NSSC Soil Quality and Ecosystems Branch:
New Endeavors for Soil Survey

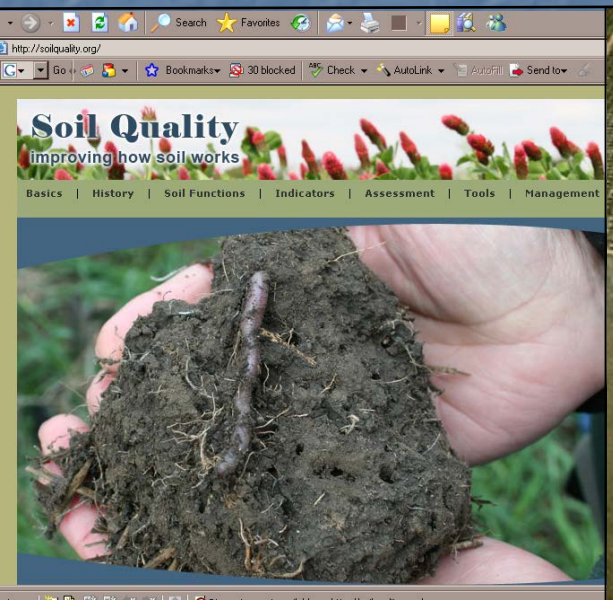
Susan Andrews, Ph.D.
National Leader
June 5, 2012

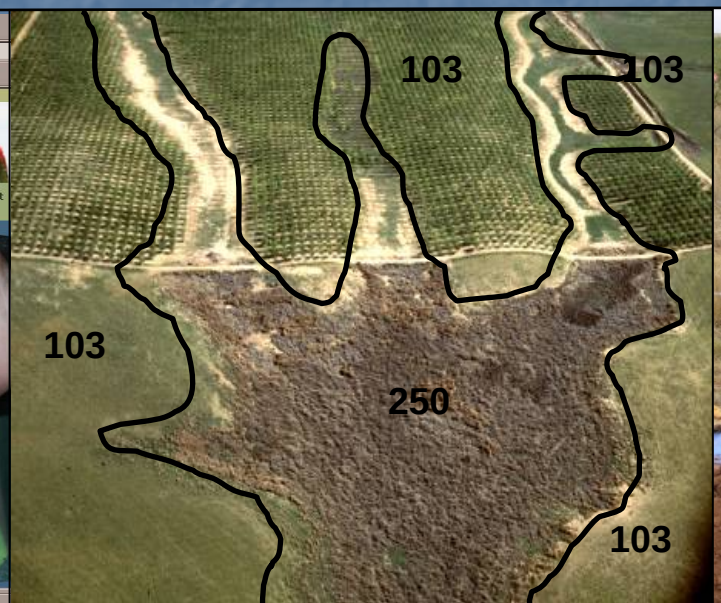
Soil Quality & Ecosystems Staff

- Susan Andrews, *Leader & Ecologist*
- Craig Busskohl, *Forester*
- Faustin Iyamuremye, *Soil Scientist*
- Mike Kucera, *Agronomist*
- Curtis Talbot, *Range Conservationist*
- Skye Wills, *Soil Scientist*
- Vacant, *Soil Quality Specialist*
- Vacant, *Ecological Economist*

Three Main Areas of Responsibility:

- Soil Quality (SQ)
- Dynamic Soil Properties (DSPs)
- Ecological Sites (ESs)





Soil Quality in Soil Survey

- 1995; 2004 & 2010 reorganizations
- SQEB has technical development responsibility
- Some tech transfer
- Emphasis on assessment tools

Soil Quality Definitions

“capacity of the soil to function”

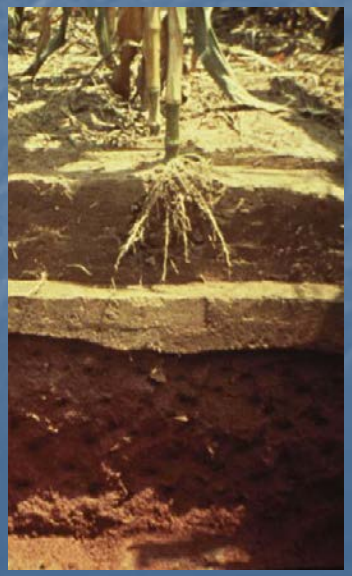
- Karlen et al. 1997

“fitness for use”

