WildEarth GUARDIANS
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Submitted via the project webpage at: https://www.fs.usda.gov/project/?project=50218

Re: Huckleberry Landscape Restoration Project – DEIS

Dear Mr. Lannom:

WildEarth Guardians respectfully submits these comments to the U.S. Forest Service concerning the agency's Draft Environmental Impact Statement (DEIS) completed under the National Environmental Policy Act (NEPA) for the Huckleberry Landscape Restoration Project (hereafter, "project") located on the Council Ranger District of the Payette National Forest. The landscape restoration proposal includes timber harvest, thinning, prescribed burning, road management, and motorized recreation designations across 67,000 acres. We submitted timely input on the scope of the project that we incorporate by reference, (hereafter, "scoping comments").[1]

As we stated in our scoping comments, we are very encouraged to see the Payette National Forest considering ecosystem restoration on a large scale to address many of the factors that continue to degrade the area's ecological integrity, such as the deteriorating road system. Toward that end, we strongly support the use of the Payette National Forest's (PNF) 2015 Travel Analysis Report (TAR) to inform the project's analysis, and the decision to be made of identifying the Minimum Road System (MRS). Including a definitive statement in the draft Record of Decision that the project identifies the MRS and unneeded roads in compliance with the Travel Management Rule Subpart A (36 C.F.R. 212.5(b)) will put the PNF at the forefront of the agency's efforts to finally comply with the rule since it was first enacted in 2001.[2] Such a decision would be better supported if the Forest Service improved its analysis as we describe below.

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[1] See WildEarth Guardians Nov. 14, 2016 letter re: Huckleberry Landscape Restoration Project – Scoping
[2] *See* 70 FR 68288.

I. Further analysis and disclosure is necessary to identify the minimum road system.

Though we support the use of the TAR to identify the minimum road system for the project area, the Forest Service omitted the actual risk/benefit rankings for the roads in the project area. The scores and rankings were based on “...20 resource risk criteria grouped into 6 categories (Wildlife, Soils, Water Quality, Riparian, Fisheries, and Invasive Weeds) and 4 benefit criteria grouped into 3 categories (Recreation, Range, and Vegetation-Fuels)...,”(TAR at 21). Based on these scores, roads were assigned high, medium or low rankings, which agency specialist used to make recommendations for the MRS and to identify unneeded roads, (*Id.*) Yet, the PNF did not include a table in the TAR showing each road’s rankings and it deferred making recommendations for 979 miles explaining, “[s]ite specific data was not adequate to make an informed recommendation and further evaluation will be required at the project level,” (TAR at 26). The project level analysis provides another opportunity for the Forest Service to disclose each road’s risk/benefit ranking and explain the rationale for retaining or decommissioning a road under each action alternative, which is especially important for those roads where agency specialists did not make specific recommendations in the TAR.

Further, the project’s analysis should include a summary table listing how many roads in the analysis area have high, medium and low risks sorted by maintenance level (ML). This information is crucial to understanding how many roads with high or medium risks are being retained as part of the MRS. It would also show the number or roads with low benefits the PNF recommends for decommissioning. Essentially, the PNF should create a project level travel analysis report that incorporates the findings of the forest-wide TAR, updates the recommendations and lists the individual rankings for each road. At the same time, the Forest Service should reevaluate the rankings to adjust for any changed conditions, and to incorporate the better understanding of how roads intersect with wildfire. Our scoping comments provided a literature review of road effects, including studies that demonstrate increased risk of human wildlife ignitions and changes in wildfire behavior along roads, (Scoping Comments Appendix C at 29-30). The PNF TAR only identified road benefits in relation to wildfires, reflected in the project’s analysis discussing the MRS in the context of fire and fuels, (DEIS at 165). The Forest Service should disclose the risks associated with roads and wildfires, especially the increased human-caused ignitions, which would logically occur where road traffic is greater; typically the wildland urban interface.

We strongly urge the PNF to decommission all low benefit roads, especially those with high or medium risks. It may be the action alternatives achieve this goal, but the DEIS lacks the necessary information for us to provide meaningful comments on specific road recommendations, either in support or to ask for changes to the proposed action.

Under the proposed action, the Forest Service would decommission 50.9 miles of system roads, (DEIS at 52). Yet, the analysis also states 51.6 miles of system roads would be decommissioned, and after the addition of unauthorized routes to the system the total reduction would only be 42 miles, (DEIS at 390). Table 1 in Appendix 2 lists the TAR recommendations and several roads recommended for decommissioning would instead be placed in long term storage. Roads with no clear benefit after 20 years should be decommissioned.[3] At the very least, the Forest Service should explain the rationale for changing recommendations in the TAR, specifically for the following roads: FSRs 50045, 50072, 50253, 50296, 50499, and 50506. The Forest Service should also explain why it is retaining roads that the TAR indicated required site specific analysis, especially those proposed for long term storage such as FSRs 50129, 50280, and 50514. In addition, the TAR recommended decommissioning 240 miles of system roads, (194 miles of ML1 Roads, 44 miles of ML2 Roads, 2 miles of ML3 Roads), (TAR at 25). While the DEIS under Appendix 2 provided a table listing road management proposed for each action alternative, the analysis lacked sufficient discussion about how much the project would move the PNF toward achieving the MRS across the whole forest. In other words, decommissioning 50.9 miles of roads in the project area would move the PNF 21.2% closer to removing unneeded roads. The Forest Service should explain how cumulatively this helps achieve the MRS forest-wide, and if further road decommissioning in the project area is necessary to achieve the total decommissioning recommendations specified in the TAR.

Further, the project area contains 132.8 miles of unauthorized routes and under the proposed action the Forest Service would add 6 miles as system roads. We strongly oppose adding unauthorized routes to the road system, especially as several were the result of accessing dispersed campsites greater than 300 ft from the road, (DEIS at 53). This shows the dangers of the dispersed camping exemption to the prohibition on motorized cross-country travel, which we discuss further below in these comments. At the very least, the Forest Service should determine the risks and benefits of these roads and disclose them in future project analysis. The agency must also demonstrate how these additions aligns with the purpose and intent of the TMR Subpart A as we explained in our scoping comments.

Road Maintenance

Under the proposed action, the Forest Service would implement a number of road maintenance treatments “on open and closed NFS roads that are used for project activities,” (DEIS at 50). The analysis should confirm those treatments will bring each road in line with its objective maintenance level listed in their road management objectives (RMOs). Further, the Forest Service should disclose the number of roads in the analysis area that would not receive treatments and still need maintenance to meet their objective maintenance level.

Part of the reason to identify and implement a minimum road system to achieve a more affordable transportation system, one that can be properly maintained and ultimately eliminate the backlog of deferred maintenance. The Forest Service provided some good discussion of the

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[3] The Forest Service identifies roads for long term closure if they will be used after 30 years, which is much too long for the agency to make a reasoned determination, especially given the life of forest plans only last 15-20 years: “For Forest System roads needed sooner than 30 years in the future but still 15+ years out, Level One Maintenance would be the alternative treatment to a full long-term closure,” (DEIS at 257).

road maintenance costs, including disclosing the current annual backlog of $140,641 dollars, (DEIS at 390, Table 3.11-3), but the discussion should have also included the current total deferred maintenance backlog that has accumulated from past years. In addition, while the analysis provided annual maintenance costs for each ML, the discussion did not explain the PNF's capacity to perform this maintenance. In other words, what are the current and projected funding levels to meet these annual costs? Does the PNF have enough CMRD funding to perform annual maintenance or do forest officials expect the deferred maintenance backlog to increase. Ultimately this discussion is necessary to demonstrate how the MRS identified under the proposed action will reflect long-term funding expectations required under the TMR Subpart A. Unfortunately, the Forest Service acknowledges "[r]oad maintenance cost savings realized through the reduction of NFSR mileage is negligible across alternatives, 4% reduction for Alternative 2 and 2% increase for Alternative 3," (*Id.*). Such an admission begs the question of precisely how many miles would need to be removed to reflect long term funding expectations, or how much of a budget increase would be necessary to maintain the MRS under each alternative, including the No Action alternative.

Temporary Roads

Our scoping comments urged the Forest Service to consider the effects of its proposal to construct temporary roads when combined with the effects of its minimum road system. It must also consider how construction of the proposed temporary roads will detract from the purpose of TMR under Subpart A. The number of temporary roads proposed for use under Alternative 2 is significant: "[u]p to 27.0 miles of new construction and 40.5 miles of existing unauthorized routes would be used as temporary roads and obliterated after use," (DEIS at 50). While we appreciate the PNF proposes to fully recontour these temporary roads after 3 years of construction, (*Id.*), this does not relieve the agency's duty to fully analyze the potential environmental consequences from their construction, reconstruction and especially their use. Further, the project design features suggest that not all temporary roads would be removed after 3 years: "Temporary roads would be fully recontoured within 3 years of harvest unless otherwise agreed to in writing," (*Id.* at 84). The Forest Service does not provide an explanation of what may lead to retaining temporary roads, or what management status they would receive after such written agreement.

The analysis failed to adequately disclose the effects from temporary roads as compared to the use of system roads in its analysis. For example, how much sediment will the construction, reconstruction and use of these temporary roads cause in comparison to system roads. It may be that some unauthorized roads would have disproportionate risks, even with project design features, when compared with simply obliterating the road. The analysis lacks the necessary level of specificity in this regard, and thereby precludes the opportunity to provide meaningful and informed comments.

II. The Forest Service should improve the analysis of a broad array of impacts related to forest roads in its NEPA analysis.

