# Sage-grouse habitat feature extraction using 2009 NAIP orthophotography

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## Introduction

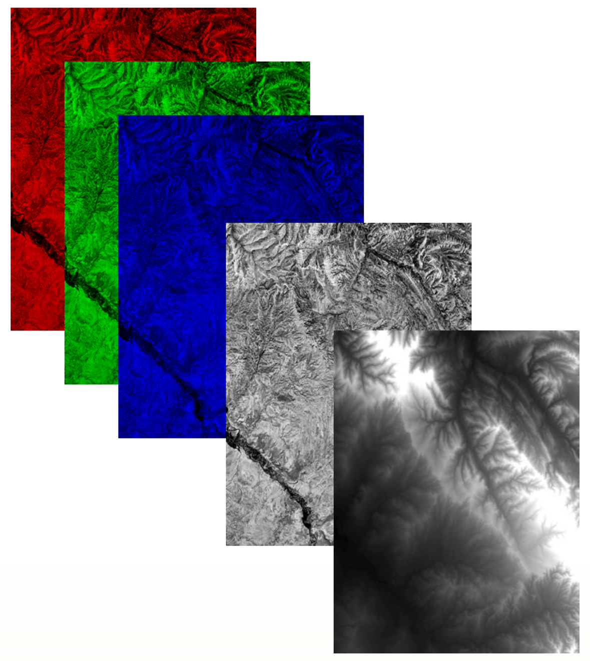
This work was performed to map greater sage-grouse (*Centrocercus urophasianus*) potential nesting habitat within a defined project area in the Bighorn Basin in north-central Wyoming. While mapping within the designated 'sage-grouse core area' must be fine scale and highly accurate, more cost-effective techniques of identifying potential habitat at slightly lower resolutions is preferred for areas outside of core areas.

For the portion of the project area within the core area, potential habitat was mapped from ATV and delineated using professional-grade GPS units. For the areas outside the core area, potential habitat was identified using supervised feature extraction methods and 2009 National Agricultural Imagery Program 1-meter digital orthophotography.

## Initial Feature Extraction

All mapping and analysis was completed using the ArcGIS v. 9.3.1 (ESRI) software package. Image preparation was completed using the Spatial Analyst v. 9.3.1 (ESRI) extension. Image feature extraction was conducted using the Feature Analyst for ArcGIS v. 4.2 (VLS, Inc.) extension.

Feature Analyst is an Automated Feature Extraction application which uses spectral information and feature characteristics such as spatial association, size, shape, texture, pattern, and shadow in user-specified training features to identify and extract target features within image scenes.



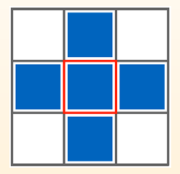
Input Bands:

Spectral Bands-
True-color RGB 2009 NAIP 1-meter Orthophotography

Texture Band-
Calculated from NAIP Green Band

Elevation Band-
10m USGS Digital Elevation Model

Input Representation:



