Basin & Range Mapping Zone Documentation:
Mapping Methods and Accuracy

1) Predictor Layer Preparation:

a) Image Standardization:

Standardization from DN values to at-sensor reflectance was performed by EROS Data Center as part of the MRLC Preprocessing Procedure. This procedure uses the method presented by Huang et. al (2001a) to transform Landsat 7 ETM+ imagery (Note, Landsat 5 used for some dates). The equation used for reflectance was as follows:

$$r_{BandN} = (\Pi((DN_{Band} * Gain_{Band} + Bias_{BandN}) * D2) / (E_{BandN}(E_{BandN}(SINq))$$

r_{BandN} = Reflectance for Band N
DN = Digital Number for Band N
D = Normalized Earth-Sun Distance
E_{BandN} = Solar Irradiance for Band N
q = Solar Elevation
$Gain_{BandN}$ = Provided within header file, and band specific
$Bias_{BandN}$ = Provided within header file, and band specific

b) Image Dates and Mosaic:

Images were mosaicked using ERDAS Imagine 8.7 Mosaic Tool with "no cutline" for *type*, and the "Overlay" option for *overlap function*.

Image dates and scenes were as follows:

Path/ Row	Spring Sat	Spring Julian Date	Spring Calender	Spring Overlay Order	Summer Sat	Summer Julian Date	Summer Calender	Summer Overlay Order	Fall Sat	Fall Julian Date	Fall Calender	Fall Overlay Order
42029	7	01115	4/25/2001	10	7	99206	7/25/1999	10	7	00257	9/13/2000	10
43028	7	02093	4/3/2002	3	7	02205	7/24/2002	3	7	00280	10/6/2000	3
44028	7	01081	3/22/2001	5	7	02196	7/15/2002	5	7	01273	9/30/2001	5
43031	7	00120	4/29/2000	4	7	99181	6/30/1999	4	7	00280	10/6/2000	4
44030	5	02124	5/4/2002	8	7	00207	7/25/2000	8	7	01273	9/30/2001	8
44031	7	00095	4/4/2000	9	7	01209	7/28/2001	9	7	01273	9/30/2001	9
45030	5	00142	5/21/2000	12	7	02219	8/7/2002	12	7	00278	10/4/2000	12
41030	7	01124	5/4/2001	14	7	02191	7/10/2002	14	7	00282	10/8/2000	14
41031	7	00154	6/2/2000	11	7	02191	7/10/2002	11	7	99247	9/4/1999	11
42031	7	01131	5/11/2001	6	7	00209	7/27/2000	6	7	99270	9/27/1999	6
42030	7	02134	5/14/2002	7	7	02182	7/1/2002	7	7	99254	9/11/1999	7
43030	7	02157	6/6/2002	1	7	02221	8/9/2002	1	7	02285	10/12/2002	1
43029	7	00120	4/29/2000	2	7	02205	7/24/2002	2	7	00264	9/20/2000	2
44029	5	02124	5/4/2002	15	7	02164	6/13/2002	15	7	01273	9/30/2001	15
45029	7	00086	3/26/2000	12	7	99211	7/30/1999	12	7	00278	10/4/2000	12

c) Image Derived Datasets:
Normalized Difference Vegetation Index (NDVI): This dataset was provided by the EROS Data Center as part of the MRLC processing output.

Tasseled cap: Brightness, Greenness & Wetness band transformations were provided by

the EROS Data Center as part of the MRLC processing output. This transformation followed the methods of Huang et. al 2001b.

Shrub Cover: Overall percent of shrub cover was described following Jennings et. al 2004. Overlap in the top three occurring shrubs strata where addressed by the following:

$$C_i = \left(1 - \prod_{j=1}^{n} (1 - \%\,\mathrm{cov}\ j / 100)\right) * 100$$

where C_i is the percent cover of stratum i for species or growth form j in stratum i.