- Larson & Pierce, 1991

Kinds of Soil Quality

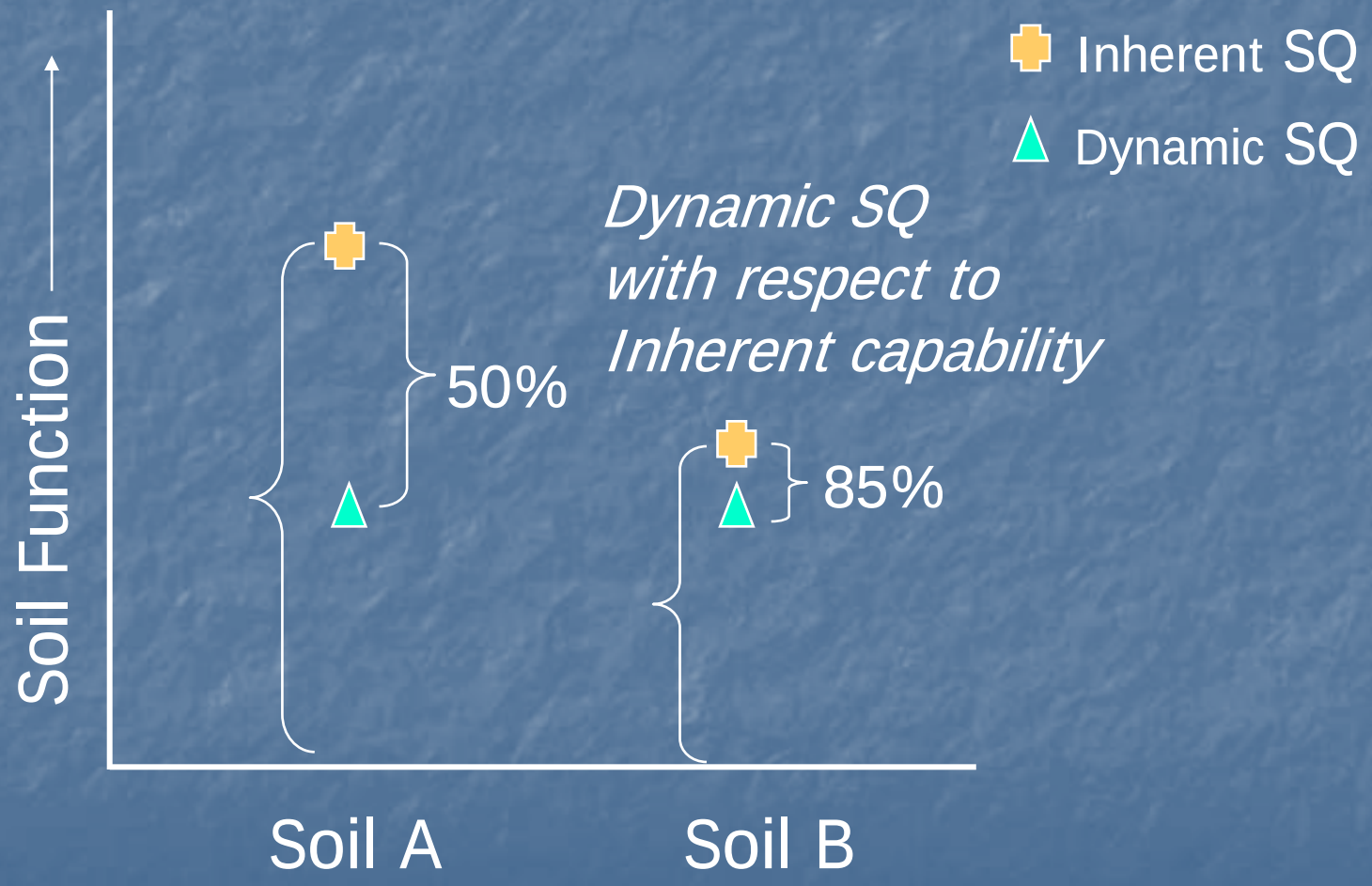
- INHERENT SOIL QUALITY
  - reflects natural characteristics
  - based on soil forming factors
    - climate, parent material, topography, and biota, all acting over time – Jenny, 1941



