Using SamplePoint to Determine Vegetation Percent Cover in a Sagebrush Steppe Ecosystem

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Introduction and Research Problem

Satellite imagery can be used to map species level vegetation across large areas. This is because plants have unique spectral signatures in the electromagnetic spectrum and satellite imagery collects data from specific areas of the electromagnetic spectrum in bands. However, in order to use satellite imagery to map vegetation using spectral signatures, vegetation information from the ground is needed to "train" the satellite imagery. One of the ways of collecting vegetation information is using signature plots. Signature plots are high resolution local images of ground vegetation in a specific environment. These signature plots can then be analyzed using a computer software called SamplePoint in order to produce a percent vegetation cover. SamplePoint offers a unique way to expand small physical observations to large landscapes.
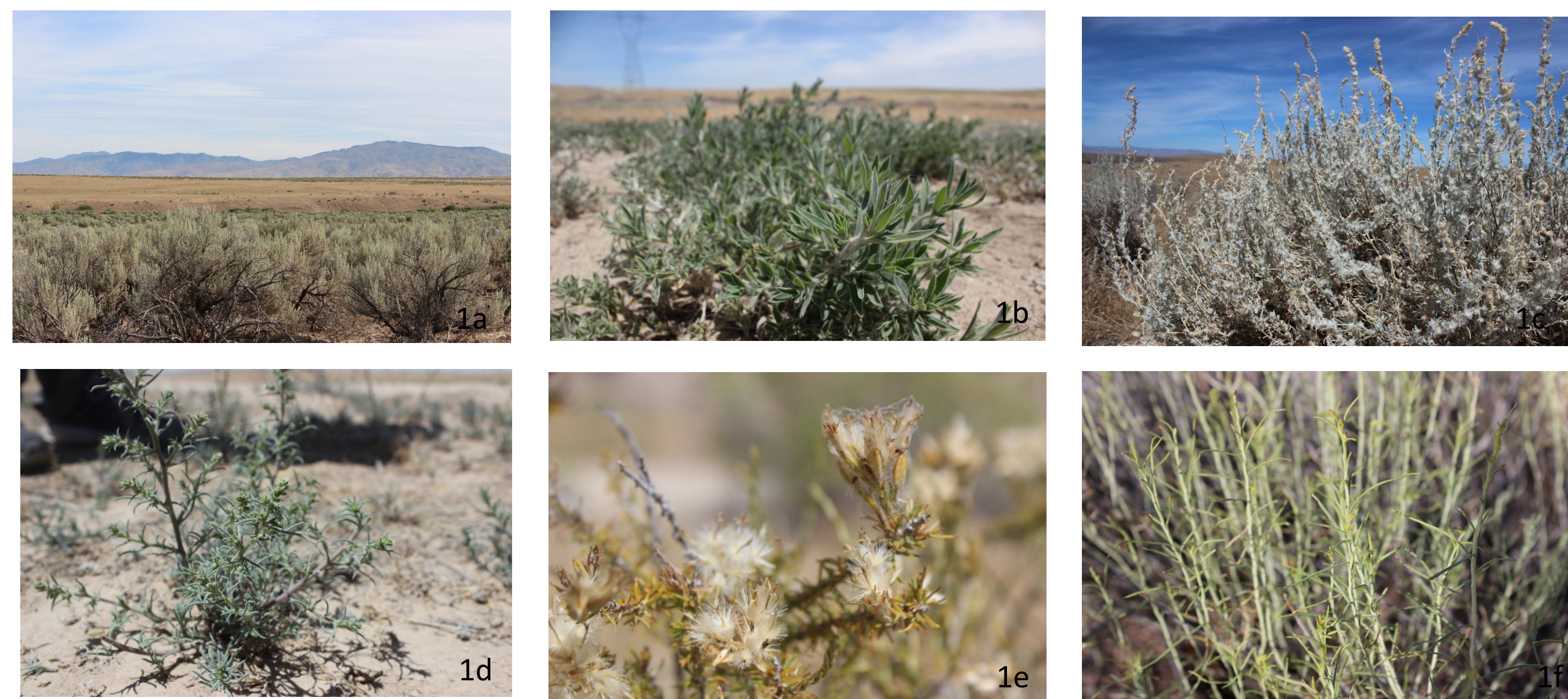