A. Threatened, Endangered Species and other Wildlife

Our scoping comments explained the need to ensure compliance with Section 7 of the Endangered Species Act (ESA), and that the Forest Service must ensure its proposal to authorize logging that will require use of forest roads will not harm listed wildlife. Here we repeat our request that the Forest Service be transparent about any consultation process and affirmatively post all consultation documents, including any Forest Service Biological Evaluations or Assessments, any letters seeking concurrence, and any responses or Biological Opinions from FWS. Without these records, we are unable to assess the agency's analysis of impacts to wildlife in light of FWS's expert opinion.

Next we remind the Forest Service that in order to demonstrate compliance with the TMR Subpart B requirements, (see section IV. below), the Forest Service must show how additional motorized designations under the action alternatives will minimize wildlife harassment or significant disruption of wildlife habitat.[4] These requirements extend beyond the ESA focus on populations and designated critical habitat, but rather focus on all wildlife habitat that may be harmed by ORVs, and on individual wildlife that may be harassed as evidenced by increased stress, flight, or even habituation that can lead to greater levels of mortality, among others. As it stands, the Forest Service failed to provide sufficient wildlife analysis that shows compliance with the TMR Subpart B minimization criteria. For example, in regards to Canada lynx the Forest Service acknowledges "roads and/or over-the-snow trails increase the potential for human interactions, disturbance, and lynx vulnerability to trapping (O'Neil et al. 2001; Wisdom et al. 2000)," (DEIS at 195). The agency also describes second tier influences as those that may result in a take, but do not affect lynx populations. While there has been no lynx observations in the project area, (*Id.* at 196), the analysis failed to explain if the motorized designations under the action alternatives would significantly disrupt lynx habitat in the Granite and Rapid River LAUs. Such a determination must consider the increased ORV traffic that would result from the new designations. This example demonstrates the scope of analysis necessary for all wildlife species that may be affected by new off-road vehicle designations in the planning area, or affected cumulatively with existing motorized designations.

Elk is one species that may most benefit from reductions in the road system, especially if the Forest Service achieves road densities less than 2 mi/mi^2, (DEIS at 202). While the Forest Service provides a table showing changes in acres of elk security (DEIS at 232, Table 3.4-17), the alternatives analysis does not provide a table specific to elk habitat effectiveness, reductions in road density, or if the proposed action would reduce road and motorized trail densities below the 2 mi/mi^2 threshold. This is especially important because "[w]hen open roads are combined with seasonally open, closed roads, and unauthorized routes, the road density on NFS lands in the Project area increases to 3.82 miles/square mile of NFS land. We urge the Forest Service to implement a MRS that maximizes elk habitat effectiveness, and reduces road and motorized

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[4] See 36 C.F.R. § 212.55(b)(2)

trail densities below 2 mi/mi^2 in practice (i.e. with measures to preclude unauthorized motorized use).

Finally, it is important for the Forest Service to consider how each alternative affects habitat connectivity, especially for species that live in isolated pockets and need secure areas in which to travel. For example, Forest Service notes that for ESA threatened Northern Idaho Ground Squirrel there are "[t]en known colonies inside, or along, the Project area boundary. Six colonies located either adjacent to the Project area boundary, or within 5 miles of the boundary," (DEIS at 175, Table 3.4-1). The analysis also explains that off-road vehicle use and shooting have contributed to the species' decline, but does not explain how roads, motorized trails and their use affects the ability of the NIGS to migrate between pockets. Consideration of wildlife linkages should be part of the wildlife analysis for all species considered in the project analysis.

B. Watersheds

We generally support the use of the Watershed Condition Framework to disclose current conditions and measure potential improvements through the action alternatives. The DEIS explains one of the project's purposes is to "[m]ove all subwatersheds within the project area toward the desired conditions for soil, water, riparian, and aquatic resources (SWRA) as described in the Forest Plan and the Watershed Condition Framework (WCF) (USDA Forest Service 2011b) by: [r]educing overall road density, road-related sediment, and other road-related impacts across the project area; restoring riparian vegetation and floodplain…," (DEIS at 2). The Forest Service also explains, "[t]he desired conditions for this project are based upon the Forest Plan (USDA Forest Service 2003a), and the WCF (USDA Forest Service 2011b).," (*Id.* at 3). Yet, when analyzing the project's alternatives, it is unclear how the Forest Service incorporates the WCF indicators and attributes into its watershed analysis and for disclosing the environmental consequences of the project's alternatives.

The Forest Service provides a brief discussion on the intersection between the WCF, the Aquatic Conservation Strategy (ACF) and the Watershed and Aquatic Recovery Strategy (WARS), yet it is unclear how the WCF aligns with the other two strategies, (*Id.* at 214). In other words, the analysis lacks a clear crosswalk showing how all the WCF indicators and attributes align with the twenty-six watershed condition indicators (WCIs) used to assess SWRA conditions, (*Id.*) Further, the watershed analysis appears to use WCIs, specifically water quality (sediment), and hydrologic function (channel conditions, changes in peak and base flows, floodplain connectivity, and road density and location), (*Id.* at 249). The latter distinguishes road density between the subwatershed scale and RCAs. (*Id.*). Looking more closely at the measurement indicators, the Forest Services focuses on only two variables: modeled sediment and road density. This may be sufficient for the project analysis, but the Forest Service failed to explain why it did not use any of the other 26 WCIs or WCF indicators. For example, under the WCF road and trail indicator there are four attributes: open road density, road & trail maintenance, proximity to streams and mass wasting.[5] The Forest Service did not explain why the analysis only utilized the open road density thereby omitting the three other attributes. It may be that some of those attributes were included into the GRAIP-Lite Calibrated model used to predict potential sedimentation, (DEIS at 239), but the Forest Service does not explain how the model incorporates those attributes. In other words, the modeled sedimentation for each alternative does not show how many miles of road are in proximity to a stream. The same is true for the potential for mass wasting.

The distinction and omission is important because the analysis fails to demonstrate how the action alternatives improve WCF condition class scores or the indicator and attribute ratings. Specifically, the DEIS fails to show changes in WCF indicator scores or if the action alternatives will actually move the Bear, Lick or Indian Creeks classification out of their “impaired” classification. Here it is important to note that when looking closely at the WCF ratings, of the three 6th HUC watersheds, the PNF lists Bear Creek and Indian Creek as functioning at risk, and Lick Creek as impaired under the WCF, (DEIS at 14, Table 1.4-1). Yet, when looking at the WCF Interactive Map, each watershed has a 3 ranking, meaning they are impaired.[6] In fact, each has a poor rating for roads and trails. Ultimately, the Forest Service needs to show how the action alternatives will change specific scores and ratings under the WCF.

GRAIP-Lite Calibrated Model

The Forest Service explained that it utilized a fairly new model to predict potential sedimentation under each action alternative called GRAIP-Lite that was calibrated for the project analysis, (DEIS at 239). The model includes “...information about processes that are important drivers for sediment delivery, including road slope, road surface material, maintenance level (amount of use), and probability of drain-point connection (proximity to a stream),” (*Id.*). We appreciate the Forest Service developing and utilizing new tools to determine potential sedimentation from project activities, and the GRAIP Lite model includes good variables such as proximity to streams. Still, in order for the Forest Service to rely on this model, especially if it is being used to demonstrate compliance with the Clean Water Act, the analysis needs to address two major concerns with the model. First, it is unclear how the analysis incorporates road and motorized trail use. For example, the Forest Service does not estimate how many log truck loads will drive on roads or the amount of sediment that will result from the increased traffic. While the model uses road maintenance level as a proxy for the amount of use, there is a clear difference between ML 2 roads used for log hauling and those that are not utilized but still within the project area. The Forest Service needs to distinguish potential sedimentation among specific groups of roads: constructed, reconstructed, haul roads, temporary roads, and existing roads not used for log hauling. The analysis must also explain how it accounts for increased traffic from new off-road vehicle designations, which will increase use overall in adjacent areas.

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[5] See USFS. 2011. Watershed Condition Classification Technical Guide. FS-978 at 6 and 26.
[6] See https://apps.fs.usda.gov/wcatt/, and Appendix A.

Road Densities

Road density is a good indicator of watershed function when combined with other indicators, such as those in the WCF. The Forest Service explains, "[i]n the project area subwatersheds, road densities (including NFS and unauthorized routes) range from 3.2 to 5.6 miles per square mile on NFS lands and from 3.6 to 5.3 miles per square mile on all ownerships (Table 3.5-4). With respect to Forest Plan Appendix B, all subwatersheds with road densities above 1.7 miles per square mile are considered FUR," (DEIS at 247). Obviously the project area needs significant road reduction, and sadly no action alternative will achieve the 1.7 mi threshold, (DEIS at 262, Table 3.5-6). That is why we urge the Forest Service to identify more system roads for decommissioning, or at the very least disclose how many more miles would need removal to achieve the road density thresholds.

In addition, while we support including known unauthorized routes in the road density calculations, we urge the Forest Service to include a broader open road definition, specifically the one used in the WCF:

> "... the term "road" is broadly defined to include roads and all linear features on the landscape that typically influence watershed processes and conditions in a manner similar to roads. Roads, therefore, include Forest Service system roads (paved or nonpaved) and any temporary roads (skid trails, legacy roads) not closed or decommissioned, including private roads in these categories. Other linear features that might be included based on their prevalence or impact in a local area are motorized (off-road vehicle, all-terrain vehicle) and nonmotorized (recreational) trails and linear features, such as railroads."[7]

By this definition, we expect the open road densities would be much higher, but including these linear features provides a more accurate depiction of potential watershed impacts. Further, we urge the Forest Service to delineate between the categories, which is especially important for determining short term effects from temporary roads. It is also important to demonstrate how adding unauthorized roads to the system and increasing ORV designations will change open motorized route densities.