- DYNAMIC SOIL QUALITY
  - describes status or condition of soil
  - result of land use or management practice

-after Pierce and Larson, 1993

Relative Assessment



- After Andrews et al., 2004

Soil Health v. Soil Quality

- Soil health is used as a synonym for soil quality - Doran and Parkin, 1996
- Minor exceptions:
  - Soil health includes only dynamic quality
  - Health some greater emphasis on biology

A soil may have poor inherent soil quality but still have good soil health.

-Gregorich and Carter, 1997

Soil Quality Priorities

- Simple tools for conservation planning (CDSI)
- Develop tools and interpretations
  - Identify and quantify soil function
  - Agronomics, forestry, range, economics
- Inform NRCS trainers of latest science
- Advise the Soil Health Management Initiative
- Inform farm bill policy

Dynamic Soil Properties in Soil Survey

Richter and Markowitz, 2001

To inventory soil change over the human time scale, due to:

-human management

-natural disturbance

- Decades to centuries - the *recovery* time scale
- Decades and less - the *management* time scale

Tugel et al., 2005

Improve Accuracy of SS Databases

(and provide reference values for SQ indicators)

Soil organic matter

Soil	Database estimate	Grassland-measured	Cultivated-measured
Aksarben	2-4 %	6.0	3.0
Monona	2-4 %	3.6	2.9

(Grossman, unpublished)

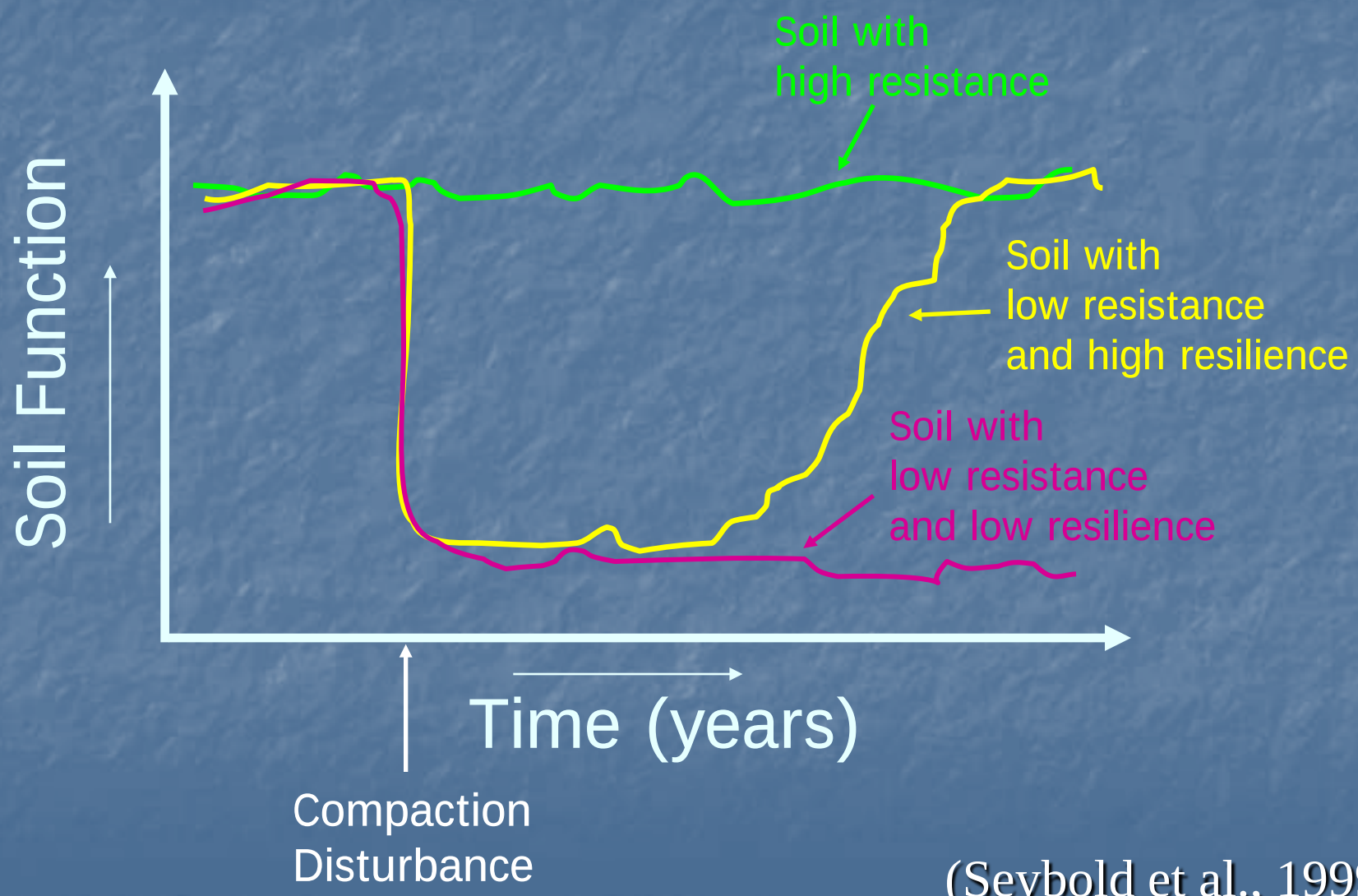
- Important for C-sequestration, water holding capacity, agg. stability, pesticide applications, nutrient applications