Figure 1 A-F. Examples of vegetation in a semi-arid environment

Study area

The Snake River Birds of Prey National Conservation Area and Mountain Home Air Force Base (MHAFB), 50 miles south of Boise, Idaho (Fig. 2). MHAFB is a semi-arid environment with vegetation that includes big sagebrush (*Artemisia tridentata*), green/yellow rabbitbrush (*Chrysothamnus viscidiflorus*), gray/rubber rabbitbrush (*Ericameria nauseosa*), winterfat (*Krascheninnikovia lanata*), shadscale, bitterbrush (*Atriplex confertifolia*), forage kochia (*Bassia prostrata*), sandberg bluegrass (*Poa secunda*), cheatgrass (*Bromus tectorum*), crested wheatgrass (*Agropyron cristatum*), bluebunch wheatgrass (*Pseudoroegneria spicata)*, Idaho fescue (*Festuca idahoensis*),

Figure 2. Study Area

Thurber's needlegrass (*Achnatherum thurberianum*), weed kochia, mustard, bur buttercup (*Ceratocephala testiculata*), Russian thistle (*Salsola tragus*), shrubs, grasses, and forbs. Data was collected from the study area during May, June, July, and August 2016.
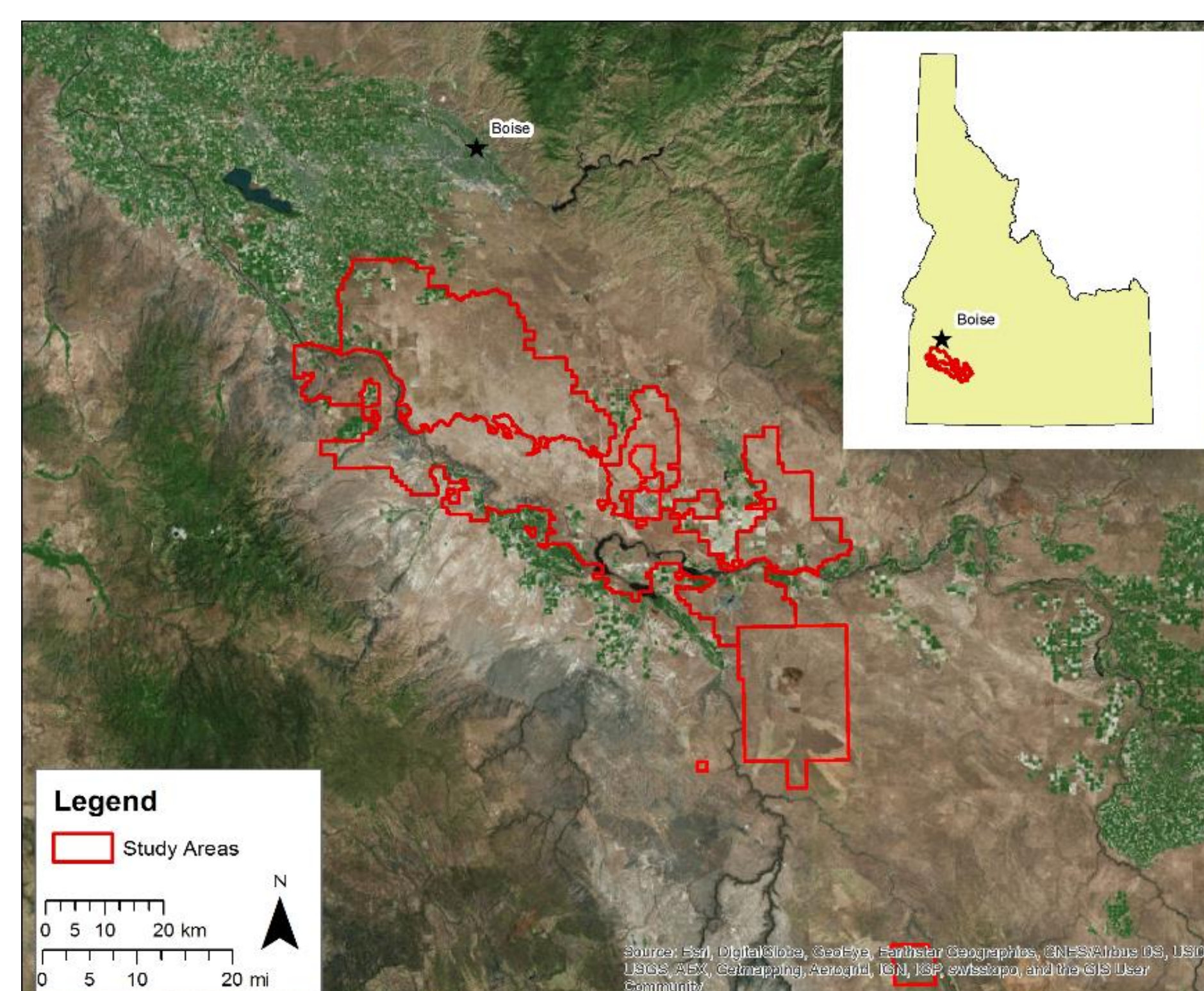
Methods