C. Aquatic Species

The need to clarify open road densities and better measure sedimentation for the watershed analysis also necessitates corresponding changes to the aquatic species analysis. Further, the WCF includes relevant indicators that may overlap with the WCI, but just as with the analysis for watershed resources, the Forest Service does not provide a crosswalk between the WCF indicators/attributes and the WCIs. The analysis also fails to show changes in the relevant WCF indicator scores or attribute ratings under each alternative. For fisheries and riparian dependent

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[7] *Id.* at 26.

species these indicators include Water Quality, Aquatic Biota Condition, Riparian/Wetland Vegetation and Aquatic Habitat. The WCIs used for the baseline project analysis include temperature, sediment/turbidity, physical barriers, large woody debris, and road density/location, (DEIS at 283, Table 3.6-2). Certainly these overlap with some of the WCF indicator attributes, but not all such as channel shape and function, and the presence of aquatic invasive species. The Forest Service needs to show the changes to each indicator and attribute for the action alternatives and compare them with the current scores and rankings.

The road density/location WCI is a good measure of RCA function, and the project analysis shows the current road densities are extremely high, with Lick Creek subwatershed being the worst with 64.7 mi/mi^2, (DEIS at 289, Table 3.6-12). Unfortunately, none of the action alternatives achieve the desired condition of having no roads in the RCA, or even lowering the ranking to functioning at risk from the current status of functioning at unacceptable risk, (DEIS at 306, Table 3.6-16). The Forest Service should include more road decommissioning to at least achieve a functioning at risk status for the RCAs in the planning area.

The Bear Creek and Indian Creek subwatersheds contain critical bull trout habitat and Indian Creek supports local bull trout populations, (DEIS at 275, 278). "Physical barriers and sediment delivery to streams are affecting fish habitat in the analysis area," (*Id.* at 280). "The ESA determination of effects for each action alternative is May Affect, Likely to Adversely Affect bull trout and critical habitat in Indian Creek and Bear Creek drainages, (*Id.* at 307). The determination is due in part to culvert replacement, which we fully support and realize short term effects may result, but minimized by project design features. Still we have concerns with the Forest Service's assertion that analysis and disclosure of the project's effects adequately addresses those effects on PCEs:

> "Bull trout critical habitat includes nine Physical or Biological Features (PBFs, formerly Primary Constituent Elements or PCEs) (75 FR 63898). A crosswalk was developed by Nelson (2011) that links the PBFs and the Forest Plan WCIs described in the baseline and the matrices. Nelson demonstrated how analysis and disclosure of project effects and using the effects matrix adequately addresses effects on PCEs."

The Forest Service needs to better explain how disclosure addresses effects on the nine PBFs, and list actions in each alternative that will improve those features.

D. Climate Change and Project Design Features

Our scoping comments explained the Forest Service should consider the impacts of climate change and the resulting cumulative impacts from the project in the context of changing climate conditions. The Forest Service provided some limited discussion of climate change in the project's analysis citing the Intermountain Region's climate vulnerability assessment (DEIS at 24). Yet, the project's analysis failed to adequately incorporate the assessment's findings and recommendations into the action alternatives. This omission is especially concerning given the number of roads the Forest Service proposes to retain as the MRS and its reliance on project design features to mitigate much of the proposed action's harmful environmental consequences. The following excerpts provide context for our concerns:

- "Warmer locations will experience more runoff in winter months and early spring, whereas colder locations will experience more runoff in late spring and early summer. In both cases, future peakflows will be higher and more frequent," (Halofsky et al. 2018 at ii.)

- "The frequency and extent of midwinter flooding are expected to increase. Flood magnitudes are also expected to increase because rain-on-snow-driven peak flows will become more common," (*Id.* at 83).

- "Roads and other infrastructure that are near or beyond their design life are at considerable risk to damage from flooding and geomorphic disturbance (e.g., debris slides). If road damage increases as expected, it will have a profound impact on access to Federal lands and on repair costs. Trails and developed recreation sites may also be sensitive to increased flooding and chronic surface flow, especially in floodplains," (*Id.* at viii)
    - "Primary adaptation strategies focus on...increasing resilience of the transportation system to increased disturbances (especially flooding), **and ensuring that design standards are durable under the new conditions imposed by a warmer climate,** " (*Id.*, emphasis added).

    - "Adaptation tactics include improving roads and drainage systems to survive higher peak flows and more flooding, conducting risk assessments of vulnerable roads and infrastructure, decommissioning roads where appropriate, documenting seasonal traffic patterns, emphasizing potential increases in extreme storm events when evaluating infrastructure inventory, fireproofing of buildings, and coordinating with partners whenever possible." (*Id.*)

The Forest Service established widths for Riparian Conservation Areas (RCAs) and explained "[i]nput on treatment design would be given by the District hydrologist and/or fisheries biologist to ensure all riparian functions are maintained or improved, as required by Forest Plan Standard SWST01 (USDA Forest Service 2003a)," (DEIS at 40). The PNF needs to explain how it considered increased runoff and flooding from climate change when establishing these RCA distances, as well as for ensuring the effectiveness of buffer strips. The Forest Service explains, "[f]or preventing sediment delivery via overland flow (sheet erosion) from road fill slopes on basalt-derived soils, they reported that buffer strips of 35 to 127 feet were capable of trapping 83.5% of sediment; adding 60 feet in length to those resulted in 97.5% efficiency," (DEIS at 254). The Forest Service should ensure the effectiveness of these buffer strips in the context of climate change if it is going to rely on them to mitigate potential sedimentation.

Given the Forest Service's reliance on project design features to mitigate harmful environmental consequences under the action alternatives, (DEIS at 72), the agency needs to show these features will still be effective given the changes in flooding, snowmelt and runoff noted in the climate vulnerability assessment. This is especially true of PDFs/mitigation measures rated moderately effective, but also of those considered highly effective where their purpose is to control sedimentation and erosion such as PDFs #21 and #67, (*Id.* at 85 and 103).

III. Improve Roadless Character and better analyze effects

The proposed action includes a number of road and trail management activities within Inventoried Roadless Areas (IRAs) and we support the proposed actions that will address deteriorating trail conditions and improve the area's roadless character. For example, we fully support converting 1.2 miles of Trail 226 within the Rapid River IRA to a non-motorized designation. In fact, a number of motorized trails exist in the Idaho's IRAs, and the PNF should take this opportunity to further improve roadless characteristics by eliminating motorized use, which is incompatible with maintaining many roadless characteristics.

The Forest Service notes the establishment of several unauthorized routes in the project's IRAs, and all of these should be fully obliterated, or treated to prevent future illegal motorized use. For example, 2 miles of unauthorized routes within the Indian Creek IRA would be abandoned, (DEIS at 59), but the Forest Services failed to explain how these routes were established and if their current condition is such that would prevent future motorized use. Typically, roads and trails need effective barriers to prevent unauthorized use and recontouring the first 500 ft is an alternative to abandonment.

Roads undermine the purposes and character of IRAs, and as such we urge the Forest Service to decommission all roads with the IRAs. In particular, 1.4 miles of NFS Road 50072 in the Indian Creek IRA would be placed in long term closure under the proposed action, (DEIS at 59), but the TAR recommends this road be decommissioned, (DEIS, Appendix 2 Table 1 at 4). The DEIS failed to sufficiently explain why this road would be necessary or what treatments would be effective to prevent unauthorized use, which is especially important given the purpose of the closure is to stop illegal ORV driving, (DEIS at 59). We urge the Forest Service to decommission 3.4 miles of FSR 50072.

The Idaho Roadless Rule lists resources and features indicative of Roadless Areas, and these characteristics provide a useful basis for analyzing project actions proposed in IRAs. These include the following:

(1) High quality or undisturbed soil, water, and air;

(2) Sources of public drinking water;

(3) Diversity of plant and animal communities;

(4) Habitat for threatened, endangered, proposed, candidate, and sensitive species, and for those species dependent on large, undisturbed areas of land;

(5) Primitive, semi-primitive nonmotorized, and semi-primitive motorized classes of dispersed recreation;

(6) Reference landscapes;

(7) Natural appearing landscapes with high scenic quality;

(8) Traditional cultural properties and sacred sites; and

(9) Other locally identified unique characteristics.

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Instead of using IRA characteristics in the project's analysis, the Forest Service used a set of wilderness characteristics from its handbook, (DEIS at 369). It may be that some specific characteristics of the two lists align, but certainly not all. While it is important to know if the project will continue to allow uses that may preclude future wilderness designation, the central question is if the action alternatives will reduce roadless character. The wilderness evaluation does not serve as an effective proxy for evaluating IRAs, especially for specific characteristics such as reference landscapes, which will be increasingly important in the context of climate change. For IRA characteristics not addressed through the wilderness evaluation, the Forest Service states "[t]he analysis for the effects on other roadless resource attributes, such as water resources, soils, and wildlife habitat, are found in other sections of this document," (DEIS at 370). Yet, in each of these resource sections, the DEIS lacks any section dedicated to describing IRAs, their corresponding characteristics pertinent to the resource section, or the impacts from each alternative. Such analysis is necessary to support the Forest Service statement.

