

Applications and Outreach to Land Management Agencies: *tools and training based on JRN LTER I-V, constantly updated based on VI.*

Jornada LTER Site Review October 7-9, 2015



Photo: NRCS Training at the Konza June 15-19, 2015



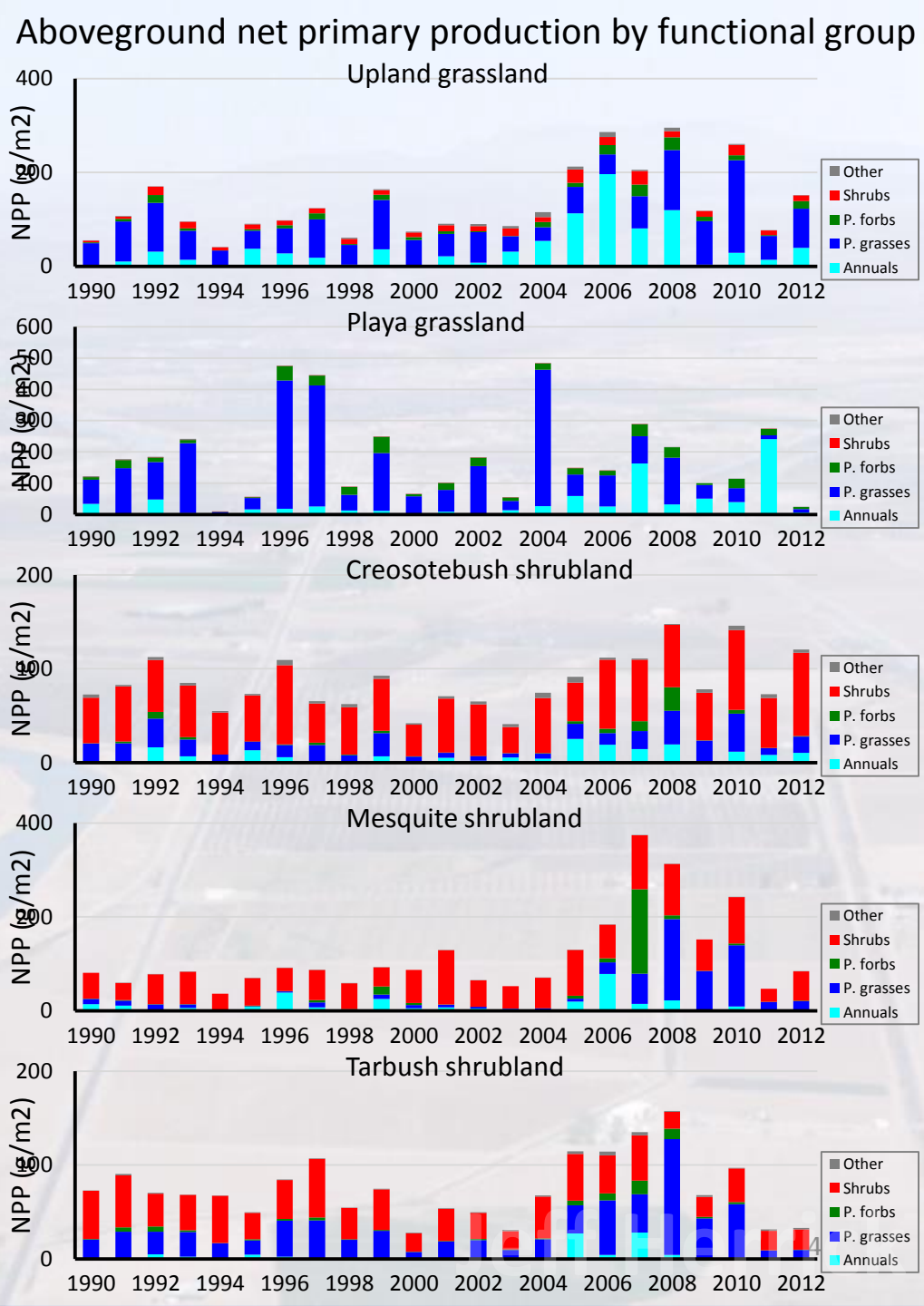
Jeff Herrick

Key JRN LTER Findings for Applications

- Soil variability matters
- Connectivity matters
- Understanding thresholds matters

An aerial photograph showing a wide river meandering through a landscape. The land on either side of the river exhibits significant color and texture variations, ranging from light tan to dark brown, which likely represent different soil types or moisture levels. The river itself is a prominent blue line cutting through the terrain.

JRN Key Finding: Soil variability matters



JRN Key Finding: Connectivity matters

Do Changes in Connectivity Explain Desertification?

