Sagebrush / Sage Grouse Habitat Metric

User's Guide

A rapid assessment measuring sagebrush and Sage grouse habitat quality for improved conservation outcomes

March 2012

Dedicated to the memory of

Doc Hatfield

*Visionary of the range
and conservation hero*

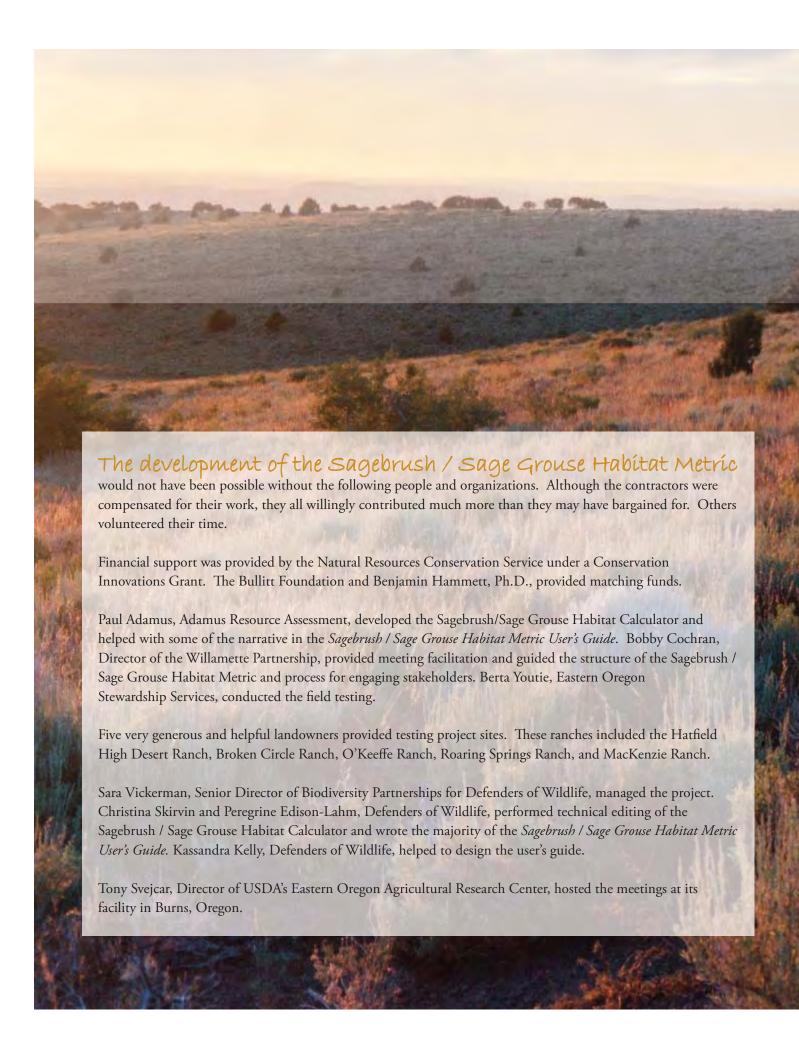# Sagebrush / Sage Grouse Habitat Metric

User's Guide

Contents

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Greater Sage-grouse (*Centrocercus urophasianus*). Photo courtesy of U.S. Fish and Wildlife Service.

*D*espite relatively widespread distribution across the intermountain west in the United States, a very small percentage of sage-brush ecosystems are managed specifically for conservation values. A larger percentage has been impacted by conversion to agricultural and urban uses, livestock grazing, invasive species, the invasion of juniper, energy development and transmission, and a variety of other human activities. Symbolic of this ecological decline is the Greater Sage-grouse (*Centrocercus urophasianus*), a species dependent on sagebrush for survival. The Greater Sage-grouse (sage grouse) is a candidate for listing under the federal Endangered Species Act. If listed, there will be social, economic and political consequences across the region. Addressing the conservation needs of the sage grouse and the sagebrush ecosystem is a high priority for diverse interests working to implement conservation programs that could make it unnecessary to list the species.

A variety of approaches are used in sagebrush conservation. Invasive juniper can be removed, thereby enhancing the potential for sagebrush to grow. Cattle can be managed to avoid damage to the ecosystem. Roads, power lines, renewable and non-renewable energy facilities can be located away from areas used by sage grouse. Perches that allow raptors to prey on sage grouse can be placed away from where the birds concentrate. Several federal and state agencies are investing substantial amounts of money in conservation efforts. Are these efforts working? How will we know?

There is a growing interest in measuring conservation outcomes rather than implementing management practices in scattered locations and hoping for the best. The Sagebrush/Sage Grouse Habitat Metric (metric) is one of several ecological measures that have been developed to help managers determine where to invest limited resources and how to calculate the ecological

impact and improvement associated with the implementation of conservation actions. The metric is encompassed in two documents, the *Sagebrush/Sage Grouse Habitat Metric User's Guide* (user's guide) and a Sagebrush/Sage Grouse Habitat Calculator (calculator). The metric may be used by state and federal wildlife agencies to measure the impact to sagebrush habitat on a development site, and to measure the habitat improvement on a site managed for conservation. It is part of a larger effort to provide information on the overall ecological context within sagebrush ecosystems and to implement mitigation programs more strategically.

It became clear in developing this metric that potential users had different goals in mind for its application. Some experts felt that it would be most important to measure the overall integrity of the sagebrush system. Others were more narrowly focused on the specific needs of the sage grouse. Consequently, this metric produces two different scores, one for overall ecological integrity and one for sage grouse. The sponsors assumed that good sagebrush habitat would support healthy populations of sage grouse, but there are in fact habitat features that are specific to the needs of the species.

Each assessment will be applied to an area of development or conservation (defined as "project site" throughout this user's guide and calculator).[1] Experts, advisors and contractors designed the metric to measure both the quality of a project site's sagebrush ecosystem and the project site's ability to support sage grouse. Metric users will assess project site conditions using maps, aerial imagery, existing databases, interviews and at least one site visit . During the visits, data will be gathered which may confirm or correct information obtained from other sources. Resulting data are entered into the calculator to reveal the two final scores: the Sagebrush Ecosystem Quality Score (sagebrush score) and Sage Grouse Habitat

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[1] "Project site" as used in the Metric is not the same as "Ecological Site" (a term used by Natural Resources Conservation Service and other resource planners).

Quality Score (sage grouse score). Collectively, they are called the "final scores." Each score is a percentage of optimum.

The user's guide and calculator will be included in a suite of ecological measures under the Willamette Partnership's program, **Counting on the Environment**,[2] as well as on the Conservation Registry's web site (see http://www.conservationregistry.org/). Other similar calculators within the Counting on the Environment program have been developed for oak woodland,

floodplain habitat, upland prairie and wetlands, which are also habitats at risk in the western United States.

Metric users who wish to register, or expect to be buying or selling, habitat credits in a regulatory context (as in candidate conservation banking) may wish to have their credits verified and registered on the Ecosystem Crediting Platform (see http://willamettepartnership.ecosystemcredits.org/ for more detail on the crediting platform and requirements for participation).

Berta Youtie, Eastern Oregon Stewardship Services, conducting field testing on the Hatfield Ranch in Deschutes County, Oregon. *Photo by Eastern Oregon Stewardship Services.*

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[2] Counting on the Environment, http://willamettepartnership.org/ongoing-projects-and-activities/nrcs-conservation-innovations-grant-1

*T*his tool is intended to provide an assessment of the habitat quality of a localized area containing (or potentially containing) sagebrush vegetation. "Habitat quality" is defined as the capacity of an area to support healthy populations of one or more native animal or plant species of conservation concern that typify sagebrush systems in some part of the western United States. This assessment is intended to be applicable mainly to Oregon. It may be applicable in other parts of the western United States that potentially or actually support a predominance of sagebrush, but no testing has occurred outside of the state of Oregon. Also, the sage grouse score was developed for the Greater Sage-grouse and has not been field tested for any other sage grouse species.

The assessment may be used to:
 a) Assess the impacts of development;
 b) Assess the benefits of reducing threats and hazards;
 c) Assess the potential ecological implications of planned management actions, e.g., prescribed fire, weed control, drill-seeded green strips, juniper removal;
 d) Prioritize sagebrush project sites for management actions, regulation, or preservation;
 e) Assess the equivalency of sagebrush areas as part of land exchange transactions and offsite mitigation, e.g., as related to energy development.

Some of these applications may be useful for programs such as U.S. Fish and Wildlife Service's Candidate Conservation Agreements with Assurances, Oregon Department of Fish and Wildlife's Private Land Habitat programs (e.g., Access and Habitat), and incentives on public lands through development of Candidate Conservation Agreements.

CATEGORIES[3] IN THE SAGEBRUSH/SAGE GROUSE HABITAT CALCULATOR

<u>Vegetation</u>

Note: *Within the calculator and user's guide, the term non-invasive(s) includes all non-invasive plants, native and non-native.*

- Overstory vegetation – juniper invasion in the overstory lowers both final scores;
- Stage of juniper invasion – a more advanced stage of juniper invasion lowers both final scores;
- Sagebrush cover – higher percentages of sage brush canopy covering a project site raises both final scores;
- Height of sagebrush – taller shrubs on a project site raises both final scores;
- Ecological site description – greater similarity between a project site's vegetative cover and the Natural Resources Conservation Service's description of healthy sagebrush communities for the project site's geographic area raises both final scores;
- Type of ground cover – greater diversity of non-invasive vegetation on a project site raises both final scores;
- Percent non-invasive – a higher proportion of non-invasive plants found at the project site raises both final scores;
- Invasive or bare – a higher proportion of invasive plants and bare ground at the project site lowers both final scores;
- Height variation – greater variation in height among plants at the project site raises both final scores;
- Functional diversity –greater diversity of vegetation types at the project site raises both final scores.