Fractional Vegetation: The percent of ground covered by photosynthetic vegetation was estimated by the equation of Carlson and Ripley (1997). Reference values used in the equation were identified by examination of NDVI histograms and locating known sites of bare soil and irrigated agricultural fields. The equation is N* = (SQRT ((NDVI - NDVImin)/(NDVImax - NDVImin))) * 100, where NDVImin is the NDVI value for bare soil pixels in the scene, and NDVImax is the NDVI value for fully vegetated pixels in the scene. Fractional vegetation is related to calculations of impervious surface (Imp. Surface = 100 - fractional vegetation). The output is an integer layer with values between 0 and 100.

br_summer_fv = (SQRT((sawt_ndvi_summer - 0.07) / (0.9 - 0.07))) * 100
Image Texture: The texture of the image is

d) DEM Derived Datasets:
Thirty-meter digital elevation models were obtained from the EROS Data Center, National Elevation Database (NED, 1999). DEMs were converted from floating point grids to integer grids and mosaicked for the region, then clipped to the mapping area.

Slope: A slope layer was created using the ARC/INFO SLOPE command. Values represent slope in degrees.

Topographic Relative Moisture Index: A TRMI grid (values ranging from 0-28) was created using an Arc/INFO AML obtained from the Southwest Regional GAP Project created by G. Manis (Manis et. al 2001). The TRMI model is based on the methods defined by Haplin, P. N. 1999, and Parker, A. J. 1982.

Landform: A 10 class landform grid was created using an Arc/INFO AML obtained from the Southwest Regional GAP Project created by G. Manis (Manis et. al 2001). This product was derived from the topographic relative moisture index.

For modeling purposes all arcinfo grids were converted to ERDAS Imagine .img files.

2) Samples:

a) Sample Collection Methods:

Samples were collected in a variety of ways. Originally, it was thought that most, if not all, of the sampling would be derived from field collected information polygons delineated over imagery in the field by field crews. Classification trees, however, require substantial amounts of training data so that additional information had to be acquired. All samples were assigned a label corresponding to an Ecological System (Comer et. al 2003). On the ground data was collected as polygons delineated over imagery in the field by ORNHIC field crews. A listing of the number of ground points by source is provided below. On screen digitizing was done using ETM imagery as a backdrop.

Source Sites

Map Region	Shrub Sample (2003)	Nevada ReGap	Bureau of Land Mangement			US Forest Service								Screen Digitized
	Training		Burns	Lakeview	Vale	Freemont NF	Gifford Pinchot NF	Malheur NF	Mt Hood NF	Ochoco NF	Umatilla NF	Wallowa NF	Winema NF	
Basin & Range	682		4618	2481	1616			20678						201

3) Cover Types:

a) Classification Tree Modeled Cover Types:

Thirty-four cover types were modeled in this zone. All forest and barren types were modeled and later reclassified into single classes in the overall Tree modeling.

The following cover types were modeled using the See5 Classification Tree:

ES	Total	Code
Annual/Biannual Farmland	390	280
Non-Specific Disturbed (Bare Ground)	25	301
Columbia Basin Foothill and Canyon Dry Grassland	2718	137
Columbia Plateau Low Sagebrush Steppe	1311	154
Columbia Plateau Scabland Shrubland	162	44
Columbia Plateau Silver Sagebrush Seasonally Flooded Shrub Steppe	265	142
Columbia Plateau Steppe and Grassland	171	135
Invasive Annual Grassland	442	308
Great Basin Xeric Mixed Sagebrush Shrubland	21	55
Inter-Mountain Basins Big Sagebrush Shrubland	1765	54
Inter-Mountain Basins Big Sagebrush Shrubland - ssp. tridintata	287	149
Inter-Mountain Basins Big Sagebrush Steppe	1947	78
Inter-Mountain Basins Big Sagebrush Steppe - ssp. tridintata	362	150
Inter-Mountain Basins Greasewood Flat	189	96
Inter-Mountain Basins Juniper Savanna	615	75
Inter-Mountain Basins Mixed Salt Desert Scrub	115	65
Inter-Mountain Basins Montane Sagebrush Shrubland	501	126
Inter-Mountain Basins Montane Sagebrush Steppe	81	71
Inter-Mountain Basins Mountain Mahogany Woodland and Shrubland	69	50
Inter-Mountain Basins Playa	167	15
Inter-Mountain Basins Semi-Desert Shrub-Steppe	448	79
Inter-Mountain Basins Volcanic Rock and Cinder Land	171	13
Mediterranean California Alkali Marsh	28	161
Northern Rocky Mountain Ponderosa Pine Woodland and Savanna	2948	146
Open Water	47	211
Rocky Mountain Lower Montane Foothill Shrubland	2577	47
Rocky Mountain Montane Aspen Forest and Woodland	9	23
Temperate Pacific Freshwater Emergent Marsh	57	199
Rocky Mountain Lodgepole Pine Forest	35	31
Rocky Mountain Montane Dry-Mesic Mixed Conifer Forest and Woodland	10671	28
Rocky Mountain Montane Mesic Mixed Conifer Forest and Woodland	1668	34
Temperate Pacific Subalpine-Montane Wet Meadow	14	103