GREGORY S. OKIN, ANTHONY J. PARSONS, JOHN WAINWRIGHT, JEFFREY E. HERRICK, BRANDON T. BESTELMEYER, DEBRA C. PETERS, AND ED L. FREDRICKSON

Arid and semiarid regions cover more than 40% of Earth's land surface. Desertification, or broadscale land degradation in drylands, is a major environmental hazard facing inhabitants of the world's deserts as well as an important component of global change. There is no unifying framework that simply and effectively explains different forms of desertification. In this article, we argue for the unifying concept that diverse forms of desertification, and its reversibility, are driven by changes in the length of connected pathways for the movement of fire, water, and soil resources. Biophysical feedbacks increase the length of connected pathways, explaining the persistence of desertified landscapes around the globe. Management of connectivity in the context of environmental and socioeconomic change is essential to understanding, and potentially reversing, the harmful effects of desertification.

Keywords: desertification, connectivity, erosion, fire, vegetation dynamics

Broadscale land degradation in arid and semiarid regions of the globe—desertification—directly affects about 250 million people in the developing world through the loss of soil nutrients and reduction in the land's productivity, and could potentially affect the 2.5 billion people who live in drylands worldwide (Reynolds et al. 2007). In addition to imposing the direct impacts of land degradation on people living in drylands, desertification is increasingly recognized as an important element of global change. For instance, changes in vegetation structure and albedo as a result of desertification can significantly affect regional climate, with feedbacks to ecosystem dynamics (Taylor et al. 2002). Desertification has been shown to affect animal biodiversity (Bestelmeyer 2005). Atmospheric dust, with its myriad effects (Okin et al. 2004, Kaufman et al. 2005, Kellogg and Griffin 2006), is produced by erosional processes in deserts worldwide and increases with desertification (Mortlin and Chitapello 2006). A recent report by Seager and colleagues (2007) suggests that increasingly arid conditions are expected in the next decades in the southwestern United States, southern Europe, the Mediterranean, and the Middle East. This "aridification" will contribute to desertification, with significant impacts on human populations and important feedbacks within the global environment.

Understanding the causes and consequences of desertification requires an integrated analysis of the dynamics and interactions of key biophysical and socioeconomic variables across multiple spatial and temporal scales (Reynolds et al.

2007). The objective of this article is to describe the unifying concept that the length of connected pathways (LOCOOP) in landscapes explains four major types of desertification in terms of both the patterns and the processes that occur. The LOCOOP concept can also serve as a framework for anticipating future landscape dynamics and for guiding management and remediation efforts.

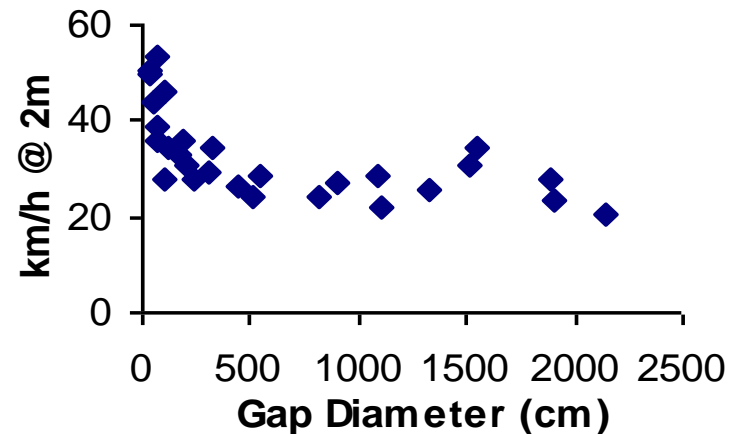
The term "desertification" has been used to refer to many disparate land degradation phenomena, but, in part because of the flexibility of the term, an integrated biophysical understanding of the processes of desertification has been lacking. Any general biophysical model of desertification and the feedbacks that propagate it must encompass at least four dominant forms of desertification, as reflected in changes in vegetation cover, composition, and spatial distribution (figure 1): form 1, vegetation loss due to agriculture (Paigefabregas 1998, Okin et al. 2001); form 2, vegetation loss due to changes in climate or land use (Khalaf and Al-Ajmi 1993, Gonzalez 2001); form 3, invasion of woody vegetation into perennial grasslands (Van Auken 2000, Cahal et al. 2003); and form 4, invasion of exotic grasses into desert shrublands, resulting in replacement of woody vegetation (D'Antonio and Vitousek 1992). Each of these forms of desertification is associated with a complex suite of changes in dynamic soil properties, micrometeorology, and animal communities. Each is also sustained by an important set of feedbacks (figure 2).

