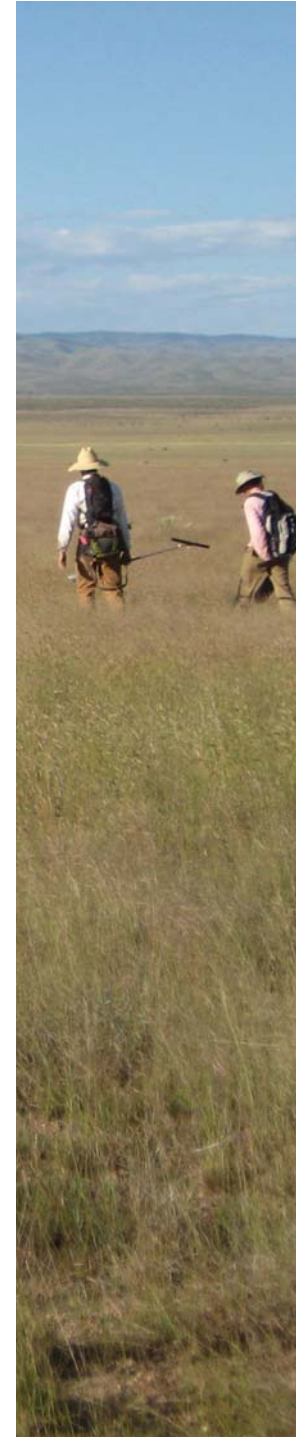
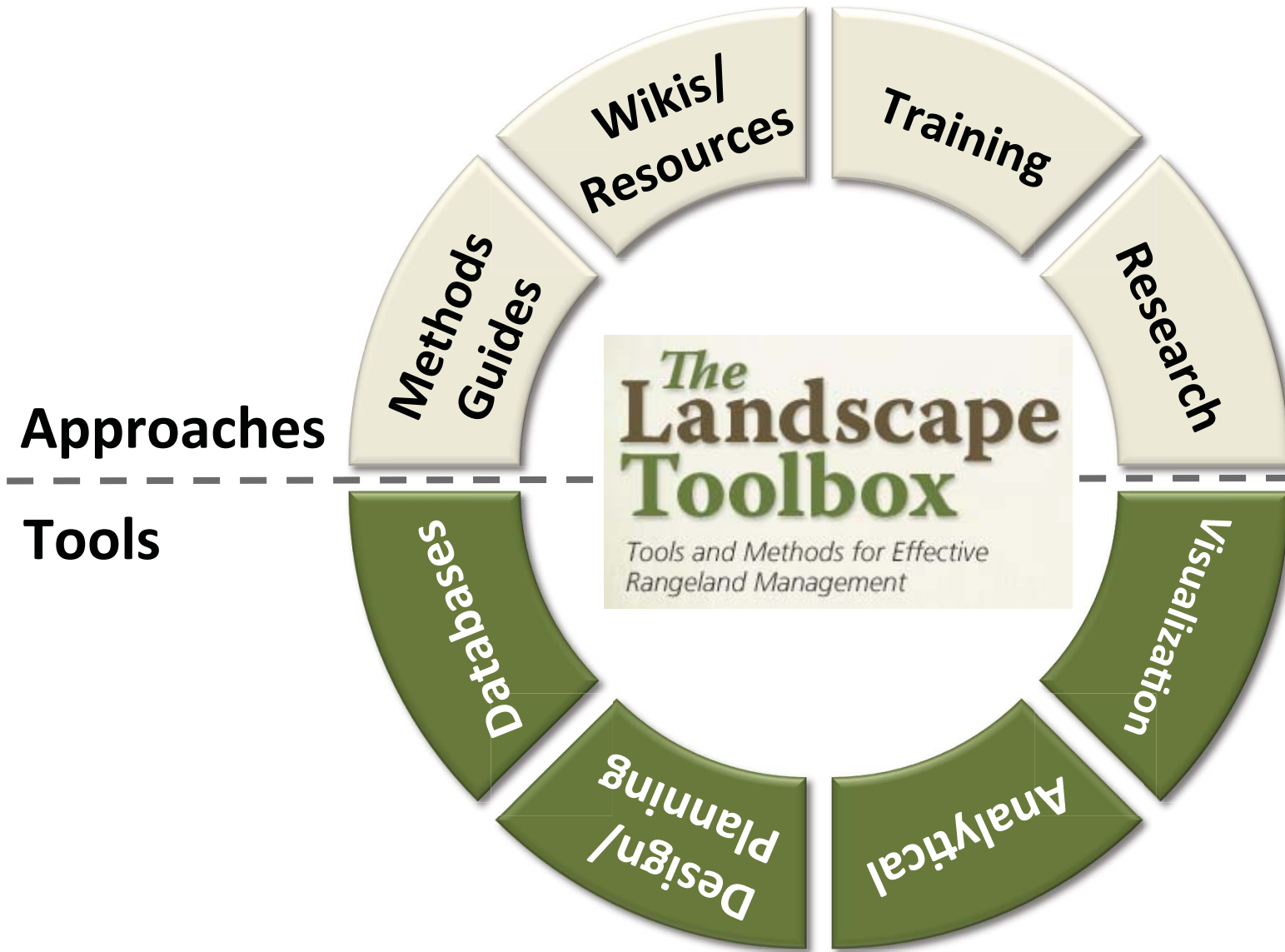


