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An Application of Terrestrial Assessment, Inventory, and Monitoring (AIM) Data to Set Benchmarks in the Malheur Field Office, Oregon

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An Application of Terrestrial Assessment, Inventory, and Monitoring (AIM) Data to Set Benchmarks in the Malheur Field Office, Oregon

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Abstract

The mission of the Bureau of Land Management (BLM) is to sustain the health, diversity, and productivity of the public lands for the use and enjoyment of present and future generations. The BLM manages approximately 245 million acres of public land for multiple uses, including livestock grazing, energy development, wildlife habitat, and outdoor recreation. Data collected through the BLM Assessment, Inventory, and Monitoring (AIM) Program represent one of the largest available datasets to inform resource management decisions on public lands. This technical note serves as a companion to BLM Technical Note 453, "Guide to Using AIM and LMF Data in Land Health Evaluations and Authorizations of Permitted Uses," by providing an example of using AIM data to set quantitative benchmarks for land health assessments and evaluations. An interdisciplinary team set benchmarks for four terrestrial AIM indicators to evaluate Oregon/Washington land health standard 1 for a land health evaluation within the Malheur Field Office. This technical note describes how the team completed the five steps outlined in Appendix 2 of Technical Note 453 using terrestrial AIM data to establish the benchmarks. After benchmarks were established, the team applied them to terrestrial AIM points within a group of allotments. The technical note concludes with discussion about whether the area is achieving the standard and lessons learned.

1. Background

1.1 Land Health Assessments and Evaluations in Oregon/Washington

Within the Bureau of Land Management (BLM), land health standards and guidelines provide structure to the agency's directive to maintain the health of public lands (43 CFR 4180; BLM 2001, 2009). Specifically, the purpose of the land health assessment and evaluation process is (1) to assess the current ecological condition of BLM-administered lands by synthesizing available data and information and (2) to evaluate whether current conditions are achieving regionally specified standards. When one or more of these standards are not achieved, the BLM then (3) determines the significant causes and proposes appropriate management changes (43 CFR 4180.2). Though the land health process is mostly considered a critical precursor to public land decisions pertaining to grazing management, land health standards often inform land management decisions pertinent to many other landscape uses and values, such as fuels, recreation, and invasive species management actions.

Approved in 1997, the five Oregon/Washington land health standards are subsequently listed (BLM 1997) (Appendix 1). In relation to each of these standards, the BLM assesses current conditions and evaluates whether these conditions are "achieving" or "not achieving" a standard, or where applicable, "making" or "not making" significant progress towards regaining achievement of a standard.

> **Standard 1 – Watershed Function – Uplands:** Upland soils exhibit infiltration and permeability rates, moisture storage, and stability that are appropriate to soil, climate, and landform.
>
> **Standard 2 – Watershed Function – Riparian/wetland areas:** Riparian-wetland areas are in properly functioning physical condition appropriate to soil, climate, and landform.
>
> **Standard 3 – Ecological Processes:** Healthy, productive, and diverse plant and animal populations and communities appropriate to soil, climate, and landform are supported by ecological processes of nutrient cycling, energy flow, and the hydrologic cycle.
>
> **Standard 4 – Water Quality:** Surface water and groundwater quality, influenced by agency actions, complies with State water quality standards.
>
> **Standard 5 – Native, Threatened and Endangered, and Locally Important Species:** Habitats support healthy, productive, and diverse populations and communities of native plants and animals (including special status species and species of local importance) appropriate to soil, climate, and landform.

1.2 Cow Lakes Assessment Area

Beginning in 2018, the BLM Malheur Field Office of the Vale District in Oregon began working on land health assessments and evaluations of the Cow Lakes Assessment Area (Figure 1). The assessment area is about 366,981 acres of public land located in central Malheur County, Oregon. This area is bordered by Idaho to the east, the main fork Owyhee River to the northwest and west, and Jordan Valley, Oregon, and U.S. Highway 95 to the south. It contains important habitat for greater sage-grouse (*Centrocercus urophasianus*), including the Cow Lakes Priority Area for Conservation. This area was prioritized for assessment and evaluation because greater sage-grouse population declines and habitat loss within the priority area for conservation tripped soft habitat and soft population triggers defined in Appendix J of the "Oregon Greater Sage-Grouse Approved Resource Management Plan Amendment" (BLM 2015). Tripping two soft triggers initiated adaptive management responses. In addition, there is a general need to assess land health and review effects of current grazing management as part of the grazing permit renewal process.

The Cow Lakes Assessment Area is comprised of 18 allotments and one pasture from a 19th allotment that form four groups (Figure 1). That will be evaluated with four land health assessments, one for each group. To inform the assessments, the interdisciplinary team spent several years assembling existing datasets and collecting field data, for example following describing indicators of rangeland health (DIRH) (Pellant et al. 2020) and proper functioning condition (PFC) (Dickard et al. 2015) protocols. In terms of data availability in the assessment area, BLM terrestrial Assessment, Inventory, and Monitoring (AIM) points (also referred to as plots) are distributed throughout the area (Figure 2), but the area otherwise has significant gaps in mapped soil units and ecological site information and inconsistent and/or unavailable long-term trend monitoring data. Given this context, the interdisciplinary team was interested in establishing benchmarks from AIM data as a quantitative line of evidence to complement other relatively qualitative datasets (DIRH, PFC, etc.) to inform the Cow Lakes Assessment Area land health assessments and evaluations.

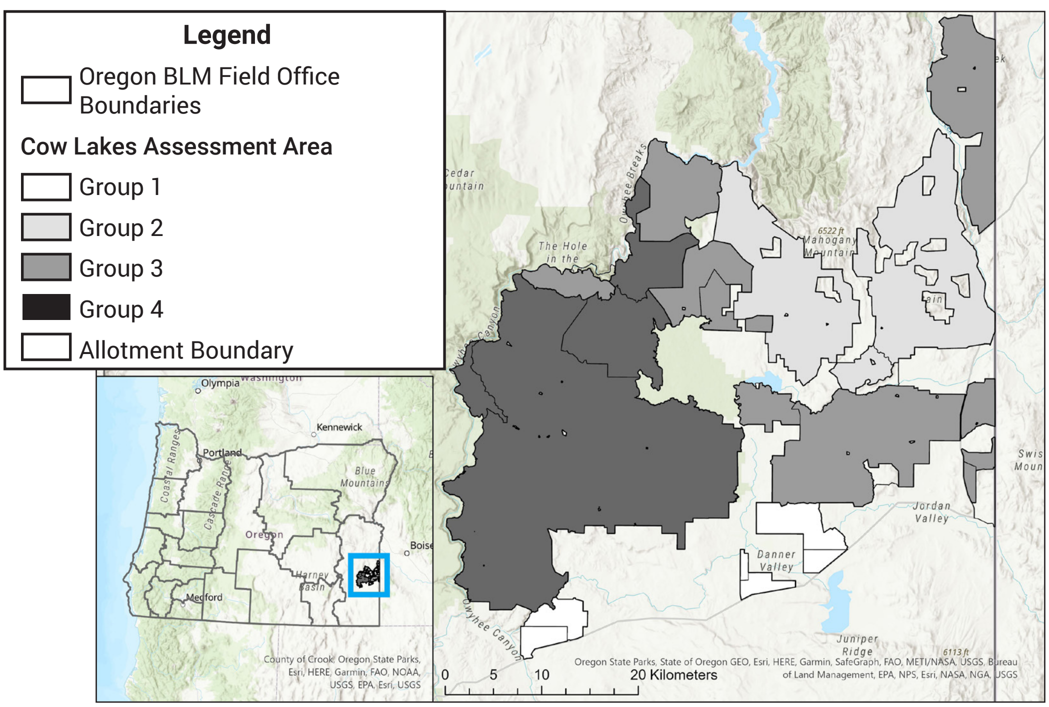

Figure 1. Map of the grouped allotments in the Cow Lakes Assessment Area located within the administrative boundary of the BLM Oregon/Washington Malheur Field Office.

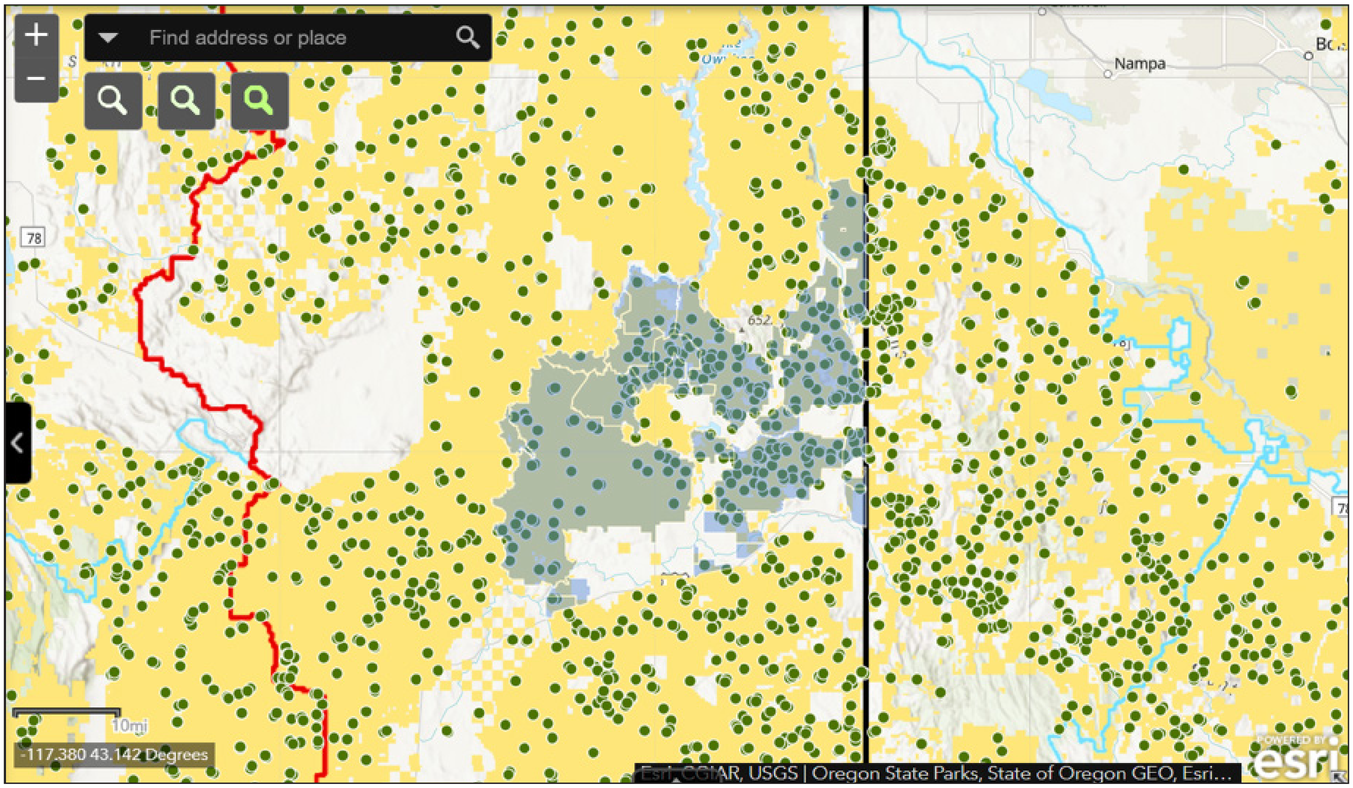

Figure 2. Screenshot of the BLM National AIM Terrestrial Data Portal showing the Cow Lakes Assessment Area. The blue polygon represents the Cow Lakes Assessment Area, green dots depict available information from terrestrial AIM points in the Terrestrial AIM Database as of April 2023, and yellow polygons define BLM-managed public lands.

1.3 Benchmarks for Evaluating Land Health Standards

Ecological indicators can be calculated from data collected at terrestrial AIM points. As a quantitative line of evidence, these AIM indicators can be evaluated against benchmarks developed to provide ecologically relevant insights into degree of departure from specific land health standards. Indicators are calculated from field-collected data and are structural or functional measures that either directly or indirectly provide quantitative information on the condition of critical ecosystem processes and/or attributes. Good indicators for assessing standards are relevant to the standards and noticeably change with management practices. It is best to use a suite of indicators to adequately address questions posed by standards because no single indicator can fully describe whether a point is achieving a standard (43 CFR 4180; BLM 2001, 2009).

Benchmarks are indicator values or ranges of values that establish goals for resource conditions (e.g., land health, desired future conditions identified in land use planning documents) and are meaningful for management (Kachergis et al. 2020). Observed indicator values at assessed points are compared to benchmark values to help decide whether land health standards are achieved. An indicator value that does not attain a benchmark can indicate that desired resource conditions or objectives are not being met to achieve standards, in which case the cause of the resource issue should be identified and addressed through appropriate management actions (e.g., modification to a grazing plan). BLM Technical Note 453, "Guide to Using AIM and LMF Data in Land Health Evaluations and Authorizations of Permitted Uses" (Kachergis et al. 2020) outlines a workflow on how to choose indicators and set appropriate benchmarks as a line of evidence to assess current conditions and evaluate land health standards. This technical note describes the workflow used to set benchmarks pertinent to "watershed function – uplands" (Oregon/Washington standard 1), hereafter referred to as standard 1.

Appendix 1 of Technical Note 453 provides a crosswalk among all land health standards and relevant AIM indicators than can be used to evaluate them. AIM core indicators listed for standard 1 include bare ground, proportion of large gaps between plant canopies, vegetation composition, vegetation height, and soil aggregate stability (Figure 3). Indicator data collected at AIM points (right column) can be used to calculate data for indicators associated with land health standards (left column). As lines of evidence to assess standard 1, the team chose the core indicators bare soil cover (bare ground) and average soil stability rating (soil aggregate stability) and the associated indicator total foliar cover (amount and distribution of plant cover).