IV. The DEIS fails to demonstrate new motorized trail designations and existing area designations satisfies the minimization criteria.

The proposed action includes new trail designations for off-road vehicle use, and the Forest Service fails to demonstrate their compliance with the TMR Subpart B criteria that we discussed in our scoping comments.[8] This is especially concerning in regards to designating 9.4 miles of unauthorized routes for motorized recreation, (DEIS Appendix 2, Table 1). Use on these routes is illegal, and under the proposed action, the Forest Service is rewarding rogue behavior by designating them as motorized trails. The appropriate response is to obliterate these unauthorized routes and recontour them to the original slope. Anything less is an advertisement to lawbreakers that repeated illegal activity is acceptable, which will only encourage future creation and use of unauthorized routes.

Further, 6 miles of unauthorized routes would be added to the Forest Service road system and that "[s]everal of the routes added provided access to dispersed camping sites and were longer

[8] See Scoping Comments at 10 discussing compliance with 36 C.F.R. § 212.55(b).

than 300 feet from a System road," (DEIS at 53). The creation of these unauthorized routes demonstrates the harm and enforcement failures that results from allowing cross-country motorized travel for dispersed camping. The PNF should recognize the exemption is unmanageable, and reevaluate the blanket allowance in the project area. We recommend eliminating the dispersed camping exemption altogether, and only allow roadside parking with one car length distance from the side of the road. To be clear, we do not propose eliminating dispersed camping, or even rehabilitating dispersed campsites; we support non-motorized access for dispersed camping where those sites are not causing ecological damage. Given the establishment of unauthorized routes as a result of the dispersed camping exemption (0.1 mile of which is in the RCA), the Forest Service needs to demonstrate how continuing to allow cross-country travel within 300 ft of a designated road and trail meets the minimization criteria. This is especially true in ecologically sensitive areas such as RCAs, and where decommissioned roads intersect with open roads. Here the proposed action would continue to allow the 300 ft dispersed camping exemption, which could result in illegal use of the decommissioned road and further pioneer authorized routes at these intersections, (DEIS at 56). The Forest Service should clarify dispersed camping at such intersections is "walk-in" only in its final project decision. In Appendix B we provide best management practices the Forest Service should consider when designating roads, trails and areas for ORV use.

Conclusion

The Forest Service has an opportunity to identify and implement an MRS that will truly restore watershed conditions, improve wildlife habitat and overall help the agency achieve a more ecologically and economically sustainable system. To do so however requires significantly more road decommissioning, especially within RCAs. We urge the agency to further consider and identify more unneeded roads.

Cordially,

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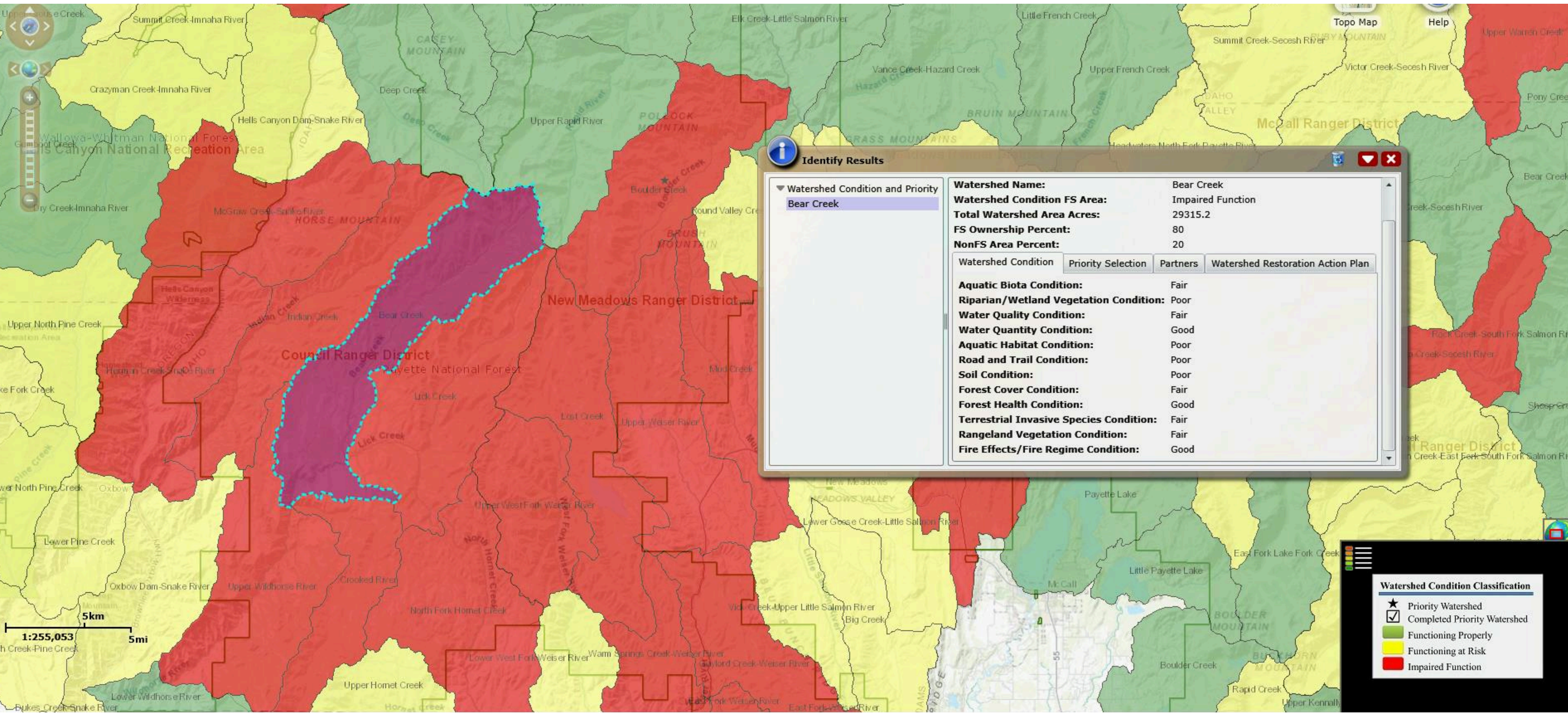
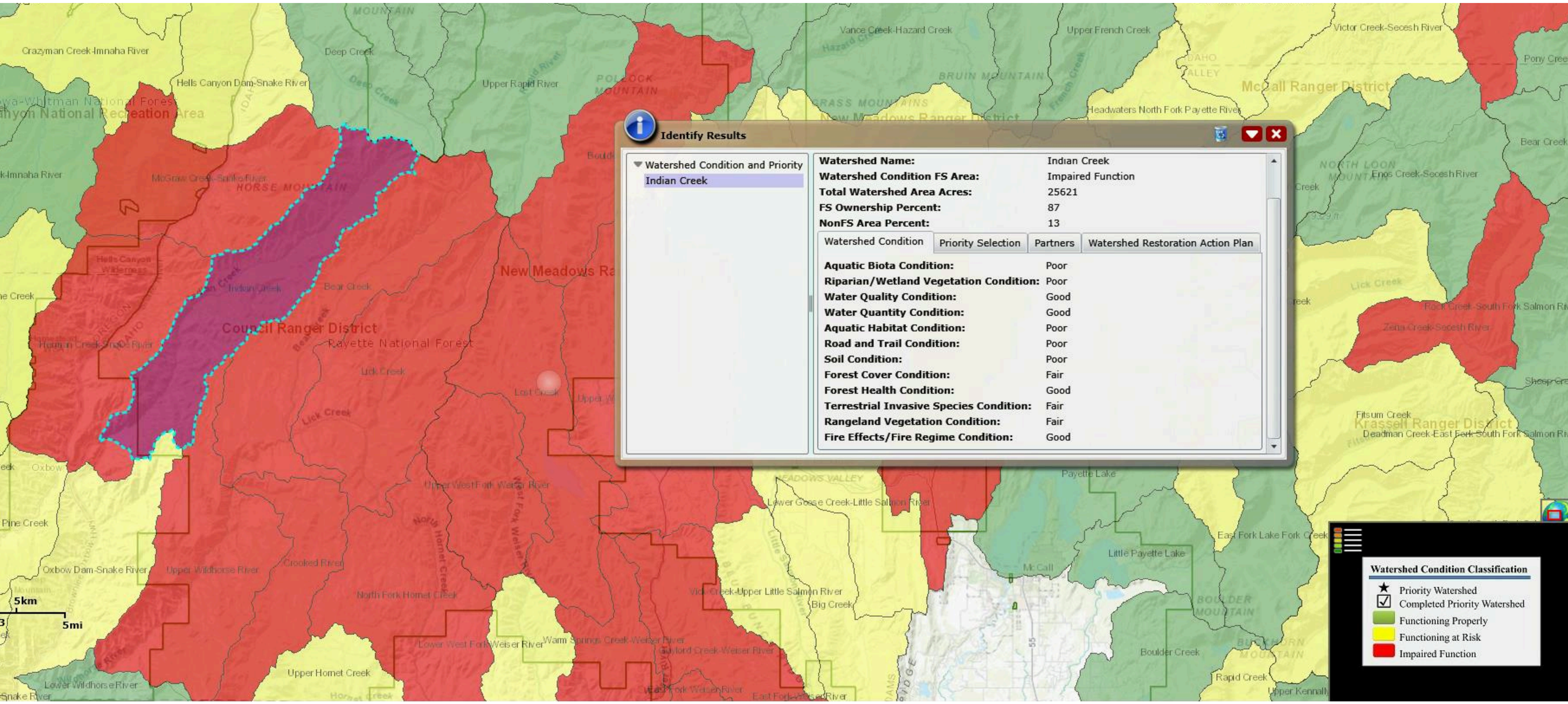
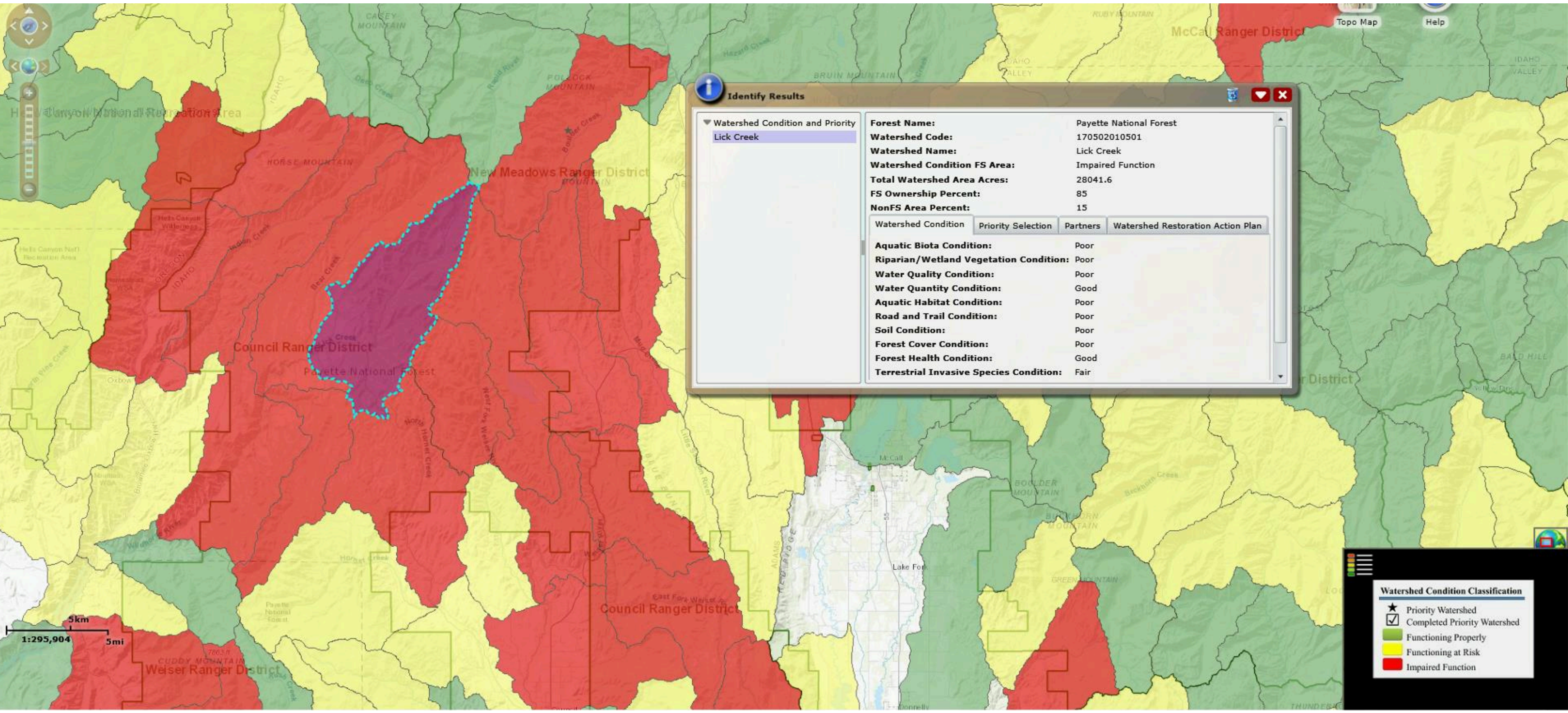
Attachment A: Watershed Condition Framework Maps, Condition Class Score and Indicator Rankings for the Bear Creek, Indian Creek and Lick Creek Subwatersheds.

