Field Measures of Wilderness Character
Hoodoo Mountain Wilderness Study Area

2016

Wilderness Institute
College of Forestry and Conservation
University of Montana

By Lisa Gerloff and James Tricker
For more information please contact the Wilderness Institute
(406) 243-6936 or citizenscience@cfc.umt.edu
Executive Summary

This report summarizes field measures of wilderness character collected in the Hoodoo Mountain Wilderness Study Area (WSA) in western Montana. During fall 2014 and early summer 2015, Wilderness Institute crews hiked boundary roads and interior roads within the WSA and made detailed field observations of measures related to the qualities of wilderness character identified in the Wilderness Act of 1964: untrammeled, natural, undeveloped, and opportunities for solitude or primitive and unconfined recreation. The Wilderness Institute led two multi-day trips – one with 10 community volunteers and one with 9 University of Montana students.

Monitoring highlights include:

- **Weeds**: 6 weed patches were recorded, representing 3 species – Canada thistle (3), Houndstongue (2), and one unknown. (17%).

- **Installations and developments**: 13 installations and developments were reported. Range developments were the most common (5 fences, 2 water troughs, and one corral. Other recorded developments included cabins and metal poles. At least 38% appear to be agency-created.

- **Signs**: 17 signs were encountered along and within the WSA boundary. Most signs were interpretive (7), followed by trail junction/directional (4) boundary (2), recreational use (2) and survey markers (2). The majority of signs were in acceptable condition (47% and 29% in good and faded-legible condition, respectively).

- **Non-system trails**: A total of 7 NSTs or trail fragments covering 3.6 miles were mapped. Dominant trail use was foot travel.

- **Noise intrusions**: 16 noise intrusions were opportunistically recorded in the WSA, with 75% coming from airplanes and 25% from motorized vehicles.

- **Visual intrusions**: Only 2 visual intrusions (buildings) were observed.

- **Campsites**: 3 campsites were recorded. Two located inside the WSA and one just outside the WSA boundary.

- **Cultural**: 3 cabins recorded.

- **Motorized or Mechanized Use**: 1 set of double ATV tracks recorded within WSA boundary.
# Table of Contents

Executive Summary.............................................................................................................. Error! Bookmark not defined.

INTRODUCTION......................................................................................................................... 5
  DATA MANAGEMENT.................................................................................................................. 8

FIELD MEASURES OF WILDERNESS CHARACTER............................................................... 9
  I. UNTRAMMELED QUALITY .................................................................................................... 8
    Weed Control Action ............................................................................................................ 8
  II. NATURAL QUALITY ............................................................................................................ 9
    Weeds .................................................................................................................................. 9
  III. UNDEVELOPED QUALITY................................................................................................ 13
    Installations and Developments .......................................................................................... 13
    Range Improvements .......................................................................................................... 15
    Signs ................................................................................................................................. 16
    Evidence of Mechanized and Motorized Use on Trails ...................................................... 19
  IV. SOLITUDE OR PRIMITIVE AND UNCONFINED RECREATION QUALITY .................. 19
    Non-system Trails ................................................................................................................ 20
    Noise .................................................................................................................................. 21
    Visual Intrusions .................................................................................................................. 23
    Campsites ........................................................................................................................... 24
  V. OTHER FEATURES OF VALUE .......................................................................................... 27
    Cultural Resources .............................................................................................................. 27

LITERATURE CITED .................................................................................................................. 27

APPENDIX 1. MONITORING ATTRIBUTES ........................................................................... 28
APPENDIX 2. CAMPSITE INVENTORY & CONDITION .............................................................. 32
APPENDIX 3. CAMPSITE CONDITION EVALUATION WORKSHEET ....................................... 36
List of Tables

Table 1. Number of weed patches where weed control action was taken, and proportion of patch pulled. .................................................................................................................................................................................. 9
Table 2. Duration and Intensity of Noise Intrusions. ............................................................................................................................... 22
Table 3. Number of campsites by impact evaluation score class ............................................................................................................. 25

List of Figures

Figure 1. Number of weed patches by species ................................................................................................................................. 10
Figure 2. Distribution of observed weed species ............................................................................................................................... 11
Figure 3. Spatial distribution of weed species ................................................................................................................................. 12
Figure 4. Primary and secondary disturbances associated with weed patches ...................................................................................... 13
Figure 5. Ecosystem type associated with weed patches Error! Bookmark not defined.
Figure 6. Number of installations and developments by type ................................................................................................................ 14
Figure 7. Locations of installations and developments by Range type ................................................................................................. 15
Figure 8. Number of signs by type and condition .............................................................................................................................. 16
Figure 9. Location and types of signs ................................................................................................................................................... 17
Figure 10. Number of non-system trails by trail type. .......................................................................................................................... 20
Figure 11. Locations of non-system trails ........................................................................................................................................ 21
Figure 12. Source of all opportunistic noise intrusions heard within the WSA ..................................................................................... 22
Figure 13. Location and source of all opportunistic noise intrusions heard within the WSA............................................................ 23
Figure 14. Visual intrusions seen from within the WSA Error! Bookmark not defined.
Figure 15. Location and impact class of documented campsites. ........................................................................................................ 25

List of Photos

Photo 1. West Fork Spring with water trough ....................................................................................................................................... 15
Photo 2. Remnent of a corral .............................................................................................................................................................. 15
Photo 3. Evidence of mechanized and motorized use ............................................................................................................................ 18
Photo 4. Non-system trail .................................................................................................................................................................. 19
INTRODUCTION