b) Non Tree modeled Cover Types:
Screen digitized over ETM:

Intermountain Basins Playa (15) was supplemented using Feature Analyst [tm] and the ETM imagery. All sites identified by the BLM, and screen digitizing to supplement the eastern portion of the map zone where used to train the feature extraction.

Columbia Plateau Silver Sagebrush Seasonally Flooded Shrub Steppe (142) was supplemented using Feature Analyst [tm] and the ETM imagery. All sites identified by the BLM, and screen digitizing to supplement the eastern portion of the map zone where used to train the feature extraction.

Recently Burned (302) areas were developed from Fires in Western North America by visually comparing the shapefile to the ETM imagery and selecting those fire scars visible on the imagery and those fires that occurred after the image date. Source of shapefile: USGS Snake River Field Station, 2004, http://sagemap.wr.usgs.gov

Interstates and highways were buffered by 30m to develop a transportation mask.

Sources: Idaho Department of Lands Interstates and Highways and Oregon BLM Highways.

c) Cover Types Modified with a Post-Classification model:
(see section 5c for details)

Ecological System	Action
Agriculture - Irrigated and Non-Irrigated	Umatilla Basin portion modified with agricultural boundaries
Agriculture - Pasture	Malheur region modified to pasture
Columbia Basin Foothill and Canyon Dry Grassland	Zumwalt Prairie & adjacent forest modifed
Columbia Plateau Scabland Shrubland	Cutlines adjusted
Columbia Plateau Silver Sagebrush Seasonally Flooded Shrub Steppe	Modified with feature extraction
Great Basin Xeric Mixed Sagebrush Shrubland	Shrub Cover applied to split for steppe vs shrubland
Inter-Mountain Basins Big Sagebrush Shrubland	Shrub Cover applied to split for steppe vs shrubland
Inter-Mountain Basins Big Sagebrush Shrubland - ssp. tridintata	Shrub Cover applied to split for steppe vs shrubland
Inter-Mountain Basins Big Sagebrush Steppe	Shrub Cover applied to split for steppe vs shrubland
Inter-Mountain Basins Big Sagebrush Steppe - ssp. tridintata	Shrub Cover applied to split for steppe vs shrubland
Inter-Mountain Basins Montane Sagebrush Shrubland	Shrub Cover applied to split for steppe vs shrubland
Inter-Mountain Basins Montane Sagebrush Steppe	Shrub Cover applied to split for steppe vs shrubland
Inter-Mountain Basins Playa	Modified with feature extraction
Inter-Mountain Basins Semi-Desert Shrub-Steppe	Shrub Cover applied to split for steppe vs shrubland
Inter-Mountain Basins Semi-Desert Grassland	Modified with feature extraction
Open Water	Terrain modified to remove from slopes
Conifer Forests	All classfied forest type converted to Conifer Forest (242)
Recently Burned	Updated from LandFire boundaries