Oregon and Washington	
Indicators Associated with Land Health Standard	**AIM Terrestrial and Lotic Core and Contingent Indicators Associated with Land Health Standard**
STANDARD #1 — Watershed function - uplands: Upland soils exhibit infiltration and permeability rates, moisture storage, and stability that are appropriate to soil, climate, and landform.	
Protection of the soil surface from raindrop impact; detention of overland flow; maintenance of infiltration and permeability and protection of the soil surface from erosion, consistent with the potential/capability of the site, as evidenced by the: • Amount and distribution of plant cover (including forest canopy cover) • Amount and distribution of plant litter • Accumulation/incorporation of organic matter • Amount and distribution of bare ground • Amount and distribution of rock, stone, and gravel • Plant composition and community structure • Thickness and continuity of A horizon • Character of microrelief • Prescence and integrity of biotic crusts • Root occupancy of the soil profile • Biological activity (plant, animal, and insect) • Absence of accelerated erosion and overland flow Soil and plant conditions promote moisture storage as evidenced by: • Amount and distribution of plant cover (including forest canopy cover) • Amount and distribution of plant litter • Plant composition and community structure • Accumulation/incorporation of organic matter	• Bare ground • Proportion of large gaps between plant canopies • Vegetation composition • Vegetation height • Soil aggregate stability

Figure 3. Oregon/Washington standard 1 and relevant AIM indicators that can be used to help evaluate whether standard 1 is being achieved (adapted from Kachergis et al. 2020).

The team decided that, when combined, scientific literature, screened data from terrestrial AIM points, and best professional judgement represented the best available information to set benchmark values for the assessment area. Figure 4 in Technical Note 453 outlines a hierarchical approach for determining suitable information to set benchmark values. The approach suggests beginning with policy and decision documents and then considering reference conditions and/or scientific literature (Figure 4). Standard 1 does not include quantitative thresholds, and the relevant resources available for the Cow Lakes Assessment Area (e.g., resource management plan, biological opinions, land treatment/reclamation objectives, allotment management plans) are vague and/or nonquantitative. Thus, the team considered reference conditions (e.g., ecological site descriptions, predictive models) and scientific literature. Ecological site descriptions often specify quantitative thresholds for bare ground cover, total foliar cover, and soil aggregate stability ratings for proper ecological function in a soil type. Thresholds obtained from ecological site descriptions are ideal for setting benchmark values, but soils are not yet fully mapped across this region. Therefore, ecological site descriptions have not been developed for the entire assessment area. Due to unavailability of identified reference sites, the team referred to information from screened AIM data, scientific literature, and best professional judgement to set benchmark values for the assessment area.

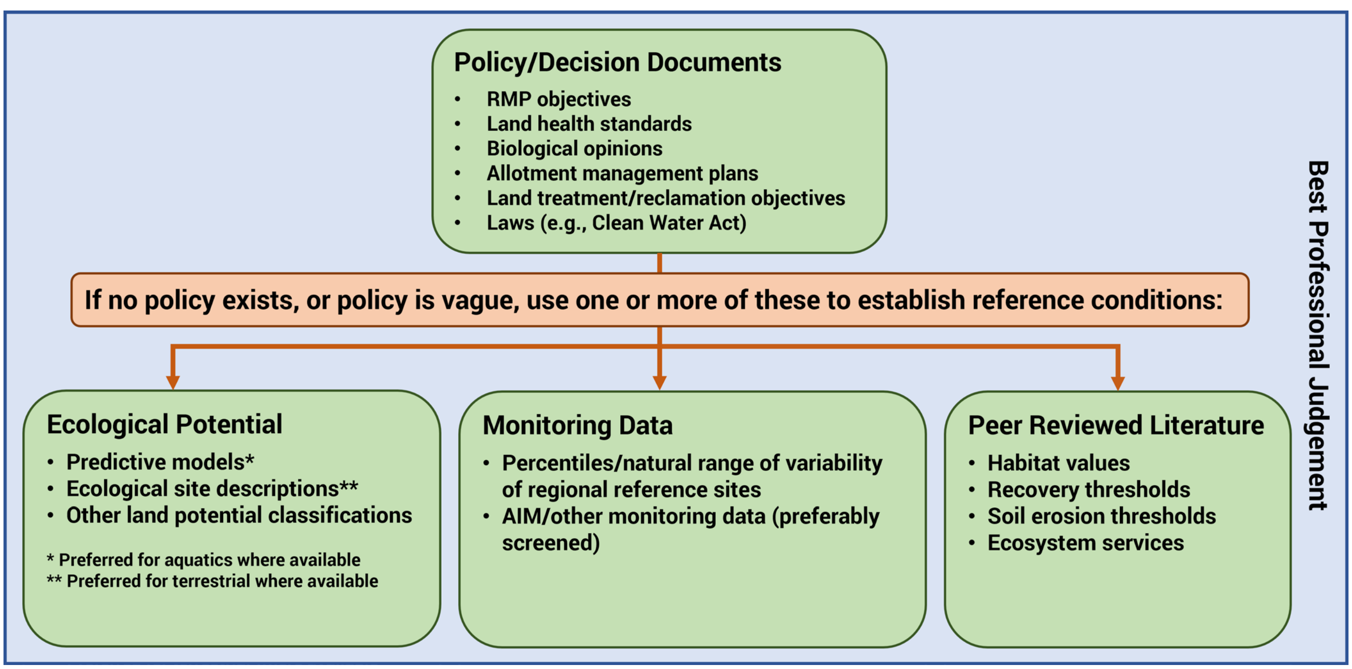

Figure 4. Example information sources that can be used to set benchmarks (adapted from Kachergis et al. 2020).

2. Set Benchmarks

The team followed the workflow outlined in Appendix 2 of Technical Note 453 to set benchmark values with screened data from terrestrial AIM points, findings from scientific literature, and best professional judgement. The workflow outlines the following steps:

1. Identify AIM, LMF [Landscape Monitoring Framework], and other comparable monitoring data within a broad, geographically similar area (e.g., ecoregion, watershed).
2. Screen monitoring data to identify points that represent reference conditions and/or that are maintaining ecological functions.
3. Group monitoring points by geographic areas having similar climatic, topographic, geologic, vegetation, and soil conditions (e.g., ecoregions, ecological site types, stream types).
4. Visualize indicator values within each group using box points or frequency distributions.
5. To establish benchmarks, select percentiles of the indicator value distribution.
6. This section demonstrates how the team completed each step to establish benchmarks for standard 1 in the Cow Lakes Assessment Area.

2.1 Step 1. Identify AIM, LMF, and other comparable monitoring data within a broad, geographically similar area (e.g., ecoregion, watershed).

The team chose ecoregions of the finest scale (Level IV) to delineate areas geographically similar to the assessment area and identify reference AIM points to set benchmarks (Thorson et al. 2003). Ecoregions characterize areas by relative homogeneity in ecological systems, their response to change, and primary land uses (Gallant et al. 1989). The BLM uses the Level III ecoregion framework (Omernik 1987) as a standard for broad-scale landscape assessments in rapid ecoregional assessments, which BLM managers and partners use to meet the BLM's multiple use and sustained yield mission (Toevs et al. 2011). The team determined that Level IV ecoregions most accurately represented the ecological heterogeneity within the assessment area and were broad enough in scale to sufficiently capture AIM points (at least 30 reference points). The team also considered other large-scale mapping and characterization tools (e.g., Disturbance Response Groups, LANDFIRE, Level III ecoregions).

Two Level IV ecoregions, 80a Dissected High Lava Plateau and 80f Owyhee Uplands and Canyons, intersect the assessment area (Figure 5). Both ecoregions are dominated by sagebrush grasslands and nested within Level III ecoregion 80 Northern Basin and Range (Thorson et al. 2003). Ecoregion 80a (32,873 km²) spans the corner of southeastern Oregon, dips into northern Nevada, and extends into south-central Idaho and northeastern Nevada. Defining features of ecoregion 80a include alluvial fans, rolling plains, and shear-walled canyons that are cut into extrusive rocks. Ecoregion 80f (11,097 km²) is smaller and lies north of ecoregion 80a in eastern Oregon and extends into southwest Idaho. Ecoregion 80f is characterized by deep, precipitous river canyons, barren lava fields, badlands, and tuffaceous outcrops that are riddled with caves. It has higher stream density and water availability than ecoregion 80a (Thorson et al. 2003).

The team extracted terrestrial AIM data for each ecoregion from the BLM Terrestrial AIM Database (internal site, https://blm.gov/aim/TerrestrialDataPortal; public site, https://gbp-blm-egis.hub.arcgis.com/pages/aim).

At the time of data extraction in early 2022, data were available from 2,013 and 653 AIM points in ecoregions 80a and 80f, respectively; these data were collected from 2011 to 2020 (Figure 5, Table 1). The database includes a dataset collected by the BLM and a dataset collected by the Natural Resources Conservation Service for a component of the AIM strategy—the BLM Landscape Monitoring Framework (LMF). Both datasets include data collected with AIM methods described in the “Monitoring Manual for Grassland, Shrubland, and Savanna Ecosystems” (Herrick et al. 2021). Hereafter, the term terrestrial AIM refers to both datasets unless specified otherwise.

Table 1. Summary of terrestrial AIM and LMF points with available data to set benchmarks by ecoregion.

	Ecoregion	
Point Type	**80a**	**80f**
AIM	986	450
LMF	1,027	203
Total	**2,013**	**653**

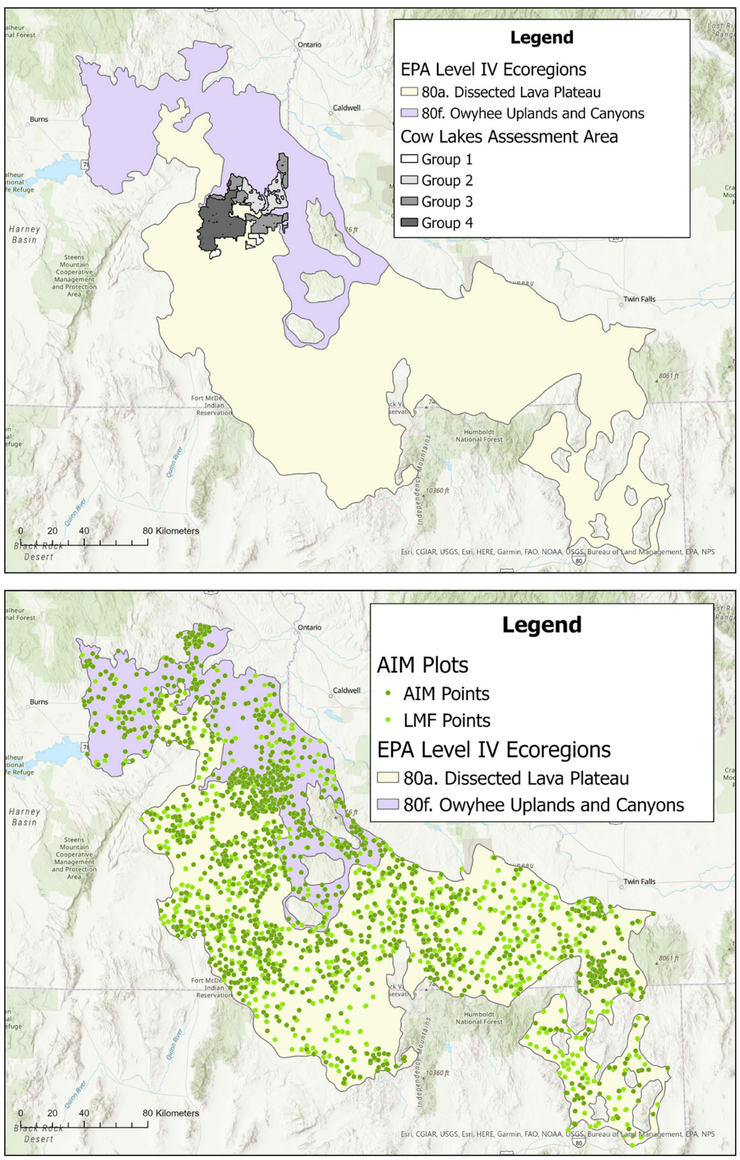

Figure 5. (Top) Level IV ecoregions 80a Dissected High Lava Plateau and 80f Owyhee Uplands and Canyons and (bottom) terrestrial AIM and LMF points with data available to set benchmarks within each ecoregion.

2.2 Step 2. Screen monitoring data to identify points that represent reference conditions and/or that are maintaining ecological functions.

The team screened the extracted data in two phases to identify reference points that are more likely to maintain proper upland watershed functions. In the first phase, the team identified realistic thresholds to screen points for reference with percent cover values. Points containing > 5% annual grass cover and < 9% biological soil crust cover were excluded. The team applied a second phase to the remaining points in ecoregion 80f, using photos and AIM indicators to identify reference points.

The team selected a threshold of ≤ 5% annual grass cover because high invasive annual grass cover can increase fire frequency and reduce cover potential for functioning native perennial species, which may reduce the ability to achieve standard 1. High cover of invasive annual grasses, such as cheatgrass (*Bromus tectorum*), medusahead (*Taeniatherum caput-medusae*), ventenata (*Ventenata dubia*; also known as north Africa grass and wiregrass), and other nonnative bromes, can increase fire frequency in shrubland ecosystems (D'Antonio and Vitousek 1992). Shifts in fire frequency are known to change sagebrush density and cover, altering habitat and triggering population declines for sagebrush obligates like the greater sage-grouse (Nelle et al. 2000; Coates et al. 2015). Furthermore, Baker (2006) explains that fire regimes are likely significantly altered from their historical range in sagebrush ecosystems now dominated by cheatgrass. Bradley et al. (2018) found that fire probability increases rapidly in areas with 1 to 5% cheatgrass cover in the Intermountain West; cheatgrass cover was > 15% across nearly one-third of the study area in which the Cow Lakes Assessment Area resides. In both ecoregions combined, the proportion of annual grass cover measured at terrestrial AIM points that is comprised of cheatgrass, medusahead, and ventenata is high (mean = 90.6%, standard deviation = 24.0%). The team determined that points with > 5% annual grass cover (indicated by the AIM indicator 'AH_AnnGrassCover') did not meet the definition of reference based on the findings in Bradley et al. (2018).