This report summarizes field measures of wilderness character in the Hoodoo Mountain Wilderness Study Area (WSA) on the BLM-Missoula Field Office in western Montana. This WSA, like other BLM Wilderness Study Areas in Montana, was designated by U.S. Congress through the through Section 603(a) of the Federal Land Policy and Management Act (FLPMA) in 1976. The Act requires that the BLM maintain the wilderness characteristics of each WSA until Congress determines if they should be designated as part of the National Wilderness Preservation System or released for other uses. In 2009, the Wilderness Institute, part of the College of Forestry and Conservation at the University of Montana, collaborated with the Aldo Leopold Wilderness Research Institute, the Forest Service, and several local non-governmental organizations to develop field measures of the qualities of wilderness character identified in the Wilderness Act of 1964 (Pub.L. 88-577) and described by (Landres et al, 2008) in Keeping It Wild: An Interagency Strategy to Monitor Trends in Wilderness Character Across the National Wilderness Preservation System. While field measure used during this project were based primarily on the original Keeping it Wild, the recently published Keeping it Wild 2: An Updated Interagency Strategy to Monitor Trends in Wilderness Character Across the National Wilderness Preservation System (Landres et al. 2015) was reviewed for additional guidance. This report summarizes 2014 and 2015 field monitoring data in the Hoodoo Mountain WSA for selected measures of attributes of the five wilderness character qualities: 1) untrammeled, 2) natural, 3) undeveloped, 4) opportunities for solitude or primitive and unconfined recreation, and 5) other features of value.

During fall 2014 and summer 2015, Wilderness Institute crews hiked boundary and interior roads of the WSA and made detailed observations related to these qualities. Measures of naturalness focused on invasive plants, wildlife, livestock, and lake and streambank erosion. Undeveloped measures included installations and developments (both recreational and non-recreational), range improvements, signage, evidence of mechanized and motorized use, and trail closure devices. Measures of opportunities for solitude and primitive and unconfined recreation included trail conditions, non-system (user created) trails, campsite conditions, recreational use, motorized noise, and visual intrusions. The other feature of value by the BLM was cultural resources. The single measure of the untrammeled quality of the area was weed pulling by Wilderness Institute crews (all other measures of untrammeled require non-field related work). Results for measures (attribute groups; see Appendix 1) are reported here, often accompanied by tables and maps.
Observations of the following attributes were used to monitor wilderness character:

<table>
<thead>
<tr>
<th>Untrammeled</th>
<th>Natural</th>
<th>Undeveloped</th>
<th>Opportunities for solitude or primitive and unconfined recreation</th>
<th>Other features of value</th>
</tr>
</thead>
<tbody>
<tr>
<td>pulling weeds</td>
<td>invasive plants</td>
<td>installations &amp; developments</td>
<td>non-system trails</td>
<td>cultural</td>
</tr>
<tr>
<td>wildlife</td>
<td>range improvements</td>
<td>campsite</td>
<td>conditions</td>
<td></td>
</tr>
<tr>
<td>livestock</td>
<td>signs</td>
<td>recreation use</td>
<td></td>
<td></td>
</tr>
<tr>
<td>water erosion</td>
<td>mechanized or motorized use</td>
<td>auditory intrusions</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>trail closures</td>
<td>visual intrusions</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Please note that this project emphasized collection of quantifiable field data appropriate for collection with GIS-based technology. Many aspects of wilderness character were not evaluated as part of this project, either because non-field measures were required (e.g. agency actions that impact trammeling or recreation opportunities) or because data collection was beyond the scope of this project (e.g. air and water quality data). This report represents a snap-shot of on-the-ground conditions within the Hoodoo Mountain WSA, and does not attempt to infer how measured qualities of wilderness character may be changing over time, or evaluate the efficacy of current management approaches. To do so would require repeated monitoring efforts over a period of years, and the inclusion of non-field measures of wilderness character as outlined in “Keeping it Wild.” This report does, however, create a current baseline that will enable subsequent assessments to expose how certain attributes of the qualities of wilderness character are changing. For a detailed description of wilderness character monitoring, please see: [http://www.wilderness.net/character](http://www.wilderness.net/character).

This project was conducted as part of the Wilderness Institute’s Citizen Science Program, which has recruited community volunteers to help monitor selected measures of wilderness character in designated Wilderness and WSAs since 2005. Wilderness Institute field leaders led small groups of volunteers on multi-day trips, surveying all boundary roads of the WSA as well as non-system (user-created) trails. Two trips were conducted with 17 volunteers. This program was founded on the belief that including community members in on-the-ground monitoring and stewardship of public lands builds community capacity, increases public involvement in nearby public lands, and improves dialogue between local communities and managing agencies.

This work was funded by the Bureau of Land Management and the University of Montana. For more information please contact us at: [citizenscience@cfc.umt.edu](mailto:citizenscience@cfc.umt.edu) or (406) 243-6936.
DATA MANAGEMENT

The following section describes the steps taken to collect and analyze field measures of wilderness character (attributes) in the Hoodoo Mountain WSA: (1) protocol development, (2) field data collection, (3) data analysis and mapping, and (4) data reporting.

Protocol Development

The Wilderness Institute has been monitoring wilderness attributes since 2005, and developed a list of standardized protocols for this purpose. In 2009, these protocols were updated to specifically monitor selected measures of wilderness character described in Landres et al. (2008). These new protocols were implemented within a menu-based form containing predefined categories for data entry, which could be loaded onto Trimble GeoExplorer units utilizing Trimble Pathfinder software. A full list of the collected attributes, and their descriptions, are provided in Appendix 1. Detailed protocols are available upon request.