Develop Interpretations of Management Effects on Soil Function

- The importance of soil change is its affect on function.
- The consequences of change depend on its reversibility.

(Arnold et al.,1990)

Differences in Resistance and Resilience



(Seybold et al., 1999)

Main DSP Priorities

- FINISH RaCA!
- Develop new methodologies to rapidly populate the database
  - Models and pedotransfer functions
  - Validation sampling transects
- Hire postdoc for data mining and modeling
- Training in sampling & field office analyses
- Standards and database requirements

Ecological Sites in Soil Survey

- *Partnership* with S&T Ecological Sciences Division and National Grazinglands Team
- Soil Survey offers *procedures* to standardize, control and assure quality
- New *standards* follow basic MLRA planning
- For the ES acceleration succeed, we must work in *interdisciplinary teams*

Ecological Site Definition

An *ecological site* is a distinctive kind of land based on:

- recurring soil, landform, geological, and climatic characteristics that differs from other kinds of land
- in its ability to produce distinctive kinds and amounts of vegetation, and
- in its ability to respond similarly to management actions and natural disturbances.

Ecological Site Descriptions

Post oak/flowering dogwood/ tick trefoil-goldenrod. Multi-story. Canopy: 30-90%

Hot summer burn and /or long-term grazing →

← Burn, Site prep & Planting / Seeding. No grazing or limited controlled grazing

Post oak/buckbrush (or similar) Lacks mid-story. Understory single species woody dominated