The team selected ≥ 9% biological soil crust cover as a reference threshold because areas with low biological soil crust cover are more likely to have been impacted by anthropogenic disturbances and cheatgrass invasion. Biological soil crusts are comprised of microorganisms (e.g., algae, cyanobacteria), nonvascular plants (e.g., mosses), and lichens which help facilitate proper upland watershed functions by protecting soils from wind and water erosion. Biological soil crusts may be sensitive to disturbance from grazing, recreation, and loss of native bunchgrasses (Ponzetti et al. 2007; Root and McCune 2012). Ponzetti and McCune (2001) found that exclosures in central and eastern Oregon averaged 9.7% biological soil crust cover as opposed to 6.9% outside the exclosures where active grazing occurred. Based on their results, the team used ≥ 9% cover of biological soil crusts as a threshold for point exclusion with the assumption that points with biological soil crust cover of ≥ 9% are less likely to have been impacted by anthropogenic disturbances and loss of native bunchgrasses. The team calculated any-hit biological soil crust cover (i.e., ground cover of biological soil crust with or without vegetation above) in statistical program R version 4.2.1 (R Core Team 2022) with functions provided by the terradactyl package (McCord et al. 2022) and data collected with the line-point intercept method at terrestrial AIM points. Moss, cyanobacteria, and lichen hits were included when calculating biological soil crust cover, but vagrant lichen hits were not included. Points near anthropogenic features like major roads, fences, and water developments were not excluded based on recommendations by BLM staff in another office that found points near those features may achieve standard 1.

The team applied the phase one screening thresholds to the data in each ecoregion. In ecoregion 80a, 348 (17%) points met both thresholds; 693 (34%) points and 246 (12%)

points did not meet the biological soil crust cover threshold and exceeded the annual grass cover threshold, respectively; and 726 (36%) points met neither threshold. Of the 653 points in ecoregion 80f, 48 (7%) points met both thresholds, 91 (14%) points failed the biological soil crust cover threshold, 126 (19%) points exceeded the annual grass cover threshold, and 388 (59%) points failed both thresholds (Table 2, Figure 6). This concluded phase one screening.

Table 2. Summary of phase one screening results by ecoregion. Two thresholds were applied to identify terrestrial AIM points for reference: ≤ 5% annual grass cover and ≥ 9% biological soil crust cover.

	Ecoregion	
Point Type	80a	80f
< 9% Biological Soil Crust Cover	693 (34%)	91 (14%)
> 5% Annual Grass Cover	246 (12%)	126 (19%)
< 9% Biological Soil Crust Cover and > 5% Annual Grass Cover	726 (36%)	388 (59%)
Met Thresholds	**348 (17%)**	**48 (7%)**

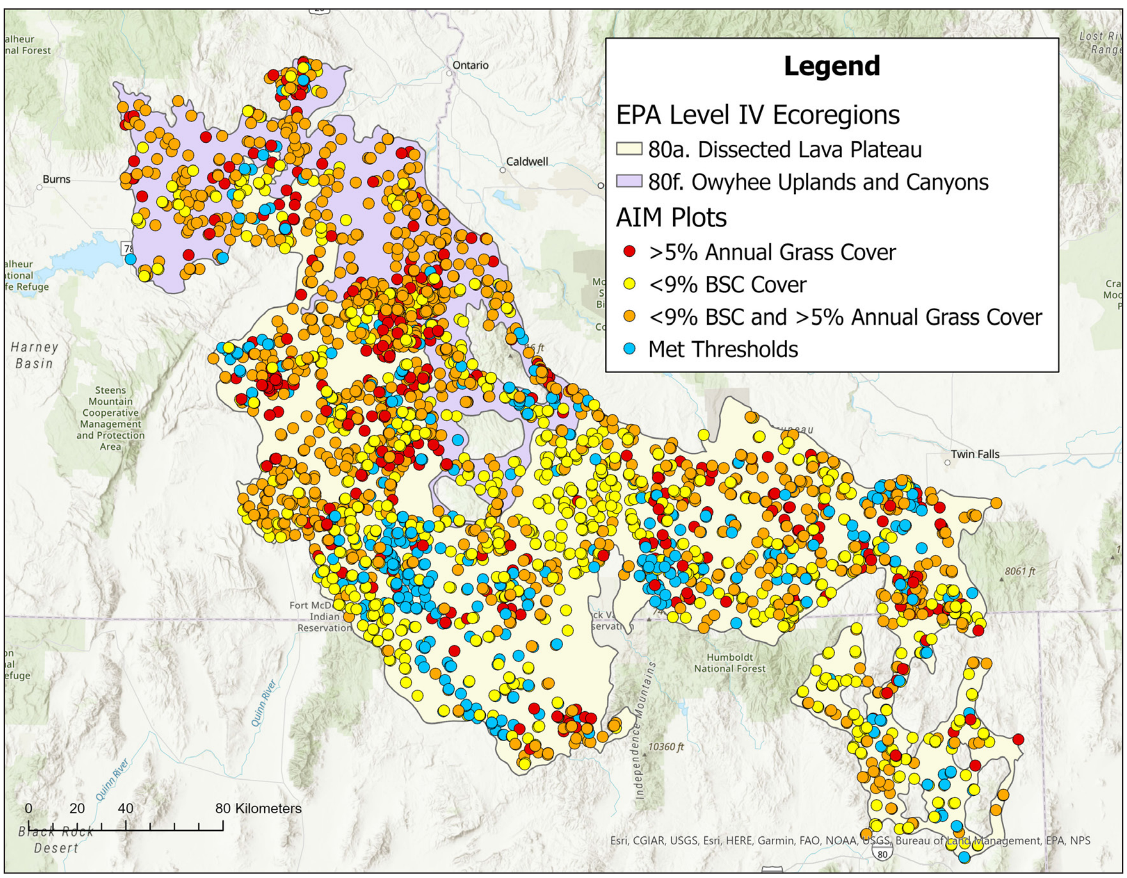

Figure 6. Map displaying phase one screening results in Level IV ecoregions 80a and 80f. Two thresholds were applied to identify terrestrial AIM points for reference: ≤ 5% annual grass cover and ≥ 9% biological soil crust cover (BSC). Red points are > 5% annual grass cover; yellow points are < 9% biological soil crust cover; orange points are > 5% annual grass cover and < 9% biological soil crust cover; and blue points met both thresholds.

Next, the team applied a second screening phase to ecoregion 80f. For every AIM point that met both phase one screening thresholds, the team generated a PDF summary that contained point photos, point characteristics (e.g., location, elevation), soil pit information, a list of detected species, and AIM indicator values. The team also extracted a spreadsheet from the Terrestrial AIM Database with indicator values for all points that met phase one screening thresholds. A conditional formatting in Excel was used to flag data values that were below the 25th and above the 75th percentiles for each indicator listed in Table 3. The flagged values helped identify points with extreme indicator values relative to the other points. With point photos, the team examined distribution of canopy gaps among plants and presence and abundance of functional/structural groups. The photos made it easy to identify anomalous points, such as juniper stands and rock outcrops, and visualize cover values from AIM indicators (Figure 7). From the AIM data, the team relied mostly on species composition information and percent shrub cover and tall perennial grass cover values to understand a point's ability to retain and infiltrate snowmelt. The team also reviewed additional AIM indicators outlined in Table 3. When it became difficult to determine whether a point was achieving standard 1, the team erred on the side of inclusion. The team categorized 35 points as reference for proper upland watershed functions, 6 points as not reference, and 7 points as anomalous (e.g., juniper-dominated, extraordinary rock cover) (Appendix 2).

Table 3. Definitions of terrestrial AIM indicators used to evaluate whether a point was achieving Oregon/Washington standard 1 for reference.

AIM Indicator	Description
AH_NonNoxAnnGrassCover	% Cover of nonnoxious annual grasses
AH_NonNoxPerenGrassCover	% Cover of nonnoxious perennial grasses
AH_NonNoxSubShrubCover	% Cover of nonnoxious sub shrubs
AH_NonSagebrushShrubCover	% Cover of nonsagebrush shrubs
AH_NoxAnnGrassCover	% Cover of noxious annual grasses
AH_NoxPerenGrassCover	% Cover of noxious perennial grasses
AH_SagebrushCover	% Cover of sagebrush
AH_ShortPerenGrassCover	% Cover of short-statured perennial grasses
AH_ShrubCover	% Cover of shrubs
AH_TallPerenGrassCover	% Cover of tall-statured perennial grasses
Spp_Nox	Noxious species present
Spp_Sagebrush	Sagebrush species present
Spp_ShortPerenGrass	Short-statured perennial grass species present
Spp_TallPerenGrass	Tall-statured perennial grass species present

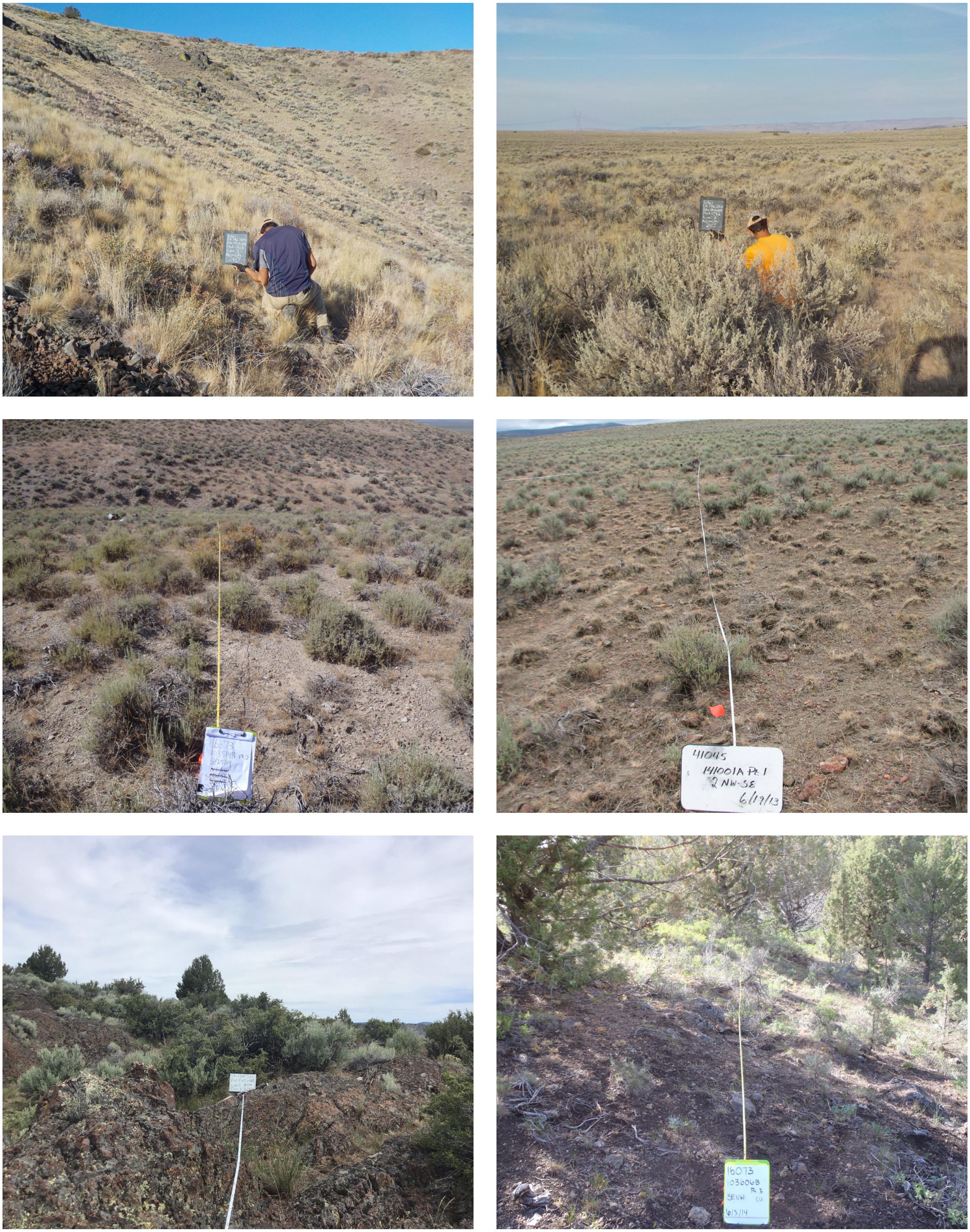

Figure 7. Photos from terrestrial AIM points that BLM staff determined to be reference points for Oregon/Washington standard 1 (top row), not reference points (middle row), or anomalous points (bottom row) in ecoregion 80f.

Instead of implementing a second screening phase to points in ecoregion 80a, the team organized ecoregion 80a points into subsets based on BLM field office boundaries. Applying the second screening phase was effective in ecoregion 80f but also the most time-intensive step of the workflow. The team decided it was not feasible to implement a second screening phase to the remaining 348 points in ecoregion 80a based on the time commitment to review 48 points in ecoregion 80f. Because the geographic extent of ecoregion 80a was large, the team excluded AIM points that did not occur in field offices that neighbored the Malheur Field Office. Instead, the team took extra measures when selecting percentiles from the less screened data in step 5. This resulted in 213 reference points in ecoregion 80a from the Malheur Field Office in Oregon, Owyhee Field Office in Idaho, and Tuscarora and Humboldt Field Offices in Nevada (Figure 8).

To avoid circular reasoning, it is recommended to remove the points used to set benchmarks (i.e., those points determined by the team as reference points) from the pool of points that will be evaluated against the benchmarks. Because the reference points were determined from a pool of points at the larger, ecoregional scale rather than the allotment or assessment area scale, the team agreed circular reasoning would be avoided. Therefore, the team did not remove reference points when evaluating points against benchmarks.