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[3] Willamette Partnership. 2011. *Measuring Up: Synchronizing Biodiversity Measurement Systems for Markets and Other Incentive Programs.* The Willamette Partnership, Hillsboro, OR. 39p. <u>Http://willamettepartnership.org/measuring-up/Measuring Up.pdf.</u> (These are categories of indicators consistent with the national framework described in the Willamette Partnership's *Measuring Up* report (which was sponsored by the national Office of Environmental Markets). The framework suggests using the following categories to evaluate ecosystems and/or habitats.)

Context

- Assessment of land cover – increased presence of native vegetation and irrigated meadow, hayfield, or pastureland within three miles of the center of the project site raises both final scores;
- Contiguous patch of shrubland – a project site with a larger patch of shrubland (including patches that extend beyond the project site's boundaries) receives higher final scores than project sites with smaller patches;
- Distance to sage grouse lek (mating area) used within the past five years – a project site that contains or is within three miles of a lek (or leks) receives a higher sage grouse score;
- Distance to other sage grouse habitats (not leks) occupied within the past five years – a project site that has or is in close proximity to sage grouse habitats (not leks) occupied within the past five years receives higher final scores;
- Within a conservation priority area – a project site, in Oregon, within a designated conservation priority area raises both final scores;
- Habitat viability – for a project site in Oregon, a higher Habitat Viability Rating for sage grouse raises both final scores;
- Sage grouse conservation category – a project site, in Oregon, within a designated sage grouse core area raises both final scores;
- Core area for sage grouse – a project site, outside of Oregon, within an area recognized by wildlife agencies as core habitat for sage grouse raises both final scores.

Risk

- Proximity to dangers (maintained roads; inhabited human structures; and trees, buildings, or other raptor structures greater than 5' tall) – greater proximity to these dangers lowers both final scores;
- Land cover on project site where trees or shrubs do not exist – a greater proportion of land cover in native grassland raises both final scores;
- Soil compaction – greater soil compaction on a project site lowers both final scores.

Species

- Special-status plant species – the presence of a special-status plant species on the project site raises the sagebrush score;
- Special-status animal species – the presence of a special-status animal species (other than sage grouse) that is reproducing on or within a 1/2-mile of the project site raises the sagebrush score.

Abiotic

- Distance to persistent water – closer proximity to water that has persisted until about August during 4 of the last 5 years raises both final scores.

This assessment is designed to be program-neutral. It should be applied to an area that will be impacted by development or a conservation action. It is suitable for application in formal mitigation programs, incentive programs, payments for ecosystem services, ecosystem service valuation studies, and to help guide conservation investments. For example, at the site of a proposed development, a baseline assessment can determine the overall quality of the habitat at the site of impact. Either hypothetically or after the development is complete, the assessment can be repeated to quantify the reduction in habitat quality. The difference between the baseline score and the post-development score is a measure of impact. Where conservation projects (including mitigation actions) are planned, a baseline assessment followed by a repeat assessment after conservation actions are implemented will quantify the ecological improvement or uplift. In landowner incentive programs, the assessment can be used to compare sites, or to measure the habitat improvement after conservation projects are completed. For more traditional land protection programs, like fee title acquisitions, conservation easements or protective designations, the assessment can be used to determine which sites offer the highest quality habitat and help determine which ones are more likely to be ecologically viable long term. However, the assessment is not designed for use in landscape-scale assessments or management plans.

This assessment is distinguished from most other rangeland assessment methods partly by requiring no more than 1-2 days per project site to apply. This includes both a project site visit and a review of background information. The calculator is intended to be used by expert technical service providers, who have or will receive training for field application. It does not require GIS technology, advanced skills in plant identification, soil classification, or statistical sampling methods, although they would be helpful. All that is required is a computer with Microsoft Excel, Internet access, a measuring tape and pole, basic plant identification skills, printed copies of data forms, and an aerial image of the project site.

Metric test sites featuring a diversity of vegetation. *Photos by Eastern Oregon Stewardship Services.*

*T*he metric includes two documents, this user's guide and a calculator (anExcel workbook). Both office and fieldwork are required to complete the assessment.

Calculator updates

This metric (calculator and user's guide) may be updated periodically. Be sure to use the most recent version of the calculator and user's guide for each assessment. Before evaluating a project site, check the Conservation Registry web site (http://marketplace.conservationregistry.org/) or the Willamette Partnership web site (http://willamettepartnership.org/) to confirm the most current versions of the calculator and user's guide in use. Once a project assessment has begun, use the same version of the calculator and user's guide throughout the life of the project. Do not transfer data to a newer version even if one was released while the assessment was taking place.

A project site should ideally be visited in May or June (or about a month later at higher elevations), although any time during the growing season is acceptable, to get the most meaningful results from the vegetation component of the calculator.

After all data have been entered, the calculator automatically computes the final scores. Each score is expressed as a percentage of optimum ecological functioning.

TO START: IN THE OFFICE

1. Obtain the Sagebrush/Sage Grouse Habitat Metric Calculator Excel Workbook[4]

The calculator and user's guide can be found and downloaded from two different websites: (1) Conservation Registry http://www.conservation registry.org/ and (2) Willamette Partnership http://willamettepartnership.org/. ***Note:*** *It is recommended that all calculator users print and keep on hand the user's guide; not only will it be helpful in the office, but it will be very useful during the project site visit.*

Download the calculator and change the file name to one that uniquely describes the project site, e.g., SageCalculator_RockyFlat3.xls.
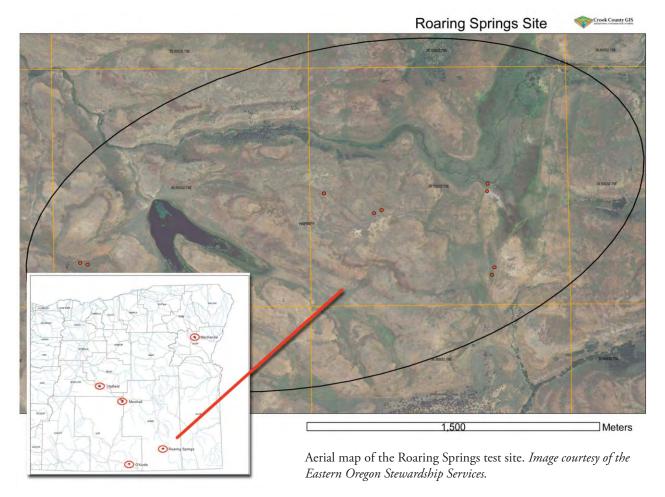
The calculator contains eight worksheets. The eight worksheet tabs are:
- Cover Page
- Calculator
- VegData
- RarePlants (for Q #8)
- RareVertebrates (for Q #9)
- Cover Page Form
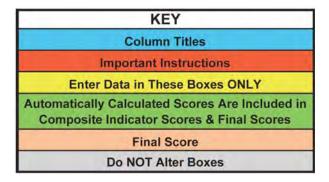- Project Site Visit Form
- VegData Form

Open the newly saved file. Glance through the different worksheets in the Calculator, familiarizing yourself with the question in the Main Indicators table and the instructions for vegetation data collection in the VegData Data Entry Sheet. There are three places information and data will be entered:
1) Main Indicators Table on the Calculator worksheet
2) VegData Data Entry Sheet on the VegData worksheet
3) Cover Page worksheet

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[4] In Microsoft Excel, a document is called a "workbook." Within a workbook are multiple "worksheets." Each worksheet can be accessed by its respective tab at the bottom edge of the workbook. The name on each tab refers to the name of the worksheet.

Aerial map of the Roaring Springs test site. *Image courtesy of the Eastern Oregon Stewardship Services.*

There are colored cells throughout the calculator. The key below indicates the meaning of each color and will help with navigation among the worksheets.

KEY

Column Titles
Important Instructions
Enter Data in These Boxes ONLY
Automatically Calculated Scores Are Included in Composite Indicator Scores & Final Scores
Final Score
Do NOT Alter Boxes

2) Obtain and review images, maps, and other documents

Aerial images, existing maps, and other data sources will need to be obtained before data can be entered into the Cover Page worksheet and the Main Indicators Table on the Calculator worksheet:

1. Obtain the most recent and detailed (finest-resolution) aerial image available that covers the project site. Google Earth[5] may be the most convenient source but should not be used if higher-resolution images are easily available. **Print** the aerial image and mark the approximate boundary of the project site, adjusting the boundary to exclude parts that cannot be safely accessed in the field. A project site may include land cover types other than sagebrush if they will be manipulated or are part of a parcel being considered for a land transaction. In that case, the entire parcel should be assessed.