Attachment B: Switalski, T. A. and A. Jones, *Off-road vehicle best management practice for forestlands: A review of scientific literature and guidance for managers*, J. Cons. Planning 8:12-25 (2012).



Identify Results
Watershed Condition and Priority
Bear Creek
Watershed Name: Bear Creek
Watershed Condition FS Area: Impaired Function
Total Watershed Area Acres: 29315.2
FS Ownership Percent: 80
NonFS Area Percent: 20
Watershed Condition
Priority Selection
Partners
Watershed Restoration Action Plan
Aquatic Biota Condition: Fair
Riparian/Wetland Vegetation Condition: Poor
Water Quality Condition: Fair
Water Quantity Condition: Good
Aquatic Habitat Condition: Poor
Road and Trail Condition: Poor
Soil Condition: Poor
Forest Cover Condition: Fair
Forest Health Condition: Good
Terrestrial Invasive Species Condition: Fair
Rangeland Vegetation Condition: Fair
Fire Effects/Fire Regime Condition: Good
Watershed Condition Classification
Priority Watershed
Completed Priority Watershed
Functioning Properly
Functioning at Risk
Impaired Function
Topo Map
Help
New Meadows Ranger District
Council Ranger District
McCall Ranger District
Payette National Forest
Bear Creek
Payette Lake
Little Payette Lake
1:255,053
5km
5mi


Identify Results
Watershed Condition and Priority
Indian Creek
Watershed Name: Indian Creek
Watershed Condition FS Area: Impaired Function
Total Watershed Area Acres: 25621
FS Ownership Percent: 87
NonFS Area Percent: 13
Watershed Condition
Priority Selection
Partners
Watershed Restoration Action Plan
Aquatic Biota Condition: Poor
Riparian/Wetland Vegetation Condition: Poor
Water Quality Condition: Good
Water Quantity Condition: Good
Aquatic Habitat Condition: Poor
Road and Trail Condition: Poor
Soil Condition: Poor
Forest Cover Condition: Fair
Forest Health Condition: Good
Terrestrial Invasive Species Condition: Fair
Rangeland Vegetation Condition: Fair
Fire Effects/Fire Regime Condition: Good
Watershed Condition Classification
Priority Watershed
Completed Priority Watershed
Functioning Properly
Functioning at Risk
Impaired Function
Council Ranger District
Payette National Forest
New Meadows Ranger District
McCall Ranger District
Krassel Ranger District
5km
5mi


Identify Results
Watershed Condition and Priority
Lick Creek
Forest Name: Payette National Forest
Watershed Code: 170502010501
Watershed Name: Lick Creek
Watershed Condition FS Area: Impaired Function
Total Watershed Area Acres: 28041.6
FS Ownership Percent: 85
NonFS Area Percent: 15
Watershed Condition
Priority Selection
Partners
Watershed Restoration Action Plan
Aquatic Biota Condition: Poor
Riparian/Wetland Vegetation Condition: Poor
Water Quality Condition: Poor
Water Quantity Condition: Good
Aquatic Habitat Condition: Poor
Road and Trail Condition: Poor
Soil Condition: Poor
Forest Cover Condition: Poor
Forest Health Condition: Good
Terrestrial Invasive Species Condition: Fair
Watershed Condition Classification
Priority Watershed
Completed Priority Watershed
Functioning Properly
Functioning at Risk
Impaired Function
Topo Map
Help
McCall Ranger District
New Meadows Ranger District
Council Ranger District
Council Ranger District
Weiser Ranger District
Payette National Forest
Lake Fork
McCall
5km
5mi
1:295,904

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Off-road vehicle best management practices for forestlands: A review of scientific literature and guidance for managers

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ABSTRACT: Management of off-road vehicles (ORVs) on forestlands has become increasingly challenging as various user groups compete for a finite amount of land on which to recreate. Additionally, no uniform methods exist for managing ORVs in forests to reduce their impacts to the environment and lessen conflicts with other user groups. The objectives of this paper are to review recent research on the environmental and social effects of ORVs in forested landscapes, and based upon the best available science, propose Best Management Practices (BMPs) for forestlands to help minimize ORV impacts. We found extensive scientific literature documenting the physical and ecological effects of ORVs in forestlands, ranging from soil compaction to non-native plant dispersal. Many species of wildlife are also affected by ORV use through direct and indirect mortality, disturbance and cumulative loss of habitat. Conflict with non-motorized users has been documented as well, resulting in diminished recreational experience and displacement of quiet users. The BMPs presented here for ORV management and monitoring in forestlands should help managers provide opportunity for motorized recreation while protecting natural resources and reducing user conflicts.

Keywords: Off-road vehicle, ORV, Best Management Practices, BMPs, erosion, stream sedimentation, invasive species, wildlife disturbance, user conflicts

INTRODUCTION

Management of outdoor recreation including off-road vehicles (ORVs) use is becoming increasingly challenging as more people recreate on public and private forestlands. Technological advances have given ORVs more power and control, allowing even beginners to access remote wildlands. This has increased the popularity of riding ORVs, and the potential for impacts on natural resources and conflicts between off-roaders and non-motorized forest visitors. The environmental and social impacts of their use have been well documented in hundreds of research articles, extensive literature reviews (e.g., Joslin and Youmans 1999, Schubert and Associates 1999, Gaines et al. 2003, Davenport and Switalski 2006, Ouren et al. 2008) and books (e.g., Knight and Gutzwiller 1995, Liddle 1997, Havlick 2002). While the majority of research on this topic has focused on arid locations (e.g., Webb and Wilshire 1983) and more recently beach environments (e.g., Lucrezi and Schlacher 2010), many recent studies have also addressed ORV use in forested landscapes.