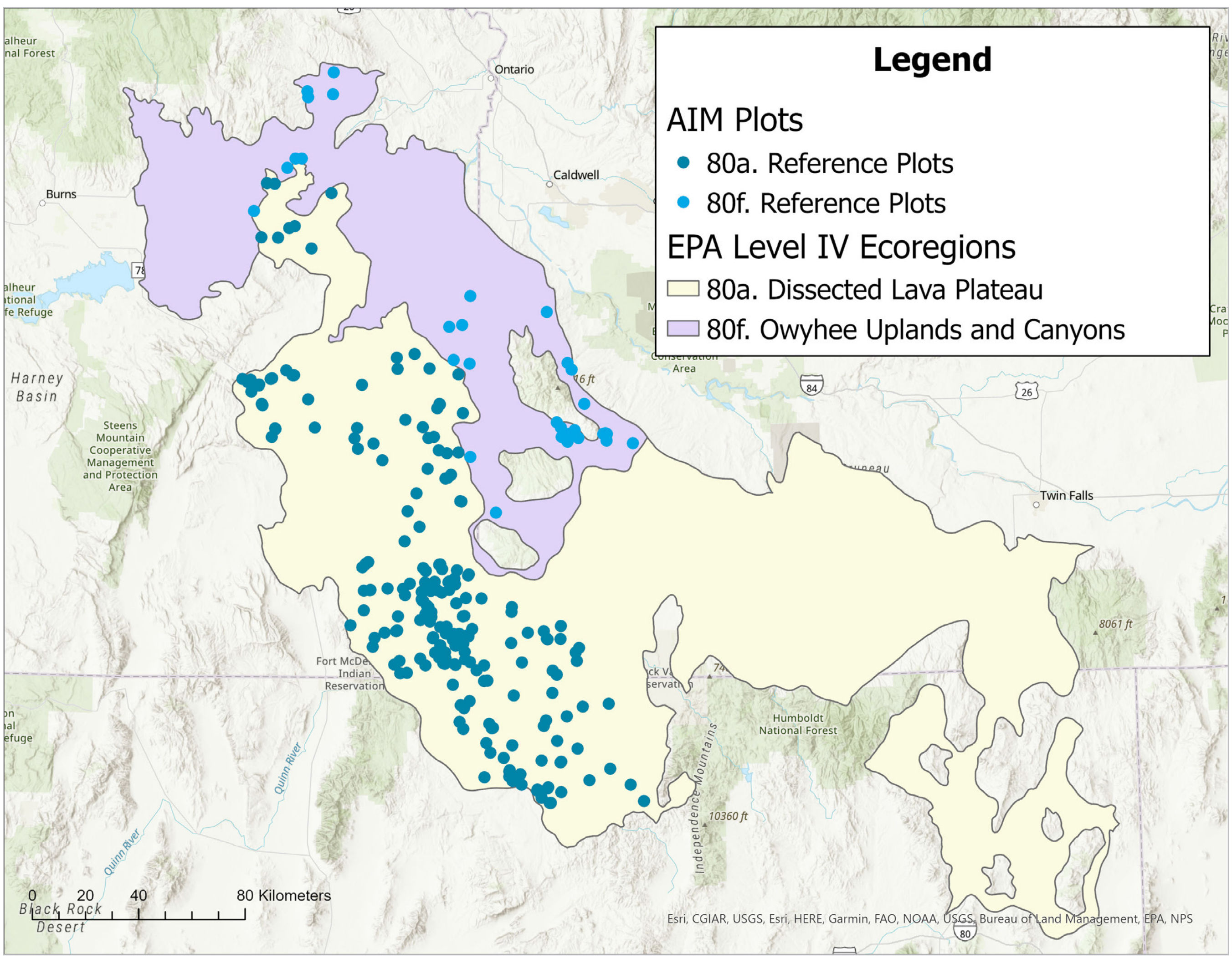

Figure 8. Map of terrestrial AIM points rated as reference for Oregon/Washington standard 1 in Level IV ecoregions 80a and 80f.

2.3 Step 3. Group monitoring points by geographic areas having similar climatic, topographic, geologic, vegetation, and soil conditions (e.g., ecoregions, ecological site types, stream types).

AIM points were not stratified into benchmark groups finer than the scale of Level IV ecoregions because stratifying further would have resulted in an insufficient amount of points in at least one stratum. Previous recommendations suggest selecting percentiles from indicator distributions from no less than 30 reference points. In ecoregion 80f, 35 points were rated as reference, and stratifying further would have resulted in less than 30 reference points in at least one stratum. Thus, the Level IV ecoregions 80a and 80f were the benchmark groups.

The team used two-sided Kolmogorov-Smirnov tests (K-S tests) to assess whether reference points were representative of the ecoregion's topography and elevation. For ecoregion 80f, all terrestrial AIM points in the ecoregion were compared with points rated as reference. K-S tests indicated that reference points were representative of AIM points in ecoregion 80f with respect to percent slope ($D = 0.16$, $p > 0.05$), but reference points had slightly higher elevation ($D = 0.23$, $p < 0.05$) than AIM points. However, because the difference between the average elevation of ecoregion 80f AIM points (mean = 1,361 m) and reference points (mean = 1,454 m) was less than 100 meters and distribution shapes were similar (Figure 9), the team decided this difference was ecologically insignificant and the reference points were representative of all AIM points in the ecoregion. For ecoregion 80a, all terrestrial AIM points in the ecoregion that occurred in the Malheur, Owyhee, Tuscarora, and Humboldt Field Offices were compared with points rated as reference. Reference points represented slightly gentler slopes (mean = 4.15%) and slightly higher elevations (mean = 1,572 m) than all points in neighboring field offices (mean slope = 5.62%, mean elevation = 1,501 m). The K-S tests indicated that reference points were not representative of the subset of AIM points in ecoregion 80a with respect to slope ($D = 0.12$, $p < 0.05$) and elevation ($D = 0.23$, $p < 0.05$). Despite this, because of the slight differences in means and similar distribution shapes (Figure 9), the team again concluded the results were ecologically insignificant and reference points were representative of all AIM points in the ecoregion.

The team also calculated Pearson's correlation coefficients (r) to assess whether benchmark indicator values were influenced by elevation and topography. For each ecoregion, a Pearson's correlation coefficient was calculated for each combination of the benchmark indicators with slope and elevation at all available AIM points. All indicators were weakly correlated ($r < 0.3$) with slope and elevation in both ecoregions (Table 4).

Table 4. Calculated Pearson's correlation coefficients (r) among AIM indicators bare soil cover, total foliar cover, and average soil stability rating with percent slope and elevation in terrestrial AIM points in Level IV ecoregions 80a and 80f.

	Ecoregion 80a		Ecoregion 80f	
Indicator	Slope	Elevation	Slope	Elevation
Total Foliar Cover	-0.28	0.15	-0.28	-0.13
Bare Soil Cover	0.17	-0.02	0.15	-0.07
Average Soil Stability	-0.02	-0.13	-0.09	0.07

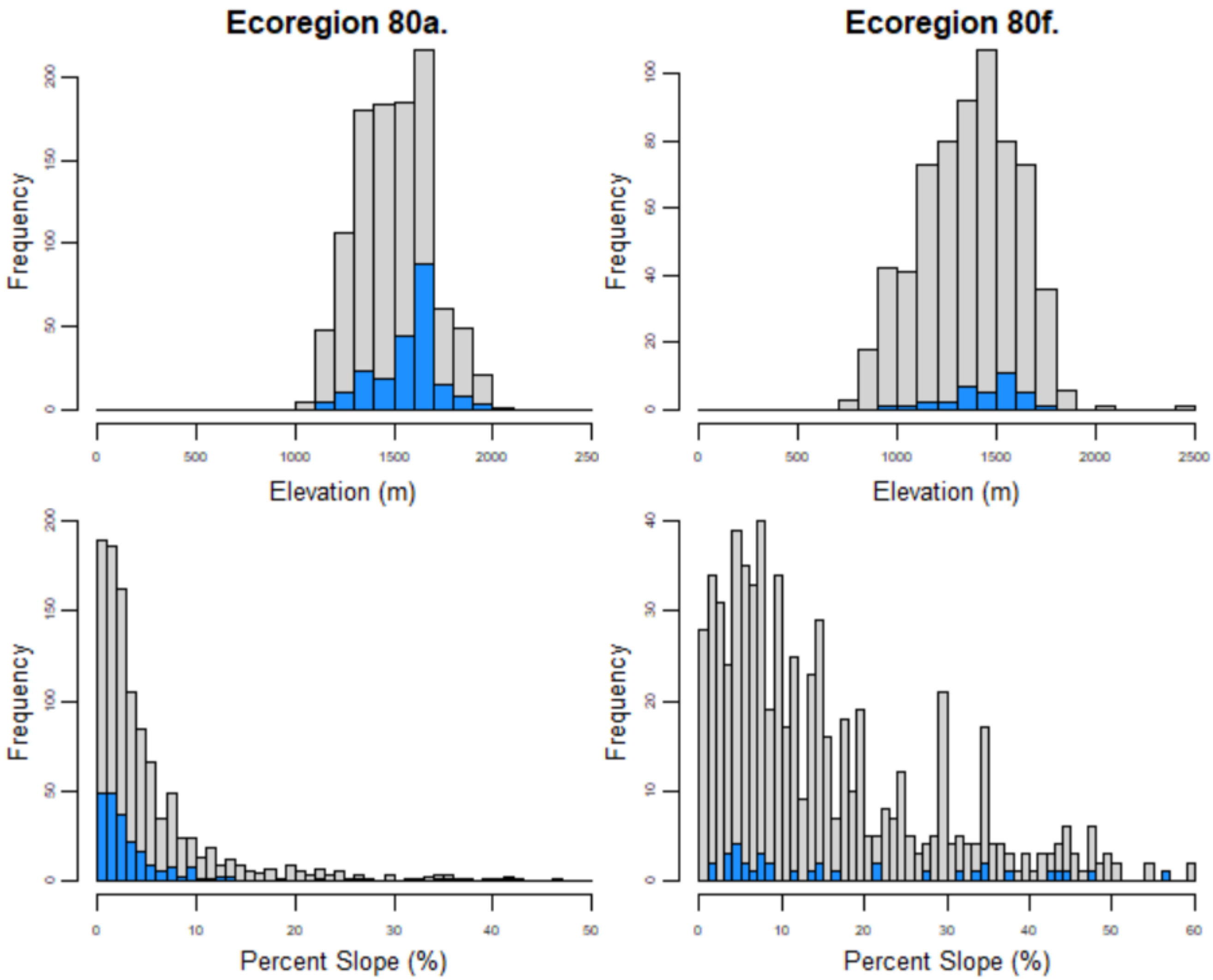

Figure 9. Comparison of distributions of elevation (top row) and percent slope (bottom row) of terrestrial AIM points in Level IV ecoregions 80a (left) and 80f (right) between all terrestrial AIM points (grey bars) and points rated as reference (blue bars) for Oregon/Washington standard 1 in each ecoregion.

2.4 Step 4. Visualize indicator values within each group using box points or frequency distributions.

The team plotted distributions of the benchmark indicators at reference points and visualized potential benchmark ranges with the 10th, 25th, 75th, and 90th percentiles (Figure 10, Table 5). For bare soil cover, 0% was used to visualize the lower limit instead of the 10th and 25th percentiles because low values of bare soil cover do not directly threaten proper upland watershed functions. Likewise, a soil stability value of 6 was used to visualize the upper limit for average soil stability rather than the 75th and 90th percentiles since more stable soils do not threaten proper upland watershed functions in this region.

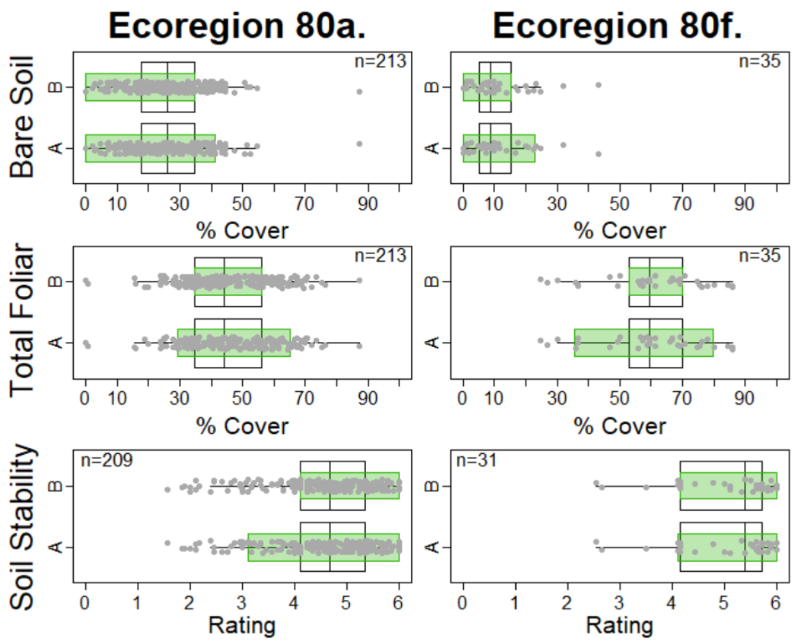

Figure 10. Box plots of AIM indicator values for bare soil cover, total foliar cover, and average soil stability rating from terrestrial AIM points rated as reference for Oregon/Washington standard 1 in Level IV ecoregions 80a (left) and 80f (right). The green boxes outline potential benchmark value ranges with the 10th and 90th (A) and 25th and 75th (B) percentiles, using minimum and maximum values as appropriate.

Table 5. AIM indicator values at the 10th, 25th, 75th, and 90th percentiles of their distributions from terrestrial AIM point data that were rated as reference for Oregon/Washington standard 1 in Level IV ecoregions 80a and 80f.

Ecoregion	Indicator	10th Percentile	25th Percentile	75th Percentile	90th Percentile
80a	Bare Soil Cover	0%*	0%*	34.67%	41.2%
	Total Foliar Cover	29.7%	34.65%	56%	64.67%
	Average Soil Stability	3.1	4.1	6**	6**
80f	Bare Soil Cover	0%*	0%*	15.42%	23.07%
	Total Foliar Cover	36.27%	53%	70%	79.32%
	Average Soil Stability	4.11	4.17	6**	6**

* 0% was used instead of the 10th and 25th percentiles.
** 6 was used instead of the 75th and 90th percentiles.