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Threshold Velocity for Saltation

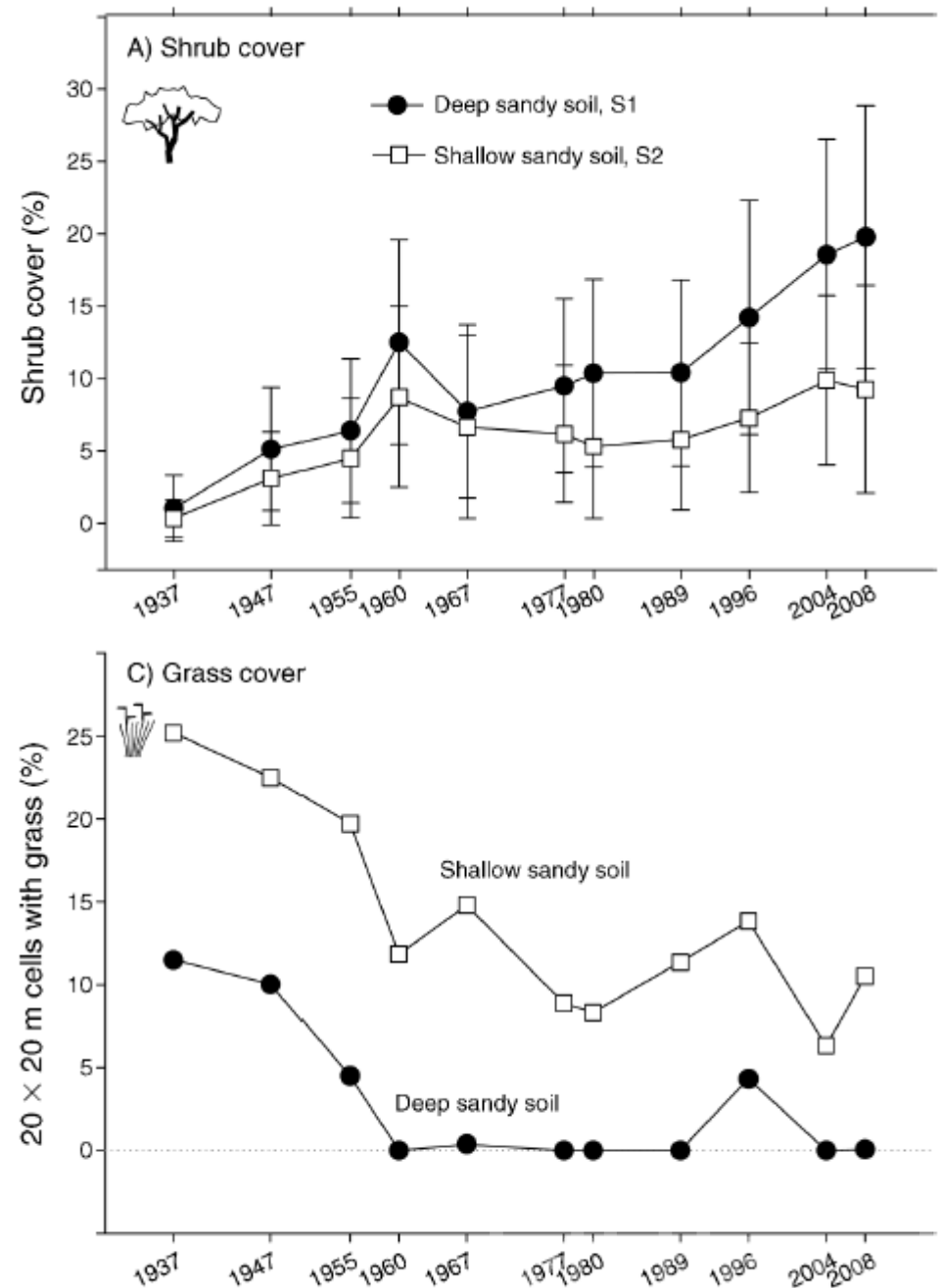


Herrick et al. 2012

Understanding thresholds matters

Browning et al. 2012

DAWN M. BROWNING ET AL.