4) Summary of Predictor Layers Used:

a) Multi band predictors:
ETM bands 1-5 & 7 for fall
ETM bands 1-5 & 7 for spring
ETM bands 1-5 & 7 for summer

b) Single Band Predictors:

Fall Tasseled Cap brightness band
Fall Tasseled Cap greenness band
Fall Tasseled Cap wetness band
Summer Tasseled Cap brightness band
Summer Tasseled Cap greenness band
Summer Tasseled Cap wetness band
Spring Tasseled Cap brightness band
Spring Tasseled Cap greenness band
Spring Tasseled Cap wetness band

Tree model Shrub Cover Percentage (integer) **

Continuous (integer) slope
Continuous (integer) elevation
Categorical 10 class landform (from DEM)
Topographic Relative Moisture Index (from DEM)
** Post Classification

5) Modeling Methods:

a) See5 Classification Tree Modeling:
Sub-Sampling: Pseudo-replication within each sample polygon was conducted in order to increase the number of samples used by the classification algorithm. While this use of non-independent data is not ideal for classification tree modeling, it has been found to improve classification accuracies, particularly when there are limited amounts of training data. 30 random points were placed within each polygon using the Arcview tool Hawth's Tool. The points were converted to pixels while ensuring that the resulting pixels (the new grid) aligned with the raster predictor layers. The resulting sub-sampled pixels would often be less than 30 per sample polygon, if random points fell within the same pixel.

Training and Validation Sites: Twenty percent of the all sample polygons were withheld for validation using the Feature Select extension in ArcView. With the remaining 80%, 30 sub-samples were randomly generated within each sample polygon. This was done by first randomly generating points within each polygon using the Random Points extension in Hawth's Tool for ArcVGIS, later converted to *.img files. Individual points were converted to *.img files (each to be considered a separate observation for the See5 classifier) and were `drilled' through predictor layers using the Sampling tool from CART Module for Imagine (EarthSatellite Corp. 2003), producing two important files for See5: the *.names and *.data files.

See5 Classification Tree: See5 (Release 2.01) data mining software (Rulequest 2004) was used for generating classification trees. Boosting was employed using 20 trials.

The following briefly describes the files used by the See5 Program (Rulequest 2004).

*.names file: Identifies the dependent variable *.img file and the predictor *.img files created from the CART Module Sampling tool. Required by See5 software.
*.data file: Contains the training cases from which See5 extracts rules. This is also produced from the CART Module Sampling tool, by `drilling' the dependent variable pixels through the specified predictor images. Required by See5 Software.
*.set file: Produced from See5 software. This file contains the settings for the classification tree run. For example the third value `15' indicates the number of boosts used for boosting.

*.tree file: Produced from the See5 software. This file contains the classification tree in `tree' format. This along with the *.data and *.names file are required by the CART Module Classifier tool to spatially apply the tree.

*.out file: Output file generated by See5 and displayed when See5 classification tree model has completed the final run. This file provides a visual representation of the classification tree that is somewhat easier to interpret than the *.tree file.

As a result of spatially applying the classification tree using the CART Module's Classifier an *.img file, which is the spatial application of the tree's rules was created.

b) Shrub Cover: Sampling protocols followed by project teams (section 2a) required the collection of a visual estimate of percent coverage of individual shrub strata. Following similar methodology used in trial regions of SW-ReGap (Huang et. al 2003, Jennings et. al 2004) a overall percent shrub cover was estimated for each training site (80%/20% training/validation). The total percent coverage is represented as a continuous surface at each site, and was reclassified to five categorical types following guidelines suggested by LandFire.