Data Collection

Data was collected in September 2014 and June 2015. Field crews recorded observations of each attribute when encountered and entered them into GPS units using the data dictionary. All attributes were mapped as point, line, or area features. Photos were taken of attributes, where relevant. After each trip, GPS data and digital photos were checked for quality control. A Microsoft Excel database, as well as a geodatabase containing all attribute data and photos is available upon request.

Data Analysis

GPS files were differentially corrected using Trimble Pathfinder Office software (Trimble Navigation Limited 2009). Differential correction is a process in which GPS coordinate data can be compared with a fixed spatial reference and adjusted to reduce any systematic error in position that often occurs with field GPS data. After this process was completed and data for each attribute group combined from individual GPS units, all data were imported into a spatial geodatabase using ArcGIS (ESRI 2009). All monitoring data was re-projected into North American Datum 1983 as Universal Transverse Mercator (UTM) grid coordinates in zone 12. All spatial analyses were performed using ArcGIS (ESRI 2010). Monitoring attribute summaries are provided in a combination of tables, figures, and maps.

Data Reporting

This report presents visual and/or numerical summary data from all attribute groups related to the four primary qualities of wilderness character (see Appendix 1). Note that this report does not summarize every attribute collected; for example, much more detail was collected for weeds, campsites, and wildlife observations than is summarized here (see Appendix 1). Furthermore, many attributes have associated pictures that are not compiled in this report. A comprehensive dataset and photographs of collected attributes are available upon request.
FIELD MEASURES OF WILDERNESS CHARACTER

The following sections describe field measures used to assess the five primary qualities of wilderness character identified in the Wilderness Act of 1964: untrammeled, natural, undeveloped, opportunity for solitude or primitive and unconfined recreation, and other features of value. After a brief explanation of each wilderness character quality, the data collected for each indicator is summarized. Please note that some aspects of wilderness character were not evaluated as part of this project (see introduction). A comprehensive list of database attributes and the associated qualities of wilderness character can be found in Appendix 1.

I. UNTRAMMELED QUALITY

Wilderness is “an area where the earth and its community of life are untrammeled by man” (Wilderness Act, 1964). Untrammeled wilderness has come to signify areas free from modern human control and actions which manipulate nature, even when taken to restore natural systems (Landres et al., 2008). For this project, weed control action constituted the only trammeling data collected. Actions taken by field crews to manage weed infestations diminish the untrammeled character of the Middle Fork Judith River WSA. Agency actions that affect the untrammeled quality of the WSA (e.g. any action that disrupts the naturally functioning ecosystem or the unencumbered nature of the area, such as fire suppression, herbicide treatment of invasives, and fish stocking) are beyond the scope of this field-based study and are not reported here.

Weed Control Action

Hand pulling was undertaken on 2 of the 6 weed patches encountered. The two hand pulled patches were Houndstongue (Table 1).

Table 1. Number of weed patches where weed control action was taken, and proportion of patch pulled.

<table>
<thead>
<tr>
<th>Control Action</th>
<th>No. Weed Patches</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>4</td>
</tr>
<tr>
<td>71-80% pulled</td>
<td>1</td>
</tr>
<tr>
<td>91-100% pulled</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>6</td>
</tr>
</tbody>
</table>
II. NATURAL QUALITY

Natural quality reflects the extent “wilderness ecological systems are substantially free from the effects of modern civilization” (Landres et al., 2008). Natural quality is assessed by monitoring attributes that reflect the integrity of ecological systems, such as species composition and physical characteristics. For this project, we identified three measures of naturalness appropriate and feasible to monitor with field protocols: 1) distribution and prevalence of non-indigenous plant species (weeds) along trail systems; 2) visible sign of select wildlife populations (scat and/or other signs of carnivores, bears, other megafauna); and 3) user-created erosion associated with lakes and streambanks. Within these indicator categories, multiple attributes were recorded (see Appendix 1) that capture the detail and context of weed infestations, wildlife signs, and erosion events. Please note that not all attributes are summarized in the following sections, but are available in the associated data files.

Weeds

The invasion and spread of non-native weeds is a growing problem across western landscapes, and poses a serious threat to native biodiversity. Weeds have few, if any, natural controls on their reproduction and distribution, and occurrences closely follow areas of highest use and disturbance. By recording weed type, location, size and intensity of the infestation, land managers can identify priority areas for treatment and eradication. Furthermore, ecological, topographic and physical associations of weed patches can expose patterns of invasion and further understanding of the multiple factors that influence the spread of weeds in remote areas. In the following section we highlight and summarize weed monitoring data; please note that we do not provide visual or graphical summaries of all attributes collected. Patch-specific information, as well as additional attribute data, is located in the associated electronic database. Monitoring was focused along boundary roads, interior roads, and non-system trails and therefore patches not visible from the road/trail may have gone undetected.

Weed Species

A total of six weed patches were recorded: Canada thistle, Houndstounge and one unknown.

![Figure 1. Number of weed patches by species.](image-url)
Weed infestations were observed along boundary roads and non-system trails. Three weed locations are just outside the WSA boundary. Canada thistle was most prevalent (50%).

Figure 2. Distribution of observed weed species.
**Spatial Distribution**

The spatial distribution of each weed patch was categorized as individual (a single plant), clumpy (one dense patch), scattered-even (evenly distributed across the infestation area), scattered-patchy (distinct patches scattered across the infestation area), or linear (along a trail or stream).

The six weed patches recorded were comprised of a single individual plant, two clumpy patches and three scattered patchy.