Key JRN Products

- Key Products
- Ecological site classification and STM's: increasingly based on understanding of process, rather than just pattern. (soils, spatial context)
 - Nationally adopted rangeland assessment protocol
 - Nationally adopted rangeland monitoring protocol
 - Nationally applied wind erosion model
 - Internationally adopted rangeland monitoring protocol (to Brandon's presentation?)
 - Tablet field data entry system and database (DIMA) for assessment and monitoring.
 - Mobile apps for soil inventory and vegetation monitoring (including connectivity) with USAID and NRCS

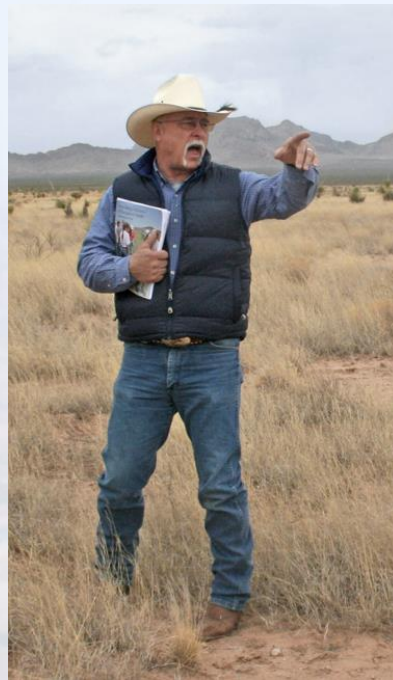
Interagency Ecological Site



Handbook for Rangelands

January 2013

Inventory (US)



Interpreting Indicators of Rangeland Health

Technical Reference 1734-6



Assessment

Version 4 - 2005



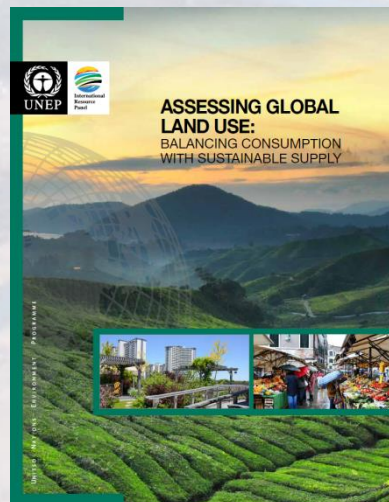
Volume I: Quick Start Monitoring Manual

for Grassland, Shrubland and Savanna Ecosystems

by
Jeffrey E. Herrick, Justin W. Van Zee,
Kris M. Havstad, Laura M. Burkett and Walter G. Whitford

with contributions from
Brandon T. Bestelmeyer, Ericha M. Courtright, Alicia Melgosa C.,
Mike Pelland, David A. Pyke, Maria D. Remington, Patrick Shaver,
Amanda G. de Souza, Aylene J. Tugel and Robert S. Umstad

Monitoring (US/Mongolia)



Monitoring Rangeland Health

A Guide for Pastoralist Communities and Other Land Managers in Eastern Africa

Version II

By Corinna Riginos and Jeffrey Herrick

With Contributions from Silo Sundaresan, Cory Farley,
Dickson Ole Kizels, Jeffrey Worden, and Jayne Beinap

Monitoring (Africa)



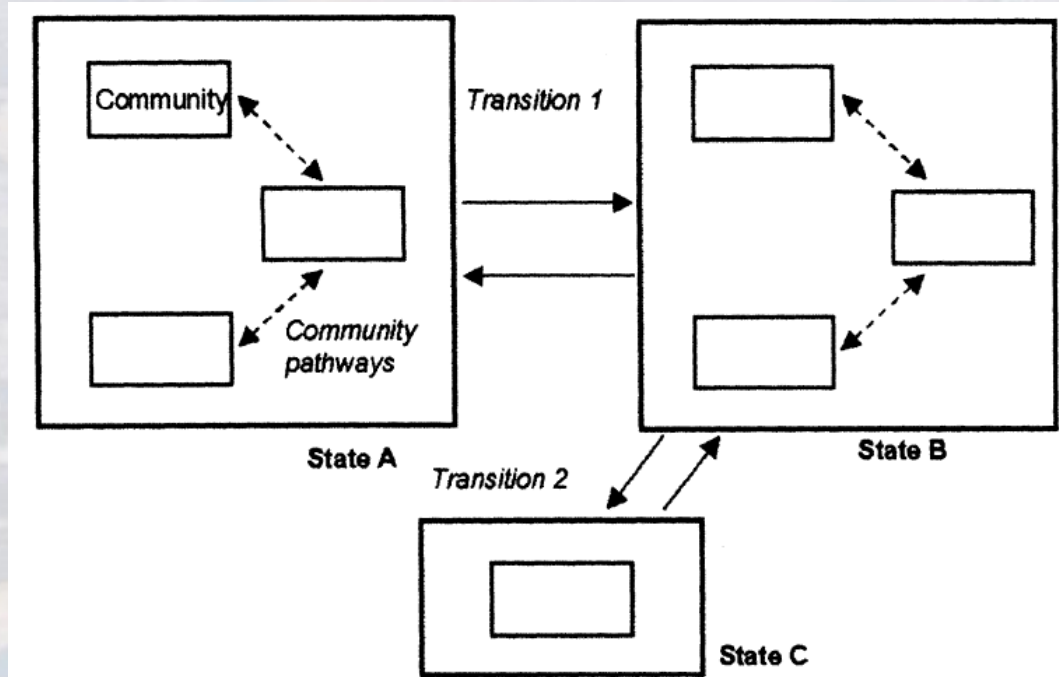
Ecological site classification and inventory system: nationally adopted, including Jornada-led integration of process-based understanding of thresholds

Interagency Ecological Site



Handbook for Rangelands

January 2013



Assessment protocol: nationally applied;
wind and water connectivity emphasis
based on JRN research.