2. If the vegetation cover classes have been mapped at this project site previously, obtain that map. Otherwise, view the aerial image and draw tentative polygon boundaries around the four most extensive

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[5] Google Earth: http://www.google.com/earth/index.html

vegetation groups. Distinguish the groups by their differences in density, color, and pattern. Assume, for the ourposes of this assessment, that these differences represent different rangeland cover groups. Do not delineate patches that comprise less than about 20% of the project site. Patch or zone boundaries do not need to be precise. Polygon boundaries will be verified and may be adjusted during the field visit.

a) *Alternatively*, if vegetation is not clear in aerial image(s), delineate soil zones using a soils map in lieu of delineating vegetation from an aerial image. A soils map can be viewed online by going to the Web Soil Survey: http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm.

b) Press the green "Start WSS" button, and enter the project site coordinates by selecting "Latitude and Longitude," under "Quick Navigation". This will zoom in on the project site area; then use the AOI tool to bound the approximate project site. Finally, click the Soil Map tab. Draw polygon boundaries around these soil zones on the aerial image. ***Note:*** *If more information is necessary, click on the Map Unit Names.*

3. Four transects, each 50 m long, will be surveyed in the field. On the aerial image, draw one transect through the middle of the largest polygon delineated for each of the four cover groups identifiable in the aerial image. If fewer than four cover groups were delineated, place one transect in each cover groups and place the remainder in a spatially dispersed manner within the project site. Using Google Earth, note the coordinates of the start point of each transect and the compass bearing that will go through the approximate middle of its cover groups polygon. For transects that could not be associated with a cover groups identifiable from the aerial image, use a randomly selected bearing. **No part of any transect should be within 50 meters of a road.**

4. Request information from the State Natural Heritage Program or other sources on occurrences of plants or animals of conservation concern that have been documented within the project site (this will help with answering questions #8 and #9 in the Main Indicators Table on the Calculator worksheet). ***Note:*** *There may be a fee for this information.*

5. Determine if vegetation data has already been collected from the project site as part of recent surveys for an Ecological Site Inventory, Rangeland Health Assessment, or other purpose. If so, review the data. Such data might be available from the local offices of the Bureau of Land Management, Natural Resources Conservation Service, Forest Service, university extension, watershed councils, or state agencies.

6. Review the *Greater Sage-Grouse Conservation Assessment and Strategy for Oregon* (2011 version): http://www.dfw.state.or.us/wildlife/sagegrouse/ or the equivalent in other states. This may help with answering some questions in the Main Indicators Table on the Calculator worksheet, especially question #10 through #13.

7. Contact the project site's landowner(s) and/or managers to get a historical understanding of the property before the project site visit. This can be done through a phone call or email, even a preliminary visit if that is most helpful. ***Note:*** *While an initial contact is particularly important to gain permission to visit the project site and to provide historical context, continue to follow up with the landowner or manager as needed throughout the process.*

8. Review the *Western Juniper Field Guide*[6] to understand the different stages of juniper invasion (this will help with answering question #17 in the Main Indicators Table on the Calculator worksheet). **Print** pages 35-41 of this publication to take on the project site visit, for specific descriptions of each stage.

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[6] Miller, R.F., Bates, J.D., Svejcar, T.J., Pierson, F.B., and Eddleman, L.E. 2007. Western Juniper Field Guide: Asking the Right Questions to Select Appropriate Management Actions: U.S. Geological Survey Circular 1321, 61 p. http://oregonstate.edu/dept/EOARC/publication/2007/605

9. Contact the local Natural Resources Conservation Service office or go online (see instructions below) to find the **Ecological Site Description(s)** for the **Ecological Site(s)** that overlap the project site (this will help with answering question #21 in the Main Indicators Table on the Calculator worksheet). Each Ecological Site will have a corresponding Ecological Site ID and Ecological Site Description. According to the Natural Resources Conservation Service, "[a]n 'ecological site' is the product of all the environmental factors responsible for its development. It has characteristic soils that have developed over time; a characteristic hydrology, particularly infiltration and runoff, that has developed over time; and a characteristic plant community (kind and amount of vegetation). The vegetation, soils, and hydrology are all interrelated. The plant community on an ecological site is typified by an association of species that differs from that of other ecological sites in the kind and/ or proportion of species or in total production."[7]

   a. Go to the Web Soil Survey: http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm

   b. Press the green "Start WSS" button.

   c. Click on "Latitude and Longitude," under "Quick Navigation" and enter the project site coordinates. This will zoom in on the project site area; then use the AOI tool to bound the approximate project site. ***Note:** If Ecological Site information is not available for the chosen project site, it will say so after the project site coordinates have been entered.*

   d. Click on the "Soil Data Explorer" tab.

   e. Select "Land Classifications" under "Suitabilities and Limitations Ratings" on the left-side of the page.

   f. Select "Ecological Site ID."

   g. Select "View Rating."

   h. The Ecological Site ID will be in a table on the bottom right-hand side of the page. (The Ecological Site IDs for the project site area will be listed under the column labeled "Rating," and should be made up of approximately 11 numbers and letters.) ***Note:** There may be more than one Ecological Site intersecting the project site. Make note of each Ecological Site ID and its corresponding Percent of AOI.*

   i. Go to the Ecological Site Description System for Rangeland and Forestland Data: http://esis.sc.egov.usda.gov/Welcome/pgReport-Location.aspx?type=ESD.

   j. Select the state in which the project site is located. Click "Submit."

   k. A five-column table will appear. A list of the state's available Ecological Site IDs is located in the column labeled "ID." Locate, and click on, the Ecological Site ID, noted in step (h), with the highest Percent of AOI.

   l. The Ecological Site Description will appear. On the left hand side of the page, under "Report Selections" click "Plant Communities."

   m. A Reference State or Historic Climax Plant Community description will appear.

***Note:** If there is more than one Reference State cited, then use the "light grazing, intermediate to long fire return interval" plant community to answer question #21 in the Main Indicators Table on the Calculator worksheet. It supports the highest overall habitat quality for sage grouse, and is generally the least well represented on today's landscapes.[8]*

   n. **Print** and review at least the Ecological Site Description's Reference State or Historical Climax vegetation composition information.

***Note:** If there are multiple Ecological Site IDs, found in step (h), for the chosen project site, and the Percent of AOI for each is fairly close, it may be worthwhile to repeat steps (k) through (n) for each Ecological Site ID for use in answering question #21 in the Main Indicators Table on the Calculator worksheet.*

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[7] From Description – Ecological Site ID, at http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx
[8] As the NRCS implements new standards for the State and Transitions diagrams that are replacing the Historical Climax Plant Communities, the Reference State description will describe all plant communities that occurred under normally occurring historical disturbance processes.

3) Enter Information on Cover Page

The cover page provides a summary of project site information as well as the final scores. ***Note:*** *This page can be printed and serve as an overview document upon completion of the assessment.*

On the cover page, enter relevant data into all data boxes **except** the Final Scores Table; those cells will automatically update after all data has been entered on the Calculator worksheet and VegData worksheet.

The cover page solicits important information on project site history, please include this information here.

4) Begin Entering Data in the Calculator worksheet

At the top of the Calculator worksheet, re-enter the name of the project site and date assessed. This is the same information entered on the Cover Page worksheet.

CATEGORY VS. INDICATORS VS. SUBSCORES

References to categories, indicators, subscores and data are available throughout the calculator and user's guide. The Category Indicator Table shows how they are interrelated. as data is entered, Excel calculates a subscore for each indicator. Each indicator falls within a category.

Answer questions #1-#13 using the aerial images, existing maps, and other data sources.

For a majority of the questions in the Main Indicators Table, there will be drop-down menus from which the correct answer should be selected. ***Use the drop-down menus whenever they are available.***

Once question #13 is completed, **save** the document.
5) Gather Materials for Project Site Visit

Locate the three forms within the saved Excel workbook (see the purple-highlighted tabs). They are:
1. Cover Page Form
2. Project Site Visit Form
3. VegData Form

Print each form.

Fill in, by hand, (1) data entered in questions #1 through #13 on the Main Indicators Table of the Calculator worksheet on the printed Project Site Visit Form and (2) the information from the Cover Page worksheet on the printed Cover Page Form.

Below is a handy checklist of all the materials needed for the project site visit:

Materials Checklist:
1. Printed aerial image with the approximate transect locations, and a list of their coordinates and proposed bearings
2. User's Guide
3. Cover Page Form
4. Project Site Visit Form
5. VegData Form
6. Stages of Juniper Invasion (pages 35-41 from Western Juniper Field Guide) – Step #8 under "Obtain and review images, maps, and other documents"
7. Handheld GPS
8. Compass (if the GPS lacks one)
9. 50 m measuring tape
10. Measuring stick or pole that can measure height up to at least 6' (2 m)
11. Pen/pencil

Note: *Before heading into the field, review the RareVertebrates and RarePlants worksheets as they may help answering some of the questions in the Main Indicators Table.* **Print** *if necessary, though table contains several pages.*

PROJECT SITE VISIT

Although any time during the growing season is acceptable, the project site should ideally be visited in May or June (or about a month later at higher elevations) to obtain the most meaningful results from the vegetation component of this assessment.