![Spatial distribution of weed species.](image)

**Primary and Secondary Disturbance Types**

Weed patches are often associated with disturbance. We recorded the primary and secondary disturbances associated with each mapped weed patch. The primary disturbance is the most likely vector for infestation, and the secondary disturbance reflects the broader disturbance matrix that may be present. For example, a weed patch found along a trail that passes through a burned area would have “trail” and “fire” listed as the respective primary and secondary disturbances.

The primary disturbance associated with four of the mapped weed patches were trails (Figure 4). The other two patches were campsite and stock. Secondary disturbance associations were roads (67%) and trail (33%).

Roads are the primary access routes to and into the Hoodoo Mountain WSA, and it is important to recognize that the high proportion of weeds associated with roads is partly a reflection of sampling bias. Nonetheless, the data clearly show that weeds commonly occur in close proximity to roads and trails, and that these serve as important vectors for overall weed dissemination within the WSA.
Ecological Associations

Ecological associations, including ecosystem type, dominant life form, and habitat were recorded for each weed patch observed to provide an ecological context for understanding weed distributions. Please see Appendix 1 for a comprehensive list of ecological attributes collected and the associated database for detailed data on ecological attributes not covered in this report.

All of weed infestations encountered were in forest (tree cover ranged from <25% to 25%-50%; Figure 5). The dominant life forms within the area of infestation were conifer (66%) followed by forb (17%). Dominant life form information was missing for 1 patch. No associations were apparent between specific weed species and ecosystem types or life forms.
**Distance to Water**

To assess basic physical associations with mapped weed patches, we measured distance to water in 3 classes (0-10 ft., 10-50 ft., and > 50 ft.). Two of weed patches were located 1-10 feet from water, one was >50 feet from water, and three patches had no water distance information recorded.

**II. UNDEVELOPED QUALITY**

Undeveloped is the third quality of wilderness character found within the language of the 1964 Wilderness Act. This quality refers to the extent in which “wilderness retains its primeval character and influence, and is essentially without permanent improvement or modern occupation” (Landres et al., 2008). Non-recreational developments such as installations and signs are considered to affect the undeveloped quality of wilderness character. It is important to note that recreationally-focused developments, such as trails, campsites, shelters, etc. are considered in the next section, under the solitude or primitive and unconfined quality of wilderness character. This distinction is made so that developments are not double-counted under both qualities (Landres et al., 2008).

**Installations and Developments**

Types of human installations and developments were reported in the following categories: bench, bridge, corral, dam, game hang, fence, latrine, old cabin, pole stash, cairn, hitch rail, or water trough. Photos were taken of all reported developments and are available upon request.

**Development Type**

A total of 13 installations and developments were reported (Figures 6). Fences and cabins were most common. Please see Other Features of Value – Cultural Resources on 27 for more information on cabins. Five of the thirteen of installations and developments were clearly agency created. The source of the remaining eight is unclear.

![Bar chart showing number of installations and developments by type]

**Figure 6. Number of installations and developments by type.**
Range Improvements

Livestock grazing is allowed in many BLM managed WSAs. Therefore, the BLM is particularly interested in the number of range developments such as fences, corrals, and stock tanks located within WSAs.

Figure 7. Locations of installations and developments by Range type (note: not all developments are visible due to overlapping symbols).

See following photos for examples of recorded installations and developments.
Signs

All signs were noted by type and condition. Sign types included: trail junction/directions, interpretive, trail marker, and recreational use sign (i.e. allowable uses/closures). Sign condition was categorized as: vandalized-legible, vandalized-illegible, missing (post with no sign), faded-illegible, faded-legible, or good condition. Signs with words were photographed for reference (digital files of sign photographs are available upon request).

Sign Type and Condition

A total of 17 signs were encountered along and within the WSA boundary. Most signs were interpretive (7). The remaining signs were classified as trail junction/directional (4) boundary (2), recreational use (2) and survey markers (2). Almost half of the signs (47%) were in good condition, while 29% were faded-legible, 12% were faded-illegible, and 12% were in poor condition or missing. Figures 8 and 9 numerically and spatially depict these attributes.

![Figure 8. Number of signs by type and condition.](image-url)
Figure 9. Location and types of signs (note: not all sign types are visible due to overlapping symbols). Numbered signs correspond to following photos.
Sign 3: Boundary; agency; faded - legible

Sign 9: Survey marker; agency; good condition

Sign 5: Trail junction/direc; agency; good condition

Sign 11: Interpretive; agency; good condition

Sign 6: Recreational use; agency; good condition

Sign 16: Interpretive; unclear; faded - legible
Evidence of Mechanized and Motorized Use on Trails

Wilderness character monitoring protocols (Landres et al., 2008) were designed for use in designated Wilderness, where recreational motorized or mechanized vehicle use is prohibited. The Wilderness Institute added this attribute to record motorized or mechanized use in Wilderness Study Areas in Montana (where motorized and mechanized use may be permitted on designated trails). Indirect evidence (e.g. tracks) of mechanized or motorized use was monitored on all trails. Presence was recorded for trail segments as a point and the type of track (bicycle, motorcycle, ATV, or vehicle) was recorded. This measure is not designed to capture volume of use, but indicates presence of evidence on a trail segment from a single survey of system and non-system trails in the WSA. This measure cannot account for the timing of use, and therefore does not include violations of daily restrictions or use after seasonal closure dates.

Type of Mechanized or Motorized Tracks

A single point was recorded for mechanized and motorized use. ATV tracks were observed in a meadow near where the road drops down into the Wet Cottonwood Creek drainage (Easting 358680.092; Northing 5178504.077).

Photo 3: Evidence of mechanized and motorized use.