Indicator
1. Rills
2. Water-flow Patterns
3. Pedestals and/or terracettes
4. Bare ground _____%
5. Gullies
6. Wind-scourd, blowouts, and/or deposition areas
7. Litter movement
8. Soil surface resistance to erosion
9. Soil surface loss or degradation
10. Plant community composition and distribution relative to infiltration
11. Compaction layer
12. Functional/structional groups
13. Plant mortality/decadence
14. Litter amount
15. Annual production
16. Invasive plants
17. Reproductive capability of perennial plants

→ ***#2 Water flow patterns.***

→ ***#6. Wind scoured,
blow-outs and/or
deposition areas (soil
movement by wind).***

→ ***#7. Litter movement.***

→ ***#10. Plant community composition and
distribution relative to infiltration & runoff.***



Monitoring manual: nationally adopted, includes standardized connectivity measurement

Long-Term Methods: Gap intercept

Gap intercept

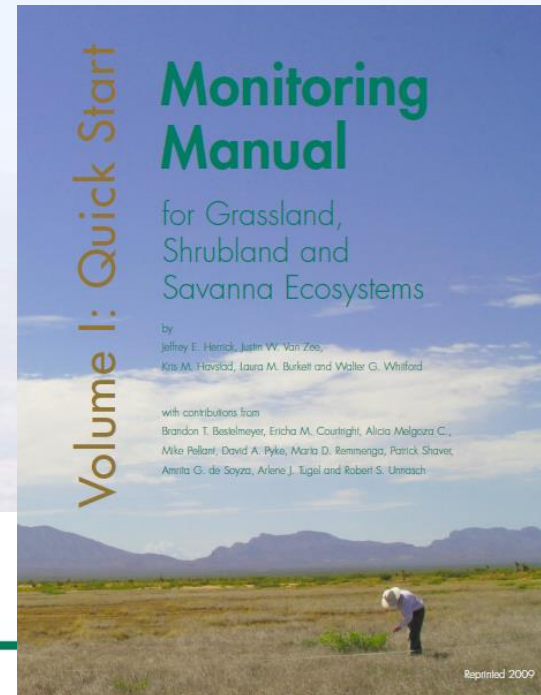
Gap intercept measurements provide information about the proportion of the line covered by large gaps between plants. Large gaps between plant canopies are important indicators of potential wind erosion and weed invasion. Large gaps between plant bases are important indicators of runoff and water erosion.

Materials.

- Measuring tape (at least as long as transect)—if tape is in feet, use one marked in tenths of feet.
- Two steel pins for anchoring tape
- Meter stick or other stiff stick
- Clipboard, Gap Intercept Data Form (page 20)



Figure 9. A canopy gap.



Applications of JRN/JER-developed or supported products

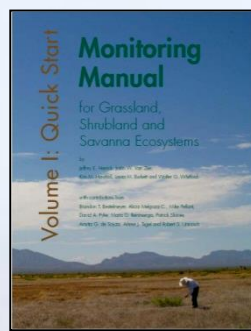
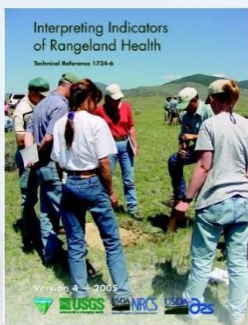
– NRCS National Resource Inventory

- Assessment and monitoring tools applied to 2,000 field plots/year on non-federal lands (2004-present) and 2,000 on BLM lands (2011-present)
- Data reported in 2011 Resource Conservation Assessment (RCA – report to Congress)

– BLM AIM

- Assessment, Inventory and Monitoring protocols now being nationally applied.
- Ecological site-based statistical designs adopted by BLM.