Data was collected by taking photographs of signature photo plots. Plots of land were measured at 20X20 meters and recorded with a GPS device (Fig. 3a). From the center of the plot, photos were taken with a camera on a survey pole with a boom. The photographs were taken 2 meters above ground facing straight down onto the plot (Fig. 3b). These photos were taken 7 meters from the center at five locations on the plot: north, east, south, west, and center. Each photo was taken south facing due to shadows in photographs with a total of 5 photographs per plot (Fig. 3c). These are signature photo plots.

Figure 3a: Example of data being recorded with GPS device and camera

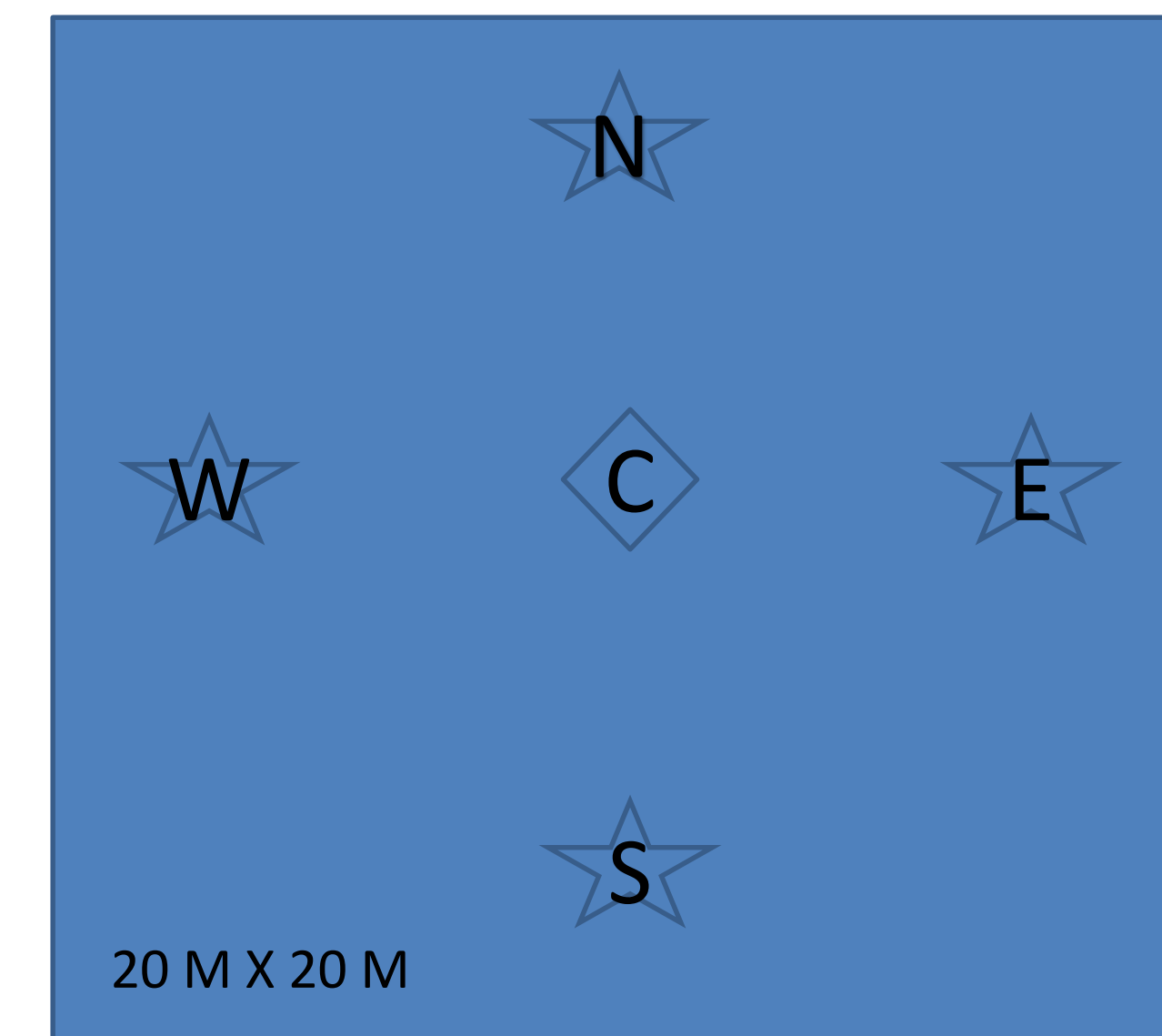Figure 3b: Example of photo taken 2 meters above ground