Best Management Practices (BMPs) provide science-based criteria and standards that land managers follow in making and implementing decisions about human uses and projects that affect natural resources. BMPs are usually developed for a particular land use and are based on ecological considerations, legal obligations and pragmatic experience, and should be supported by the best available scientific knowledge. Several states have adopted ORV management plans, policies or strategic plans (e.g., Michigan Department of Natural Resources 2008, California State Parks 2009, Arizona State Parks 2010) and trail design, and construction and maintenance manuals have been written (e.g., Wernex 1994, Meyer 2002, Crimmins 2006). Unfortunately, no consistent broad-based guidelines have been developed for planning, implementing and monitoring off-road vehicle use on forestlands based on ecological considerations. In addition, most of the state plans and policies, and design and construction manuals, tend to consider ORV trail and forest road design, management, maintenance and monitoring from a viewpoint centered around legal and administrative stipulations, user needs and desires, and avoiding soil erosion. It is very seldom that such state plans or design and construction manuals take a more ecological or holistic viewpoint in deciding where to site trails, or one that stresses consideration of multiple natural resources.

This paper reviews recent scientific literature on ORV effects on forestlands, and based upon the best available science, proposes Best Management Practices (BMPs) to aid land managers in travel planning or in any decision-making process related to off-road vehicle management on forested lands. Each section reviews research on a key resource impact of ORVs, and is followed by a list of BMPs for planning and decision-making, implementation and monitoring to mitigate the impact. These BMPs will help transportation managers place ORV routes in areas where they can be enjoyed by motorized recreationists while minimizing harm to the environment and reducing user conflicts.

Off-road vehicle BMPs can be easily used by a manager who wants to incorporate science into creating an ecologically and socially sustainable route system. For example, research has found that the risk of stream sedimentation and negative impacts on aquatic habitat are highest at stream crossings. Thus, we propose the BMP to choose route locations with the fewest number of stream crossings when planning a route. In another example, research found that ORVs cause disturbance in a number of wildlife species. Accordingly, our BMP recommends setting levels of acceptable disturbance that are compatible with maintaining species viability. Furthermore, studies have found that closing routes benefits plant and wildlife populations. We further recommend that routes be closed and restored if there is an unacceptable impact to the resource.

This paper is an abridged and updated version of our original report, *“Best Management Practices for Off-Road Vehicle Use on Forestlands,”* available online at: http://www.wildlandscpr.org/ORV-BMPs. These BMPs have already been used during environmental analyses for travel management planning on many national forests (e.g., USDA FS 2009, USDA FS 2010, USDI BLM and USDA FS 2010). For example, the Ashley National Forest found them to be useful to fill information gaps and supplement existing direction (USDA FS 2009). Additionally, the Forest Service has recently included these Best Management Practices for reference in its report, *“Comprehensive Framework for Off-Highway Vehicle Trail Management”* (Meyer 2011). This official Forest Service document will be widely used in all future efforts to manage off-road vehicle use on national forest lands.

METHODS

To identify the most current research on off-road vehicles, we searched an online bibliographic database of over 20,000 citations documenting the physical and ecological effects of roads and off-road vehicles (http://www.wildlandscpr.org/bibliographic-database-search). First completed in 1995, this database is updated every two years by Wildlands CPR by systematically searching for literature related to roads and motorized recreation. The database contains a variety of scientific and "grey" literature including journal articles, conference proceedings, books, lawsuits, and agency reports. The database was most recently updated in 2010 using an established protocol that systematically searches 13 ecological and scientific databases. Seventeen primary keywords/descriptors were used to identify research on any road, highway, or ORV effect (positive or negative) on ecosystems, wildlife, and natural resources. Each primary keyword was used alone and in Boulian combination with 89 descriptor words and phrases. Each secondary keyword was used alone and in Boulian combination with primary keywords and other descriptor words and phrases (for a list of keywords please contact lead author).

Review of the Literature and Best Management Practices

We found extensive research on the effects of off-road vehicles (ORVs) on natural resources. Several studies published in the 1970s first documented the effects of ORVs on soils in the California desert. A flurry of studies followed resulting in the first book dedicated to this topic, *Environmental Effects of Off-Road Vehicles – Impacts and Management in Arid Regions* (Webb and Wilshire 1983). As ORV popularity expanded beyond the California deserts, so did research examining its effects around the globe. Impacts on streams, vegetation, and wildlife have come to the forefront of research, as have other ecosystems such as beach environments and forestlands - the primary focus of this review.

Soil Compaction and Erosion Research

Weighing several hundred pounds, ORVs compress and compact soil, reducing the absorption of water into the soil, resulting in increased flow of water across the ground (Sack and da Luz 2003, Meadows et al. 2008). This surface flow increases erosion of soils and can also add sediment to streams (Chin et al. 2004, Ayala et al. 2005, Welsh 2008), which degrades water quality, buries fish eggs, and generally reduces the amount and quality of aquatic habitat (Newcombe and MacDonald 1991).

In ORV use areas, soil erosion is accelerated directly by the vehicles, and indirectly by increased runoff of precipitation and by creating conditions favorable to wind erosion. Knobby and cup-shaped tires that help ORVs climb steep slopes are responsible for major direct erosional losses of soil. As the tire protrusions dig into the soil, forces far exceeding the strength of the soil are exerted, resulting in a "rooster tail" of soil and small plants thrown behind the vehicle. In an Ohio forest, Sack and da Luz (2003) measured erosional losses in high-use ORV areas as high as 209 kg/m^2. Meadows et al. (2008) found that ATV trails on U.S. Forest Service lands on average produced 10 times more sediment that undisturbed soils. It has also been demonstrated experimentally that sediment loss increases with increased ORV traffic (Foltz 2006), and the greatest sediment yields occur when trails are wet (Wilson and Seney 1994).

Most soils are vulnerable to compaction and erosion due to several factors. An analysis of more than 500 soils at more than 200 sites found that virtually all types of soils are susceptible to ORV damage (Schubert and Associates 1999). Clay-rich soils, while less sensitive to direct mechanical displacement by ORVs, have higher rates of erosion than most other soil types, and when compacted, produce a strong surface seal that increases rainwater runoff and gullying. Sandy and gravelly soils are susceptible to direct excavation by ORVs, and when stripped of vegetation, are susceptible to rapid erosion – usually by rill and gully erosion.

ORV impacts on forest soils are compounded by the loss of vegetation following ORV use. Stable vegetation keeps soil in place; once anchoring vegetation is removed, soil erosion increases. When vehicles damage or uproot plants, exposed soils easily become wind-blown or washed away by water. Wilshire et al. (1978) first described the direct effects of ORVs on vegetation, such as crushing and uprooting of foliage and root systems, as well as the indirect effects caused by the concomitant erosion. The indirect effects include undercutting of root systems as vehicle paths are enlarged by erosion, creation of new erosion channels on land adjacent to vehicle-destabilized areas due to accelerated runoff or wind erosion, burial of plants by debris eroded from areas used by vehicles, and reduction of biological capability of the soil by physical modification and stripping of the more fertile upper soil layers. Biological soil crusts (commonly found in deserts, but also present in some forestlands) are particularly sensitive to wind erosion following ORV use and take decades to recover (Belnap 2003).

Stream Sedimentation Research

While driving on roads has long been identified as a major contributor to stream sedimentation (for review see Trombulak and Frissell 2000), recent studies have found ORV use on trails to be a significant source of fine sediment in streams (Chin et al. 2004, Ayala et al. 2005, Welsh 2008). Stream sedimentation greatly degrades aquatic habitat (Newcomb and MacDonald 1991). For example, Chin et al. (2004) found that in watersheds with ORV use streams contained higher percentages of sands and fine sediment, lower depths and lower volume – all characteristics of degraded stream quality.

While forest roads often have greater erosion potential, ORV routes often lack culverts or bridges at stream crossings, and users often simply drive across creeks. By fording creeks, sediment is released into the water by several mechanisms including: 1) concentration of surface runoff through the creation of wheel ruts, 2) exposed surfaces from the existence of tracks, 3) increased runoff from soil compaction, 4) vehicle backwash, and 5) undercutting of banks from waves (Brown 1994). A modeling exercise found that the average annual sediment yield from one ORV stream crossing in Alabama could reach 126.8 tons/ha (Ayala et al. 2005). Another study in Colorado found that ORV trails produced six times more sediment than unpaved roads and delivered 0.8 mg/km^2 of sediment to the stream network each year (Welsh 2008). Coe and Hartzell (2009) recently reported that the well-traveled Rubicon jeep trail in California's Sierra Nevada Mountains had rates of stream sedimentation 50 times higher than adjacent forest roads.

Best Management Practices for soils

PLANNING AND DECISION-MAKING BMPS FOR FOREST SOILS

- Do not locate routes in areas with highly erodible soils.
- Locate routes only in areas with stable soils; avoid locating routes in areas with biological crusts.
- Do not locate routes to climb directly up hillslopes. Route grades should be kept to a minimum and not exceed an eight degree (15 %) grade.
- Do not locate routes above treeline or in other high elevation areas that are ecologically significant and/or especially prone to erosion.
- Locate routes a minimum distance (as listed below) from waterbodies and wetlands:
    - Fish-bearing streams and lakes – 91 m (300 ft)
    - Permanently flowing non-fish-bearing streams – 46 m (150 ft)
    - Ponds, reservoirs, and wetlands greater than one acre – 46 m (150 ft)
- Do not designate new routes requiring stream crossings and prioritize closure, re-routing or creating bridge crossings for existing routes that have stream crossings.
- Do not locate routes in areas with soils contaminated by mine tailings, or mine tailings reclamation sites, at least until they are recovered, fully stable and able to sustain safe ORV usage. If route construction is necessary, reclamation activities should be completed prior to route construction.
- Close and restore routes that cause high levels of erosion (e.g., raise sedimentation above Total Maximum Daily Loads (TMDL) and reduce native fish population potential).
- Require all motorized camping to occur in designated campsites. Reclaim undesignated motorized camping sites.