Category	Range %
Very High	> 45%
High	36-45%
Moderate	26-35%
Steppe	11-25%
Grassland	<10%

Tree model Validation: Twenty percent of the sample polygons were randomly selected and withheld from Tree modeling. The preliminary Tree models were run as described in section 5a using the remaining 80% of the training site data. The 20% withheld samples were used to assess the predictive capability of the Tree modeled map via the kappa_stats.avx extension for ArcView by intersecting the reference polygons with the Tree modeled land cover map. This extension considers the site correctly mapped when the majority of pixels within the reference polygon agree with the reference label. Output from kappa_stat.avx includes the kappa statistic and an error matrix indicating errors of omission and commission.

c) Post Classification, Recoding and Other Modeling Steps: Post-classification modeling was done to map classes where there were not enough training data to map using the full Tree model, to differentiate between ecological systems that have similar characteristics, use ancillary data sets, or correct problems found during qualitative review. The processes are listed in the order in which they were implemented.

Post-Classification Tree modeling
Shrub Coverage: Unique combinations of all shrub dominated ecological systems and the independent shrub cover were modified to represent a Shrub -> Steppe -> Grassland type based upon the ecoregion of occurrence.

Ecological System	Shrub Cover				
	Very High	High	Moderate	Steppe	Grassland
Great Basin Xeric Mixed Sagebrush Shrubland	Shrubland	Shrubland	Shurbland	Steppe	Steppe
Inter-Mountain Basins Big Sagebrush Shrubland	Shrubland	Shrubland	Shurbland	Steppe	Steppe
Inter-Mountain Basins Big Sagebrush Shrubland - ssp. tridintata	Shrubland	Shrubland	Shurbland	Steppe	Grassland
Inter-Mountain Basins Big Sagebrush Steppe	Shrubland	Shrubland	Steppe	Steppe	Grassland
Inter-Mountain Basins Big Sagebrush Steppe - ssp. tridintata	Shrubland	Shrubland	Steppe	Steppe	Grassland
Inter-Mountain Basins Montane Sagebrush Shrubland	Shrubland	Shrubland	Shurbland	Steppe	Grassland
Inter-Mountain Basins Montane Sagebrush Steppe	Shrubland	Shrubland	Steppe	Steppe	Grassland
Inter-Mountain Basins Semi-Desert Shrub-Steppe	Shrubland	Shrubland	Steppe	Steppe	Grassland

Corrections
A visual examination of the 100% Tree model was done using ETM imagery.

Grasslands and Scablands
Columbia Plateau Scabland Shrubland was affected in several areas by image artifacts propagated when the regional mosaic was completed. Errors generally were comprised of ridgeline scablands ending abruptly at image boundaries. Ridgelines from the Landform data layers were used to correct and extend the scabland type.

Inter-Mountain Basins Semi-Desert Grassland and *Columbia Basin Foothill and Canyon Dry Grassland*. The region of primary conflict occurred in the North-East portion of the map zone in the vicinity of Zumwalt Prairie. The complex interactions of grassland types in the region required that ORNHIC ecologist to identity multiple boundaries in which a series of "if then" statements where used to switch between the two grassland types and correct for tree model errors.

Open Water
Water was over-mapped throughout the canyon regions of the mapping area. Primary areas of error were due to shadows in the deep canyons in which the available image dates did not penetrate the full spatial extent of the canyon wall.

Forest
Conifer Forest (242) is a composite type composed of all individual ecological systems present within the map zone.

Water
Canyon terrain models were used to remove shadow-water conflicts. Groups of misclassified pixels were replaced using a focal majority routine which used the surrounding pixels as representative values.

Recent Fires
The recent fires layer was applied as a mask over the landcover map superseding all underlying ecological systems with the Recently Burned (302) land cover type

Transportation
Following the lead of the SWGAP project, Interstates and Highways were applied to the final product. The transportation layer, recoded as Developed Medium (223), was applied as a mask over the landcover map using a conditional statement. See 3b for development

c) Generalizing to MMU and Map Completion:
Once the Tree model and the post-classification steps were employed, the map was generalized using the Clump tool in ERDAS Imagine 8.7. The parameter of 4 connected neighbors was used in the clumping process. Isolated pixels that fell under the specified 1-acre (5 pixels) minimum mapping unit (MMU) were removed using the Eliminate tool.