Category*	Indicator*	Table Location
Context		
	LULC3mi	Main Indicators Table
	SizeContigSS	Main Indicators Table
	LekDist	Main Indicators Table
	HabDist	Main Indicators Table
	CPA	Main Indicators Table
	HabViabil	Main Indicators Table
	ConsCat	Main Indicators Table
	CoreAlt	Main Indicators Table
	Lscape	Composite Indicators Table
Risk		
	MortDist	Main Indicators Table
	LCsite	Main Indicators Table
	Compac	Main Indicators Table
	Risk	Composite Indicators Table
Abiotic		
	WaterDist	Main Indicators Table
Species		
	RarePlant	Main Indicators Table
	RareAnim	Main Indicators Table
	Spp	Composite Indicators Table
	Presence	Composite Indicators Table
Vegetation		
	NumForms	Main Indicators Table
	Overstory	Main Indicators Table
	JunipStage	Main Indicators Table
	SageCov	Main Indicators Table
	Height	Main Indicators Table
	ESD	Main Indicators Table
	PctNonInv	VegData Indicators Table on Calculator and VegData worksheets
	BareInvas	VegData Indicators Table on Calculator and VegData worksheets
	NormHtVar	VegData Indicators Table on Calculator and VegData worksheets
	FuncDiv	VegData Indicators Table on Calculator and VegData worksheets
	FuncGps	Composite Indicators Table
	VNonInv	Composite Indicators Table
	Sstruc	Composite Indicators Table
	NonInvForbs	VegData Indicators Table on VegData worksheet only
	NonInvGram	VegData Indicators Table on VegData worksheet only
	HerbSum	VegData Indicators Table on VegData worksheet only
	Sage	VegData Indicators Table on VegData worksheet only
	AllShrubs	VegData Indicators Table on VegData worksheet only
	SagePct	VegData Indicators Table on VegData worksheet only
	BareLDW	VegData Indicators Table on VegData worksheet only
	HtVar	VegData Indicators Table on VegData worksheet only
	VegDataShan	VegData Indicators Table on VegData worksheet only
	NormVegDataShan	VegData Indicators Table on VegData worksheet only

* A detailed explanation of each category and indicator can be found in the glossary

Field data does not need to be collected in one day, although that will be possible for most of the smaller project sites. If one objective is to monitor this same project site in future years, permanently mark and photograph the start and end points of each transect (e.g., with a colored stake) in addition to documenting their GPS coordinates.

Note: If possible, revisit the project site at a different time of the growing season and modify responses to account for any differences noted.

VegData Form

Note: For the purposes of this assessment, the term non-invasive(s) includes all non-invasive plants, native and non-native.

At the project site, lay out the 50 m tape at each of the designated locations and survey the vegetation transects, recording the data on the VegData Form. Beginning at the 1 m mark on the tape, at 1 meter intervals, place the pole in the ground so that it is angled vertically and touches the near side of the tape at the correct interval point (every 1 m for 50 marks).

On the VegData Form, under the Top Layer column, in the Veg subcolumn, record the Vegetation Group Name of the vegetation type with the highest leaf or stem *touching* the pole. (For a list of Vegetation Group Names, see table on next page.) Also, measure and record the height in centimeters of that plant (if any). For shrubs, exclude flower or seed stalks. For grasses and forbs, include seed and flower stalks, but do not straighten the plant before measuring its height. In the Under Layer column, record the next vegetation type that has the next-highest leaf or stem *touching* the pole.

If the transect point is bare, record "B" (see table next page) in the Top Layer. Do not include "B" in the Under Layer

Measuring a transect at test site.

Marking one meter intervals with colored stake.
Photos courtesy of Eastern Oregon Stewardship Services.

Vegetation Group Description*	Vegetation Group Name
Forbs: Annual, Invasive	FAI
Forbs: Perennial, Invasive	FPI
Grass-like Plants: Annual, Invasive	GAI
Forbs: Annual, Non-Invasive	FAN
Forbs: Perennial, Non-Invasive	FPN
Grass-like Plants: Annual, Non-Invasive	GAN
Grass-like Plants: Perennial, Short & Shallow-rooted	GPS
Grass-like Plants: Perennial, Medium-Tall, Deep-rooted	GPT
Grass-like Plants: Perennial, Non-native	GNN
Sagebrush: Mountain	MS
Sagebrush: Wyoming	WS
Other Shrubs <20 ft	OS
Bare	B
Plant Litter/ Downed Wood	LDW

Measuring and recording vegetation type and height in transect. *Photos courtesy of Eastern Oregon Stewardship Services.*

when there is vegetation in the Top Layer, just leave the Under Layer cell blank.

If shrubs are dead, record them as LDW (Plant Litter and Downed Wood) in the Top Layer or Under Layer as appropriate. Record forbs and grasses (using the appropriate Vegetation Group Name) whether they are alive or dead (residual).

*Note: At each transect point, only Under Layer vegetation types that are **different** from the Top Layer types will be counted in the final scores.*

Project Site Form

Answer questions #14-#20 on the Project Site Visit Form.

Refine responses to the questions already answered in the office as appropriate (questions #1 through #13).

Cover Page Form

Refine and add to the information on the Cover Page Form as necessary, documenting highlights of the field assessment.

BACK AT THE OFFICE

Enter all the hand-written data obtained from the project site visit into the saved Excel file:
- Data from the Cover Page Form goes on the Cover Page worksheet;
- Data from the VegData Form goes on the VegData Data Entry Sheet on the VegData worksheet;
- Data from questions #14-#20 of the Project Site Visit Form goes on the Main Indicators Table on the Calculator worksheet.

If any modifications were made in the field to questions #1 through #13, update them now on the Main Indicators Table.

Note: Do not use information from the VegData worksheet to answer question #15. While the question does inquire

about various vegetation groups within the project site, it is important to consider vegetation groups' site-wide. Transect data collected on the VegData worksheet gathers precise information about vegetation groups within the transect area.

Answer question #21. Compare your VegData Frequency Scores (found in the VegData Frequency Scores Table on the VegData worksheet) to the ESD information (found previously in Step #9 under "Obtain and review images, maps, and other documents." Review all of the data entered in the Main Indicators Table and the VegData Data Entry Sheet, confirming that each question has in fact been answered fully and completely.

On the Calculator worksheet, do **NOT** enter information into the VegData Indicators Table, Composite Indicators Table, or Final Scores Table as they will be automatically populated with data.

Note: The VegData Indicators Table on the Calculator worksheet is a modified version of the VegData Indicators Table on the VegData worksheet. It displays the four VegData indicators involved in the final scores and three additional columns (Category, Weight in Sage Grouse Habitat Quality Score, and Weight in Sagebrush Ecosystem Quality Score).

Once all data have been entered in the Calculator and VegData worksheets, final scores will compute automatically. Review the results to see if they make sense intuitively. If not, check all questions in the Main Indicators Table and vegetation data on the VegData Data Entry Sheet, confirming they were answered completely and correctly. If no errors are apparent but the final scores still seem incorrect, trying changing responses to the questions in the Main Indicators Table. View closely to see how changes can influence the final scores. This process may help point out a data entry error. **Do not save changes** to this table.

If certain responses and the final score(s) still seem counterintuitive, describe possible reasons on the Cover Page worksheet. Also, information in the "How the Scores are Calculated" section of the user's guide might help explain the reasons for the score.

Note: If assessing other project sites or other scenarios for the same project site, name each Excel file uniquely and save it, then repeat the above for each project site.

*T*his metric is not intended to be the only or best tool to inform decision-making. It could be used as an initial screening tool for deciding where and when more intensive and costly assessment methods need to be employed (e.g., insect surveys, protocols of Pellant et al. 2005, Karl & Sadowski 2005, Haufler et al. 2009, Kiesecker et al. 2009[9]). More time-consuming and precise methods should be used to detect relatively subtle changes at a project site between years, or to define realistic quantitative expectations for specific sagebrush plant communities that are being rehabilitated or enhanced.

The Sagebrush Ecosystem Quality Score has not been optimized to predict the habitat of any single species of conservation concern, nor does it attempt to (a) assess the capacity of a particular project site to sustain sagebrush over the long term (e.g., "project site index"); or (b) parse out the individual services of sagebrush ecosystems such as carbon sequestration, soil stabilization, pollination support, and forage production. The calculator also computes a separate final score that specifically addresses general habitat suitability for sage grouse. Because the assessment does not require comprehensive inventories of wildlife use or vegetation composition at the species level, there is a risk that some elements of biodiversity may be unaccounted for in land exchanges and other projects if this metric is used alone. Therefore, whenever possible more comprehensive species surveys and more rigorous assessments of rangeland "health" should be conducted. Finally, the metric is not intended to predict future condition of the vegetation in an area, either as a result of project actions or from natural succession, climate change, or other factors. However, given specific assumptions about any of those factors, the metric can indicate possible implications for the future quality of sagebrush habitat at a local scale.

Different indicators, thresholds, and indicator weights (e.g., for patch size, vegetation structure, and condition) may sometimes be appropriate for different vegetation community types within the sagebrush ecosystem. This assessment does not incorporate those differences because of lack of sufficient data on each community from a spectrum of reference project sites encompassing both the human stressor gradient and natural spatial and temporal variation. Also, even when limited only to consideration of sage grouse habitat, the assessment does not use all variables important to predicting habitat quality or sagebrush system integrity. It uses only those that are science-based and can be assessed rapidly during a single project site visit or by using data that are available from other sources throughout most of the western United States. When this metric is used to compare two properties, it should be used to compare properties only within the same ecoregion.

This score is believed to reflect the best available science but has not been calibrated against actual measurements of sagebrush ecosystem production, rates of ecosystem processes, or habitat use by sage grouse or other species. The vegetation component of this assessment yields only rough estimates of vegetation structure and composition in arid rangelands. It is not intended to yield statistically valid estimates of any variable.

