting a potential hazard to the riders of ATVs.

SEVERE ... even the limited use of ATVs in these fragile areas will cause detrimental soil conditions. In some instances, the resource damage could be irreversible due to minor slumps or larger landslides. Most of the terrain is steep to very steep and commonly consists of soils that are quite clayey or less than 20 inches deep over bedrock. These landscapes present an extreme hazard to the operator of any motorized vehicle. Paths and trails are very difficult to construct due to the many restrictive features of the landscape.

UNSUITED ... most of these areas are miscellaneous land types consisting of rock outcrops, canyon walls, taluslands, badlands or landslide debris.

References

- Fishlake National Forest – GIS Plot / ATV Interpretations, 05-14-2003 developed by Michael D. Smith, Wanda Bennett and Jenneka Jewkes.
- Fishlake National Forest – GIS Plot / Geologic Map, 01-06-1998 developed by Michael D. Smith, Wanda Bennett and Jenneka Jewkes in cooperation with the Utah Geological and Mineral Survey Map of 1980.
- Fishlake National Forest – GIS Coverage / Fremont – Monroe – Salina / Soil Survey Area # 649, 1995 – 2005 ... on-going project, continues to be developed by Michael D. Smith and Wanda Bennett.
- Fishlake National Forest – GIS Plot / Potential for Water Erosion, 09-19-2002 developed by Michael D. Smith, Wanda Bennett and Jenneka Jewkes.
- Fishlake National Forest – GIS Plot / Potential for Wind Erosion, 10-30-2003 developed by Michael D. Smith, Wanda Bennett and Jenneka Jewkes.
- Fishlake National Forest – GIS Plot / Puddling and Compaction, 03-30-2004 developed by Michael D. Smith, Wanda Bennett and Jenneka Jewkes.
- Fishlake National Forest – GIS Plot / Topsoil Thickness, 03-16-2004 developed by Michael D. Smith, Wanda Bennett and Jenneka Jewkes.
- Fishlake National Forest – GIS Coverage / Tushar – Pahvant – Canyon / Soil Survey Area # 651, 1995 – 2005 ... on-going project, continues to be developed by Michael D. Smith and Wanda Bennett.

**(all 6 of these GIS plots are available for public review;
they are currently located in the OHV / Project File)**

- Biological Soil Crusts: Ecology and Management, USDI – BLM and USGS, Technical Reference 1730 – 2, 2001.
- Fishlake National Forest / Land and Resource Management Plan, 1987.
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