– BLM Restore New Mexico



NRCS National Resources Inventory

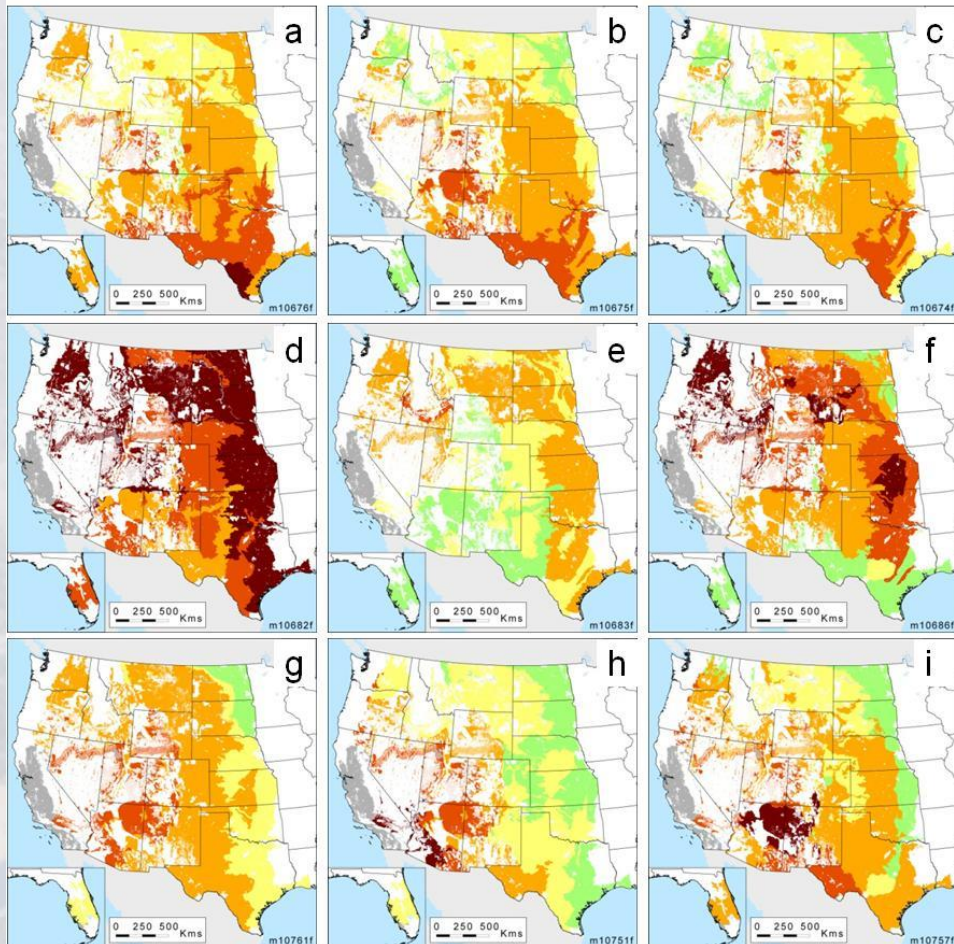
RESEARCH COMMUNICATIONS RESEARCH COMMUNICATIONS

National ecosystem assessments supported by scientific and local knowledge

Jeffrey E Herrick^{1*}, Veronica C Lessard², Kenneth E Spaeth³, Patrick L Shaver⁴, Robert S Dayton², David A Pyke⁵, Leonard Jolley⁶, and J Jeffery Goebel⁶

An understanding of the extent of land degradation and recovery is necessary to guide land-use policy and management, yet currently available land-quality assessments are widely known to be inadequate. Here, we present the results of the first statistically based application of a new approach to national assessments that

comparative observations completed at over 10000 plots in the on remains an issue, loss of biotic integrity is more widespread at the same locations support the assessments and veness of policy and management initiatives, including de the information necessary to support strategic decisions



- *Rangeland health*
- *Gap size/ connectivity*
- *Wind erosion*
- *National distribution and dominance of non-native species*



2011

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
WASHINGTON, D.C. 20240
<http://www.blm.gov>

May 4, 2012

In Reply Refer To:
1734 (WO-200), (NOC-100) P

EMS TRANSMISSION 05/16/2012
Information Bulletin No. 2012-080

To: All WO and Field Officials
From: Assistant Director, Renewable Resources and Planning
Subject: Assessment, Inventory, and Monitoring (AIM) Strategy Update

This Information Bulletin transmits the completed AIM Strategy with an associated Technical Note, and introduces the National AIM Implementation Team and State-level Monitoring Points-of-Contact.