All of these caveats aside, what this metric does offer is a quick and low-cost tool to generate relative measures of a project site's ecological and sage grouse habitat values. Used appropriately, it can provide useful guidance for conservation and management decisions in sagebrush habitats across the intermountain west.

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[9] See References section for bibliographic info on each article cited.

*T*he vegetation data gathered in the field (in the Veg-Data Data Entry Sheet) and the questions answered in the office and field (in the Main Indicators Table on the Calculator worksheet) produce subscores. Those subscores are used to calculate subscores for seven composite indicators (found in the Composite Indicators Table on the Calculator worksheet). Each composite indicator subscore is then weighted and used in one or both of the final score equations.

Note: *Follow the way the score is calculated by following the tables down the Calculator worksheet: main indicators & vegdata indicators* ➡ *composite indicators* ➡ *final scores.*

WEIGHTS

The **Sagebrush Ecosystem Quality Score** (Eco) comes from combining the subscores for six composite indicators that are weighted differently, with weights shown in parentheses below, followed by the abbreviations used in the calculator.

> Landscape context (3) (Lscape)
> Non-Invasive vegetation (3) (VNonInv)
> Risks to sage grouse (2) (Risk)
> Vegetation diversity (1) (FuncGps)
> Vegetation structure (1) (Sstruc)
> Sensitive/rare species (1) (Spp)

The **Sage Grouse Habitat Quality Score** (SGQ) comes from combining the subscores for six composite indicators:

> Sage grouse presence and use (3) (Presence)
> Landscape context (3) (Lscape)
> Risks to sage grouse (2) (Risk)
> Vegetation structure (2) (Sstruc)
> Vegetation diversity (1) (FuncGps)
> Non-Invasive vegetation (1) (VNonInv)

In general, advisory participants recommend the weights given to each of the composite indicators make up the final scores. Nonetheless, a high degree of discretion had to be exercised in assigning these weights and formulating the categories of indicator groupings and combination rules. This is not meant to be a deterministic model, and science is insufficient to clearly support a specific set of weights, groupings and combination rules.

Several alternatives were tested, and the ones in the final version of the calculator seemed to match the rankings of the test sites based on the field tester's general impressions.

The VegData indicator and main indicator weights are then determined by taking the assigned weight of a composite indicator (1, 2, or 3) and dividing by the number of indicator variables in that composite indicator equation (e.g., 2/3 = 0.6). However, both the Main Indicators Table and VegData Indicators Table have column titles "Maximum Weight in Sagebrush Ecosystem Quality Final Score" and "Maximum Weight in Sage Grouse Habitat Quality Final Score" because some of the indicators will have a different weight in a final score depending on the data entered. Thus, the weights listed in these columns are the maximum amount each particular indicator could have in influencing a final score. For example, some VegData and main indicators are involved in more than one equation, like "HabDist." It has a different weight in the two composite indicator equations it could potentially be in ("Lscape" and "Presence"). Also, some indicators drop out of a composite indicator equation because they are left blank, as instructed; thus, the weights of the indicators remaining in that equation increase. If "ESD" is left blank, as instructed, because no information is available, then "ESD" drops out of the composite indicator, "FuncGps," and the weight of both "NumForms" and "FuncDiv" increase in both final scores.

VEGDATA

To produce the 14 VegData Indicator Subscores, found on the VegData Indicators Table on the VegData worksheet, transect data is filtered through the VegData Transect Sums Table (bottom left on VegData worksheet) and the VegData Frequency Scores Table (top right on VegData worksheet).

Only the four VegData Indicator Subscores (PctNonInv, BareInvas, NormHtVar, and FuncDiv) that are necessary for the calculations of the final scores are carried over to the VegData Indicators Table on the on the Calculator worksheet. The other 10 VegData Indicator Subscores do not influence the final scores in any way, but are included because they are likely to be of use in understanding the vegetative composition of the project site.

TECHNICAL NOTES

1. When a main or VegData indicator is left blank, either through instruction or by mistake, it is not carried forward into a composite indicator equation, and is, thus, not included in a final score. Blank answers do not function as "0" answers. Not until data is entered, zero or otherwise, will a main or VegData indicator be included in subsequent scores.

2. If the main indicators, "RarePlant" and "RareAnim," are left blank, as instructed, because no information is available, then the composite indicator, "Spp," will be left blank. If "Spp" is blank, it will not be carried forward into the Sagebrush Ecosystem Quality Final Score.

3. Most composite indicator equations average relevant VegData indicator subscores and main indicator subscores. However, there are a few that do not.

   a) The composite indicator, "Presence," uses the main indicator, "LekDist," subscore as its subscore, unless no evidence of leks is known, in which case it uses the main indicator, "HabDist," subscore.

   b) If "LekDist" = 0, then the "HabDist" indicator is used in the Sage Grouse Quality Score instead of the "LekDist" indicator. Therefore, the "LekDist" indicator will lower the Sage Grouse Quality Score only when "HabDist" is zero.

   c) The composite indicator, "Spp," uses either the main indicator, "RarePlants," subscore or the main indicator, "RareAnim," subscore, whichever is greater, as its subscore.

4. Since the "Other" answer choice in question #14, could indicate either a positive or negative attribute on the project site, it is not included in the "LCsite" subscore. Nevertheless, it is included as an answer choice in order to ensure a sum of 100%.

5. The subscores for main indicator, "NumForms," and VegData indicator, "FuncDiv," are calculated by taking the Shannon Diversity Index of the non-invasive plant groups, normalizing the index to a scale of 0-1, then subtracting the percentage of invasive plants.

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[9] Using the assumption of a minimum of 0 and a maximum of 1.79, the minimum and maximum the calculator will produce.

Development of the Metric

*T*his metric was developed by Paul Adamus of Adamus Resource Assessment under a Natural Resources Conservation Service Conservation Innovation Grant awarded to Defenders of Wildlife. The Bullitt Foundation and Benjamin Hammett, Ph.D. provided matching funds. At the outset of the effort, journal articles and reports related to sage grouse and sagebrush habitat were compiled and reviewed. In particular, elements from the following sources were incorporated to varying degrees into the metric:

- *Oregon Department of Fish and Wildlife. Greater Sage-Grouse Conservation Assessment and Strategy for Oregon: A Plan to Maintain and Enhance Populations and Habitat.* March 2011 Draft.

- Karl, M. and J. Sadowski. 2005. *Assessing Big Sagebrush at Multiple Scales: An Example in Southeast Oregon.* Technical Note 417. Bureau of Land Management, Denver, Colorado.

- Haufler, J., C. Mehl, and S. Yeats. 2009. *A Measurement System for Offproject site Habitat Mitigation Using NRCS Ecological Project sites to*

Enhance Ecosystem Health and Wildlife Habitat. Ecosystem Management Research Institute. Seeley Lake, MT.

- Stiver, S.J., E.T Rinkes, and D.E. Naugle. 2010. *Sage-grouse Habitat Assessment Framework.* U.S. Bureau of Land Management, Idaho State Office, Boise, Idaho.

Development of the metric began with a half-day workshop of technical experts and stakeholders from Oregon hosted by Defenders of Wildlife and facilitated by the Willamette Partnership, in Burns, Oregon, in November 2010. The metric was then refined in two subsequent half-day workshops of sagebrush habitat experts and applied to a limited number of project sites in Oregon by Berta Youtie, Eastern Oregon Stewardship Services. Paul Adamus and Bobby Cochran, director of the Willamette Partnership, then used the results and recommendations to adjust field data forms and scoring weights, leading to the final version of the calculator. With further use, additional modifications may be made to improve the accuracy, sensitivity, and applicability of the metric, especially in other western states.

Sunset on Steens Mountain, Harney County, Oregon. Photo by Bruce Taylor.