2.5 Step 5. To establish benchmarks, select percentiles of the indicator value distribution.

The team used photos, AIM indicators, and scientific literature to aid discussions while considering each percentile as a potential benchmark limit. Benchmarks were set for bare soil cover, total foliar cover, soil stability, and perennial to annual grass cover ratio for each ecoregion, beginning with 80f.

Ecoregion 80f

Bare Soil Cover. The team selected 20% as an upper limit because it was close to the 90th percentile (23.07%) and is commonly used as a threshold to prevent acceleration of soil erosion from wind and water (Webb et al. 2014). For the lower limit, the team selected 0% because low levels of bare soil do not directly threaten proper upland watershed functions. The team considered whether 0% bare soil cover would be too low of a threshold as it could indicate other issues affecting upland watershed functions (e.g., extensive litter cover). To avoid flagging areas that are properly functioning and inherently have low values of bare soil cover (e.g., highly productive sites) as potentially problematic, the team decided it would be more appropriate to address those concerns with a separate benchmark (e.g., total litter cover), which was not developed in this effort.

Total Foliar Cover. The team selected the 20th percentile (49%) for the lower limit and 100% for the upper limit. The team first considered the 10th percentile (36%) for the lower limit but decided that was too low for proper upland watershed functions. Then the team considered the 25th percentile (53%) but decided the 25th percentile was too restrictive and explored the 15th and 20th percentiles. After reviewing photos of reference points with total foliar cover values between the 10th and 25th percentiles, the team decided the 20th percentile (49%) was the most appropriate. The team discussed using percentiles to set an upper limit because of concern that very high foliar cover would indicate extensive annual grass invasion. The team considered the 90th percentile (79%) to exclude only extreme cases of high foliar cover and therefore extensive invasive annual grass invasion. To test this threshold, the team reviewed photos from AIM points with total foliar cover greater than 79% that attained the benchmarks for bare soil cover and soil stability. The team determined this threshold excluded highly productive sites with little annual grass invasion and therefore chose 100% as the upper limit. To address concerns of extremely high annual grass cover, the team considered a new benchmark indicator—perennial to annual grass cover ratio, which is subsequently explained.

Soil Stability. The team selected 4 for the lower limit and 6 for the upper limit. For the lower limit, the 25th (4.17) and the 10th (4.11) percentiles were considered, but because both values were similar, 4 was selected for the lower limit, rounding down the percentile values to agree with the whole number nature of the soil aggregate stability test metric. For the upper limit, the maximum score (6) was chosen because high levels of soil stability do not threaten proper upland watershed functions.

Perennial to Annual Grass Cover Ratio. To quantify annual grass dominance, the team calculated a fourth benchmark indicator, perennial to annual grass cover ratio, based on Wood and Mealor's (2022) approach to identify rangelands needing restoration. The team selected 1 for the lower limit and infinity for the upper limit.

While the direct effects of invasive annual grasses on infiltration, runoff, and erosion processes are not well understood, professional knowledge indicates perennial grasses may offer better hydrologic function than annual grasses. Therefore, the team anticipates that a transition in grass dominance from perennial to annual grasses would reduce a site's hydrologic function capabilities. Cheatgrass does not outcompete established perennial grasses under current and changing environmental conditions alone (McGlone et al. 2012; Larson et al. 2018; Blank et al. 2020) but is able to outcompete perennial grasses with disturbance (e.g., fire on actively grazed rangelands) (Condon and Pyke 2018) that may be mitigated through management. Medusahead may outcompete native perennial bunchgrasses under normal conditions directly by its ability to grow faster and longer (Mangla et al. 2011; Young and Mangold 2008), but established, tall vegetation can prevent medusahead populations from spreading (Davies and Svejcar 2008; Davies et al. 2010). Medusahead may also outcompete native species indirectly through development of thick thatch layers which inhibits other species and contributes to an increase in fuel load and fire frequency (Nafus and Davies 2014).

The perennial to annual grass cover ratio was calculated with the quotient of AIM indicators perennial grass cover (AH_PerenGrassCover) and annual grass cover (AH_AnnGrassCover) to determine whether a point's grass composition is dominated by perennial or annual grasses. A value of 1 indicates equal annual and perennial grass cover, less than 1 indicates more annual grass cover, and greater than 1 indicates more perennial grass cover. Thus, the team selected 1 for the lower limit and infinity for the upper limit, to exclude points where grass composition was dominated by annual grasses.

Ecoregion 80a

Bare Soil Cover. The team selected the 75th percentile (35%) for the upper limit and 0% as the lower limit. For the upper limit, the team first considered the 90th percentile (41%) because the 90th percentile was selected for ecoregion 80f. However, after reviewing photos from AIM points with bare soil cover between 35% and 41%, the team decided 41% was too high for proper upland watershed functions. Acknowledging the fact that data from ecoregion 80f were more thoroughly screened, the team conducted further photo review and considered a secondary benchmark, percent cover of canopy gaps greater than 100 cm (sum of AIM indicators GapCover_25_50 and GapCover_51_100), for points with bare soil cover between 35% and 41%. This indicator was considered based on a suggestion from Webb et al. (2014) that wind and water erosion could be effectively controlled when canopy gaps greater than 100 cm comprise less than 35% of ground cover. The team reviewed photos from AIM points with bare soil cover between 35% and 41% and compared points with less than 35% of canopy gaps greater than 100 cm to points with more than 35%. After the review, the team did not find 35% of canopy gaps to be a helpful breakpoint in characterizing points with high bare soil cover as functioning properly in this region and therefore the more restrictive 75th percentile (35% bare soil cover) was chosen for the upper limit.

Total Foliar Cover. The team selected the 25th percentile (35%) for the lower limit and 100% for the upper limit. The more restrictive benchmark, the 25th percentile, was selected over the 10th percentile (30%), because 30% appeared too low to achieve standard 1. The team selected 100% for the upper limit with the same justification used for 80f.

Soil Stability. The team selected 4 for the lower limit and 6 for the upper limit. For the lower limit, the 10th (3.1) and 25th (4.1) percentiles were considered. In nearby areas with soil maps, most ecological site descriptions use 4 as an acceptable lower limit and 3 as a limit for predominantly sandy soils. The team reviewed soil texture information from the first horizon of soil pits in ecoregion 80a points from 2013 to 2021 to examine the prevalence of sandy soils (Figure 11, Table 6). In 80a, soil pits were dug at 1,296 AIM points, and first horizon soil textures were classified as sands at 12 (< 1%) points; loamy sands at 63 (5%) points; and silts, clays, and loams at 1,221 (94%) points. Because a low percentage of points was classified as sands in the first horizon, the team selected the 25th percentile for the lower limit, rounding down to 4 to agree with the whole number nature of the soil aggregate stability test metric. For the upper limit, the team chose the maximum score (6) because high levels of soil stability do not threaten proper upland watershed functions.

Table 6. First horizon soil textures from soil pits dug at terrestrial AIM points in Level IV ecoregions 80a and 80f.

Soil Surface Texture Class	Ecoregion 80a	Ecoregion 80f
Clay (C)	40 (3%)	19 (3%)
Silty Clay (SIC)	60 (5%)	24 (4%)
Sandy Clay (SC)	27 (2%)	10 (2%)
Clay Loam (CL)	151 (12%)	63 (10%)
Silty Clay Loam (SICL)	145 (11%)	69 (11%)
Sandy Clay Loam (SCL)	122 (9%)	71 (12%)
Loam (L)	267 (21%)	122 (20%)
Silty Loam (SIL)	211 (16%)	72 (12%)
Sandy Loam (SL)	198 (15%)	115 (19%)
Loamy Sand (LS)	63 (5%)	37 (6%)
Sand (S)	12 (< 1%)	5 (< 1%)
Total	**1,296**	**607**

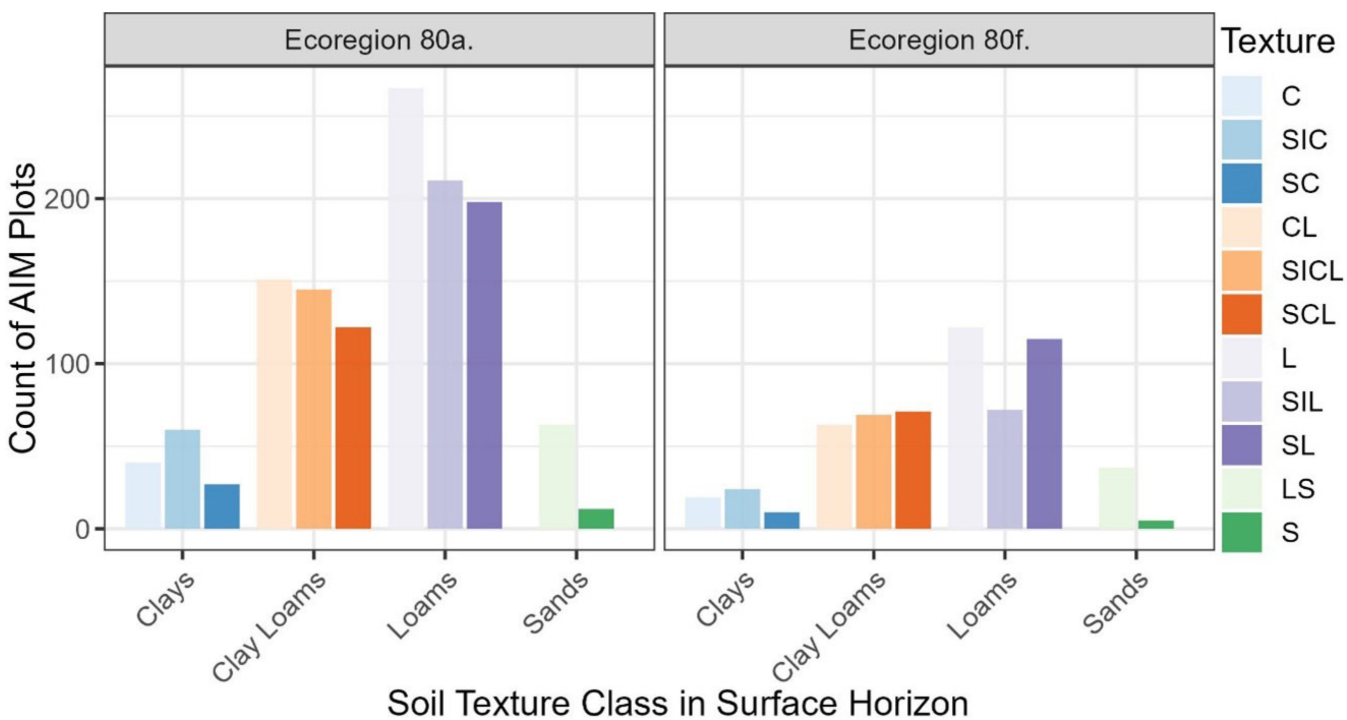

Figure 11. Bar point summary of first horizon soil textures determined from soil pits dug at terrestrial AIM points in Level IV ecoregions 80a and 80f.

3. Final Benchmarks

The final benchmarks are displayed in Table 7. Figure 12 contains transect photos from points that attained various benchmarks.

Table 7. Final benchmarks to evaluate Oregon/Washington standard 1 in Level IV ecoregions 80a and 80f within the Cow Lakes Assessment Area.

Indicator	Ecoregion 80a Lower Limit	Ecoregion 80a Upper Limit	Ecoregion 80f Lower Limit	Ecoregion 80f Upper Limit
Bare Soil Cover	0%	35%	0%	20%
Total Foliar Cover	35%	100%	49%	100%
Average Soil Aggregate Stability Rating	4	6	4	6
Perennial to Annual Grass Cover Ratio	1	∞	1	∞

Figure 12. Photos from terrestrial AIM points in the Cow Lakes Assessment Area that attained all four (left) and only two of four (right) benchmarks set for Oregon/Washington standard 1 in Level IV ecoregions 80a (top row) and 80f (bottom row).

4. Apply Benchmarks

The team applied the benchmarks to data collected from all terrestrial AIM points in group 2 allotments. Group 2 is comprised of the Mahogany Mountain and Spring Mountain allotments which are at higher elevations and more mountainous than other allotments in the Cow Lakes Assessment Area. Data from 48 points were available in the Terrestrial AIM Database at the time of extraction (June 2023) for the Mountain Mahogany allotment, and data from 49 points were available for the Spring Mountain allotment (97 total). Most of the data were collected from random sampling designs within Oregon priority areas for conservation. Most of group 2 lies within the Cow Lakes Priority Area for Conservation (92%). The remaining data were collected with sampling designs for land use planning, emergency stabilization and burned area rehabilitation, and the BLM Landscape Monitoring Framework.

The team applied benchmarks to 12 points from ecoregion 80a and 84 points from ecoregion 80f. Results were then summarized by total number of benchmarks attained and allotment (Table 8). In the Mahogany Mountain and Spring Mountain allotments, 52% and 41% of points, respectively, attained all four benchmarks (Table 8, Figure 13). Most points attained benchmarks for bare soil cover and total foliar cover, and fewer points attained soil stability and perennial to annual grass cover ratio benchmarks (Table 9). Points were most likely to fail the perennial to annual grass cover ratio benchmark where 36% of points in group 2 had more annual grass than perennial grass cover, potentially indicating a decrease in hydrologic function in much of group 2 due to invasive annual grasses. The applied benchmarks are summarized by indicator at each point in Appendix 3.

Table 8. Summary of terrestrial AIM points within the Cow Lakes Assessment Area and how many attained the four benchmarks established for evaluating Oregon/Washington standard 1 in Level IV ecoregions 80a and 80f.