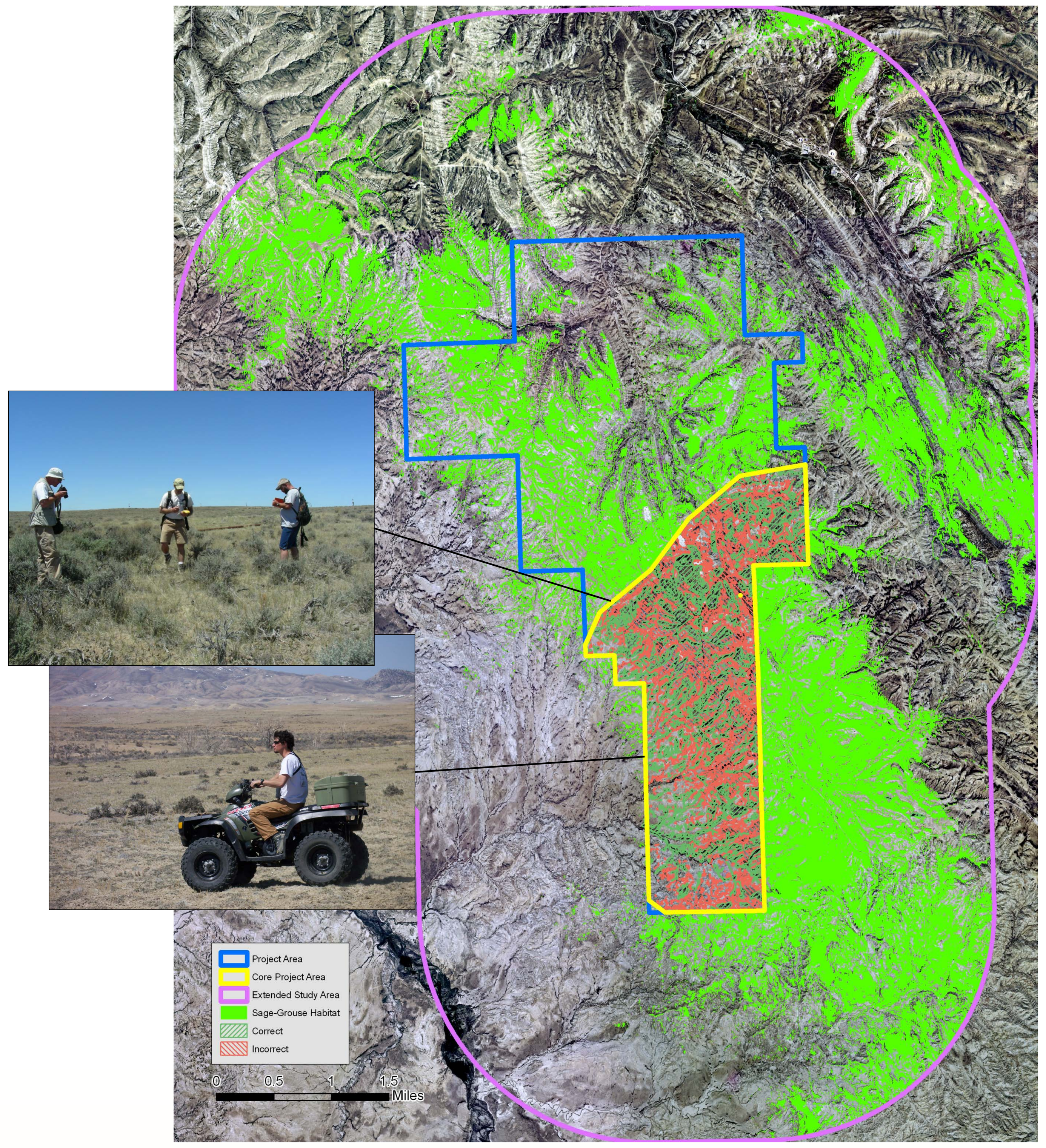
Manhattan- Width 3, Resample factor 2

The Input Representation is a 'moving window' pattern that is used to classify each pixel in the analysis. The pattern defines the data used to determine if the pixel is part of the target feature.

Sage-grouse habitat polygon training features were field mapped for the core project area using Trimble Juno GPS hardware and ArcPad v.7.1.1 (ESRI) software. The entire core area was comprehensively mapped to identify habitat and non-habitat areas. The feature extraction analysis was used to extrapolate the field-mapped information to the remaining project area and surrounding extended study area.

## Hierarchical Learning

Initial feature extraction results usually over-classify the target feature, resulting in false positive features called *Clutter*. The Clutter Removal tools in Feature Analyst allow the analyst to interactively identify correctly and incorrectly classified features, which are used as training features in subsequent feature extraction runs. The clutter removal extraction runs are limited spatially to the initial results as a *region of interest*.



As the entire core area was field surveyed, habitat training polygons were used as 'correct' clutter removal examples and the areas not identified as habitat were used as 'incorrect' examples.