IV. SOLITUDE OR PRIMITIVE AND UNCONFINED RECREATION QUALITY

Solitude or primitive and unconfined recreation is the fourth quality of wilderness character found within the language of the 1964 Wilderness Act. This quality refers to the extent to which “wilderness provides outstanding opportunities for solitude or primitive and unconfined recreation” (Landres et al., 2008), and assesses recreationally-focused developments, such as trails, restrooms, shelters and campsites. Measured attributes that reflect this quality are: trail width, non-system trails, evidence of motorized or mechanized vehicle use, encounters with other users on trails, trailhead use, motorized noise, visual intrusions from developments outside of the WSA, and campsite characteristics and impacts.
**Non-system Trails**

Non-system trails (NSTs) are generally user-created and are not part of the official Forest Service trail system. When NSTs were encountered, the trail type was categorized as: motorcycle, ATV/UTV, horse travel, foot travel, or unclear. The origin of each NST was classified as either a new route created by recreational use, or an old road from historic mining, fire access, or logging activities. The length of non-system trails was mapped to the trail end, or as far as time constraints allowed.

**Non-system Trail Type, Origin, and Monitoring Status**

A total of 7 NSTs or trail fragments covering 3.6 miles were mapped in the field (Figures 10 and 11). Dominant trail use was foot travel for mapped NSTs. NST origin on all trails was reported as old route. Five of the seven NSTs are completely within the WSA boundary. All but one trail was recorded as not finished.

![Bar chart showing trail type distribution.](image)

**Figure 10.** Number of non-system trails by trail type.

![Image of a non-system trail.](image)

**Photo 4: Non-system trail.**
Figure 11. Locations of non-system trails.

**Noise**

Noise intrusions were monitored opportunistically. The duration of noises were classified as under 1 minute, 1-5 minutes, 5-10 minutes or >10 minutes. The source of noise was recorded, and noise intensity was categorized as barely audible (far in the distance), clearly heard (moderately near), loud (<1 mile), or variable. When possible, a visual confirmation of the noise source was recorded.
**Duration, Intensity and Visual Confirmation of Noise Intrusions**

Sixteen noise intrusions were opportunistically recorded within the WSA boundary during trail monitoring. The majority of noises recorded were from airplanes (75%), with motorized vehicles, comprising the remaining 25% (Figure 12). Visual confirmation was not possible for 10 detections, so the source of these noises was based mostly on auditory identification. Four recorded noise intrusions lasted 1-5 minutes, the remaining were less than 1 minute in duration (75%, Table 2). The noise intensity was recorded as loud and close (19%), can hear clearly (56%) and barely audible (25%; Table 2). All three loud and close noise intrusions were made by motorized vehicles. Noise intrusions were distributed throughout the WSA (Figure 13).

![Figure 12. Source of all opportunistic noise intrusions heard within the WSA.](image)

<table>
<thead>
<tr>
<th>Noise Duration</th>
<th>Noise Intensity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1- 5 minutes</td>
<td>4</td>
</tr>
<tr>
<td>under 1 minute</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Table 2. Duration and Intensity of Noise Intrusions*
Figure 13. Location and source of all opportunistic noise intrusions heard within the WSA.

Visual Intrusions
Human development that was visible from within the Wilderness Study Area was documented as a visual intrusion. The location where intrusions were visible was recorded, and the type of intrusion was categorized as: buildings, highways, power lines, lights at night, cities/towns, dirt roads, clear cuts, repeaters/towers, or railways.
Type of Visual Intrusion

Two visual intrusions were observed from within the WSA. Both visual intrusions were recoded as building in the distance (Figure 14).

Figure 14. Visual intrusions seen from within the WSA.
Campsites

Attributes recorded at each campsite reflect campsite conditions and human impacts, and were based on standard Forest Service Campsite Inventory & Condition Evaluation protocols (see Appendix 3). Human impacts at each campsite were evaluated based on 1) damage to trees, 2) number of trees with exposed roots, 3) types and number of development, 4) cleanliness, 5) number of social trails, 6) barren area estimate, 7) estimate of exposed mineral soil. For each campsite, the ratings assigned to individual impact attributes were combined to generate a summary impact index score (see Appendix 3). To provide an ecological context for campsite conditions, information on campsite location and habitat associations was also collected. Here, we briefly summarize impact evaluation and ecological associations. For individual campsite attribute measures and photographs, see Appendix 2.

Impact Evaluation

A total of 3 campsites were recorded, two located inside the WSA and one just outside the WSA boundary (Figure 15). Two of the campsites were located along the boundary road and one along a non-system trail.

Based on the summary impact evaluation scores, one of campsites were rated as not a site and one was lightly impacted (Table 2). The third campsite was missing information for several of the impact attributes; and therefore, an impact evaluation score was not calculated.

<table>
<thead>
<tr>
<th>Impact Index Score Class</th>
<th>Impact Index Score Range</th>
<th>Number of Campsites</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not a site</td>
<td>0-10</td>
<td>1</td>
</tr>
<tr>
<td>Light</td>
<td>11-20</td>
<td>1</td>
</tr>
<tr>
<td>Moderate</td>
<td>21-30</td>
<td></td>
</tr>
<tr>
<td>Heavy</td>
<td>31-39</td>
<td></td>
</tr>
<tr>
<td>Extreme</td>
<td>40-48</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>2</strong></td>
</tr>
</tbody>
</table>

Table 3. Number of campsites by impact evaluation score class.
Figure 15. Location and impact class of documented campsites.