	No. of Points (%)	
No. of Benchmarks Attained	**Mahogany Mountain Allotment**	**Spring Mountain Allotment**
0	0 (0%)	1 (2%)
1	0 (0%)	2 (4%)
2	5 (10%)	7 (14%)
3	18 (38%)	19 (39%)
All	25 (52%)	20 (41%)

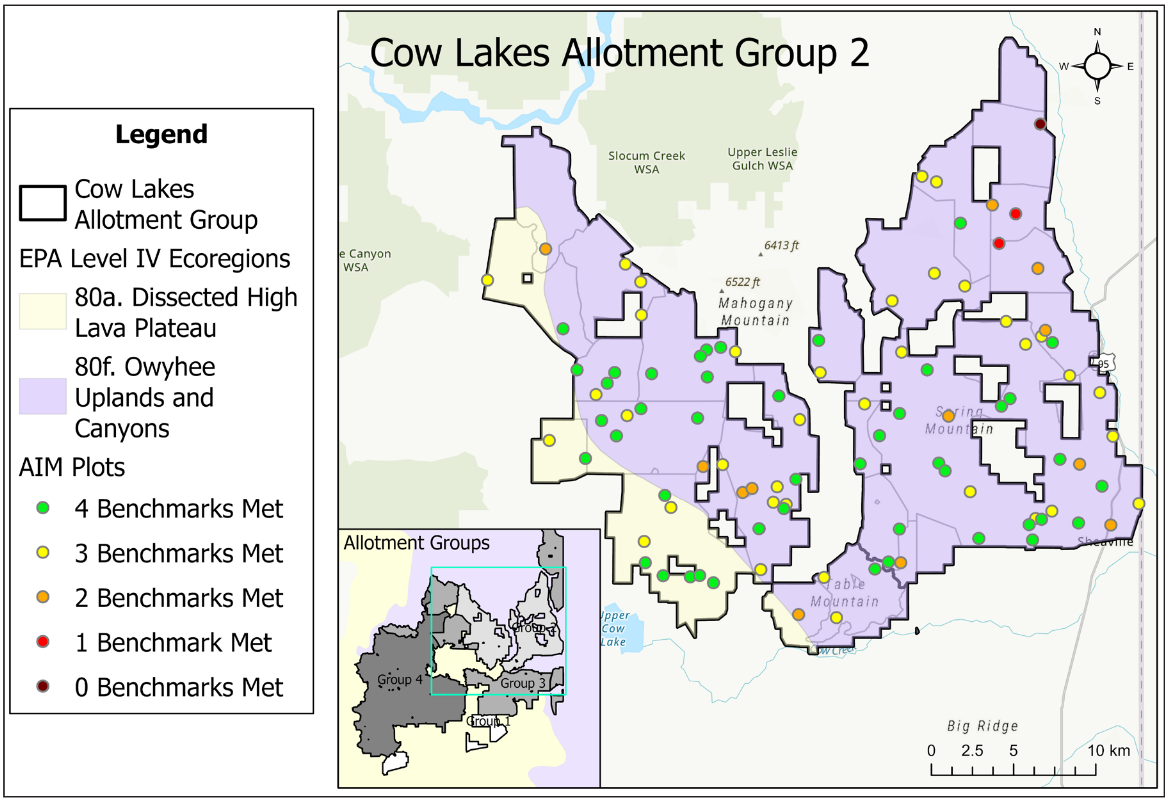

Figure 13. Map summarizing the number of benchmarks attained at all terrestrial AIM points within the group 2 allotments of the Cow Lakes Assessment Area. Group 2 is comprised of the Mahogany Mountain (left) and Spring Mountain (right) allotments. The benchmarks were developed to evaluate whether ecological conditions in a grazing allotment within Level IV ecoregions 80a and 80f achieve Oregon/Washington standard 1.

Table 9. Summary of the number of terrestrial AIM points within the Cow Lakes Assessment Area attaining each of the four benchmarks established for evaluating Oregon/Washington standard 1 in Level IV ecoregions 80a and 80f.

Indicator	No. of Points Attaining
Bare Soil Cover	91 (94%)
Total Foliar Cover	89 (92%)
Average Soil Aggregate Stability Rating	75 (77%)
Perennial to Annual Grass Cover Ratio	62 (64%)

5. Decide if Standard 1 is Achieved in Group 2

In the land health evaluation, the team determined whether standard 1 was achieved using convergent lines of evidence or a preponderance of evidence approach. The other lines of evidence used by the team for land health include, but are not limited to, data collected with the line-point intercept method, step-point transects, production transects, proper functioning condition protocol (Dickard et al. 2015), and describing indicators of rangeland health protocol. The describing indicators of rangeland health protocol is a modified version of the interpreting indicators of rangeland health protocol (Pellant et al. 2020) used in areas where ecological site descriptions are not available. Incorporating AIM data evaluated against benchmarks into the land health evaluation is an additional line of evidence.

To determine whether standard 1 is achieved with AIM data, Technical Note 453 (Kachergis et al. 2020) suggests comparing indicator values at each point to the benchmarks and considering whether the results can be extrapolated to the entire assessment area based on spatial distribution of points and their sampling designs. Technical Note 453 recommends using tables, maps, and/or graphs to visualize the results, such as those produced in Figure 13, Tables 8 and 9, and Appendix 3. The spatial distribution of points should be adequate to extrapolate findings to the entire assessment area because (1) the locations of most terrestrial AIM points in group 2 were randomly determined within boundaries that contain and are larger in scale than the assessment area; (2) few locations were determined with a sampling design with an extent that did not encompass most of the assessment area (e.g., emergency stabilization and burned area rehabilitation points); (3) few points were rejected (e.g., steep slopes, inaccessible areas); and (4) the density of points is high.

Incorporating indicator values from points evaluated against benchmarks as a line of evidence requires field offices to develop an additional workflow. To help determine whether standard 1 is achieved at a point and across the assessment area, the team found that it would have been helpful to have an outlined workflow, best practices, or examples on how to use the comparison results; Technical Note 453 does not include these. Technical Note 453 suggests components that may be incorporated into a workflow such as (1) a point-counting analysis, an unweighted analysis that will give a rough estimate of the proportion of an area attaining or not attaining each benchmark; or (2) a weighted analysis, to provide percentage of acres achieving benchmarks with a level of confidence. The most difficult portion of a workflow may be deciding whether an area is achieving standard 1 when some, but not all, benchmarks are attained at a point or in most of the assessment area. Setting a minimum number of indicators attaining benchmarks (e.g., 2 of 4) and scrutinizing additional indicators and point photos for points that fall below that minimum is one idea for a workflow. The developed workflow should result in consistent determinations that are convergent with other lines of evidence, use sound professional judgement, and are well-documented.

6. Lessons Learned

Setting benchmarks takes time. The team met for 1 hour approximately every 2 weeks for 15 months, during which benchmarks were set for four indicators in two benchmark groups for one land health standard. Much of this time was spent identifying and trying different approaches to set benchmarks with AIM data, given that the typical resources used to identify ecosystem potential and proper functioning—soil maps and ecological site descriptions—were lacking for this region. Reviewing photos for reference and selecting percentiles was also time consuming. The team's goal in documenting this workflow is to help streamline efforts conducted by other field offices to set benchmarks for indicators when guiding resources are lacking but adequate AIM data are available. The team also acknowledges that there are tradeoffs involved with incorporating additional lines of evidence into the land health process, such as the amount of time it takes to gather and evaluate data, establish a workflow to consistently evaluate the line of evidence, and incorporate results to the final document.

Quality photos are vital for context. In addition to AIM data values, photos proved vital in providing context in screening data for reference locations and determining benchmark limits (e.g., choosing one percentile over another).

Well-rounded interdisciplinary teams are effective for setting benchmarks. The team consisted of staff from BLM state offices, the Malheur Field Office, the National Operations Center, and partner organizations, including the state monitoring coordinator, a wildlife biologist, a rangeland ecologist, a conservation specialist, and two AIM data analysts. Each team member brought a distinct skillset allowing delineation of tasks to gather and summarize data, review data and photos for reference, record discussions and rationale for decisions, elicit expert input, and document results, which made the workload more feasible. The ability to divide tasks was important to not only complete a data-heavy workflow but also to document the decision-making process for the benchmarks to be defensible for litigation. In addition, the well-roundedness of the team resulted in each member bringing a different perspective and experience which made for thorough discussions and explorations before making decisions. Each step of the workflow was completed only after the group reached a consensus.

More guidance may be helpful for integrating multiple lines of evidence into decisions on whether specific standards are being achieved. The process to decide if standard 1 is achieved with the applied benchmarks is not clear in Technical Note 453. The technical note does not provide structured guidance or best practices to determine whether the assessment area is achieving standard 1 after benchmarks are applied beyond considering the sampling design and visualizing how many and which indicators attained benchmarks at each AIM point. Therefore, the field office must develop another workflow to determine whether the applied benchmarks indicate whether standard 1 is achieved in some or all of the assessment area and how to tie this line of evidence with others in the final evaluation. This may be especially challenging when there are complex or contradictory lines of evidence. Possible components to incorporate into that workflow are (1) thresholds for the number of benchmarks attained at each point, (2) taking a closer look at points that attain none or very few benchmarks, and (3) conducting a point-counting or weighted analysis. The developed workflow and decision rationales should be documented, and professional judgement should be used when applied benchmarks are a line of evidence in the land health evaluation.

Appendix 1: Oregon/Washington Land Health Standards

Table A1. Land health standards for Oregon/Washington (43 CFR 4180.2) with associated AIM indicators, which can be used to evaluate if the land health standard is being achieved (Kachergis et al. 2020).

Indicators Associated with Land Health Standard	AIM Terrestrial and Lotic Core and Contingent Indicators Associated with Land Health Standard
STANDARD #1—Watershed function - uplands: Upland soils exhibit infiltration and permeability rates, moisture storage, and stability that are appropriate to soil, climate, and landform.	
Protection of the soil surface from raindrop impact; detention of overland flow; maintenance of infiltration and permeability and protection of the soil surface from erosion, consistent with the potential/capability of the site, as evidenced by the: • Amount and distribution of plant cover (including forest canopy cover) • Amount and distribution of plant litter • Accumulation/incorporation of organic matter • Amount and distribution of bare ground • Amount and distribution of rock, stone, and gravel • Plant composition and community structure • Thickness and continuity of A horizon • Character of microrelief • Prescence and integrity of biotic crusts • Root occupancy of the soil profile • Biological activity (plant, animal, and insect) • Absence of accelerated erosion and overland flow Soil and plant conditions promote moisture storage as evidenced by: • Amount and distribution of plant cover (including forest canopy cover) • Amount and distribution of plant litter • Plant composition and community structure • Accumulation/incorporation of organic matter	• Bare ground • Proportion of large gaps between plant canopies • Vegetation composition • Vegetation height • Soil aggregate stability

Indicators Associated with Land Health Standard	AIM Terrestrial and Lotic Core and Contingent Indicators Associated with Land Health Standard
STANDARD #2—Watershed function - riparian/wetland areas: Riparian-wetland areas are in properly functioning physical condition appropriate to soil, climate, and landform.	
Hydrologic, vegetative, and erosional/depositional processes interact in supporting physical function, consistent with the potential or capability of the site, as evidenced by: • Frequency of floodplain/wetland inundation • Plant composition, age class distribution, and community structure • Root mass • Point bars revegetating • Streambank/shoreline stability • Riparian area width • Sediment deposition • Active/stable beaver dams • Coarse/large woody debris • Upland watershed conditions • Frequency/duration of soil saturation • Water table fluctuation Stream channel characteristics are appropriate for landscape position as evidenced by: • Stream channel characteristics are appropriate for landscape position as evidenced by: • Channel width/depth ratio • Channel sinuosity • Gradient • Rocks and coarse and/or large woody debris • Overhanging banks • Pool/riffle ratio • Pool size and frequency • Stream embeddedness	• Pool dimensions • Streambed particle sizes • Pool tail fines • Thalweg depth profile • Floodplain connectivity • Large wood • Greenline vegetation composition • Bank stability and cover • Bank angle
STANDARD #3—Ecological processes: Healthy, productive, and diverse plant and animal populations and communities appropriate to soil, climate, and landform are supported by ecological processes of nutrient cycling, energy flow, and hydrologic cycle.	
Photosynthesis is effectively occurring throughout the potential growing season, consistent with the potential/capability of the site, as evidenced by plant composition and community structure. Nutrient cycling is occurring effectively, consistent with the potential/capability of the site, as evidenced by: • Plant composition and community structure • Accumulation, distribution, incorporation of plant litter and organic matter into the soil • Animal community structure and composition • Root occupancy in the soil profile • Biological activity including plant growth, herbivory, and rodent, insect, and microbial activity	• Vegetation composition • Vegetation height • Soil aggregate stability • Benthic macroinvertebrates • Greenline vegetation composition

Indicators Associated with Land Health Standard	AIM Terrestrial and Lotic Core and Contingent Indicators Associated with Land Health Standard
STANDARD #4—Water quality: Surface water and groundwater quality, influenced by agency actions, complies with state water quality standards.	
• Water temperature • Dissolved oxygen • Fecal coliform • Turbidity • pH • Populations of aquatic organisms • Effects on beneficial uses (i.e., effects of management activities on beneficial uses as defined under the Clean Water Act and state implementing regulations)	• pH • Temperature • Turbidity • Benthic macroinvertebrates
STANDARD #5—Native, threatened and endangered, and locally important species: Habitats support healthy, productive, and diverse populations and communities of native plants and animals (including special status species of local importance) appropriate to soil, climate, and landform.	
Essential habitat elements for species, populations, and communities are present and available, consistent with the potential/capability of the landscape, as evidenced by: • Plant community composition, age class distribution, productivity • Animal community composition, productivity • Habitat elements • Spatial distribution of habitat • Habitat connectivity • Population stability/resilience	• Plant species of management concern • Vegetation composition • Floodplain connectivity • Benthic macroinvertebrates • Indicators listed for other standards related to aquatic species habitat requirements (e.g., temperature and fine sediment)

Appendix 2: Phase 2 Screening Results in Level IV Ecoregion 80f

Table A2. Phase 2 screening results from step 2 in the workflow for setting benchmarks. Phase 2 was applied to terrestrial Assessment, Inventory, and Monitoring points in Level IV ecoregion 80f.