Discussion management attributes
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 Assessment
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 visits models

the Landscape Toolbox

Jason Karl

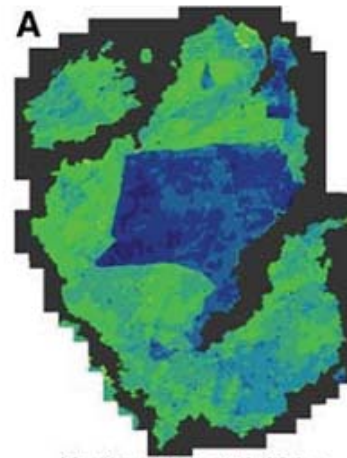
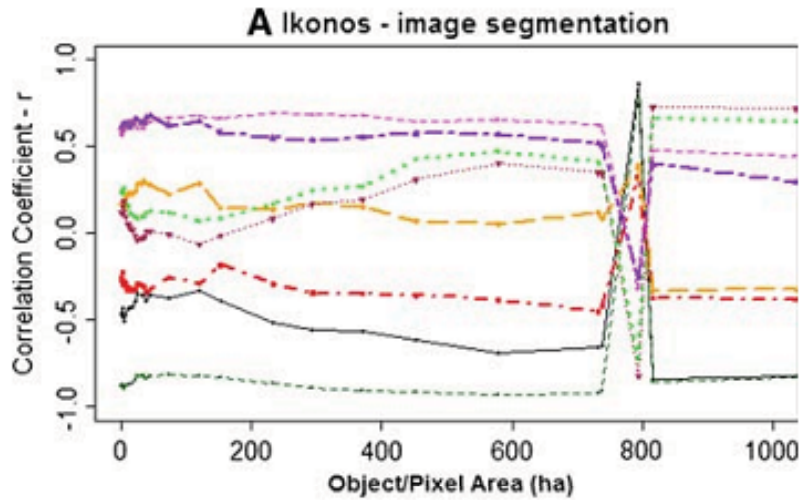




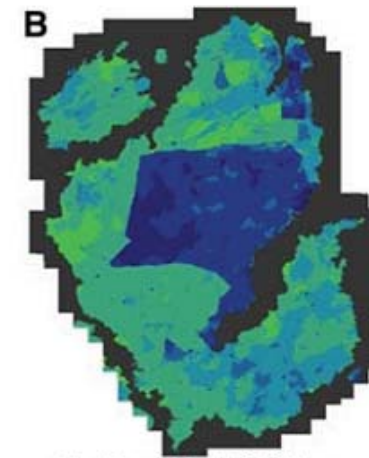
The Landscape Toolbox

- Umbrella for guiding research and organizing results
- Scale and context matter!
 - Create a structure where it becomes possible to know when/where to use different tools, techniques, knowledge
 - Within a multi-scale, ecological site framework
- Research focused on
 - Identifying appropriate scales of analysis
 - Determining where tools/techniques work and why they fail

Selecting Appropriate Scales



Median Object 5.47 ha



Median Object 21.3 ha



Median Object 452 ha



Median Object 1030 ha

Ecological Informatics

Journal homepage: www.elsevier.com/locate/ecoinform

Scale dependence of predictions from image segmentation: A variogram-based method to determine appropriate scales for reducing land-management information

by W. Karl^{a,*}, Brian A. Maurer^b

Received 15 June 2004; Accepted 23 November 2004

ABSTRACT

Land-use change is a complex process that has been studied for decades. However, the scale of observation that is used to study land-use change is often not explicitly defined. This paper presents a method for determining the appropriate scale for land-use change analysis. The method is based on the variogram, a statistical tool that is used to measure the spatial correlation of a variable. The variogram is used to determine the scale at which the correlation of a variable is highest. This scale is then used to determine the appropriate scale for land-use change analysis. The method is applied to a set of Ikonos satellite images of a landscape in the state of Michigan, USA. The results show that the appropriate scale for land-use change analysis is 452 ha. This scale is significantly larger than the scale of the original images (5.47 ha). The results also show that the correlation of land-use change is highest at this scale. This finding has important implications for land-use change analysis and management. It suggests that the scale of observation used to study land-use change should be chosen based on the results of a variogram analysis. This method can be applied to any type of land-use data and is a simple and effective way to determine the appropriate scale for analysis.

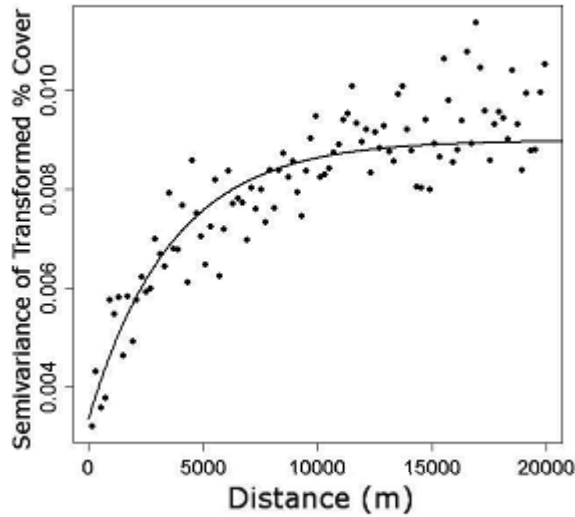
Keywords: Remote sensing; Scale; Multi-scale analysis; Object-based image analysis; Land-use change

Introduction

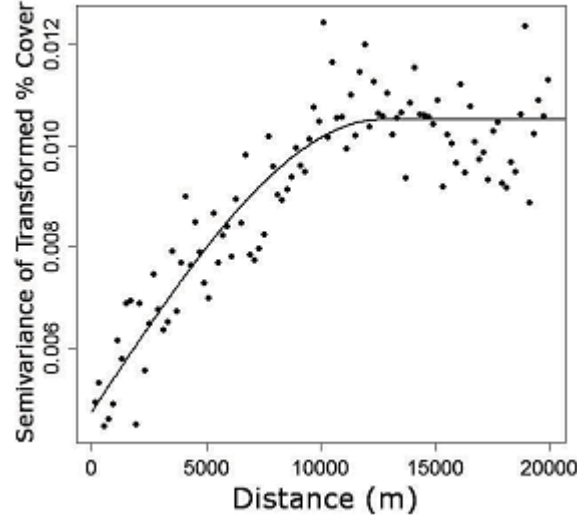
Landscapes are composed of types of patches that occur from a variety of natural and human-induced processes operating over spatially discrete spatial temporal frequencies (Forman et al., 1986; W.