Figure 3c: Layout of signature photo plots

From the images taken at the signature photo plots, data can be collected about the percent vegetation cover. In SamplePoint, each image is placed on a grid of 10x10 points for a total of 100 point per image (Fig. 3d). Classification is done in the center of the crosshairs from each point on the image (Fig. 3e).
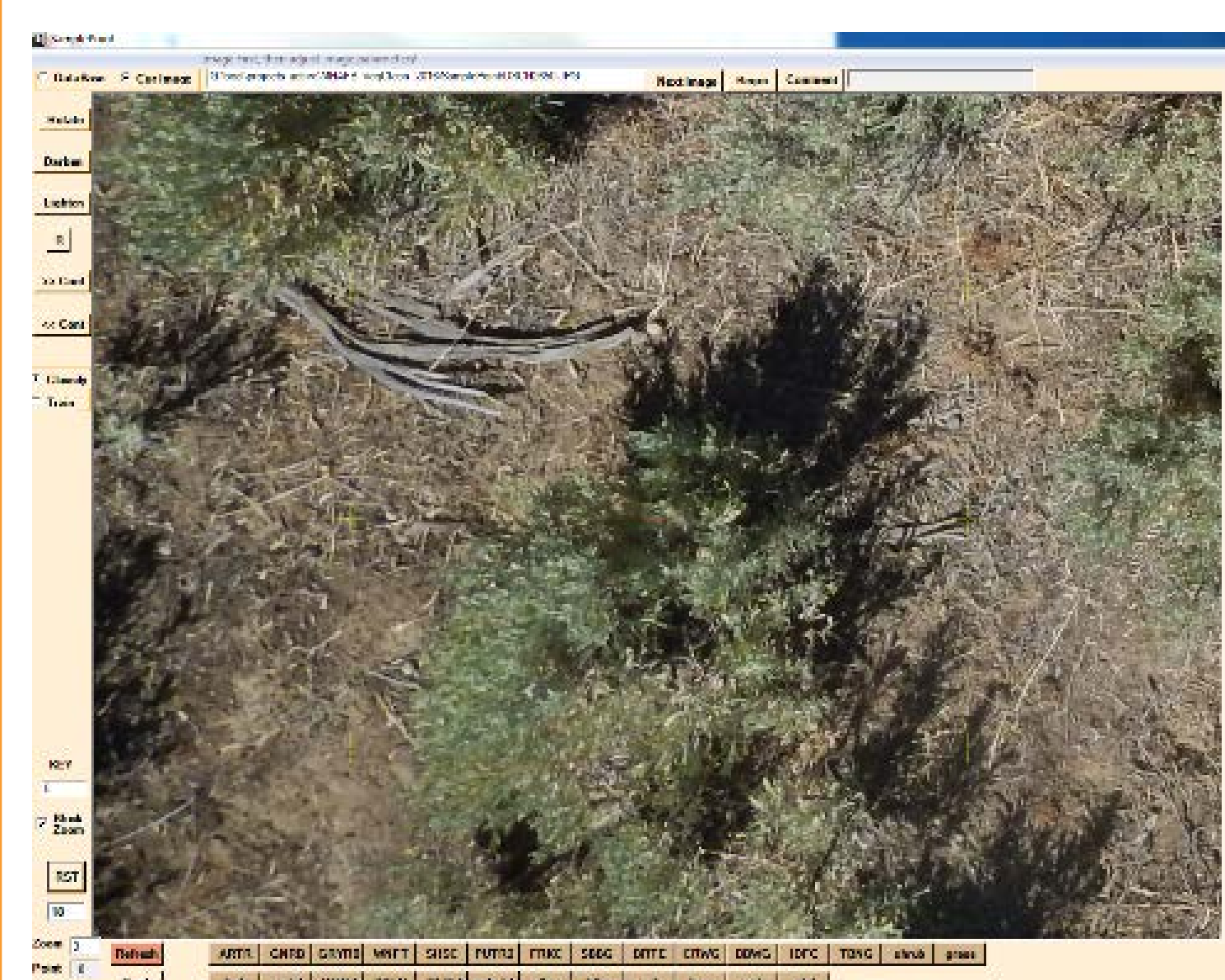

Figure 3d. SamplePoint 10x10 grid


Figure 3e. Crosshairs in SamplePoint

Results

The data that is entered into SamplePoint produces a statistics file with percent vegetation cover (Fig. 4a). This allows us to identify the specific electromagnetic signature for those plants. We can now state, for example, that a particular signature plot has 60% sagebrush and 40% cheatgrass. At the end of the process, we will produce a vegetation map that displays the vegetation percent cover in a sagebrush steppe ecosystem. The Boise State Geoscience Department Morley Nelson Snake River Birds of Prey National Conservation Map from 2013 is an example of the deliverables that can be made from the data collected from SamplePoint (Fig. 4b).