Following the Clump & Eliminate step, the non-Tree modeled classes were then "burned in" to the final map using the Overlay function.

6) Accuracy Assessment

Accuracy statistics were calculated using the 20% withheld samples on the preliminary Tree model. These statistics include an error matrix, kappa statistics and breakdown of user's/producer's accuracy and error.

Error Matrix

ERROR MATRIX: Reference Data in Columns/Classification Data in Rows	Annual/Biannual Farmland	Bare Ground	Columbia Plateau Low Sagebrush Steppe	Columbia Plateau Scabland Shrubland	Exotics	Inter-Mountain Montane Sagebrush Steppe	Northern Rocky Mountain Lower Montane Mesic Deciduous Shrubland	Northern Rockuy Mountain Ponderosa Pine Woodland and Savanna	Temperate Pacific Subalpine_ Montane Wet Meadow	Inter-Mountain Basins Mixed Salt Desert Scrub	Inter-Mountain Basins Semi-Desert Shrub-Steppe	Inter-Mountain Basins Greasewood Flat	Inter-Mountain Basins Mountain Mahogany Woodland and Shrubland	Inter-Mountain Basins Big Sagebrush Steppe - ssp. wyoming	Inter-Mountain Basins Big Sagebrush Shrub - ssp. wyoming	Columbia Plateau Steppe and Grassland	Inter-Mountain Basins Juniper Savanna	Columbia Plateau Silver Sagebrush Seasonally Flooded Shrub Steppe	Great Basins Foothill and Lower Montaine Riparian Woodland and Shrubland	Columbai Plateau Palouse Prairie	Great Basin Xeric Mixed Sagebrush Shrubland	Great Basin Xeric Mixed Sagebrush Steppe	Intermountain Basins Montane Sagebrush Shrubland	Inter-Mountain Basins Big Sagebrush Steppe - ssp. tridintata	Inter-Mountain Basins Big Sagebrush Shrubland - ssp. tridintata	Total	User Accuracy
Annual/Biannual Farmland	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	100%
Bare Ground	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	100%
Columbia Plateau Low Sagebrush Steppe	0	0	29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	29	100%
Columbia Plateau Scabland Shrubland	0	0	0	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	100%
Exotics	0	0	0	0	6	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	7	86%
Inter-Mountain Montane Sagebrush Steppe	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	100%
Northern Rocky Mountain Lower Montane Mesic Deciduous Shrubland	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	100%
Northern Rockuy Mountain Ponderosa Pine Woodland and Savanna	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	50%
Temperate Pacific Subalpine_Montane Wet Meadow	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	100%
Inter-Mountain Basins Mixed Salt Desert Scrub	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	100%
Inter-Mountain Basins Semi-Desert Shrub-Steppe	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	100%
Inter-Mountain Basins Greasewood Flat	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	100%
Inter-Mountain Basins Mountain Mahogany Woodland and Shrubland	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Null
Inter-Mountain Basins Big Sagebrush Steppe - ssp. wyoming	0	0	1	0	2	0	0	0	0	0	1	0	1	53	1	0	1	0	0	0	0	0	0	0	0	0	60	88%
Inter-Mountain Basins Big Sagebrush Shrub - ssp. wyoming	0	0	0	0	0	0	0	0	0	0	0	1	0	5	28	1	0	0	0	0	0	0	0	0	0	0	33	79%
Columbia Plateau Steppe and Grassland	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	0	0	0	0	0	0	0	0	0	0	4	75%
Inter-Mountain Basins Juniper Savanna	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	5	100%
Columbia Plateau Silver Sagebrush Seasonally Flooded Shrub Steppe	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	3	67%
Great Basins Foothill and Lower Montaine Riparian Woodland and Shrubland	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	100%
Columbai Plateau Palouse Prairie	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	100%
Great Basin Xeric Mixed Sagebrush Shrubland	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	100%
Great Basin Xeric Mixed Sagebrush Steppe	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	2	100%
Intermountain Basins Montane Sagebrush Shrubland	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	100%
Inter-Mountain Basins Big Sagebrush Steppe - ssp. tridintata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	1	7	86%
Inter-Mountain Basins Big Sagebrush Shrubland - ssp. tridintata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	3	67%
Total	1	1	31	9	8	2	2	1	1	1	7	2	1	59	28	4	6	2	1	1	1	2	1	7	3	182	
Producer's Accuracy	100%	100%	94%	100%	75%	50%	100%	100%	100%	100%	86%	50%	0%	90%	93%	75%	83%	100%	100%	100%	100%	100%	100%	86%	67%		89%