Selecting Scales – Linking to Processes

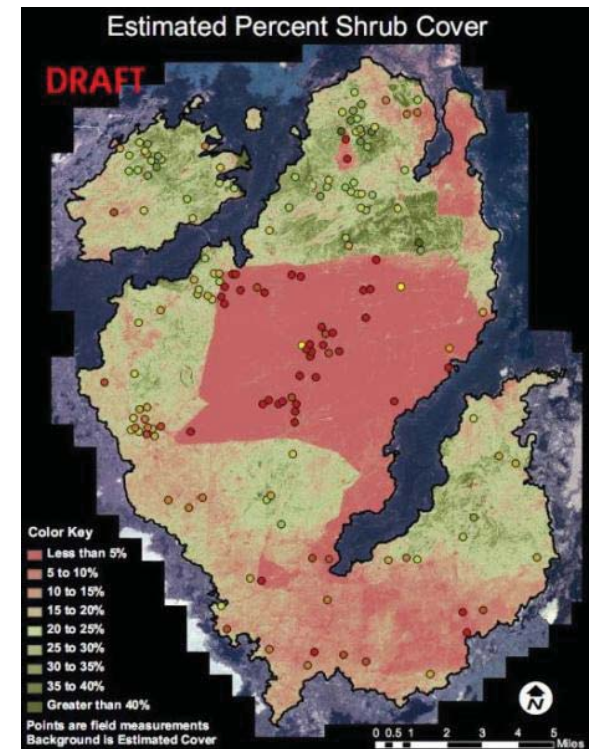
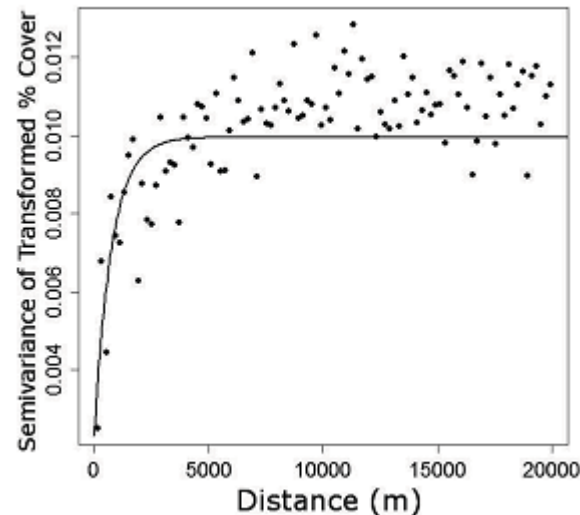
A) Shrub Residual Variogram



B) Bare Ground Residual Variogram



C) Cheatgrass Residual Variogram



NRI/CEAP *Integrated Field and Remote Sensing Monitoring*

- High-res imagery (<2cm pixels) can be used for monitoring
- How to incorporate into robust monitoring programs like NRI?
 - Training, calibration, repeatability
- What indicators can be derived reliably and where?
- Can we tell *a priori* when technique will not work?



NM Mesquite Duneland



ID Sagebrush/Annual Grass

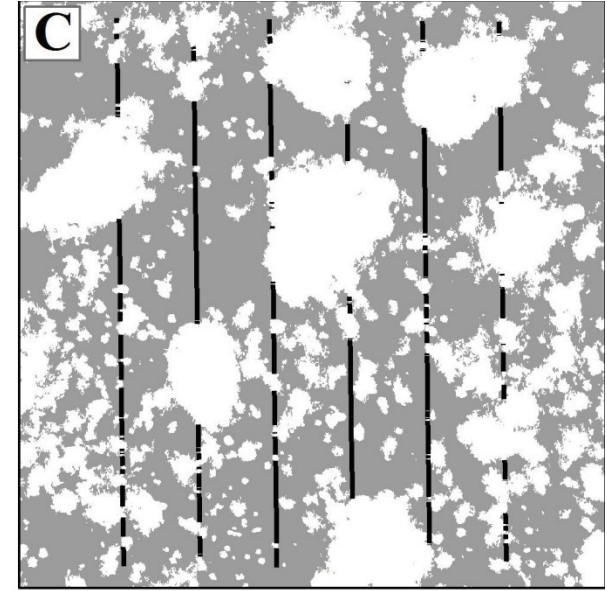
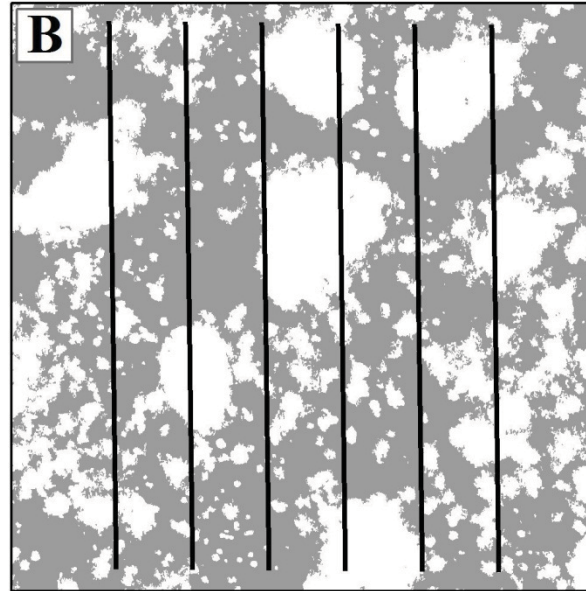
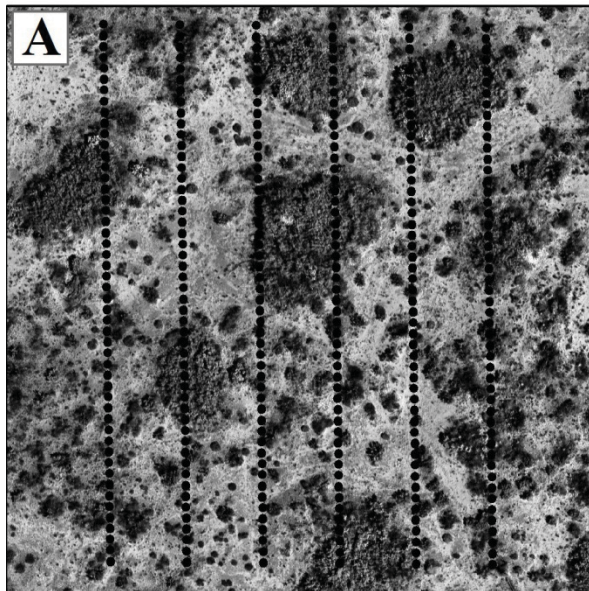
Estimating Canopy Gaps - Methods