IMPLEMENTATION BMPS FOR FOREST SOILS

- Identify the type or types of soil and steepness in the area that is being affected by ORVs and use this information to prioritize mitigation efforts and create target management objectives to minimize erosion.

- Identify where waterbodies and wetlands are located, where routes cross them, and whether fish are present.
  - Prioritize stream crossing closures and route relocations, and if necessary, determine appropriate sites for upgrades and/or bridge crossings.
- Ensure adequate maintenance of bridges and culverts on routes to help prevent unauthorized stream crossings that might damage soils, streambanks, riparian vegetation, or other aquatic resources.
- Estimate the average soil loss for areas that are currently and obviously negatively affected by ORVs using the Universal Soil Loss Equation. Close and restore routes if the soils are determined to exceed standards for tolerable soil loss.
- If closing or moving a particularly damaging route is not possible, mitigate erosion with waterbars or other erosion control measures.
- Close and restore areas that have become "mud bogging areas," or are prone to "mud bogging."
- Close and restore routes where it has been determined, through analysis, that cumulative impacts of erosive activities (e.g., ORVs combined with fire, livestock grazing or other erosive stressors) are leading to a stream failing to meet erosion standards.
- Prioritize for closure renegade routes going directly up hillslopes, into wetland areas (including wet meadows), or adjacent to designated routes.
- Adaptively manage by closing or mitigating a damaging route if monitoring identifies that forest soil conditions are no longer in compliance with planning and decision-making BMPs.

MONITORING BMPS FOR FOREST SOILS

- Monitor for the amount of erosion occurring on all routes (designated and renegade). Gather data needed for the Universal Erosion Soil Loss Equation.
- Regularly survey for and identify renegade off-route spurs.
- Map stream crossings without culverts or bridges and note stream sedimentation levels and visible soil/channel impacts in these areas.
- Identify areas of significant amounts of bare soil or route-widening along routes using photographs and route width measurements.
- Monitor closed and restored routes to ensure the measures taken are effectively mitigating impacts to forest soils.

Trampling Impacts on Vegetation and the Spread of Invasive Plants Research

Riding a several hundred pound ORV off-route or cross-country can crush, break, and ultimately reduce overall vegetative cover. Vehicular impacts on vegetation range from selective kill-off of the most sensitive plants to complete loss of vegetation in large "staging areas." Plants that do survive are weakened, malformed, and more susceptible to disease and insect predation. Trampling by ORVs can also damage germinating seeds – even those in the soil. A study that examined ORV use on several U.S. National Forests found at least a 40 percent reduction in vegetation following ORV traffic (Meadows et al. 2008). Similarly, in a desert example in southern California, Groom et al. (2007) found 4-5 times fewer plants in an ORV use area than a protected area. However, when one of the study areas was closed to motorized use (and experienced a year of high rainfall), there appeared to be a recovery of that population.

In addition to trampling effects, ORVs are a major vector for non-native invasive plant species. With knobby tires and large undercarriages, ORVs can unintentionally transport invasive non-native species deep into forestlands. For example, one study found that in a single trip on a 16.1 km (10 mi) course in Montana, an ORV dispersed 2,000 spotted knapweed (*Centaurea stoebe*) seeds (Montana State University 1992). In Wisconsin, a survey of seven invasive plant species along ORV routes found at least one of these exotic plant species on 88% of segments examined (Rooney 2005). ORVs in roadless areas pose a particular risk of spreading invasive non-native species because roadless areas often have less weeds present. Gelbard and Harrison (2003) found that ORVs are the chief vector for invasive species infestation in California roadless areas, which were shown to be very important refuges for native plants. Furthermore, as a result of ORV use, the size and abundance of native plants may be reduced, which in turn permits invasive or nonnative plants to spread and dominate the plant community (GAO 2009).

Impacts to vegetation can have cascading effects throughout an ecosystem. For example, on an intensively used ORV route in Idaho, native shrubs, bunch grasses, and biological crust were greatly reduced close to the route and replaced with rabbitbrush (*Chrysothamnus* spp.) and non-native cheat grass (*Bromus tectorum.*; Munger et al. 2003). Because of these habitat changes, fewer reptiles were found alongside the route than were found 100 m away (328 ft). In another example of cascading impacts, Waddle (2006) found that three out of four species of ground-dwelling anurans in Florida were negatively influenced by ORVs due to trampling of vegetation and altered hydrology.

Best Management Practices for vegetation

PLANNING AND DECISION-MAKING BMPS FOR VEGETATION

- Locate routes in areas that do not have sensitive, threatened or endangered plant species.
- Locate routes where there are no unique plant communities such as aspen stands, bogs, wetlands, riparian areas and alpine habitat types.

IMPLEMENTATION BMPS FOR VEGETATION

- Identify sensitive, threatened, and/or endangered plants present in ORV use areas, as well as rare, fragile and/or unique plant communities (i.e., aspen stands, bogs, wetlands, riparian, alpine areas). Record the survey information into a GIS (Geographic Information System) database.
- Close areas where sensitive, threatened and/or endangered plant species are at risk.
- Remove invasive non-native plants from routes when feasible.
- Prohibit motorized camping in areas where invasive plants are a problem.
- Control invasive plants in staging areas to avoid their spread onto routes.
- Identify areas where invasive plants present a problem and require that all ORVs using such areas wash vehicles when exiting such areas.
- Close and restore routes documented as contributing to the spread of non-native invasive plants into relatively weed-free areas.
- Use native species when revegetating a closed route.
- Modify livestock grazing practices or halt grazing in newly restored areas where routes have been closed.

MONITORING BMPS FOR VEGETATION

- Monitor routes for sensitive, threatened, and/or endangered plants in ORV use areas, as well as rare, fragile and/or unique plant communities.
- Monitor for unauthorized spur routes into areas with sensitive, threatened, and endangered plant species.
- Monitor routes for presence and spread of non-native species or the decline of native species.
- Monitor closed and restored routes to ensure effective mitigation for damaged vegetation is occurring.
- Monitor the success of revegetation projects.
- Adaptively manage by closing or mitigating a route if monitoring identifies that vegetation conditions are no longer in compliance with planning and decision-making BMPs.

Wildlife Mortality, Disturbance, and Habitat Loss Research

Driving ORVs in forested environments has led to direct and indirect impacts on wildlife. When driven at high speeds, ORVs can collide with small animals and cause direct mortality. However, there are also many indirect impacts that can increase wildlife mortality. For example, in a review of research on mesocarnivores in the U.S., Weaver (1993) reported that ORV access increases the trapping vulnerability of American marten (*Martes americana*), fisher (*Martes pennanti*), and wolverine (*Gulo gulo*). Lynx (*Lynx lynx*) are also thought to be sensitive to road density due to increased trapping pressure (Singleton et al. 2002).

ORV use also increases access for illegal harvest of wildlife in areas that are difficult for game wardens to patrol. For wolves (*Canis lupus*), one study found that 21 of 25 human-caused mortalities in the US Northern Rockies occurred within 200 m (656 ft) of a motorized route (Boyd and Pletscher 1999). Wolves often travel on roads and off-road vehicle routes where they risk increased poaching pressure. Studies in the US Great Lakes region have found that wolf persistence is reduced when road density exceeds approximately 0.6 km/km^2 (1 mi/mi^2; Wydeven et al. 2001). Grizzly bears (*Ursus arctos horribilis*) are also at risk from poaching and have been found to avoid open roads (e.g., Mace et al. 1996).

Elk (*Cervus canadensis*) have been the most extensively studied animal in relation to motorized access and ORVs. While recent studies have examined the effects of ORVs on elk (Vieira 2000, Wisdom et al. 2004, Naylor et al. 2009), most studies have looked more broadly at the impacts of motorized travel and roads. Research has found that increased motorized access results in decreased elk habitat and security, and increased elk mortality from hunter harvest both legal and illegal (Hayes et al. 2002, McCorquodale et al. 2003, see Rowland et al. 2005 for review).

Probably the most widespread ORV impact on wildlife is disturbance. Within individual species, a number of factors influence the degree of disturbance, including the animal's breeding status, size, and the size of the group it is with (Burger et al. 1995). Studies have shown a variety of disturbance is possible from ORVs, and while these impacts are difficult to measure, repeated harassment of wildlife can result in increased energy expenditure and reduced reproduction. Noise and disturbance from ORVs have been shown to result in a range of effects including increased stress (e.g., elk: Millspaugh et al. 2001), altered movement patterns (e.g., elk: Wisdom et al. 2004, Preisler et al. 2006, Naylor et al. 2009), avoidance of high-use areas or routes (e.g., Florida panthers: Janis and Clark 2002), and disrupted nesting activities (e.g., piping plovers: Strauss 1990).