User's/Producer's Accuracy and Omission/Commission Error

Ecological Systems	Producer Accurancy	User Accuracy	Secificity	Predictive Power	Omission Error	Commission Error
Annual/Biannual Farmland	1	1	1	1	0	0
Bare Ground	1	1	1	1	0	0
Columbia Plateau Low Sagebrush Steppe	0.93548387	1	1	0.986928	0.064516	0
Columbia Plateau Scabland Shrubland	1	1	1	1	0	0
Exotics	0.75	0.857143	0.994253	0.988571	0.25	0.00574713
Inter-Mountain Montane Sagebrush Steppe	0.5	1	1	0.994475	0.5	0
Northern Rocky Mountain Lower Montane Mesic Deciduous Shrubland	1	1	1	1	0	0
Northern Rockuy Mountain Ponderosa Pine Woodland and Savanna	1	0.5	0.994475	1	0	0.00552486
Temperate Pacific Subalpine_Montane Wet Meadow	1	1	1	1	0	0
Inter-Mountain Basins Mixed Salt Desert Scrub	1	1	1	1	0	0
Inter-Mountain Basins Semi-Desert Shrub-Steppe	0.85714286	1	1	0.994318	0.142857	0
Inter-Mountain Basins Greasewood Flat	0.5	1	1	0.994475	0.5	0
Inter-Mountain Basins Mountain Mahogany Woodland and Shrubland	0	Null	1	0.994505	1	0
Inter-Mountain Basins Big Sagebrush Steppe - ssp. wyoming	0.89830509	0.883333	0.943089	0.95082	0.101695	0.05691057
Inter-Mountain Basins Big Sagebrush Shrub - ssp. wyoming	0.92857143	0.787879	0.954545	0.986577	0.071429	0.04545455
Columbia Plateau Steppe and Grassland	0.75	0.75	0.994382	0.994382	0.25	0.00561798
Inter-Mountain Basins Juniper Savanna	0.83333333	1	1	0.99435	0.166667	0
Columbia Plateau Silver Sagebrush Seasonally Flooded Shrub Steppe	1	0.666667	0.994444	1	0	0.00555556
Great Basins Foothill and Lower Montaine Riparian Woodland and Shrubland	1	1	1	1	0	0
Columbai Plateau Palouse Prairie	1	1	1	1	0	0
Great Basin Xeric Mixed Sagebrush Shrubland	1	1	1	1	0	0
Great Basin Xeric Mixed Sagebrush Steppe	1	1	1	1	0	0
Intermountain Basins Montane Sagebrush Shrubland	1	1	1	1	0	0
Inter-Mountain Basins Big Sagebrush Steppe - ssp. tridintata	0.85714286	0.857143	0.994286	0.994286	0.142857	0.00571429
Inter-Mountain Basins Big Sagebrush Shrubland - ssp. tridintata	0.66666667	0.666667	0.994413	0.994413	0.333333	0.00558659

Overall Statistics:

Overall Accuracy: (162 / 182) = 0.890109890
Overall Misclassification Rate: (20 / 182) = 0.109890110
Overall Sensitivity: 0.890109890
Overall Specificity: 0.995421245
Overall Omission Error: 0.109890110
Overall Commission Error: 0.004578755

Kappa Statistics

KHAT = 0.867395
VARIANCE = 0.00078491
Z = 30.961
P = 0.00000000

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