- Data
 - High res. (3cm GSD) aerial photographs interpreted and classified
 - Field measures of canopy gap compared to image estimates
- Analysis
 - Linear relationship between field/image estimates

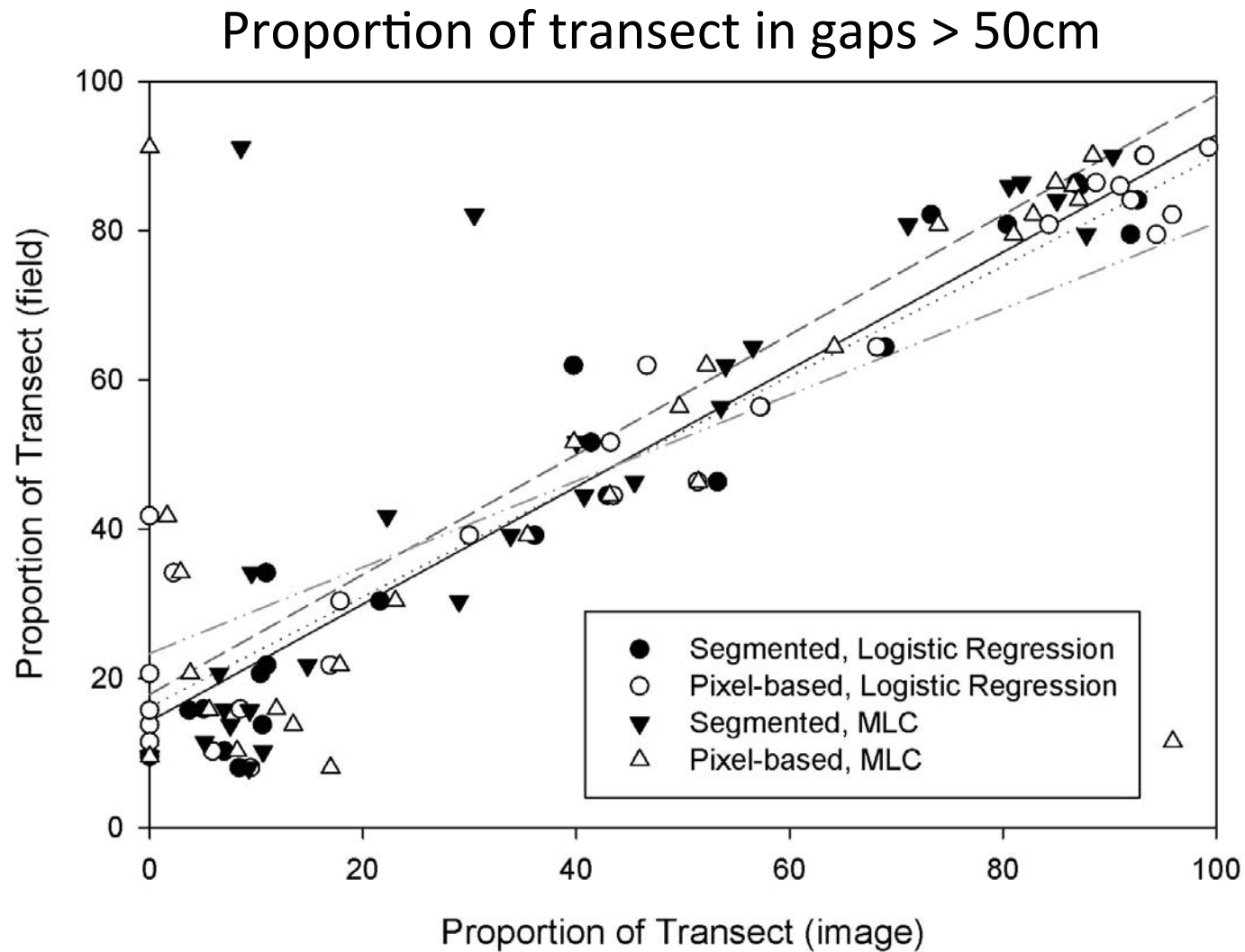
A. Image Interpretation (points)