Vieira (2000) found that elk moved twice as far from ORV disturbance than they did from pedestrian disturbance in Colorado. In studies in eastern Oregon, Wisdom et al. (2004) found that elk moved when ORVs passed within 1,640 m (5381 ft) but tolerated hikers within 500 m (1640 ft), and Naylor et al. (2009) found that elk increased their travel time and thus reduced time spent feeding or resting in response to ORV recreation. In some instances, however, low levels of disturbance do not appear to affect certain species persistence. For example, Zielinski et al. (2008) found that low levels of ORV disturbance in northern California did not change American marten occupancy or probability of detection. However, they did not measure the behavioral, physiological, or demographic responses.

Disruption of breeding and nesting birds is a particularly well documented problem (for review see Hamann et al. 1999). Several species are sensitive to human disturbance with the potential disruption of courtship activities, over-exposure of eggs or young birds to weather, and premature fledging of juveniles. Repeated disturbance can eventually lead to nest abandonment and lead to long-term bird community changes. In one example, Barton and Holmes (2007) found greater songbird nest desertion and abandonment close to ORV trails in northeastern California. While they also found less nest predation along ORV trails, some species had lower abundance than away from ORV trails.

To mitigate the impacts of disturbance, several authors have recommended spatial nest buffer zones from human disturbance for raptors (for review see Richardson and Miller 1997). Closing of ORV routes has been found to successfully restore wildlife habitat. Burger et al. (2007) found lower reproductive success of pine snakes (*Pituophus melanoleucus*) along ORV routes in the New Jersey Pinelands. However, after closing routes near nesting sites, the number of hatchlings increased to pre-disturbance levels.

Best Management Practices for wildlife

PLANNING AND DECISION-MAKING FOR WILDLIFE

- Set levels of acceptable disturbance that are compatible with maintaining species viability or recovery.
- Locate routes in areas that do not have critical habitat (formally designated or just important for survival) for sensitive, threatened and/or endangered wildlife species.
- Locate new routes where they are unlikely to significantly affect the populations of important native wildlife species specifically regarding reproduction, nesting, or rearing.
    - Do not locate routes in areas with concentrated or particularly important ungulate fawning or calving areas.

- Locate routes a minimum distance (as listed below) from waterbodies and wetlands:
    - Fish-bearing streams and lakes – 91 m (300 ft)
    - Permanently flowing non-fish-bearing streams – 46 m (150 ft)
    - Ponds, reservoirs, and wetlands greater than one acre – 46 m (150 ft)
- Locate routes as far as possible, but a minimum of 46 m (150 ft), from natural caves, tunnels, and mines where bat nurseries are commonly found.
- Locate routes in discrete, specified areas bounded by natural features (topography and vegetative cover) to provide visual and acoustic barriers and to ensure that secure habitat is maintained for wildlife.
- Locate routes in forest cover and not in open country. Long sight lines in open country make the visual effects of machines more pronounced.
- Adaptively manage routes that affect wildlife seasonal habitat needs. Reduce route density to below 0.6 km/km^2 (1 mi/mi^2) by permanently closing, or imposing seasonal use restrictions.

IMPLEMENTATION BMPS FOR WILDLIFE

- Survey for sensitive, threatened, and endangered animals, as well as critical habitat (formally designated or just important for survival), in ORV use areas. This survey information should be catalogued and regularly updated in a GIS database.
- Prohibit ORV use in critical habitat for sensitive, threatened, and endangered species.
- Maintain large unfragmented, undisturbed blocks of forestland where no routes are designated.
- Maintain and improve habitat security by protecting whole areas rather than individual route closures.
- Reduce road/route density to below 0.6 km/km^2 (1 mi/mi^2) in important wildlife areas.
- Conduct adequate nest searches to identify raptor nest sites. Seasonally close ORV areas in raptor nesting territories during sensitive nesting phases (e.g., March through August in the Rocky Mountain West).
- If routes are already in important native wildlife habitat, seasonally close during sensitive seasons.
    - Calving/fawning period for known key ungulate calving/fawning areas (e.g., May 15 through June in the Rocky Mountain West).
    - Critical ungulate wintering habitat/winter concentration areas (e.g., December through March in the Rocky Mountain West).
    - Migration corridors during migrations.
- Do not allow the use of ORVs off designated routes for game retrieval.
- Develop public information and educational programs targeting ORV users to raise wildlife awareness, such as information about wildlife species in the focal area, key wildlife sign, and the impacts of ORVs to those species.
- Address recovering carnivores such as grizzly bears and wolves:
    - Prohibit ORV use in grizzly bear habitats that provide important food sources during spring and early summer (e.g., April 1 through July 15 in the Rocky Mountain West). These habitat components include riparian shrub types, aspen stands, wet meadows, and avalanche chutes.
    - In areas with established wolf packs where there is a desire to reduce the potential for disturbance and the risk of illegal killing, limit ORV route densities to less than 0.6 km/km^2 (1 mi/mi^2).

MONITORING BMPS FOR WILDLIFE

- Monitor routes for sensitive, threatened, and endangered animals in ORV use areas.
- Monitor routes to identify whether they are impacting the reproduction, nesting or rearing of key indicator species.
- Monitor routes to identify whether there are unauthorized spur routes, especially if they approach waterbodies, wetlands and bogs that are key habitats for amphibians and reptiles; or natural caves, tunnels and mines where bat nurseries may occur.
- Monitor use concurrently with local wildlife populations to determine their impact on wildlife species.

- Monitor closed and restored routes to ensure they are effectively mitigating impacts to wildlife.
- Manage adaptively through closure, rerouting, or mitigation if monitoring identifies that wildlife conditions are no longer in compliance with planning and decision-making BMPs. ORV use in important wildlife habitats should only be allowed after peer- reviewed studies or data from wildlife and ORV monitoring conclude that wildlife populations will not be impaired.

Recreational Use Conflicts Research

Conflict is defined as an emotional state of annoyance with another group or person that can result in dissatisfaction with a specific experience (Yankoviak 2005). For example, a hiker seeking quiet in nature could experience conflict after encountering an ORV user on the same trail because the ORV use could be perceived as preventing the hiker from attaining his or her goal of a quiet, natural experience. Feelings of conflict often occur among quiet users when they hear motor vehicle noise, witness acts of great speed and/or reckless behavior, smell exhaust, and see visible environmental damage. This all leads to reduced opportunity and displacement of non-motorized recreationists from places they would normally frequent (Moore 1994, Stokowski and LaPointe 2000).

Both motorized and quiet recreationists prefer that trails be managed for multiple uses but with motorized and non-motorized activities separated (Andereck et al. 2001). Where trails are designated as multiple-use, heavy motorized use tends to cause other trail users to pursue opportunities at other locations in order to realize the desired experiences. There are numerous examples of non-motorized recreationists being displaced or leaving an area altogether where motorized use is common (e.g., Moore 1994, Stokowski and LaPointe 2000, Manning and Valliere 2002).

Best Management Practices for use conflicts

PLANNING AND DECISION-MAKING BMPS FOR USE CONFLICTS

- Designate motor-free Quiet Use Zones in both backcountry and front-country settings that emphasize wildlife needs and relatively low-impact recreational activities.
- Prioritize motorized route designations to protect public land resources and the safety of all public land users, and to minimize conflicts with other recreational uses and nearby residences.
- Ensure that ORV use does not preclude meeting the demand for hiking, equestrian and other non-motorized recreational uses.
- Do not locate ORV routes on trails, areas, or watersheds primarily used by hikers, horseback riders, mountain bikers, hunters, birdwatchers or other quiet recreationists and sportsmen, particularly those routes where unmanaged use has lead to motorized encroachment on non-motorized trails.

IMPLEMENTATION BMPS FOR USE CONFLICTS

- Undertake proactive and systematic outreach to motorized and non-motorized visitors in order to facilitate mutual understanding of the preferences and desired experiences of public land visitors.
- Establish trails or recreational working groups with both motorized and non-motorized stakeholders that meet regularly with land managers. These groups should work cooperatively to identify and resolve use conflict in a manner consistent with agency policy.
- Work with agency and local law enforcement to implement penalties and consequences for violating ORV regulations that will dissuade ORV users from such violations.
- Conduct surveys to establish the demand and opportunities for non-motorized recreation.
- Document use conflicts in a database that is shared with the public.
- Match ORV use to the available management and enforcement capacity (funding and staffing). This will assure that resources exist to guarantee adequate legal enforcement along all routes.

MONITORING BMPS FOR USE CONFLICTS

- Use monitoring to identify use conflicts on trails, areas, or watersheds traditionally used by hikers, horseback riders, mountain bikers, hunters or other quiet recreationists and sportsmen.

- Monitor closed and restored routes to ensure that motorized use is not occurring.
- Use monitoring data to limit or prohibit ORV access on routes where its use is leading to trespass onto other non-motorized trails, areas or watersheds.
- Require that motorized users have identification on vehicles equal in visibility to that found on highway vehicles.
- Monitor and enforce ORV noise violations by equipping law enforcement personnel with sound meters that can be easily calibrated and used in the field to test noise levels of ORVs at established trailheads and staging areas.

CONCLUSION

Scientific literature has firmly established ORV use as a significant perturbation to natural forest systems and ecology as well as creating conflicts among user groups. This underscores the need for widely adopted off-road vehicle Best Management Practices that are grounded in science. However, the effective implementation of these BMPs must be accompanied by adequate funding and staff levels in order to ensure that necessary monitoring and legal enforcement are carried out. With adequate funding and application of these BMPs, forest managers can designate routes that will provide for motorized recreation opportunities while managing ORVs with minimal harm to natural forests systems and the wildlife they support.

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