In 2005, the Office of Management and Budget directed the Bureau of Land Management (BLM) to develop a strategy to enhance the effectiveness of its resource monitoring activities. In response, the BLM established a Core Team, an Oversight Team, and local, regional, and national work groups to scope the issue and identify potential solutions. A detailed field survey and review of data collection activities documented current field practices and identified a number of opportunities to increase effectiveness in data collection and data management activities. The working groups identified critical management needs for information at multiple scales about resource occurrence, extent and condition, and initiated a number of pilot projects to identify best practices for data collection. For example, projects were funded to determine how the BLM could leverage field collected site data in conjunction with remote imagery to improve West-wide vegetation mapping; detect broad-scale vegetation changes and surface disturbances; develop conceptual ecological models to predict the interaction of key ecological processes and stressors; and to select core indicators and consistent collection methods. Results from these pilot projects served as the basis for the development of the attached AIM Strategy (Attachment 1).

The AIM Strategy is a high-level document developed by the BLM with input from academia, the Agricultural Research Service, and the United States Geological Survey. An internal review confirmed the strategy addresses the BLM's multiple-use and sustainable yield mission and an external peer review verified the AIM Strategy is built on sound science. The rigor within the document is intentional and will ensure the generation of defensible data to inform BLM managers and the public about key ecological processes for maintaining sustainable ecosystems. The AIM Strategy outlines a cross-program vision for data collection, analysis, use and reporting in the BLM. Moving forward, collection of monitoring data will follow a structured framework and include: (1) use of core quantitative indicators and consistent methods (BLM Technical Note 440, Attachment 2); (2) implementation of a statistically-valid, scalable sampling framework; (3) application and integration of remote sensing technologies, e.g. vegetation/ landcover maps; (4) implementation of electronic field-data collectors and enterprise data management; and (5) capture of legacy data in a digital format.

Benefits: The AIM Strategy benefits all levels of the BLM by establishing a framework for collection of monitoring data that is consistent and compatible across scales, programs, and administrative boundaries. Implementation of the AIM Strategy will provide defensible, quantitative data to inform decisions and allows data to be collected once and used many times for many purposes.

Next Steps: To integrate the AIM Strategy into day-to-day management activities, the BLM must develop an implementation plan. The AIM Implementation Plan will establish work products, timelines, capacity needs, a communication plan, cross-program guidance, performance measures, training requirements, and guidance for budget allocations. This plan will be vetted through the Deputy State Directors, the Field Committee and the Executive Leadership Team.

A National AIM Implementation Team (Attachment 3) has been established to support development of the implementation plan and includes representatives from field, state, centers, and the Washington Office. Additionally, each state has provided an AIM point of contact (Attachment 4) to facilitate communication and coordination of AIM activities.

An AIM SharePoint has been established where all BLM employees can access AIM-related documents, presentations, and meeting notes (<https://partnerteamspace.blm.doi.net/sites-oc/aim/default.aspx>).

Contact: For further information or clarification, please contact Gordon Toews (National Monitoring Lead, WO200 at 202-912-7202), Jason Taylor (Landscape Ecologist/AIM Coordinator, NOC at 303-236-1159), or Carol Spurrier (Range Ecologist, WO220 at 202-912-7272).