B. Train/Classify Imagery

C. Calculate Gaps, Compare to Field

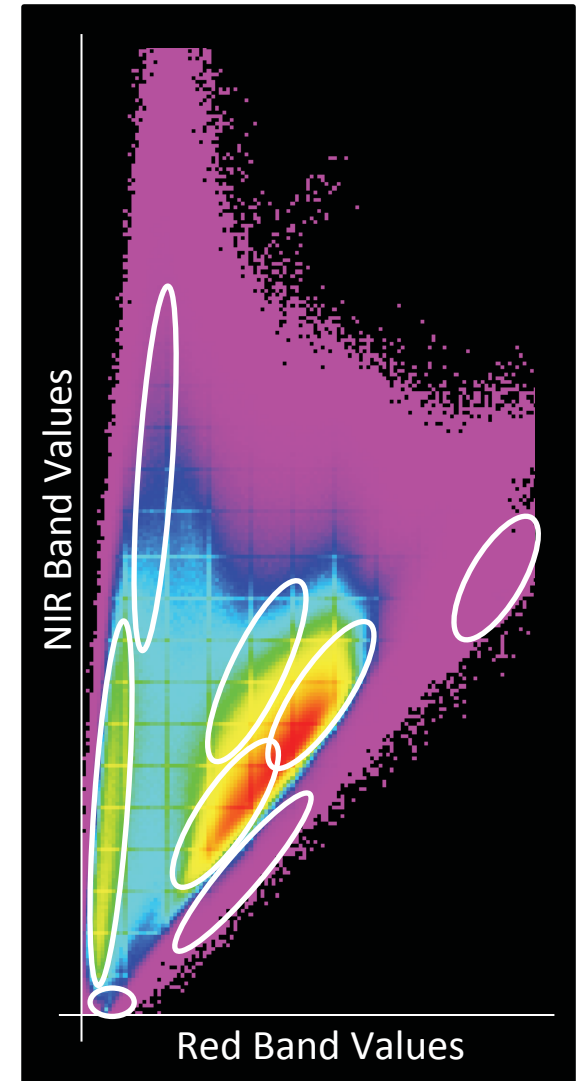


Field vs. Image Canopy Gaps



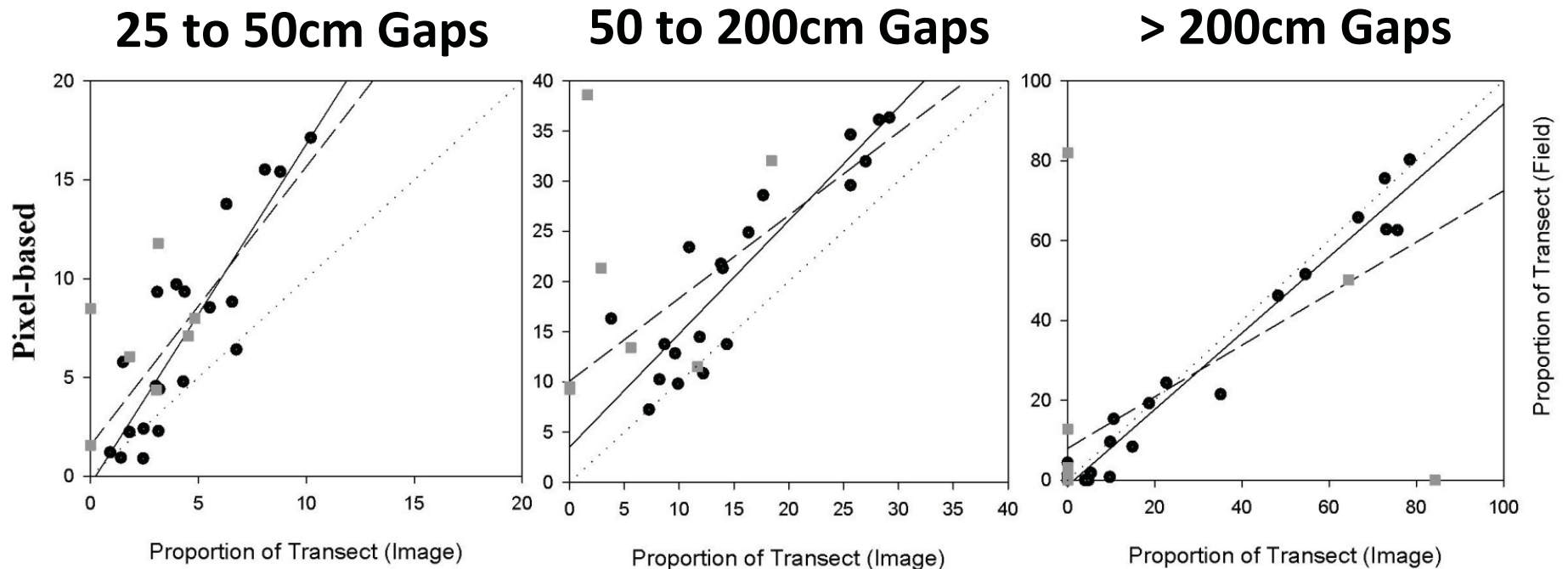
Coefficients of Agreement

- Measure of agreement between two classifications
 - Comparison of interpreted point values and image classification
 - No field data
 - How distinct classes are?
- Strongly correlated with accuracy of canopy-gap and cover estimates
 - High agreement coefficient = easily distinguished classes = robust estimates
- Suggests coefficients of agreement can be an a priori measure of how a technique will perform



Results by Canopy Gap Size

Gap size	r ² all sites	r ² kappa > 0.5	Coef.
25 to 50cm	0.607	0.772	1.721
50 to 200cm	0.330	0.845	1.129
> 200cm	0.474	0.966	0.956



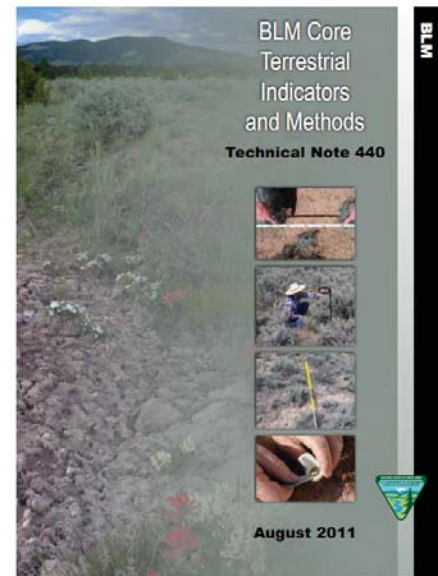
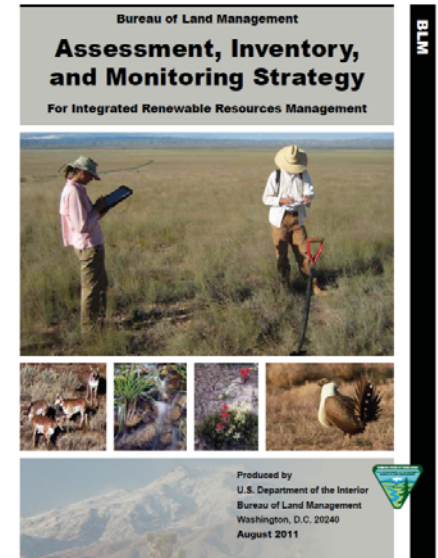
Canopy Gap Size Estimation