Point Primary Key	Reference	Justification	Bare Soil Cover (%)	Total Foliar Cover (%)	Avg. Soil Stability Rating
ID_OwyheeFOMHAFFlintCreek2020_FlintCr-003_V12020-09-01	Yes	High perennial grass and shrub cover; good infiltration.	10.67	74.67	NA
ID_OwyheeFOMHAFFlintCreek2020_FlintCr-019_V12020-09-01	Yes	High deep-rooted perennial grass cover (24.7% Idaho fescue) and moderate cover Wyoming big sagebrush.	17.33	30.00	NA
ID_OwyheeFOMHAFFlintCreek2020_FlintCr-030_V12020-09-01	Yes	Moderate deep-rooted perennial grass cover with 19% shrub cover and very high litter cover (76%).	10.00	36.67	NA
ID_OwyheeFOMHAFFlintCreek2020_FlintCr-035_V12020-09-01	Yes	Moderate Idaho fescue cover, low shrub cover, and low shrub height - reducing capacity to hold snow.	20.00	24.67	NA
17080107180635572017-09-01	Yes	High grass cover; moderate-low sagebrush cover; crested wheatgrass seeding.	11.33	66.67	4.17
16052415134750352016-09-01	Yes	No pictures. Moderate deep-rooted perennial grass cover; shrubs are not very tall.	5.33	58.67	4.11
16052912540474452016-09-01	Yes	Crested wheatgrass seeding with different soils and high bare ground.	43.33	36.67	4.17
16072209215647442016-09-01	Yes	Very high deep-rooted perennial grass and shrub cover; high foliar cover overall.	0.00	84.67	5.50
16072310424610822016-09-01	Yes	Very high deep-rooted perennial grass cover; high shrub cover.	2.67	75.33	4.78

Point Primary Key	Reference	Justification	Bare Soil Cover (%)	Total Foliar Cover (%)	Avg. Soil Stability Rating
160726083407572016-09-01	Yes	Moderate deep-rooted perennial grass and shrub cover; high shallow-rooted perennial grass cover.	7.33	57.33	5.33
180507085405725520018-09-01	Yes	High sagebrush and perennial grass cover.	6.00	86.00	5.11
180507094453604520018-09-01	Yes	25% perennial forb cover (including 15% cover of littleleaf pussytoes, *Antennaria microphylla*) and high Sandberg bluegrass and deep-rooted perennial grass cover.	6.67	78.00	5.11
180508073010521920018-09-01	Yes	Good deep-rooted perennial grass and shrub cover for infiltration.	14.00	59.33	4.11
180522121543863201 8-09-01	Yes	Good deep-rooted perennial grass and shrub cover for infiltration.	3.33	59.33	4.17
180625140523789620018-09-01	Yes	Extensive perennial grass cover and good shrub cover.	1.33	86.00	5.72
180731080626922520018-09-01	Yes	Low deep-rooted perennial grass cover; moderate shrub cover; only 2% of shrubs are evergreen.	20.67	57.33	3.50
180826082616442820018-09-01	Yes	Deep-rooted perennial grass cover a bit low but good shrub/sagebrush cover to compensate.	23.33	56.00	5.00
180828091213436201 8-09-01	Yes	High deep-rooted perennial grass cover; shrubs are a little short but close to desired condition.	0.00	61.33	5.89
190529113842205920019-09-01	Yes	Good parameters.	8.67	68.67	5.83
190531104857646320019-09-01	Yes	Moderate.	22.67	50.00	5.72

Point Primary Key	Reference	Justification	Bare Soil Cover (%)	Total Foliar Cover (%)	Avg. Soil Stability Rating
19060113051018652019-09-01	Yes	Juniper encroachment may decrease infiltration; good shrub and deep-rooted perennial grass cover.	6.00	66.00	4.44
19060208261516342019-09-01	Yes	Moderately low shrub cover and adequate deep-rooted perennial grass cover.	32.00	36.00	5.83
19060416294278522019-09-01	Yes	Shrub cover a little low but medium-high deep-rooted perennial grass cover (21% Idaho fescue and bluebunch wheatgrass).	7.33	66.67	4.17
19063011122615412019-09-01	Yes	Low sagebrush (short) and almost no deep-rooted perennial grasses but good sagebrush and shallow-rooted perennial grass cover.	10.00	46.67	5.72
19071014285445532019-09-01	Yes	Only lower end of Yes; very low shrub cover and adequate deep-rooted perennial grass cover.	8.00	69.33	5.39
19071614523323462019-09-01	Yes	Very high deep-rooted perennial grass cover; low shrub cover but good deep-rooted perennial grasses compensate.	1.33	70.67	6.00
19072511530399812019-09-01	Yes	High deep-rooted perennial grass cover and shrub cover.	8.67	59.33	5.61
19072515073974572019-09-01	Yes	Moderately low shrub cover but very high deep-rooted perennial grass cover.	10.00	58.67	5.67
19092822071976082019-09-01	Yes	Good shrub and deep-rooted perennial grass cover. **NOTE**: recently felled juniper could change vegetation composition/infiltration rates in the future.	1.33	69.33	5.61
20124145161001R1	Yes	Moderate deep-rooted perennial grass cover; moderate to low sagebrush cover; no other shrubs present.	24.75	26.73	5.56
20144145294602B1	Yes	Deep-rooted perennial grasses are minimal, although photos appear to show more than 2%; high shrub cover but mostly little sagebrush.	1.98	80.20	5.89

Point Primary Key	Reference	Justification	Bare Soil Cover (%)	Total Foliar Cover (%)	Avg. Soil Stability Rating
20161673103615B2	Yes	Deep-rooted perennial grass and shrub cover good.	11.88	49.50	2.67
20174145324627B2	Yes	Low deep-rooted perennial grass cover (~7%); moderate to low sagebrush cover at 8%; little sagebrush with low vigor.	9.90	56.44	6.00
20181673103401B1	Yes	High perennial grass cover; good infiltration.	16.83	61.39	2.56
20191673103609B1	Yes	Very high perennial grass and shrub cover; good infiltration.	4.95	76.24	5.67
20154145201413B2	No	No photos. Low deep-rooted perennial grass cover but good sagebrush cover (18% ARTRW8).	34.65	27.72	5.33
20154145263701B2	No	No photos. Juniper encroachment (8.9%) may decrease infiltration. High deep-rooted perennial grass and moderate to high sagebrush cover.	4.95	56.44	5.56
19091212575258l2019-09-01	No	Low deep-rooted perennial grass cover and moderately low shrub cover.	3.33	59.33	5.39
20082717291441352020-09-01	No	No deep-rooted perennial grass cover (although 8 species were recorded present); 21% sagebrush and 36% short-rooted perennial grass cover.	27.33	50.67	5.22
20124145141001A1	No	No deep-rooted perennial grass cover and sagebrush cover is all little sagebrush (ARARL).	32.67	31.68	6.00
20141673103514B2	No	No deep-rooted perennial grass cover (only one present is squirreltail); high sage cover but mostly little sagebrush.	17.82	42.57	3.00
15071314331827452015-09-01	Anomalous	Heavy juniper point with moderate deep-rooted perennial grass and low sagebrush cover.	1.33	42.00	4.00

Point Primary Key	Reference	Justification	Bare Soil Cover (%)	Total Foliar Cover (%)	Avg. Soil Stability Rating
16072809254297072016-09-01	Anomalous	Heavy juniper point with low perennial grass, shrub, and forb cover	10.00	67.33	4.28
20141673103306B1	Anomalous	Juniper stand; moderate deep-rooted perennial grass cover; low shrub cover.	12.87	50.50	4.00
20141673103606B3	Anomalous	Phase 2 (potentially) juniper encroachment, not old growth; moderate to low deep-rooted perennial grass and moderate shrub cover.	14.85	69.31	4.44
ID_OwyheeFOLUP2016_BigCM-079_V12020-09-01	Anomalous	High tree cover; no shrubs; very low grass and forb cover.	2.67	53.33	4.39
ID_OwyheeFOMHAFFlintCreek2020_FlintCr-001_V12020-09-01	Anomalous	Boulders; high shrub cover; possibly high slope.	4.00	50.00	NA
ID_OwyheeFOMHAFFlintCreek2020_FlintCr-043_V12020-09-01	Anomalous	Juniper point.	5.33	66.67	NA

Appendix 3: Apply Benchmarks Results

Table A3. Results from comparing the four developed benchmarks to indicator values from terrestrial AIM points in group 2 of the Cow Lakes Assessment Area.

Point Primary Key	Date Visited	Benchmark Group	Bare Soil Cover (%)	Bare Soil Cover Rating	Total Foliar Cover (%)	Total Foliar Cover Rating	Avg. Soil Stability	Avg. Soil Stability Rating	Perennial to Annual Grass Ratio	Perennial to Annual Grass Ratio Rating	No. Attaining	Allotment
18060408292286882018-09-01	6/4/2018	80a	1.33	Attaining	60.00	Attaining	5.18	Attaining	1.31	Attaining	4	Mahogany Mountain
17081017584081222017-09-01	8/10/2017	80a	0.67	Attaining	93.33	Attaining	5.39	Attaining	0.13	Not Attaining	3	Mahogany Mountain
16080504181945620 16-09-01	8/5/2016	80a	1.33	Attaining	77.33	Attaining	4.78	Attaining	0.30	Not Attaining	3	Mahogany Mountain
OR_OR_VADOPAC_2021_CL-058_ V12021-09-01	5/3/2021	80a	10.67	Attaining	54.67	Attaining	5.61	Attaining	2.55	Attaining	4	Mahogany Mountain
17060409082757382017-09-01	6/4/2017	80a	0.67	Attaining	85.33	Attaining	5.47	Attaining	0.81	Not Attaining	3	Mahogany Mountain
17060409091283522017-09-01	6/4/2017	80a	3.33	Attaining	96.00	Attaining	5.28	Attaining	1.52	Attaining	4	Mahogany Mountain
19081111073721582019-09-01	8/11/2019	80a	0.00	Attaining	92.00	Attaining	3.78	Not Attaining	0.25	Not Attaining	2	Mahogany Mountain
18060408535011662018-09-01	6/4/2018	80a	0.00	Attaining	50.67	Attaining	5.50	Attaining	2.27	Attaining	4	Mahogany Mountain
20124145140801R2	6/12/2013	80a	4.95	Attaining	64.36	Attaining	6.00	Attaining	0.16	Not Attaining	3	Mahogany Mountain
20204145284518B1	6/17/2020	80a	22.77	Attaining	59.40	Attaining	5.67	Attaining	14.33	Attaining	4	Mahogany Mountain
20124145140801R1	6/12/2013	80a	16.83	Attaining	46.53	Attaining	5.44	Attaining	4.60	Attaining	4	Mahogany Mountain
20204145284518B2	6/17/2020	80a	23.76	Attaining	56.43	Attaining	5.00	Attaining	2.73	Attaining	4	Mahogany Mountain

Point Primary Key	Date Visited	Benchmark Group	Bare Soil Cover (%)	Bare Soil Cover Rating	Total Foliar Cover (%)	Total Foliar Cover Rating	Avg. Soil Stability	Avg. Soil Stability Rating	Perennial to Annual Grass Ratio	Perennial to Annual Grass Ratio Rating	No. Attaining	Allotment
17060507014759282017-09-01	6/5/2017	80f	4.67	Attaining	88.00	Attaining	5.50	Attaining	0.86	Not Attaining	3	Mahogany Mountain
17080815193135182017-09-01	7/29/2017	80f	6.00	Attaining	70.00	Attaining	4.94	Attaining	0.87	Not Attaining	3	Mahogany Mountain
16080411061624382016-09-01	8/4/2016	80f	6.67	Attaining	73.33	Attaining	4.00	Attaining	1.25	Attaining	4	Mahogany Mountain
18073109153146122018-09-01	7/31/2018	80f	10.67	Attaining	72.00	Attaining	5.53	Attaining	2.48	Attaining	4	Mahogany Mountain
160628085457532016-09-01	6/28/2016	80f	2.00	Attaining	95.33	Attaining	5.00	Attaining	0.19	Not Attaining	3	Mahogany Mountain
1608061102569802016-09-01	8/6/2016	80f	3.33	Attaining	77.33	Attaining	3.00	Not Attaining	13.67	Attaining	3	Mahogany Mountain
17060310173765972017-09-01	6/3/2017	80f	0.00	Attaining	84.67	Attaining	5.11	Attaining	0.92	Not Attaining	3	Mahogany Mountain
17060309033061332017-09-01	6/3/2017	80f	10.67	Attaining	74.00	Attaining	4.94	Attaining	2.86	Attaining	4	Mahogany Mountain
16080908330064612016-09-01	8/9/2016	80f	0.00	Attaining	86.67	Attaining	5.72	Attaining	1.04	Attaining	4	Mahogany Mountain
16062714301789092016-09-01	6/27/2016	80f	1.33	Attaining	57.33	Attaining	4.53	Attaining	0.20	Not Attaining	3	Mahogany Mountain
18081116581522402018-09-01	8/11/2018	80f	6.00	Attaining	83.33	Attaining	5.11	Attaining	1.72	Attaining	4	Mahogany Mountain
17072909460944352017-09-01	7/29/2017	80f	0.00	Attaining	92.00	Attaining	4.67	Attaining	4.07	Attaining	4	Mahogany Mountain
18060309550495472018-09-01	6/3/2018	80f	2.00	Attaining	46.67	Not Attaining	5.82	Attaining	0.27	Not Attaining	2	Mahogany Mountain
OR_VADO_ESR_2022_HAWK_NAT_REC-01_V22022-09-01	5/15/2022	80f	0.67	Attaining	54.67	Attaining	4.72	Attaining	1.78	Attaining	4	Mahogany Mountain