Figure 4a: SamplePoint data converted to Excel Sheet

Figure 4b: example of vegetation map (Boise State Geoscience Department Morley Nelson Snake River Birds of Prey National Conservation Map from 2013)
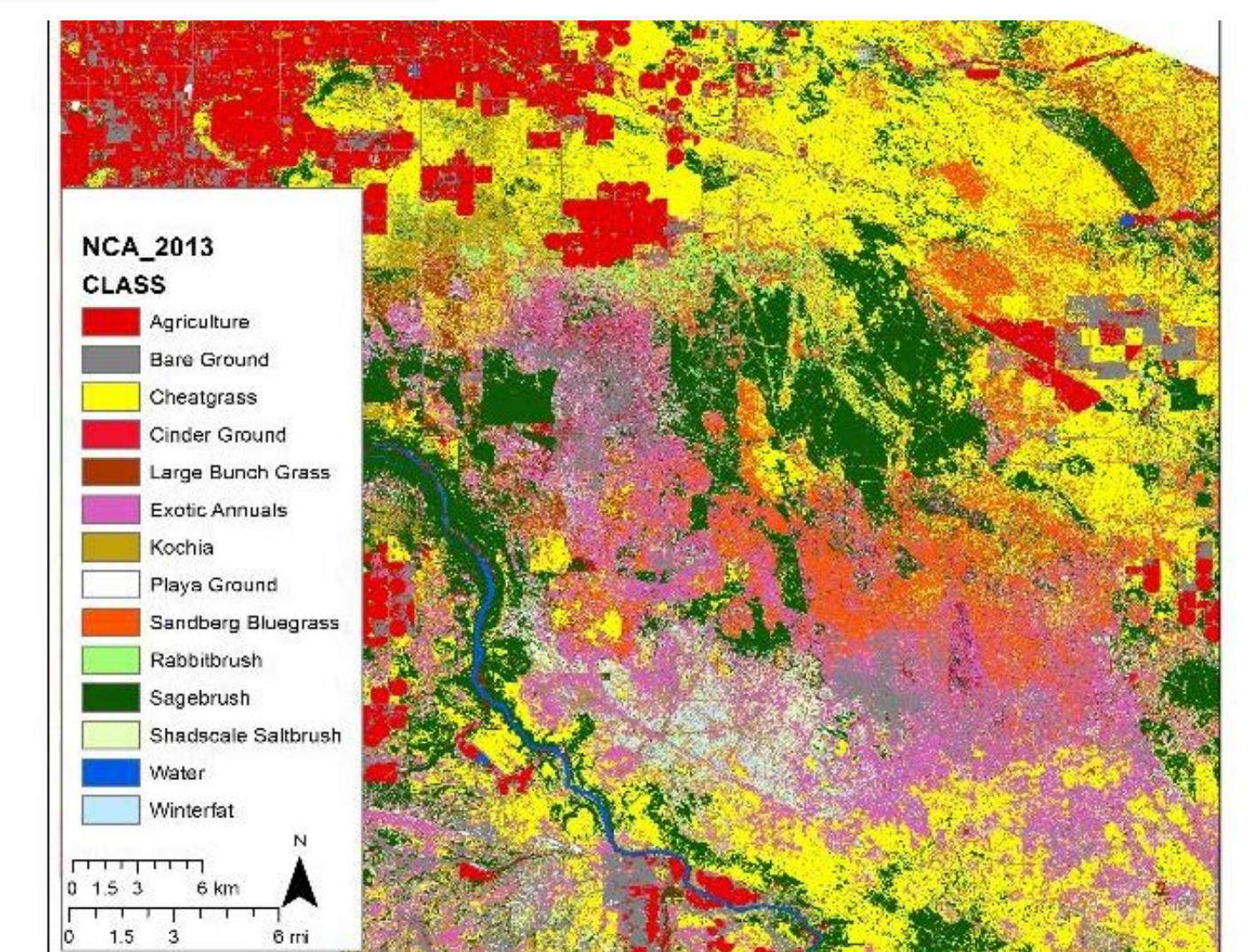
Future Steps

By using remote sensing we can identify a vegetation signature for each plant on the electromagnetic spectrum. As we identify each plant's unique signature we want to collect data throughout seasonal variations in the year in order to ensure the highest degree of accuracy (Fig.5). Continuing to collect data will correlate with the satellite imagery. Future studies will map different ecosystems and their vegetation's unique spectral signatures.

Figure 5: Collecting data in different seasons

Conclusion

Remote Sensing can be used across a variety of landscapes. We can map the vegetation population over a broad area with the use of signature photo plots and SamplePoint. Because each plant has a unique signature in the electromagnetic spectrum, we are able to locate and identify various vegetation signatures. For example, we will now be able to identify plants through an image taken with remote sensing instead of hours of manual fieldwork. Mountain Home Air Force Base will be able to collect data on plant species and monitor the vegetation that they are responsible for in a more efficient and effective way. Finally, the data created through SamplePoint will state exactly which pixel corresponds with the distribution of plants in a large landscape and will continue to correspond with satellite imagery.

References

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- Watkins, M. (2015, May 7). BCAL *SamplePoint Instructions* [Document]