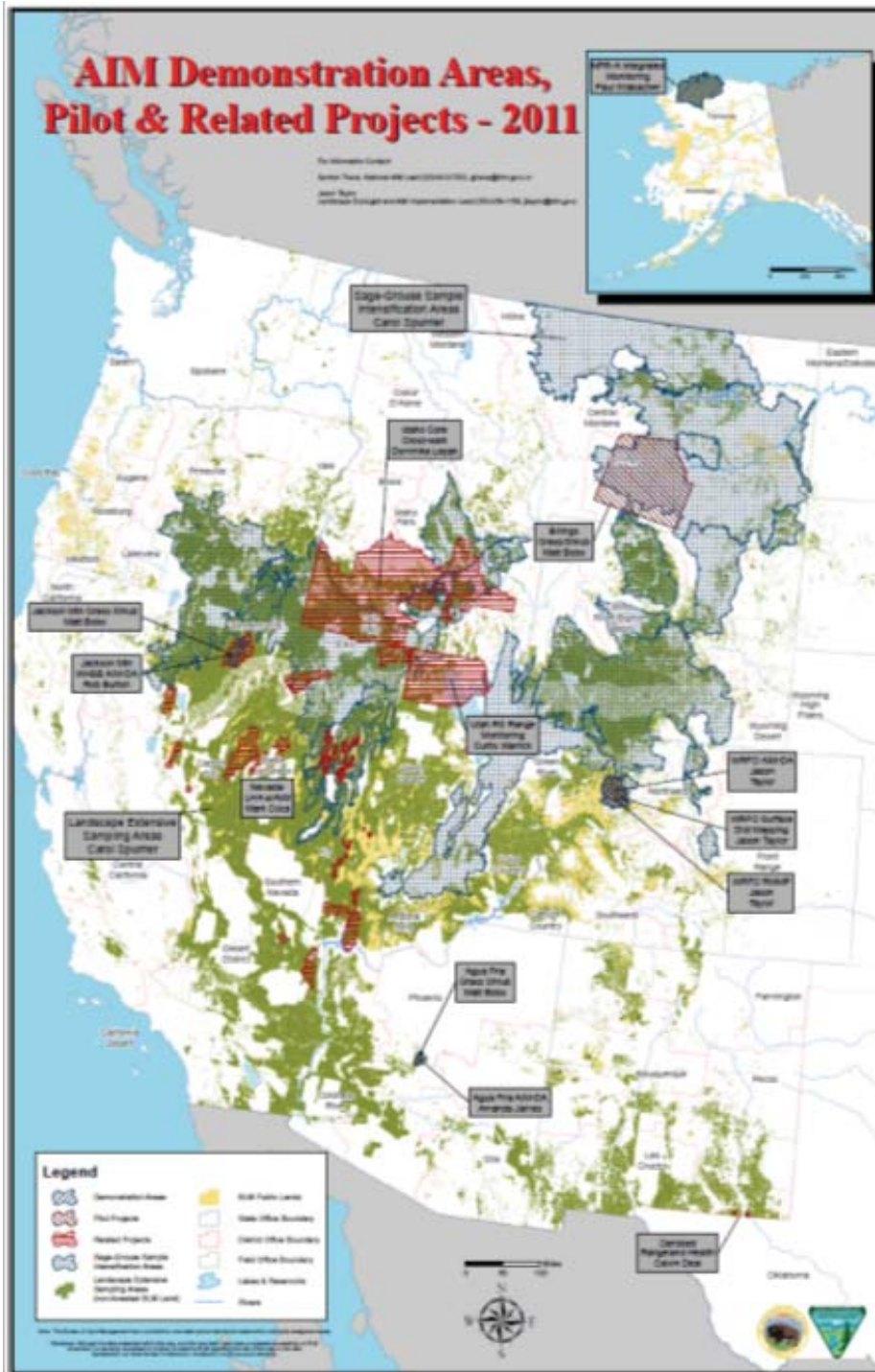
- Like other indicators, canopy gaps can be estimated from VHR imagery (in many cases)
- Research suggested an a priori measure of if/ when image-based estimates would succeed.
- To be used in monitoring programs, need to know more about when/where image-based techniques likely to succeed



BLM's AIM Strategy

- Agency-wide standard suite of indicators (what to measure), methods (how to measure), and sample design (where to measure)
- Can be supplemented with additional indicators as needed
- Provide quantitative data to address cross-program management needs
- Consistent with other large-scale monitoring efforts (e.g., NRI)