Point Primary Key	Date Visited	Benchmark Group	Bare Soil Cover (%)	Bare Soil Cover Rating	Total Foliar Cover (%)	Total Foliar Cover Rating	Avg. Soil Stability	Avg. Soil Stability Rating	Perennial to Annual Grass Ratio	Perennial to Annual Grass Ratio Rating	No. Attaining	Allotment
17080110422829902017-09-01	8/1/2017	80f	2.00	Attaining	88.67	Attaining	4.61	Attaining	1.21	Attaining	4	Mahogany Mountain
16080608424212582016-09-01	8/6/2016	80f	20.67	Not Attaining	47.33	Not Attaining	4.89	Attaining	2.17	Attaining	2	Mahogany Mountain
16062807181018922016-09-01	6/28/2016	80f	1.33	Attaining	94.00	Attaining	5.44	Attaining	0.26	Not Attaining	3	Mahogany Mountain
18062810264889732018-09-01	6/28/2018	80f	8.00	Attaining	60.00	Attaining	3.28	Not Attaining	2.63	Attaining	3	Mahogany Mountain
OR_VADO_ESR_2022_HAWK_NAT_REC-03_V22022-09-01	5/13/2022	80f	18.00	Attaining	42.00	Not Attaining	3.94	Not Attaining	5.86	Attaining	2	Mahogany Mountain
16062815144270442016-09-01	6/28/2016	80f	11.33	Attaining	74.00	Attaining	4.39	Attaining	1.94	Attaining	4	Mahogany Mountain
16090112382633022016-09-01	9/1/2016	80f	2.00	Attaining	90.00	Attaining	4.83	Attaining	0.95	Not Attaining	3	Mahogany Mountain
17071611333472942017-09-01	7/16/2017	80f	1.33	Attaining	76.00	Attaining	5.78	Attaining	2.83	Attaining	4	Mahogany Mountain
19061617371172422019-09-01	6/16/2019	80f	0.67	Attaining	90.67	Attaining	5.00	Attaining	1.43	Attaining	4	Mahogany Mountain
16080609202971622016-09-01	8/6/2016	80f	3.33	Attaining	72.00	Attaining	5.11	Attaining	1.39	Attaining	4	Mahogany Mountain
OR_VADO_ESR_2022_HAWK_NAT_REC-02_V22022-09-01	5/13/2022	80f	23.33	Not Attaining	52.00	Attaining	2.94	Not Attaining	32.50	Attaining	2	Mahogany Mountain
16080509054623432016-09-01	8/5/2016	80f	3.33	Attaining	64.00	Attaining	3.50	Not Attaining	8.83	Attaining	3	Mahogany Mountain
18062908255754032018-09-01	6/29/2018	80f	6.00	Attaining	72.67	Attaining	5.00	Attaining	0.73	Not Attaining	3	Mahogany Mountain
18062814284410282018-09-01	6/28/2018	80f	2.00	Attaining	92.67	Attaining	5.28	Attaining	1.51	Attaining	4	Mahogany Mountain

Point Primary Key	Date Visited	Benchmark Group	Bare Soil Cover (%)	Bare Soil Cover Rating	Total Foliar Cover (%)	Total Foliar Cover Rating	Avg. Soil Stability	Avg. Soil Stability Rating	Perennial to Annual Grass Ratio	Perennial to Annual Grass Ratio Rating	No. Attaining	Allotment
20062310034640662020-09-01	6/23/2020	80f	17.33	Attaining	44.00	Not Attaining	5.56	Attaining	6.25	Attaining	3	Mahogany Mountain
17071611465775820 17-09-01	7/16/2017	80f	0.00	Attaining	93.33	Attaining	5.61	Attaining	1.35	Attaining	4	Mahogany Mountain
20184145274426B1	6/6/2018	80f	1.98	Attaining	62.38	Attaining	6.00	Attaining	0.48	Not Attaining	3	Mahogany Mountain
20184145274426B2	6/6/2018	80f	13.86	Attaining	74.26	Attaining	5.67	Attaining	2.32	Attaining	4	Mahogany Mountain
20154145284504B1	5/8/2015	80f	8.91	Attaining	87.13	Attaining	5.11	Attaining	2.17	Attaining	4	Mahogany Mountain
20124145150901R1	6/14/2013	80f	7.92	Attaining	56.44	Attaining	6.00	Attaining	∞	Attaining	4	Mahogany Mountain
20154145284504B2	5/8/2015	80f	5.94	Attaining	88.12	Attaining	4.22	Attaining	0.71	Not Attaining	3	Mahogany Mountain
20124145150901R2	6/14/2013	80f	8.91	Attaining	67.33	Attaining	6.00	Attaining	8.00	Attaining	4	Mahogany Mountain
17072915561387712017-09-01	7/29/2017	80f	0.67	Attaining	96.00	Attaining	5.44	Attaining	0.58	Not Attaining	3	Spring Mountain
18072906533710952018-09-01	7/29/2018	80f	0.67	Attaining	92.00	Attaining	5.72	Attaining	1.04	Attaining	4	Spring Mountain
16062909085079572016-09-01	6/29/2016	80f	14.67	Attaining	78.67	Attaining	3.78	Not Attaining	0.86	Not Attaining	2	Spring Mountain
16072415474355512016-09-01	7/24/2016	80f	1.33	Attaining	93.33	Attaining	3.33	Not Attaining	2.66	Attaining	3	Spring Mountain
18072911534943492018-09-01	7/29/2018	80f	14.67	Attaining	65.33	Attaining	3.94	Not Attaining	6.70	Attaining	3	Spring Mountain
18072708123973472018-09-01	7/27/2018	80f	44.67	Not Attaining	33.33	Not Attaining	1.94	Not Attaining	2.20	Attaining	1	Spring Mountain

Point Primary Key	Date Visited	Benchmark Group	Bare Soil Cover (%)	Bare Soil Cover Rating	Total Foliar Cover (%)	Total Foliar Cover Rating	Avg. Soil Stability	Avg. Soil Stability Rating	Perennial to Annual Grass Ratio	Perennial to Annual Grass Ratio Rating	No. Attaining	Allotment
1607231042461082016-09-01	7/23/2016	80f	2.67	Attaining	75.33	Attaining	4.78	Attaining	47.50	Attaining	4	Spring Mountain
1706021252171372017-09-01	6/2/2017	80f	0.67	Attaining	83.33	Attaining	4.78	Attaining	∞	Attaining	4	Spring Mountain
1707171149112302017-09-01	7/17/2017	80f	2.00	Attaining	94.00	Attaining	4.67	Attaining	0.16	Not Attaining	3	Spring Mountain
1607220921564744 2016-09-01	7/22/2016	80f	0.00	Attaining	84.67	Attaining	5.50	Attaining	17.71	Attaining	4	Spring Mountain
OR_VADOPAC_2021_CL-059_ V12022-09-01	5/13/2022	80f	2.67	Attaining	76.00	Attaining	3.67	Not Attaining	0.46	Not Attaining	2	Spring Mountain
1806300940061692 2018-09-01	6/30/2018	80f	2.67	Attaining	70.67	Attaining	5.17	Attaining	1.40	Attaining	4	Spring Mountain
1607250939011612 2016-09-01	7/25/2016	80f	10.00	Attaining	81.33	Attaining	4.61	Attaining	1.85	Attaining	4	Spring Mountain
1609010842306741 2016-09-01	9/1/2016	80f	3.33	Attaining	74.67	Attaining	4.56	Attaining	2.69	Attaining	4	Spring Mountain
1807271205231702 2018-09-01	7/27/2018	80f	24.00	Not Attaining	39.33	Not Attaining	3.28	Not Attaining	2.93	Attaining	1	Spring Mountain
180630092014623 2018-09-01	6/30/2018	80f	6.00	Attaining	74.67	Attaining	5.00	Attaining	2.18	Attaining	4	Spring Mountain
1707180818083489 2017-09-01	7/18/2017	80f	1.33	Attaining	80.67	Attaining	4.67	Attaining	1.04	Attaining	4	Spring Mountain
1807280631457735 2018-09-01	7/28/2018	80f	8.00	Attaining	76.67	Attaining	4.22	Attaining	0.71	Not Attaining	3	Spring Mountain
1707280806584931 2017-09-01	7/28/2017	80f	20.00	Attaining	56.00	Attaining	2.17	Not Attaining	3.00	Attaining	3	Spring Mountain
180518131548562 2018-09-01	5/18/2018	80f	4.00	Attaining	80.00	Attaining	3.89	Not Attaining	2.36	Attaining	3	Spring Mountain

Point Primary Key	Date Visited	Benchmark Group	Bare Soil Cover (%)	Bare Soil Cover Rating	Total Foliar Cover (%)	Total Foliar Cover Rating	Avg. Soil Stability	Avg. Soil Stability Rating	Perennial to Annual Grass Ratio	Perennial to Annual Grass Ratio Rating	No. Attaining	Allotment
18072913441516272018-09-01	7/29/2018	80f	3.33	Attaining	86.67	Attaining	4.56	Attaining	0.91	Not Attaining	3	Spring Mountain
18082114294860352018-09-01	8/21/2018	80f	18.00	Attaining	50.00	Attaining	5.22	Attaining	∞	Attaining	4	Spring Mountain
18063009050642422018-09-01	6/30/2018	80f	9.33	Attaining	78.00	Attaining	5.72	Attaining	0.24	Not Attaining	3	Spring Mountain
16072110235120862016-09-01	7/21/2016	80f	0.00	Attaining	76.67	Attaining	5.17	Attaining	0.66	Not Attaining	3	Spring Mountain
16072409152593302016-09-01	7/24/2016	80f	2.67	Attaining	78.00	Attaining	4.47	Attaining	1.83	Attaining	4	Spring Mountain
16072210154015052016-09-01	7/22/2016	80f	2.00	Attaining	82.00	Attaining	3.56	Not Attaining	0.61	Not Attaining	2	Spring Mountain
17071810534974852017-09-01	7/18/2017	80f	0.00	Attaining	94.67	Attaining	5.94	Attaining	2.58	Attaining	4	Spring Mountain
16072409543252262016-09-01	7/24/2016	80f	2.00	Attaining	96.00	Attaining	5.17	Attaining	0.30	Not Attaining	3	Spring Mountain
1806301502343792018-09-01	6/30/2018	80f	3.33	Attaining	86.67	Attaining	4.33	Attaining	0.25	Not Attaining	3	Spring Mountain
17063011090975012017-09-01	6/30/2017	80f	2.00	Attaining	87.33	Attaining	4.61	Attaining	1.25	Attaining	4	Spring Mountain
16080909114919272016-09-01	8/9/2016	80f	0.67	Attaining	69.33	Attaining	4.27	Attaining	15.17	Attaining	4	Spring Mountain
17081109484245772017-09-01	8/11/2017	80f	8.00	Attaining	77.33	Attaining	5.22	Attaining	0.92	Not Attaining	3	Spring Mountain
16072512441773362016-09-01	7/25/2016	80f	8.00	Attaining	78.67	Attaining	3.22	Not Attaining	1.31	Attaining	3	Spring Mountain
18072610173419502018-09-01	7/26/2018	80f	37.33	Not Attaining	41.33	Not Attaining	1.67	Not Attaining	0.18	Not Attaining	0	Spring Mountain

Point Primary Key	Date Visited	Benchmark Group	Bare Soil Cover (%)	Bare Soil Cover Rating	Total Foliar Cover (%)	Total Foliar Cover Rating	Avg. Soil Stability	Avg. Soil Stability Rating	Perennial to Annual Grass Ratio	Perennial to Annual Grass Ratio Rating	No. Attaining	Allotment
18072813195456412018-09-01	7/28/2018	80f	1.33	Attaining	66.67	Attaining	3.88	Not Attaining	1.41	Attaining	3	Spring Mountain
18062812585076542018-09-01	6/28/2018	80f	18.00	Attaining	57.33	Attaining	3.44	Not Attaining	1.49	Attaining	3	Spring Mountain
17060209443981082017-09-01	6/2/2017	80f	0.00	Attaining	92.00	Attaining	5.35	Attaining	0.95	Not Attaining	3	Spring Mountain
17060116134358092017-09-01	6/1/2017	80f	0.00	Attaining	92.67	Attaining	5.17	Attaining	0.11	Not Attaining	3	Spring Mountain
20081314115431472020-09-01	8/13/2020	80f	26.00	Not Attaining	55.33	Attaining	2.83	Not Attaining	1.30	Attaining	2	Spring Mountain
17081009391828972017-09-01	8/10/2017	80f	0.00	Attaining	82.00	Attaining	5.39	Attaining	0.83	Not Attaining	3	Spring Mountain
16072111035767532016-09-01	7/21/2016	80f	1.33	Attaining	67.33	Attaining	6.00	Attaining	2.37	Attaining	4	Spring Mountain
18072713153977622018-09-01	7/27/2018	80f	10.67	Attaining	80.00	Attaining	3.61	Not Attaining	0.73	Not Attaining	2	Spring Mountain
OR_OR_MFO_2021_MFO2021-078_V22021-09-01	7/22/2021	80f	5.33	Attaining	85.33	Attaining	3.39	Not Attaining	0.25	Not Attaining	2	Spring Mountain
20194145274615B3	4/22/2019	80f	5.94	Attaining	32.67	Not Attaining	6.00	Attaining	0.11	Not Attaining	2	Spring Mountain
20164145284610B1	5/2/2016	80f	9.90	Attaining	60.40	Attaining	6.00	Attaining	1.22	Attaining	4	Spring Mountain
20214145284601B2	6/11/2021	80f	4.95	Attaining	85.15	Attaining	5.33	Attaining	∞	Attaining	4	Spring Mountain
20194145274615B1	4/22/2019	80f	16.83	Attaining	63.37	Attaining	6.00	Attaining	∞	Attaining	4	Spring Mountain
20164145284610B2	5/2/2016	80f	5.94	Attaining	69.31	Attaining	6.00	Attaining	2.43	Attaining	4	Spring Mountain

Point Primary Key	Date Visited	Benchmark Group	Bare Soil Cover (%)	Bare Soil Cover Rating	Total Foliar Cover (%)	Total Foliar Cover Rating	Avg. Soil Stability	Avg. Soil Stability Rating	Perennial to Annual Grass Ratio	Perennial to Annual Grass Ratio Rating	No. Attaining	Allotment
20174145274628B3	5/22/2017	80f	2.97	Attaining	59.41	Attaining	6.00	Attaining	10.75	Attaining	4	Spring Mountain

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