**Location**

All campsites were associated with ridgetops. Campsite-specific ecological attributes are detailed in Appendix 3.
V. OTHER FEATURES OF VALUE

As stated within the language of the 1964 Wilderness Act, Wilderness areas “may also contain ecological, geological, or other features of scientific, educational, scenic, or historical value.” This quality may or may not be present for any particular wilderness, but where present is part of that area’s wilderness character.

Cultural Resources

Types of cultural resources were reported in the following three categories: historic (cabins, mining, trapping), pre-historic (teepee rings, culturally scarred trees) and paleo (fossils).

Cultural Features

Three cultural points were recorded. All points were categorized as historic and all were cabin sites. The cabins were reported in poor condition. The source (agency-created, user-created, or unclear) of all the cabins was reported as unclear.

LITERATURE CITED


APPENDIX 1. MONITORING ATTRIBUTES

List of monitoring attributes recorded in the field in 2014 and 2015. Detailed protocols are available upon request.

I. UNTRAMMELED QUALITY

Attribute group: Weed Point
- Weed_Action: Action taken to manage infestation

II. NATURAL QUALITY

Attribute group: Weed Point
- Weed_Collector: Wilderness Institute default
- Weed_Landowner: BLM default
- Weed_Unit: Wales Creek WSA
- Weed_Species: Common name of weed species
- Weed_Distribution: Distribution of weeds in patch (e.g. clumpy, scattered, linear)
- Weed_Width or _Radius: Width of linear patch or radius of non-linear patch (in feet)
- Weed_Density: Percent coverage of weeds within area of infestation
- Weed_Phenology: Life history phase of weeds in infestation
- Weed_Disturb1/Disturb2: Primary and secondary disturbance/vector of infestation
- Weed_Dom_Life: Dominant lifeform within area of infestation
- Weed_Ecotype: Ecosystem type (e.g. wet meadow, grassland, forest, riparian)
- Weed_Treecov: Estimate of % treecover over infestation
- Weed_HabSeries/Type/Phase: Forest habitat series, type and phase (Pfister et. al 1977)
- Weed_DomOver1/2/3: Up to three Understory species if >10% plot representation
- Weed_DomUnder1/2/3: Up to three understory species if >10% plot representation
- Weed_Struct1/Struct2: DBH class of largest tree <15 ft/ <50 ft from infestation
- Weed_Water: Distance (ft) of infestation from nearest water
- Weed_Actions: Action taken to manage infestation
- Weed_Biocontrol: Presence or absence of biocontrol notes
- Weed_Photo: Photograph of infestation
- Weed_Notes: Additional notes

Attribute group: Livestock Point
- Livestock_Species: Species of livestock encountered (common name)
- Livestock_Total: Numeric total of individuals detected
- Livestock_Brand: Description of brand or ear tag
- Livestock_Notes: Additional notes
- Livestock_Photo: Photograph of livestock

Attribute group: Wildlife Point
- Wild_Species: Species of wildlife encountered
- Wild_ObsType: Type of wildlife sign encountered
- Wild_Group: Individual, family, pair, etc.
- Wild_Repro: Reproductive status, if evident
- Observ_Qual: Degree of observer expertise
- Wild_Total: Numeric total of individuals detected
- Wild_Notes: Description or additional details of siting
- Wild_Photo: Corresponding photo number from camera
- Pika_Behavior: Select behavior category
- Pika_Habitat: Select habitat category
- Pika_Notes: Note presence and # of green haystacks
Attribute group: 5 Needle Pine
- **5-Needle_Point** Choose from present or absent
- **5_Needle_Notes** Additional notes

Attribute group: Water Erosion (human-caused)
- **Water_Landform** Landform (stream/lake) associated with erosion point
- **Water_Width** Width class at erosion point (streams only; high water mark)
- **Water_Acres** Acre estimate of all non-stream water features
- **Water_Severity** Severity rating of erosion (see protocols for details)
- **Water_Photo1/2** Corresponding photo1/2
- **Water_Notes** Describe site and any concerns identified

III. UNDEVELOPED QUALITY
Attribute group: Development Point
- **Dev_Type** Type of installation or development encountered
- **Dev_Cond** Select condition class from drop-down menu
- **Dev_Source** Choose from user or agency created, or unclear
- **Dev_Photo** Corresponding photo number
- **Dev_Notes** Additional notes

Attribute group: Range Development Point
- **Range_Type** Type of range installation or development encountered
- **Range_Cond** Select condition class from drop-down menu
- **Range_Source** Choose from user or agency created, or unclear
- **Range_Photo** Corresponding photo number
- **Range_Notes** Additional notes

Attribute group: Sign Point
- **Sign_Type** Sign type
- **Sign_Condition** Sign condition
- **Sign_Photo** Corresponding photo number
- **Sign_Source** Choose from user or agency created, or unclear
- **Sign_Notes** Additional notes

Attribute group: Trail Closure Point
- **Closure_Type** Type of trail closure device encountered
- **Closure_Violation** Description of evidence that closure is violated
- **Closure_Photo1/2** Corresponding photo 1/2
- **Closure_Notes** Additional notes

IV. SOLITUDE OR PRIMITIVE AND UNCONFINED RECREATION QUALITY
Attribute groups: Trail Width Point
- **TrailWidth_Name** Name of trail point
- **TrailWidth_Type** Select type of trail from drop-down menu
- **TrailWidth_Start/Finish** Start/Finish of trail
- **TrailWidth_Notes** Additional notes

Attribute group: Motorized or Mechanized Use Point
- **MotorMech_Point** Name evidence with trail number and ID
- **MotorMech_Width** Select track width from drop-down menu
- **MotorMech_Photo** Indicate if photo is taken
### Attribute group: Non-system Trails Line