Term	Definition	Location in the Metric	Notes
Abiotic	A category of indicators including soils, temperature, and other non-living factors. This category is comparable to the "Abiotic Condition" category discussed in the 2011 report *Measuring Up*, by Willamette Partnership.	Main Indicators Table on the Calculator worksheet	
AllShrubs	All Shrubs. A VegData indicator measuring the percentage of transect points at which Mountain Sagebrush (MS), Wyoming Sagebrush (WS), and Other Shrubs (OS) were recorded.	VegData Indicators Table on the VegData worksheet	Equation: MS + WS + OS. Carried forward in the calculator, used in the equation to calculate SagePct.
B	Bare. A vegetation group used to note the presence of bare ground at transect points within a project site. In calculations, Bare denotes its VegData Frequency Score (the percentage of transect points at which Bare was recorded).	Vegetation Group Name, located throughout the VegData worksheet	
BareInvas	Bare and Invasive Area. A VegData indicator, within the Vegetation category of indicators, measuring the percentage of transect points at which bare area or invasive plants were recorded.	VegData Indicators Table on both the VegData worksheet and the Calculator worksheet	Equation: B + FAI + FPI + GAI. Carried forward in the calculator, used in the equation to calculate VNonInv (but it is denoted as OneMinusBareInvas).
BareLDW	Bare, Plant Litter, and/or Downed Wood. A VegData indicator measuring the amount of bare ground, plant litter (including still-standing dead shrubs), and/or downed wood at transect points within the project site.	VegData Indicators Table on the VegData worksheet	Equation: B + LDW. This indicator is not carried forward in the calculator, but the information may be useful in other contexts.
Calculator Worksheet	One of the worksheets in the Sagebrush/Sage Grouse Habitat Calculator workbook. The Main Indicators Table, VegData Indicators Table, Composite Indicators Table, and Final Scores Tables are all located within this worksheet. A user answers the 21 questions in the Main Indicators Table.	Sagebrush/Sage Grouse Habitat Calculator workbook	Find the other worksheets by clicking on the tabs at the bottom of the workbook.
Category	The column that denotes categories of indicators as defined in the 2011 report *Measuring Up*, by Willamette Partnership.	Main Indicators Table, VegData Indicators Table, and Composite Indicators Table on the Calculator worksheet	
Compac	Compacted Soil. A main indicator, within the Risk category of indicators, measuring the degree to which soil has been compacted by any force, including livestock, machinery, and off-road vehicles.	Main Indicators Table on the Calculator worksheet	Question #20
Composite Indicator Description	The column explaining how each composite indicator is calculated.	Composite Indicators Table on the Calculator worksheet	
Composite Indicator Name	The column denoting the name of each composite indicator.	Composite Indicators Table on the Calculator worksheet	
Composite Indicator Subscore	The column denoting the numeric value of each composite indicator.	Composite Indicators Table on the Calculator worksheet	
Composite Indicators Table	The table including all composite indicators.	Calculator worksheet	The composite indicators are derived from VegData indicators and Main indicators.
ConsCat	Conservation Category. A main indicator, within the Context category of indicators, measuring the rank level of a project site's Sage Grouse Conservation Category, as recognized by wildlife agencies.	Main Indicators Table on the Calculator worksheet	Question #12. For Oregon project sites only.
Context	A category of indicators describing the value of a project site in relation to the broader landscape. This category is comparable to the "Contextual Value" category discussed in the 2011 report *Measuring Up*, by Willamette Partnership.	Main Indicators Table on the Calculator worksheet	
CoreAlt	Core Alternative Conservation Priority Area. A Main indicator, within the Context category of indicators, specifying if a project site is within a core area for sage grouse, as recognized by wildlife agencies.	Main Indicators Table on the Calculator worksheet	Question #13. For project sites outside of Oregon only.

Glossary for the Habitat Calculator Workbook

Term	Definition	Location in the Metric	Notes
Count in Top Layer	The column indicating the number of times a certain vegetation group was found in the Top Layer at a corresponding transect.	VegData Transect Sums Table on the VegData worksheet	
Count Under Layer When Not in Top Layer	The column indicating the number of times a certain vegetation group was found in the Under Layer, but not found in the Top Layer at that same transect point.	VegData Transect Sums Table on the VegData worksheet	
Cover Page Form worksheet	One of the worksheets in the Sagebrush/Sage Grouse Habitat Calculator workbook. Print and take on the project site visit.	Sagebrush/Sage Grouse Habitat Calculator workbook	Find the other worksheets by clicking on the tabs at the bottom of the workbook.
Cover Page worksheet	One of the worksheets in the Sagebrush/Sage Grouse Habitat Calculator workbook. A user enters project site information within the indicated boxes.	Sagebrush/Sage Grouse Habitat Calculator workbook	Find the other worksheets by clicking on the tabs at the bottom of the workbook.
CPA	Conservation Priority Area. A main indicator, within the Context category of indicators, specifying if a project site is within, or contiguous to, a Conservation Priority Area.	Main Indicators Table on the Calculator worksheet	Question #10. For Oregon project sites only.
Data Entry	The column where data is entered.	Main Indicators Table on the Calculator worksheet	Users are instructed to only put data in the yellow-colored cells within this column.
Eco	Sagebrush Ecosystem Quality Score. The final score, produced by the metric, to measure the quality of a project site's sagebrush ecosystem.	Final Scores Table on the Calculator worksheet	Equation: (3*Lscape + FuncGps + 3*VNonInv + Sstruc + Spp + 2*Risk)/11. It is not intended to be the only or best tool to inform decision-making. (See Limitations section of user's guide.)
ESD	Ecological Site Description. A main indicator, within the Vegetation category of indicators, measuring how closely a project site's vegetation groups resemble either the Reference States or Historic Climax Plant Communities of any Ecological Site(s) that overlap the project site, as specified by the Natural Resources Conservation Service.	Main Indicators Table on the Calculator worksheet	Question #21
FAI	Forbs: Annual, Invasive. A vegetation group used to note the presence of annual invasive forbs at transect points within a project site. In calculations, FAI denotes its VegData Frequency Score (the percentage of transect points at which FAI was recorded).	Vegetation Group Name, located throughout the VegData worksheet	
FAN	Forbs: Annual, Non-invasive. A vegetation group used to note the presence of annual, non-invasive forbs at transect points within a project site. In calculations, FAN denotes its VegData Frequency Score (the percentage of transect points at which FAN was recorded).	Vegetation Group Name, located throughout the VegData worksheet	
Final Score	The column denoting the numeric value of each final score.	Final Scores Table on the Calculator worksheet and Cover Page worksheet	
Final Score Description	The column explaining how each final score is calculated.	Final Scores Table on the Calculator worksheet and Cover Page worksheet	
Final Score Name	The column denoting the name of each final score.	Final Scores Table on the Calculator worksheet	
Final Scores Table	The table including both final scores, Sagebrush Ecosystem Quality and Sage Grouse Habitat Quality..	Calculator worksheet and Cover Page worksheet	The final scores are derived from composite indicators.
FPI	Forbs: Perennial, Invasive. A vegetation group used to note the presence of perennial, invasive forbs at transect points within a project site. In calculations, FPI denotes its VegData Frequency Score (the percentage of transect points at which FPI was recorded).	Vegetation Group Name, located throughout the VegData worksheet	

Term	Definition	Location in the Metric	Notes
FPN	Forbs: Perennial, Non-invasive. A vegetation group used to note the presence of perennial, non-invasive forbs at transect points within a project site. In calculations, FPN denotes its VegData Frequency Score (the percentage of transect points at which FPN was recorded).	Vegetation Group Name, located throughout the VegData worksheet	
FuncDiv	Vegetation Group Functional Diversity. A VegData indicator, within the Vegetation category of indicators, measuring non-invasive plant functionality at the transect points.	VegData Indicators Table on both the VegData worksheet and the Calculator worksheet	Equation: NormVegDataShan-(FAI+GAI+FPI). Carried forward in the calculator, used in the equation to calculate FuncGps. *In contrast to NumForms where vegetation diversity and abundance is based on the user's overall impression of the project site, this indicator captures vegetation diversity and abundance at the transect points.* This indicator takes the normalized non-invasive vegetation data, that has been put through the Shannon Diversity Index, and subtracts out the percentage of invasive vegetation groups.
FuncGps	Vegetation Functional Group Diversity on the Project Site. A composite indicator, within the Vegetation category of indicators, measuring vegetation diversity on a project site.	Composite Indicators Table on the Calculator worksheet	Equation: AVERAGE(FuncDiv,NumForms,ESD)
GAI	Grass-like Plants: Annual, Invasive. A vegetation group used to note the presence of grass-like, annual, invasive plants at transect points within a project site. In calculations, GAI denotes its VegData Frequency Score (the percentage of transect points at which GAI was recorded).	Vegetation Group Name, located throughout the VegData worksheet	
GAN	Grass-like Plants: Annual, Non-Invasive. A vegetation group used to note the presence of grass-like, annual, non-invasive plants at transect points within a project site. In calculations, GAN denotes its VegData Frequency Score (the percentage of transect points at which GAN was recorded).	Vegetation Group Name, located throughout the VegData worksheet	
GNN	Grass-like Plants: Perennial, Non-native. A vegetation group used to note the presence of grass-like, perennial, non-native plants at transect points within a project site. In calculations, GNN denotes its VegData Frequency Score (the percentage of transect points at which GNN was recorded).	Vegetation Group Name, located throughout the VegData worksheet	
GPS	Grass-like Plants: Perennial, Short & Shallow-rooted. A vegetation group used to note the presence of grass-like, perennial, short and shallow-rooted plants at transect points within a project site. In calculations, GPS denotes its VegData Frequency Score (the percentage of transect points at which GPS was recorded).	Vegetation Group Name, located throughout the VegData worksheet	
GPT	Grass-like Plants: Perennial, Medium-Tall, Deep-rooted. A vegetation group used to note the presence of grass-like, perennial, medium-tall, deep-rooted plants at transect points within a project site. In calculations, GPT denotes its VegData Frequency Score (the percentage of transect points at which GPT was recorded).	Vegetation Group Name, located throughout the VegData worksheet	
HabDist	Habitat Distribution. A main indicator, within the Context category of indicators, measuring the closest distance from a project site's perimeter to other sage grouse confirmed use areas (not leks).	Main Indicators Table on the Calculator worksheet	Question #6
HabViabil	Habitat Viability. A main indicator, within the Context category of indicators, measuring the Habitat Viability Rating of a project site for sage grouse, as recognized by wildlife agencies.	Main Indicators Table on the Calculator worksheet	Question #11. For Oregon project sites only.