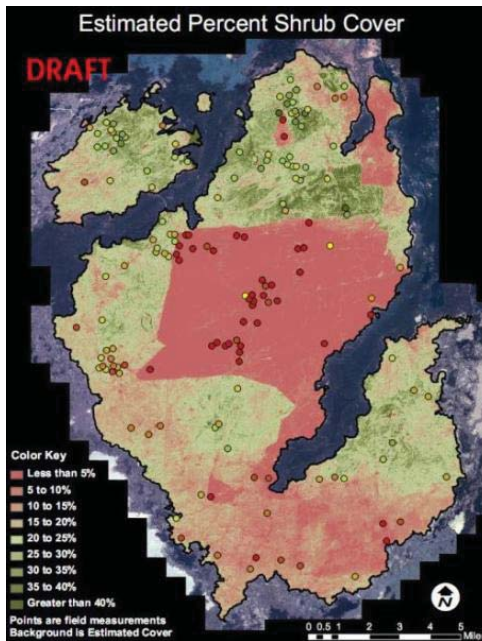


BLM AIM

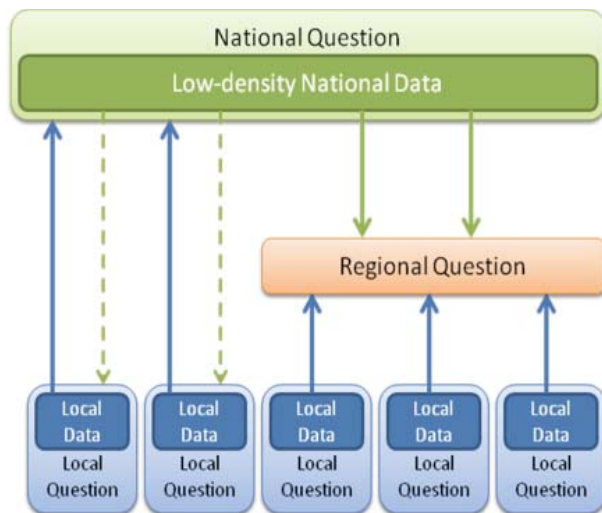
- Application of Jornada/ ARS research & products
 - Sample design software
 - DIMA
 - Training
 - Analysis/Reporting tools
- Project design, implementation support and data analysis for > 10 demonstration projects

BLM AIM –

Research Aspects



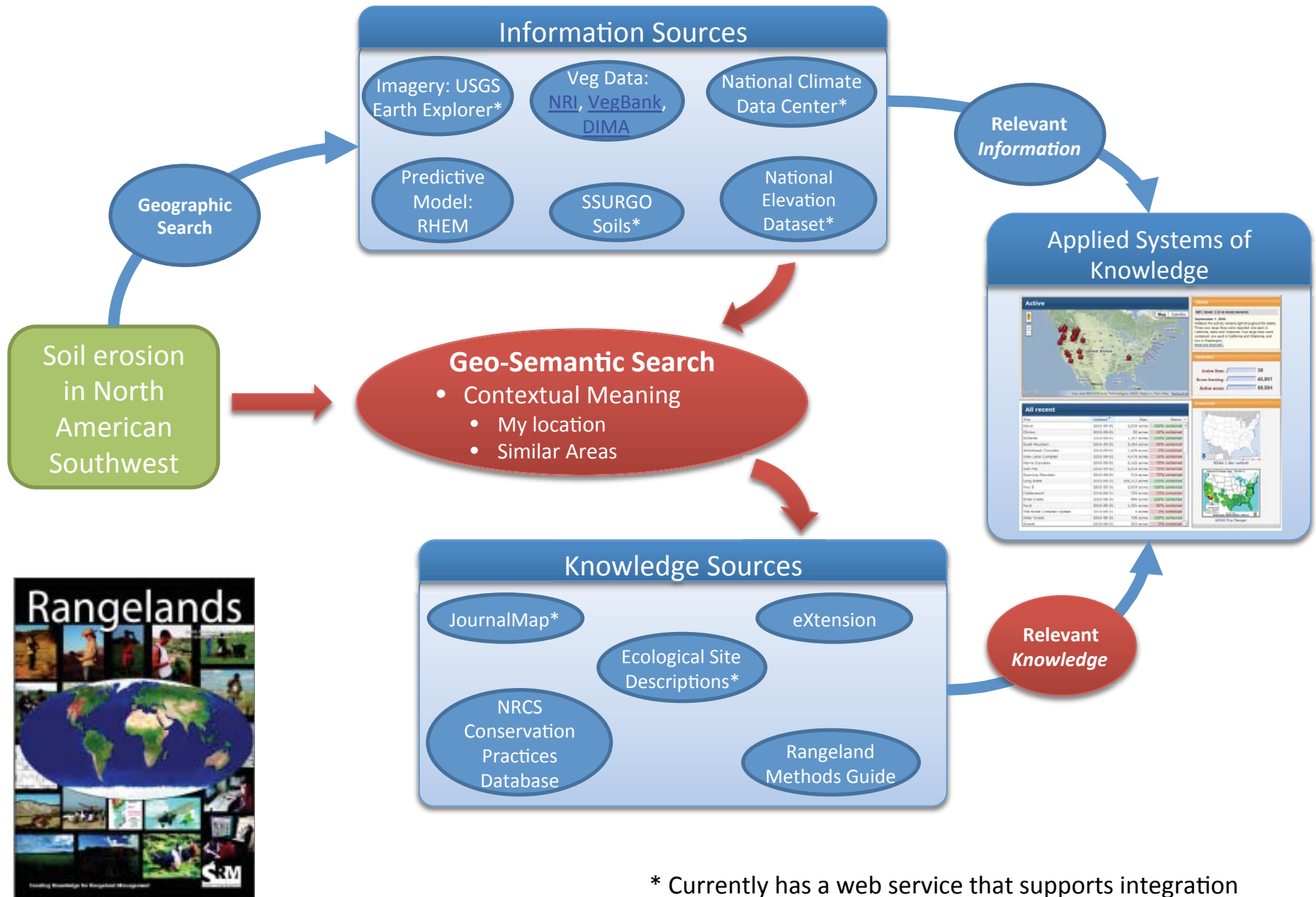
- Integration of field and remote sensing data*
 - Qualitative vs. quantitative data for training image-based products
 - Scaling up field measures to landscape-level indicators
- Statistical sample design†
 - Integrating local-level data into national-scope monitoring
 - Making use of legacy data in a statistical sampling framework
 - Using HR aerial imagery in monitoring programs (Karl et al. 2012).