## Data Sources

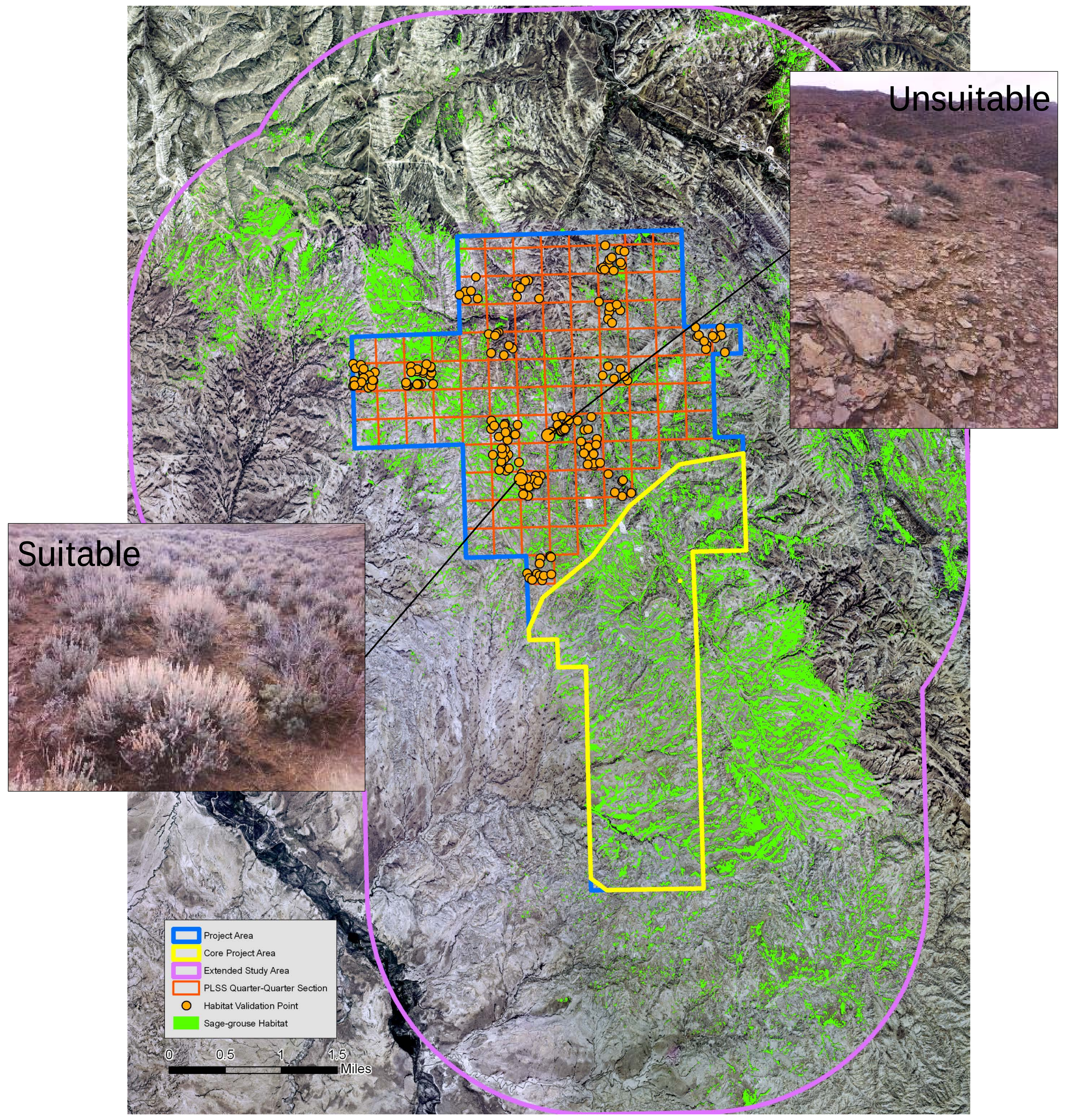
•National Agricultural Imagery Program 1-meter True-color County Mosaics, US Dept. of Agriculture, Farm Service Agency, Aerial Photography Field Office, 2009.

•1/3-Arc Second National Elevation Dataset, US Geological Survey, 2009.

•Public Land Survey System of the United States, Quarter-quarter Section Boundaries, US Geological Survey, 2003.

## Accuracy Assessment

A ground-verified accuracy assessment was conducted on non-core area land within the project area. To define ground verification locations, a stratified random sampling design was applied. The Public Land Survey System quarter-quarter section boundaries were randomly sampled to provide approximately 20% of the assessment area available for location of points. Within the sampled QQ sections, points were randomly located, dependent on the density of habitat. This design was selected to avoid over-representing non-habitat in QQ sections with little habitat available. The total number of points were pragmatically determined based on available resources for level of effort.




Verification point locations were loaded into the GPS units and navigated to by field technicians. Habitat quality was assessed and digital photos acquired for each location. The following classification error matrix was calculated and errors of omission/commission, mapping accuracy and overall classification accuracy are reported.

| | Extraction Classes | | | Errors: | | |
|---|---|---|---|---|---|---|
| **Ground Classes** | Habitat | Non-Habitat | **Grand Total** | **Omissions** | **Commissions** | **Mapping Accuracy** |
| Marginal | 20 | 13 | 33 | (Marginal combined with Suitable as correctly classified habitat) | | |
| Suitable | 73 | 6 | 79 | 17% | 6% | 78% |
| Unsuitable | 7 | 71 | 78 | 9% | 24% | 73% |
| **Grand Total** | 100 | 90 | **190** | | | **86 %** |