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nst_Type</td>
<td>Type of non-system trail encountered</td>
</tr>
<tr>
<td>Nst_Vector</td>
<td>Age and source of non-system trail</td>
</tr>
<tr>
<td>Nst_Finish</td>
<td>Non system trail surveyed to its end or not</td>
</tr>
<tr>
<td>Nst_Notes</td>
<td>Additional notes</td>
</tr>
</tbody>
</table>

### Attribute group: Campsite Point

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Camp_ID</td>
<td>Site number</td>
</tr>
<tr>
<td>Camp_Class</td>
<td>Summary description of level of user impact</td>
</tr>
<tr>
<td>Camp_Occupied?</td>
<td>Is campsite occupied?</td>
</tr>
<tr>
<td>Camp_Solitude</td>
<td>If campsite is occupied, the number of other occupied camps within sight or continuous sound</td>
</tr>
<tr>
<td>Camp_Landform</td>
<td>Associated landform (e.g. lakeshore, streamside, meadow)</td>
</tr>
<tr>
<td>Camp_Type</td>
<td>Associated camp type (e.g. foot, river, stock, outfitter, multiple, other)</td>
</tr>
<tr>
<td>Camp_WaterSource</td>
<td>Closest water source (e.g. creek, river, lake, other)</td>
</tr>
<tr>
<td>Camp_WaterDist</td>
<td>Distance to water source in feet</td>
</tr>
<tr>
<td>Camp_Dam_Trees</td>
<td>Number of damaged trees by humans or stock</td>
</tr>
<tr>
<td>Camp_Root_Exp</td>
<td>Number of trees with exposed/damaged roots in campsite</td>
</tr>
<tr>
<td>Camp_Develop</td>
<td>Level of development observed within and around campsite</td>
</tr>
<tr>
<td>Camp_Clean</td>
<td>Level of cleanliness observed within and around campsite</td>
</tr>
<tr>
<td>Camp_Trails</td>
<td>Number of social trails observed within and around campsite</td>
</tr>
<tr>
<td>Camp_Barren</td>
<td>Barren area estimate within and around campsite</td>
</tr>
<tr>
<td>Camp_Veg_On</td>
<td>Onsite estimate of ground cover canopy coverage</td>
</tr>
<tr>
<td>Camp_Veg_Off</td>
<td>Offsite estimate of ground cover canopy coverage</td>
</tr>
<tr>
<td>Camp_Min_On</td>
<td>Estimate of exposed mineral soil in core area</td>
</tr>
<tr>
<td>Camp_Min_Off</td>
<td>Offsite estimate of exposed mineral soil</td>
</tr>
<tr>
<td>Camp_Photo1/2</td>
<td>Photo number 1/2</td>
</tr>
<tr>
<td>Camp_Notes</td>
<td>Additional notes</td>
</tr>
</tbody>
</table>

### Attribute group: People Point

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>People_Activity</td>
<td>Type of user encountered</td>
</tr>
<tr>
<td>People_Number</td>
<td>Number of people seen in encounter</td>
</tr>
<tr>
<td>Packstock_Number</td>
<td>Number of packstock in party</td>
</tr>
<tr>
<td>Ridingstock_Number</td>
<td>Number of riding stock in party</td>
</tr>
<tr>
<td>Trip_Length</td>
<td>Select overnight or day trip</td>
</tr>
<tr>
<td>People_Notes</td>
<td>Additional notes</td>
</tr>
</tbody>
</table>

### Attribute group: Trailhead Point

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>TH_Name</td>
<td>Assigned name and/or number</td>
</tr>
<tr>
<td>TH_TotNumber</td>
<td>Total number of vehicles</td>
</tr>
<tr>
<td>TH_HorseNumber</td>
<td>Total number of horse trailers</td>
</tr>
<tr>
<td>TH_ORVNumber</td>
<td>Total number of ORV trailers</td>
</tr>
<tr>
<td>TH_Notes</td>
<td>Additional notes</td>
</tr>
</tbody>
</table>

### Attribute group: Noise Roving Point

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Noise_Source</td>
<td>Select source from drop-down menu</td>
</tr>
<tr>
<td>Noise_Duration</td>
<td>Duration of noise (select from categories)</td>
</tr>
<tr>
<td>Noise_Intensity</td>
<td>Intensity rating of noise (select from categories)</td>
</tr>
<tr>
<td>Noise_VisConf</td>
<td>Indicate if source was seen</td>
</tr>
<tr>
<td>Noise_Notes</td>
<td>Additional notes</td>
</tr>
</tbody>
</table>
Attribute group: Noise Sample Point

- **Noise_Sample_Start**: Start time for 15-minute sample on 24h clock
- **Noise_Heard?**: Select Yes/No; if yes continue, below
- **Noise_Source_1**: Select source from drop-down menu
- **Noise_Duration_1**: Enter numerical value in seconds
- **Noise_Intensity_1**: Intensity rating of noise (select from categories)
- **Noise_Vis_Conf_1**: Indicate if source was seen
- **Noise_Notes_1**: Additional notes

**REPEAT above attributes for up to 2 additional noises recorded**

Attribute group: Visual Intrusion Point

- **VI_Type**: Visible evidence of human impact outside WSA
- **VI_Photo**: Photograph
- **VI_Notes**: Additional notes