Glossary for the Habitat Calculator Workbook

Term	Definition	Location in the Metric	Notes
Height	Sagebrush Height Category. A main indicator, within the Vegetation category of indicators, measuring sagebrush heights throughout a project site.	Main Indicators Table on the Calculator worksheet	Question #19
HerbSum	Herbaceous Sum. A VegData indicator measuring the percentage of transect points at which herbaceous plants were recorded.	VegData Indicators Table on the VegData worksheet	Equation: FAI + FPI + GAI + FAN + FPN + GAN + GPS + GPT + GNN. Carried forward in the calculator, used in the equation to calculate PctNonInv.
Ht (cm)	Height (in centimeters). The column indicating the height of the Top Layer vegetation type at each transect point.	VegData Data Entry Sheet on the VegData worksheet	
HtVar	Vegetation Height Variation. A VegData indicator measuring the standard deviation of all the height measurements taken.	VegData Indicators Table on the VegData worksheet	Carried forward in the calculator, used in the equation to calculate NormHtVar.
Indicator	Variables used to indicate the sagebrush and sage grouse habitat quality of a project site. Divided into the following categories: Abiotic, Context, Risk, Species, and Vegetation.	throughout the user's guide and calculator	
JunipStage	Stage of Juniper Invasion. A main indicator, within the Vegetation category of indicators, measuring the stage of juniper invasion (if any) at a project site.	Main Indicators Table on the Calculator worksheet	Question #17
LCsite	Land Use/ Land Cover of the Project Site. A main indicator, within the Risk category of indicators, measuring the land use of the portions of a project site that are not covered by shrubs and trees.	Main Indicators Table on the Calculator worksheet	Question #14
LDW	Plant Litter and/or Downed Wood. A vegetation group used to note the presence of plant litter (including still-standing dead shrubs) or downed wood at transect points within a project site. In calculations, LDW denotes its VegData Frequency Score (the percent of transect points at which LDW was recorded).	Vegetation Group Name, located throughout the VegData worksheet	
LekDist	Distance to Nearest Lek. A main indicator, within the Context category of indicators, measuring the distance to the nearest active (within the last 5 years) sage grouse lek.	Main Indicators Table on the Calculator worksheet	Question #5
Lscape	Landscape on the Project Site. A composite indicator, within the Context category of indicators, measuring landscape context on a project site.	Composite Indicators Table on the Calculator worksheet	AVERAGE(LULC3mi,SizeContigSS, HabDist,HabViabil, MAX(ConsCat, CoreAlt, CPA)
LULC3mi	Land Use/ Land Cover within 3 Miles of the Center of the Project Site. A main indicator, within the Context category of indicators, measuring the land use of all the land within 3 miles of the center of a project site.	Main Indicators Table on the Calculator worksheet	Question #2
Main Indicator Name	The column denoting the name of each main indicator.	Main Indicators Table on the Calculator worksheet	
Main Indicator Subscore	The column denoting the numeric value of each main indicator.	Main Indicators Table on the Calculator worksheet	
Main Indicators Table	The table including all main indicators.	Calculator worksheet	
Maximum Weight in Sagebrush Ecosystem Quality Final Score	The column denoting the maximum weight said indicator will have in the Sagebrush Ecosystem Quality Score.	Main Indicators Table on the Calculator worksheet	The Main Indicator Table is the only table in which some of its indicators are included in two composite indicator equations. Thus, the weights listed in this column indicate the maximum amount that each particular indicator could have in influencing a final score.

Term	Definition	Location in the Metric	Notes
Maximum Weight in Sage Grouse Habitat Quality Final Score	The column denoting the maximum weight said indicator will have in the Sage Grouse Habitat Quality Score.	Main Indicators Table on the Calculator worksheet	The Main Indicator Table is the only table in which some of its indicators are included in two composite indicator equations. Thus, the weights listed in this column indicate the maximum amount that each particular indicator could have in influencing a final score.
MortDist	Mortality Distribution. A main indicator, within the Risk category of indicators, measuring the closest distance from a project site's perimeter to each of several potential sources of sage grouse mortality (maintained roads; inhabited human residences; and trees, structures and other raptor perches >5 ft).	Main Indicators Table on the Calculator worksheet	Question #4
MS	Mountain Sagebrush. A vegetation group used to note the presence of Mountain Sagebrush at transect points within a project site. In calculations, MS denotes its VegData Frequency Score (the percent of transect points at which MS was recorded).	Vegetation Group Name, located throughout the VegData worksheet	
Non-Invasive	For the purposes of this assessment, the term non-invasive(s) includes all non-invasive plants, native and non-native.	throughout the calculator and user's guide	
NonInvForbs	Non-invasive Forbs. A VegData indicator measuring the percentage of transect points at which non-invasive forbs were found.	VegData Indicators Table on the VegData worksheet	Equation: FAN + FPN. Carried forward in the calculator, used in the equation to calculate PctNonInv.
NonInvGram	Non-invasive Graminoids. A VegData indicator measuring the percentage of transect points at which non-invasive graminoids were found.	VegData Indicators Table on the VegData worksheet	Equation: GAN + GPS + GPT. Carried forward in the calculator, used in the equation to calculate PctNonInv.
NormHtVar	Normalized Height Variation. A VegData indicator, within the Vegetation category of indicators, normalizing HtVar to a range of 0 to 1 using the score of 0 to 120 centimeters (120 was the maximum variation found during initial field testing of the calculator).	VegData Indicators Table on both the VegData worksheet and the Calculator worksheet	Carried forward in the calculator, used in the equation to calculate Sstruc.
NormVeg DataShan	Normalized Shannon Diversity Index of Non-Invasive VegData Frequency Scores. A VegData indicator normalizing VegDataShan to a range of 0 to 1 using a scale of 0 to 1.79 (the minimum and maximum for the calculator).	VegData Indicators Table on the VegData worksheet	Equation: VegDataShan/1.79. Carried forward in the calculator, used in the equation to calculate FuncDiv.
NumForms	Number of Vegetative Forms. A main indicator, within the Vegetation category of indicators, measuring non-invasive plant functionality of the entire project site based on the user's overall impressions.	Main Indicators Table on the Calculator worksheet	Question #15. *In contrast to FuncDiv where vegetation diversity and abundance is captured at the transect points, this indicator captures vegetation diversity and abundance based on the user's overall impression of the project site.* The Shannon Diversity Index of non-invasive vegetation groups on the project site, normalized to a range of 0 to 1 using a scale of 0 to 1.79 (the minimum and maximum for the calculator), minus the percentage of invasive vegetation groups.
OneMinus BareInvas	1-BareInvas. This VegData indicator is a calculation necessary for the VNonInv composite indicator.	VegData Indicators Table on the VegData worksheet, also included within the VNonInv composite indicator equation	Created to make the VNonInv calculation easier, including the name in the equation instead of typing "1-BareInvas".
OS	Other Shrubs. A vegetation group used to note the presence of shrubs that are not Mountain Sagebrush or Wyoming Sagebrush at the transect points within a project site. In calculations, OS denotes its VegData Frequency Score (the percentage of transect points at which OS was recorded).	Vegetation Group Name, located throughout the VegData worksheet	

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Term	Definition	Location in the Metric	Notes
Overstory	Overstory Vegetation. A main indicator, within the Vegetation category of indicators, measuring overstory vegetation on a project site.	Main Indicators Table on the Calculator worksheet	Question #16
PctNonInv	Percent Non-Invasive Plants. A VegData indicator, within the Vegetation category of indicators, measuring the percentage of herbaceous plants that are non-invasive.	VegData Indicators Table on both the VegData worksheet and the Calculator worksheet	Equation: (NonInvForbs + NonInvGraminoids)/ HerbSum. Carried forward in the calculator, used in the equation to calculate VNonInv.
Point	Transect Point. The column denoting the stops, a meter apart, along the transect lines where vegetation type and vegetation height are recorded. There are four transect lines with 50 points on each line.	VegData Data Entry Sheet on the VegData worksheet	
Presence	Sage Grouse Presence and Use on the Project Site. A composite indicator, within the Species category of indicators, measuring sage grouse presence and use on a project site.	Composite Indicators Table on the Calculator worksheet	Equation: IF(LekDist>0)=LekDist, ELSE HabDist). This Composite indicator is only used in the Sage Grouse Habitat Quality Score.
Project Site	Each assessment will be applied to an area of development or conservation, this area is referred to as the "project site".	throughout the calculator and user's guide	"Project site" as used in this assessment is not the same as "Ecological Site" (a term used by Natural Resources Conservation Service and other resource planners).
Project Site Visit Form worksheet	One of the worksheets in the Sagebrush/Sage Grouse Habitat Calculator workbook. Print and take on the project site visit. This worksheet includes the Main Indicators Table with the 21 questions a user must answer.	Sagebrush/Sage Grouse Habitat Calculator workbook	Find the other worksheets by clicking on the tabs at the bottom of the workbook.
RareAnim	Rare Animals. A main indicator, within the Species category of indicators, measuring the presence, or absence, of special-status animal species (other than sage grouse), known to be reproducing on or within 0.5 miles of a project site.	Main Indicators Table on the Calculator worksheet	Question #9
RarePlant	Rare Plants. A main indicator, within the Species category of indicators, measuring the presence, or absence, of special-status plant species known to be within a project site.	Main Indicators Table on the Calculator worksheet	Question #8
RarePlants (for Q #8) worksheet	One of the worksheets in the Sagebrush/Sage Grouse Habitat Calculator workbook. A user can find some guidance on rare and/or protected plant species of western North America.	Sagebrush/Sage Grouse Habitat Calculator workbook	Find the other worksheets by clicking on the tabs at the bottom of the workbook.
Rare Vertebrates (for Q #9) worksheet	One of the worksheets in the Sagebrush/Sage Grouse Habitat Calculator workbook. A user can find some guidance on rare and/or protected animal species of western North America.	Sagebrush/Sage Grouse Habitat Calculator workbook	Find the other worksheets by clicking on the tabs at the bottom of the workbook.
Risk	Risk. A category of indicators describing a project site's likelihood to continue supporting biodiversity benefits over time. This category is comparable to the "Risk and Viability" category discussed in the 2011 report *Measuring Up*, by Willamette Partnership.	Main Indicators Table on the Calculator worksheet	
	Risks to Sage Grouse on the Project Site. A composite indicator, within the Risk category of indicators, measuring risks or potential risks to sage grouse on a project site.	Composite Indicators Table on the Calculator worksheet	AVERAGE(MortDist,LCsite,Compac)
Sage	Sage. A VegData indicator measuring the percentage of transect points at which Mountain Sagebrush and Wyoming Sagebrush were recorded.	VegData Indicators Table on the VegData worksheet	Equation: MS + WS. Carried forward in the calculator, used in the equation to calculate SagePct.
Sagebrush / Sage Grouse Habitat Calculator workbook	The entire Excel document, containing eight worksheets, including the calculator.	Downloadable from two different websites: (1) Conservation Registry http://www.conservationregistry.org/ and (2) Willamette Partnership http://willamettepartnership.org/	