Signed by:
Edwin L. Roberson
Assistant Director
Renewable Resources and Planning

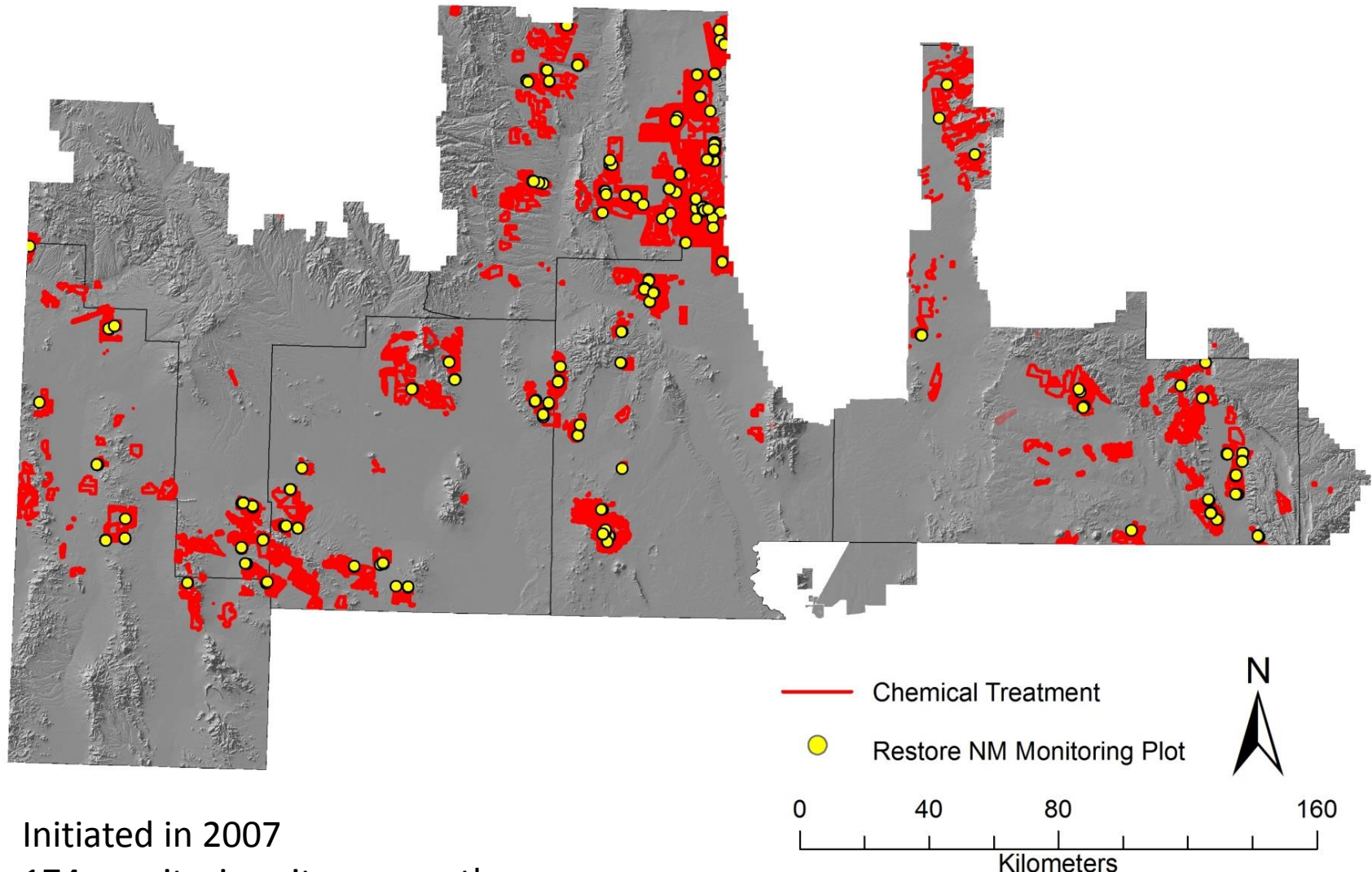
Authenticated by:
Robert M. Williams
Division of IRM Governance, WO-560

4 Attachments
1 - AIM Strategy (44 pp)



“The AIM [Assessment, Inventory and Monitoring] Strategy is a high-level document developed by the BLM with input from academia, the Agricultural Research Service, and the USGS ... outlines a cross-program vision for data collection, analysis, use and reporting in the BLM. ... collection of monitoring data will follow a structured framework and include: (1) use of core quantitative indicators and consistent methods ...; (2) implementation of a statistically-valid, scalable sampling framework; (3) application and integration of remote sensing technologies, e.g. vegetation/ landcover maps; (4) implementation of electronic field-data collectors and enterprise data management; and (5) capture of legacy data in a digital format.

Collaborative monitoring of vegetation responses to shrub-removal treatments with BLM (Restore NM program)



Initiated in 2007

174 monitoring sites currently

Many treatments employ BACI designs

Outreach

- Websites
 - Landscape Toolbox
 - Jornada's monitoring and ecological site websites
- Tools: DIMA tablet database and LandPKS apps
- Consultation
 - NRCS staff co-location @ Jornada
 - Year-long assignment in the office of the Secretary of Agriculture
 - Weekly to monthly engagement with BLM, NRCS leadership through DC visits, regular conference calls, representation on BLM National Science Committee and NRI Steering Committee
 - Direct collaboration with local offices in NM and throughout West on landscape to regional monitoring.
 - Official representation to UNCCD including frequent consultation with State Dept and Secretariat.
- Week-long field workshops for managers
 - Interagency "Interpreting and Measuring Indicators of Rangeland Health" (2-4/year domestic x 16 years x 20->100 participants = >2,500 trained).
 - BLM Assessment, Inventory and Monitoring (3-5/year).
- New opportunities associated with networks (SW Climate Hub).

GET DIMA

Take advantage of the Database for Inventory, Monitoring, and Assessment (DIMA) designed for streamlined data collection in the field using the Core Methods and management in the office.

READ MORE

Managing and Monitoring Landscapes



Protecting and improving land health requires comprehensive landscape management strategies. Land managers have embraced a landscape-scale philosophy and have developed new methods to inform decision making such as satellite imagery to assess current conditions and detect changes, and predictive models to forecast change. The Landscape Toolbox is a coordinated system of tools and methods for implementing land health monitoring and integrating monitoring data into management decision-making.





Jeff Herrick