IV. OTHER FEATURES OF VALU QUALITY

Attribute group: Cultural Resources

- **Cultural_Type**: Select from Historic (cabins, mining, trapping), Prehistoric (teepee rings, culturally scarred trees, rock art), Paleo (fossils)
- **Cultural_Condition**: Record condition as excellent, good, fair, or poor
- **Cultural_Source**: If human created, choose user-created, agency-created, unclear
- **Cultural_Photo**: Photograph
- **Cultural_Notes**: Note additional interesting information
APPENDIX 2. CAMPSITE INVENTORY & CONDITION

Location of inventoried campsites and assigned number (1-3). Numbered campsites correspond to inventory analyses, below.
Campsite #1

Location
Easting (m) 327,659.192
Northing (m) 5,193,327.581
Landform Ridgetop
Type of Use Other
Closest Water Source Other
Distance to Water 0; water likely packed in

Conditions
Damaged Trees
Root Exposure
Development
Cleanliness
Social Trails
Barren Area Estimate
Mineral Soil Exposed Area
Off-site vegetation
Off-site mineral soil exposure

Impact Evaluation
Impact Index N/A
Site Condition Class N/A
## Campsite #2

### Location
- **Easting (m)**: 327,669.021
- **Northing (m)**: 5,193,337.409
- **Landform**: Ridgetop
- **Type of Use**: Foot
- **Closest Water Source**: Creek
- **Distance to Water**

### Conditions
- **Damaged Trees**: 1-9 damaged trees associated w/site
- **Root Exposure**: primitive seat(s) and/or hitch rail, tent poles, etc.
- **Development**: 1 fire ring/scar, microtrash, human waste/manure not obvious
- **Cleanliness**: 1 discernable
- **Social Trails**: 1 discernable
- **Barren Area Estimate**: <300 sq ft.
- **Mineral Soil Exposed Area**: 0 sq ft.
- **Off-site vegetation**: 6-25%
- **Off-site mineral soil exposure**: 6-25%

### Impact Evaluation
- **Impact Index**: 9
- **Site Condition Class**: Not a site
## Campsites #3

### Location
- **Easting (m)**: 327,698.507
- **Northing (m)**: 5,193,337.409
- **Landform**: Ridgetop
- **Type of Use**: Other
- **Closest Water Source**: Other
- **Distance to Water**: 0; water likely packed in

### Conditions
- **Damaged Trees**: no more than broken lower branches
- **Root Exposure**: none
- **Development**: no facilities
- **Cleanliness**: 1 fire ring/scar, microtrash, human waste/manure not obvious
- **Social Trails**: none
- **Barren Area Estimate**: 300-1499 sq ft.
- **Mineral Soil Exposed Area**: >150 sq ft.
- **Off-site vegetation**: 6-25%
- **Off-site mineral soil exposure**: 6-25%

### Impact Evaluation
- **Impact Index**: 16
- **Site Condition Class**: Light
APPENDIX 3. CAMPSITE CONDITION EVALUATION WORKSHEET

Modeled after Anaconda-Pintler Wilderness Site Impact Worksheet - 2013 Edition

<table>
<thead>
<tr>
<th>Rating: circle one category</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>Rate x weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Damaged Trees: # associated with site</td>
<td>No more than broken branches</td>
<td>1-9 damaged trees associated with site</td>
<td>10-25 damaged trees associated with site</td>
<td>&gt; 25 damaged trees associated with site.</td>
<td>__ x 3 =</td>
</tr>
<tr>
<td>Root Exposure: # associated with site</td>
<td>None</td>
<td>1-4 trees with exposed roots</td>
<td>5-10 trees with exposed roots</td>
<td>&gt; 10 trees with exposed roots</td>
<td>__ x 3 =</td>
</tr>
<tr>
<td>Development: (Before naturalizing, exclude fire rings)</td>
<td>No facilities</td>
<td>All facilities dismantled but remnants may be visible</td>
<td>Primitive seat(s) present, and/or facilities such as hitch rail, tent poles stored</td>
<td>More facilities present than #2.</td>
<td>__ x 1 =</td>
</tr>
<tr>
<td>Cleanliness: (Before naturalizing) # fire scars</td>
<td>No waste, manure or trash or fire scar</td>
<td>1 fire ring/scar, or microtrash present, or human waste not obvious, or manure not obvious.</td>
<td>&gt;1 fire ring/scar, or microtrash and some trash present, or human waste not obvious, or manure present.</td>
<td>&gt; 2 fire rings/scars, or trash prevalent, or micro-trash persistent, or human waste obvious, or manure is prevalent.</td>
<td>__ x 1 =</td>
</tr>
<tr>
<td>Social Trails: # of social trails</td>
<td>None</td>
<td>1 discernable (Count any trail passing through the site as 1 trail)</td>
<td>2-3 discernable (Count additional trails crossing the other trail as 1 trail not 2)</td>
<td>&gt;3 discernable (Count a trail that forks off another trail as 1 trail)</td>
<td>__ x 2 =</td>
</tr>
<tr>
<td>Barren Area Estimate: (Main and associated camp areas)</td>
<td>None</td>
<td>&lt; 300 sq ft.</td>
<td>300 - 1499 sq ft.</td>
<td>&gt; 1500 sq ft.</td>
<td>__ x 3 =</td>
</tr>
<tr>
<td>Mineral Soil Exposed Estimate: for main camp and associated areas:</td>
<td>0 sq ft.</td>
<td>1-36 sq ft</td>
<td>37 - 150 sq ft.</td>
<td>&gt; 150 sq ft.</td>
<td>__ x 3 =</td>
</tr>
</tbody>
</table>

0-10 Not a site 11-20 Light 21-30 Moderate 31-39 Heavy 40 - 48 Extreme IMPACT INDEX SUM =