Term	Definition	Location in the Metric	Notes
SageCov	Sagebrush Cover. A main indicator, within the Vegetation category of indicators, measuring the percent canopy cover of the areas on a project site that contain sagebrush.	Main Indicators Table on the Calculator worksheet	Question #18
SagePct	Percent Sagebrush. A VegData indicator measuring the percentage of transect points at which sagebrush was recorded.	VegData Indicators Table on the VegData worksheet	Equation: IF((AllShrubs=0),0,Sage/ AllShrubs). This indicator is not carried forward in the calculator, but the information may be useful in other contexts.
SGQ	Sage Grouse Habitat Quality. The final score, produced by the metric, to measure a project site's ability to support sage grouse.	Final Scores Table on the Calculator worksheet	Equation: (3*Presence + 3*Lscape + 2*Risk + FuncGps + VNonInv + 2*Sstruc)/12. It is not intended to be the only or best tool to inform decision-making. (See Limitations section of user's guide.)
SizeContigSS	Size of Contiguous Shrub/Scrub Cover. A main indicator, within the Context category of indicators, measuring the total acreage of the largest patch of shrubland intersecting a project site.	Main Indicators Table on the Calculator worksheet	Question #3
Species	A category of indicators that are species-specific, such as presence/absence. This category is comparable to the "Species Attributes" category discussed in the 2011 report *Measuring Up*, by Willamette Partnership.	Main Indicators Table on the Calculator worksheet	
Spp	Sensitive/Rare Species on the Project Site. A composite indicator, within the Species category of indicators, measuring sensitive/rare plant or animal species on a project site.	Composite Indicators Table on the Calculator worksheet	Equation: MAX(RarePlant,RareAnim). This indicator does not measure the total amount of sensitive/rare plant and animal species on the project site, but instead uses the number of species in whichever group (plant or animal) has the most. This composite indicator is only used in the Sagebrush Ecosystem Quality Score.
Sstruc	Vegetative Structure on the Project Site. A composite indicator, within the Vegetation category of indicators, measuring vegetative structure on a project site.	Composite Indicators Table on the Calculator worksheet	Equation: AVERAGE(NormHtVar, JunipStage,Overstory,SageCov,Height, WaterDist)
Sum	The column denoting the total number of times each vegetation type was found at a transect point.	VegData Transect Sums Table on the VegData worksheet	
Top Layer	Vegetation Groups found in the Top Layer. The column indicating the vegetation type for the tallest plant found at each transect point.	VegData Data Entry Sheet on the VegData worksheet	
Under Layer	Vegetation Groups found in the Under Layer. The column indicating the vegetation type for second highest plant found at each transect point.	VegData Data Entry Sheet on the VegData worksheet	The calculator only includes Under Layer vegetation groups when they are different than the vegetation group in the Top Layer.
Veg	Vegetation. Found in both the Top Layer and Under Layer, the column indicating the vegetation group(s) at each transect point.	VegData Data Entry table in the VegData worksheet	The Vegetation Group Names used in these columns are listed in the VegData Frequency Scores Table on the VegData worksheet as well as on the VegData Form.
VegDataShan	Shannon Diversity Index of Non-Invasive VegData Frequency Scores. A VegData indicator measuring non-invasive vegetation diversity and abundance at the transect points using the Shannon Diversity Index.	VegData Indicators Table on the VegData worksheet	Carried forward in the calculator, used in the equation to calculate NormVegDataShan.
VegData Data Entry Sheet	The table where transect data, collected during the project site visit, will be entered.	VegData worksheet	
VegData Form worksheet	One of the worksheets in the Sagebrush/Sage Grouse Habitat Calculator workbook. Print and take on the project site visit. This worksheet includes the VegData Data Entry Sheet where a user must enter vegetation information for all transect points.	Sagebrush/Sage Grouse Habitat Calculator workbook	Find the other worksheets by clicking on the tabs at the bottom of the workbook.
VegData Frequency Score	Vegetation Data Frequency Score. The column indicating the percentage of times a corresponding vegetation group was found during the transect.	VegData Frequency Scores Table on the VegData worksheet	The calculator includes Under Layer vegetation types in the frequency scores only when they are different than the vegetation type in the Top Layer.

Glossary for the Habitat Calculator Workbook

Term	Definition	Location in the Metric	Notes
VegData Frequency Scores Table	The table where vegetation group names are called out and the frequency each vegetation group is found in the transects is determined.	VegData worksheet	
VegData Indicator Description	The column indicating how each VegData indicator is calculated.	VegData Indicators Table on both the VegData worksheet and the Calculator worksheet	
VegData Indicator Name	The column denoting the name of each VegData indicator.	VegData Indicators Table on both the VegData worksheet and the Calculator worksheet	
VegData Indicator Subscore	The column denoting the numeric value of each VegData indicator.	VegData Indicators Table on both the VegData worksheet and the Calculator worksheet	
VegData Indicators Table	On the VegData worksheet, the table includes all VegData indicators. On the Calculator worksheet, the table includes the only four VegData indicators directly involved in the composite indicator equations.	Calculator worksheet and VegData worksheet	Only four of the composite indicators are copied to the Calculator worksheet to be used in the computations of the final scores.
VegData Transect Sums Table	The table tabulates vegetation group data entered on the VegData Data Entry Sheet. It includes the number of times each vegetation group is found in either the Top Layer or Under Layer at each of the four transects.	VegData worksheet	Located below the VegData Data Entry Sheet on the VegData worksheet.
VegData worksheet	One of the worksheets in the Sagebrush/Sage Grouse Habitat Calculator workbook. The VegData Data Entry Sheet, VegData Transect Sums Table, VegData Frequency Scores Table, and the VegData Indicators Table are located within this worksheet. A user enters transect data (vegetation groups and plant heights) collected from project site in the VegData Entry Sheet.	Sagebrush/Sage Grouse Habitat Calculator workbook.	Find the other worksheets by clicking on the tabs at the bottom of the workbook.
Vegetation	A category of indicators describing vegetative attributes of the project site. This category is comparable to the "Vegetative Condition" category discussed in the 2011 report *Measuring Up*, by Willamette Partnership.	Main Indicators Table and VegData Indicators Table on the Calculator worksheet	
Vegetation Group Description	The column indicating the type of vegetation.	VegData Frequency Scores Table on the VegData worksheet	
Vegetation Group Name	The column denoting the abbreviations for the vegetation groups used in this assessment.	VegData Frequency Scores Table and VegData Transect Sums Table on the VegData worksheet	A user enters these abbreviations in the VegData Data Entry Sheet.
VNonInv	Non-Invasive Vegetation on the Project Site. A composite indicator, within the Vegetation category of indicators, measuring non-invasive vegetation on a project site.	Composite Indicators Table on the Calculator worksheet	Equation: AVERAGE(PctNonInv, OneMinusBareInvas)
WaterDist	Distance to Water Source. A main indicator, within the Abiotic category of indicators, measuring the closest distance to water from a project site that has persisted until about August during 4 of the last 5 years.	Main Indicators Table on the Calculator worksheet	Question #7
Weight	The relative weights of individual indicators, inferred from the factor the indicator is multiplied by and the placement of the indicator in the subscore and final score formulas.	throughout the user's guide and calculator	
Weighted Data	The column denoting the weighted user-entered data.	Main Indicators Table on the Calculator worksheet	
Weight in Sagebrush Ecosystem Quality Final Score	The column denoting the weight said indicator will have in the Sagebrush Ecosystem Quality Score.	VegData Indicators Table and the Composite Indicators Table on the Calculator worksheet	
Weight in Sage Grouse Habitat Quality Final Score	The column denoting the weight said indicator will have in the Sage Grouse Habitat Quality Score.	VegData Indicators Table and the Composite Indicators Table on the Calculator worksheet	
Weights for Main Indicator	Column denoting the factors by which the user-entered data will be multiplied, the larger the factor the greater the relative importance in the main indicator subscore.	Main Indicators Table on the Calculator worksheet	
WS	Wyoming Sagebrush. A vegetation group used to note the presence of Wyoming Sagebrush at transect points within a project site. In calculations, WS denotes its VegData Frequency Score (the percentage of transect points at which WS was recorded).	Vegetation Group Name, located throughout the VegData worksheet	

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