* In cooperation with BLM,

† In cooperation with Iowa State, Colorado State Universities

Building Knowledge Systems



* Currently has a web service that supports integration

Building Knowledge Systems: JournalMap

The screenshot displays the JournalMap website interface. At the top left, the logo reads "JournalMap™" with the tagline "Research. Reimagined." To the right, a green box indicates "Article Count: 784". A navigation bar includes "Search", "Development Plan", "Journals", "Help", "About", and "Support JournalMap". Below this, a "Map" tab is selected, showing "Search Results" for the keyword "grazing" with "Total Locations: 259". A search criteria panel on the left lists various filters such as "Without", "Author", "Publication", "Country", "State", "Biome", and various environmental parameters like "Topsoil Texture" and "Growing Degree Days". The main map area shows a satellite view of the United States with several red location pins and blue circular markers. A pop-up window is open over a location in Arizona, displaying the following text: "Matthew R. Loeser, Sharon D. Mezulis, Thomas D. Sisk and Tad C. Theimer (2005) Vegetation Cover and Forb Responses to Cattle Exclusion: Implications for Pronghorn. Rangeland Ecology & Management: May 2005, Vol. 58, No. 3, pp. 234-238. doi:10.2111/1551-5028(2005)58[234:VCAFRT]2.0.CO;2 View more details". A scale bar at the bottom indicates 200 km and 200 mi.

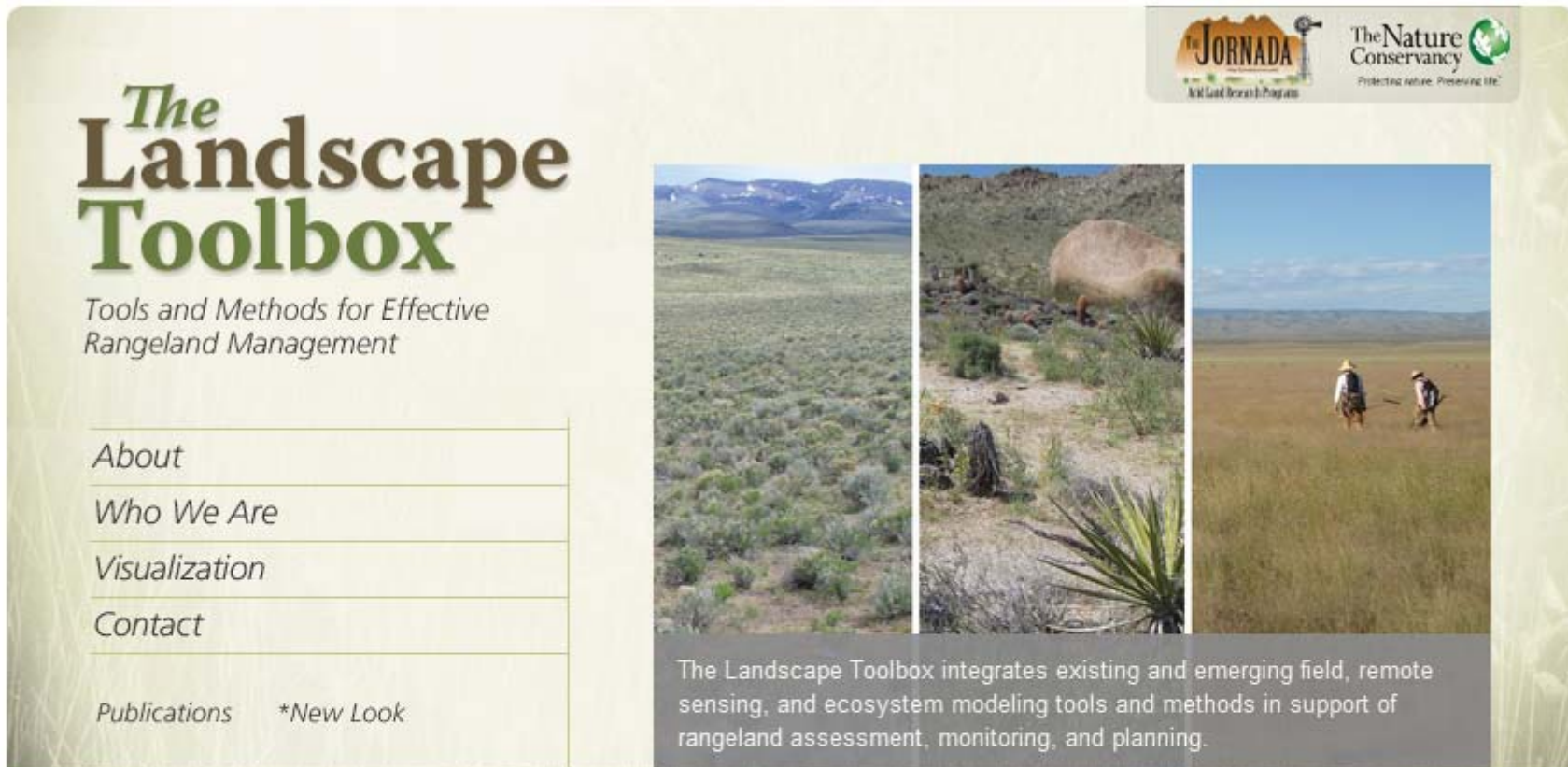
- Find relevant knowledge
- Spatial & thematic context
- Support ESD development & use

In Development

- Cooperate with NAL
- Work with societies/publishers

<http://www.journalmap.org>

www.landscapetoolbox.org




The Landscape Toolbox
Tools and Methods for Effective Rangeland Management

[About](#)
[Who We Are](#)
[Visualization](#)
[Contact](#)

[Publications](#) [*New Look](#)

JORNADA
Arid Land Research Program

The Nature Conservancy
Protecting nature. Preserving life.



The Landscape Toolbox integrates existing and emerging field, remote sensing, and ecosystem modeling tools and methods in support of rangeland assessment, monitoring, and planning.



Toolbox Wiki

A library of abstracts describing rangeland methods, terms, and tools contributed by the scientific and management community. The abstracts will help you



Rangeland Methods Guide

An interactive guide to field and remote-sensing methods for rangeland science and management focusing primarily on monitoring and



Framework

The Landscape Toolbox is built around an integrated framework for organizing, synthesizing, and applying our growing knowledge of ecosystems to facilitate better



Training & Support

The USDA-ARS Jornada Experimental Range and the Idaho Chapter of The Nature Conservancy are hosting a series of one-hour web-based training seminars in 2012.