Canopy: open 30-90%

Harvest, site prep, seeding

Pasture (improved)
Non-native grass sod

Abandonment for 20+ yr with recruitment of woody natives

Post oak/blackjack oak/little bluestem ESD, Missouri

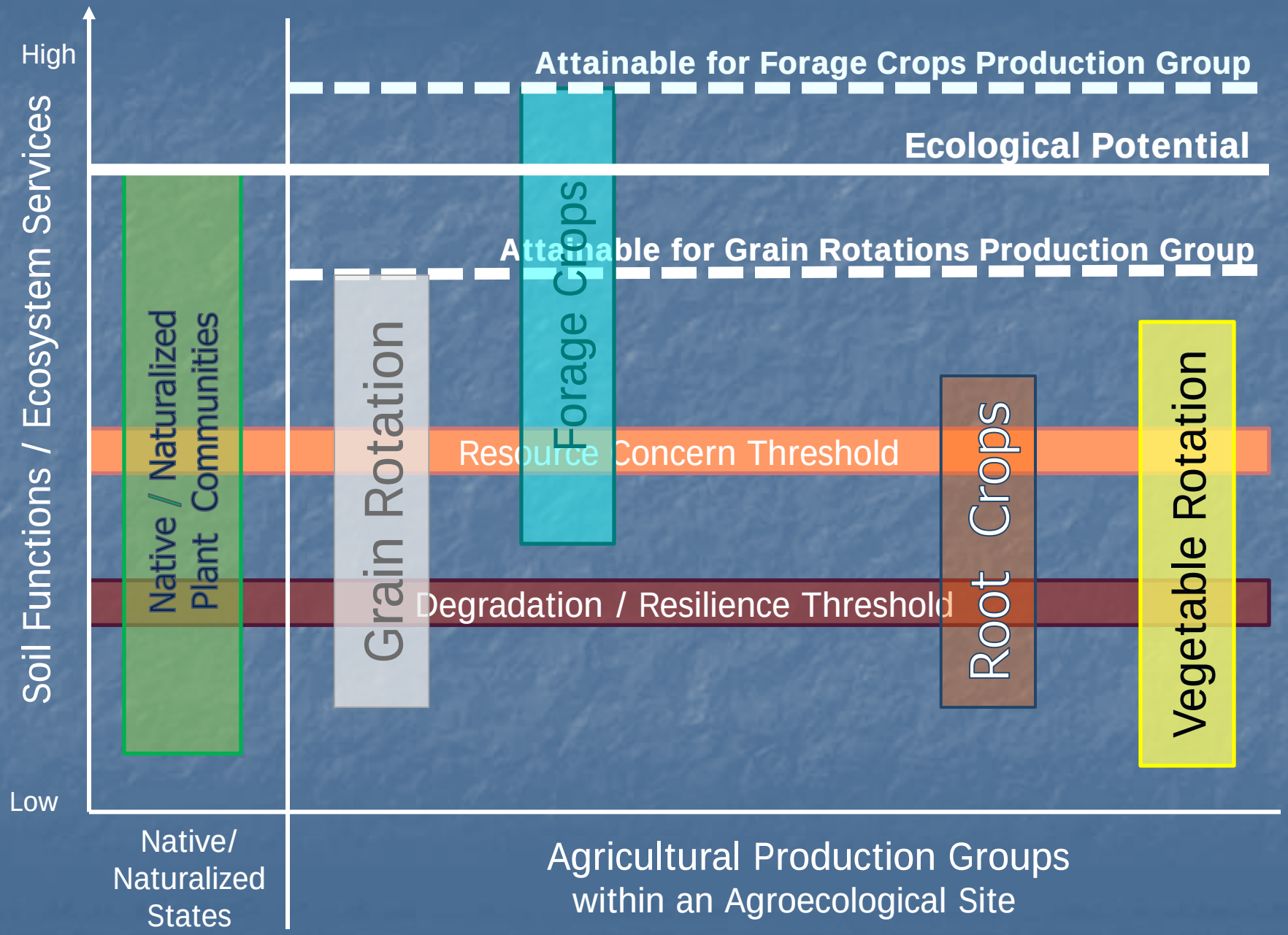
Westoby, et. al., 1989
Stringham et.al., 2001

Working Definition of a *Agro*ecological Site

An *agroecological site* is a distinctive kind of land based on:

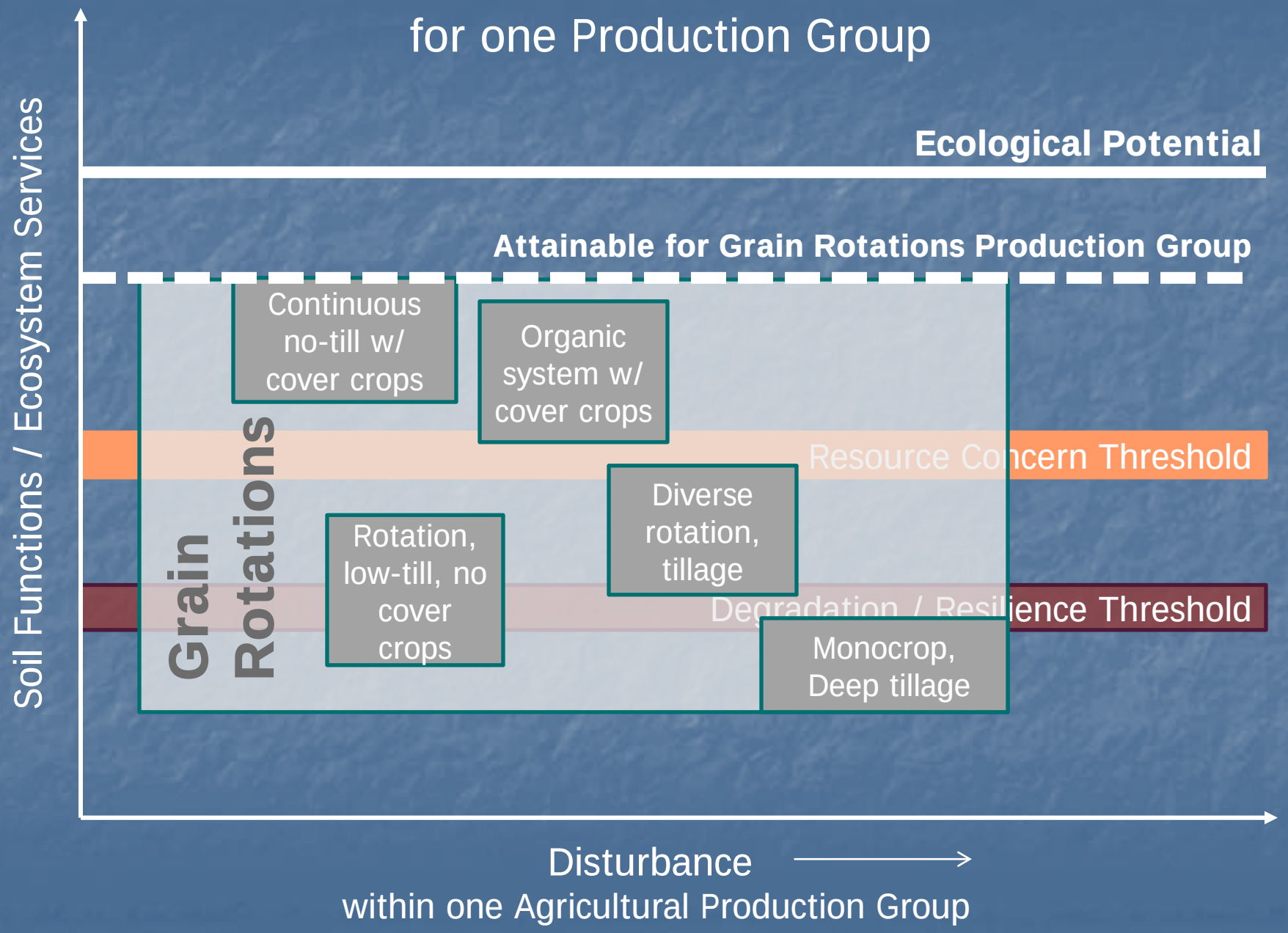
- recurring soil, landform, geological, and climatic characteristics that differs from other kinds of land
- in its potential to support distinctive ranges of soil functions (as indicated by dynamic soil properties), and
- in its ability to respond similarly to management actions and natural disturbances.

Land Management Optimization (LMO)



Land Management Optimization

for one Production Group



Main ES Projects and Priorities

- ES Policy and Standards
- New Database Requirements
- Training for Eastern and Central US
- ES for Additional Land Uses
  - Crop and pasture
  - Riparian
  - Wetlands
- Spatial Hierarchies (interagency)
- Communications and Outreach

National Cooperative Soil Survey

- Interpretations Committee and Soil Change Working Group recommended new standing committee:

  Soil and Ecosystem Dynamics

- National Steering Committee adopted it
- NC Region adopted as new ad hoc committee
- NCR Co-chairs: Mark Moseley and Susan Samson-Liebig

Questions?

Contact:
susan.andrews@lin.usda.gov