

# **USGS Projects Supporting Environmental Science on Tribal**

**Dave Meyer, Eric Wood (USGS/EROS/SAIC)  
Gene Napier (USGS/EROS)  
Contact: [dmeyer@usgs.gov](mailto:dmeyer@usgs.gov)**

**September 27, 2006**

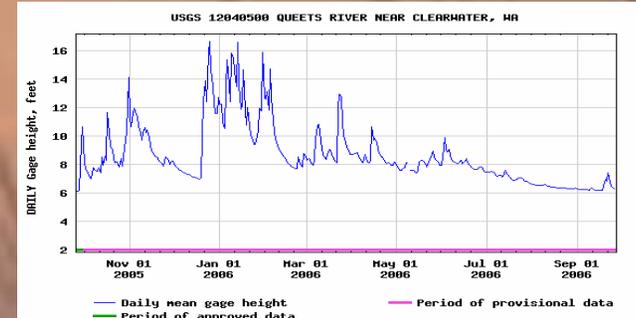
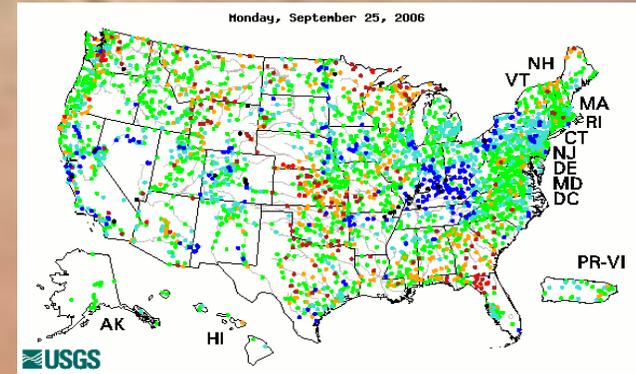
**EPA National Tribal Forum on Environmental Science  
Quinault Beach Resort, Ocean Shores, WA**

# USGS on Tribal Lands

- **Infrastructure Development**
  - Analytical tools for resource management
  - Information infrastructure
  - Workforce development
- **Science Support and Technology Transfer**
  - Alternative energy
  - Hazards assessment/mitigation
  - Resource management
  - Wildlife/biology
  - Water quality/resources
- **Synergies between Tribal/Federal**

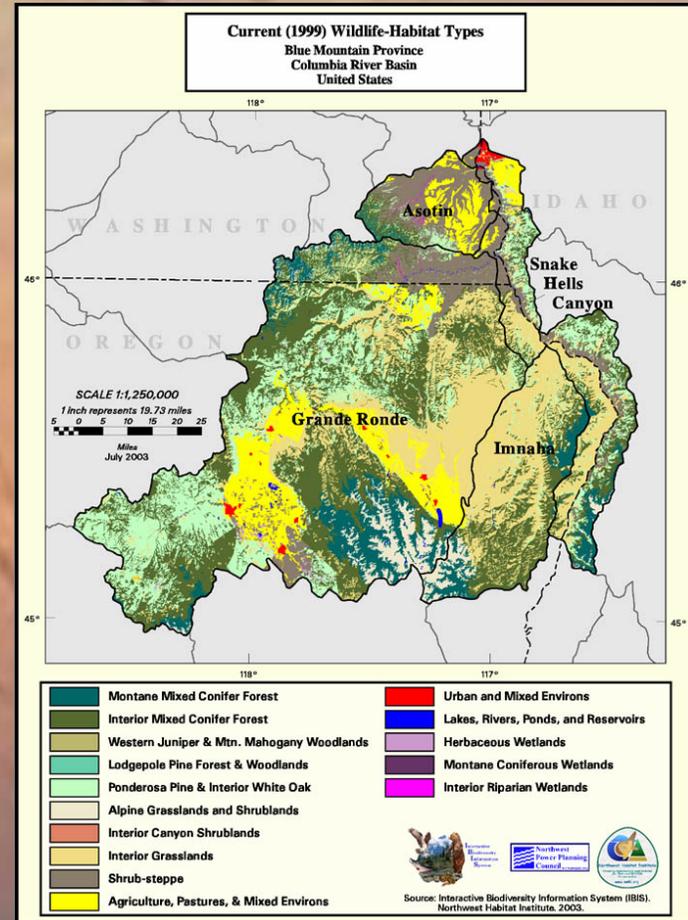
# USGS on Tribal Lands – Water

- Long standing partnerships with Tribes (EPA)
- Programs
  - Cooperative Water Projects
  - National Streamflow Information
  - Nat'l Water Quality Assessment
  - Toxic Substances
  - Ground Water Resources
  - Hydrologic Research & Development
  - State Water Resource Research Inst.
  - International Projects
  - Water Information Coordination
- Water Information for Education
  - <http://water.usgs.gov/education>
- National Water Information System
  - <http://waterdata.usgs.gov/nwis>



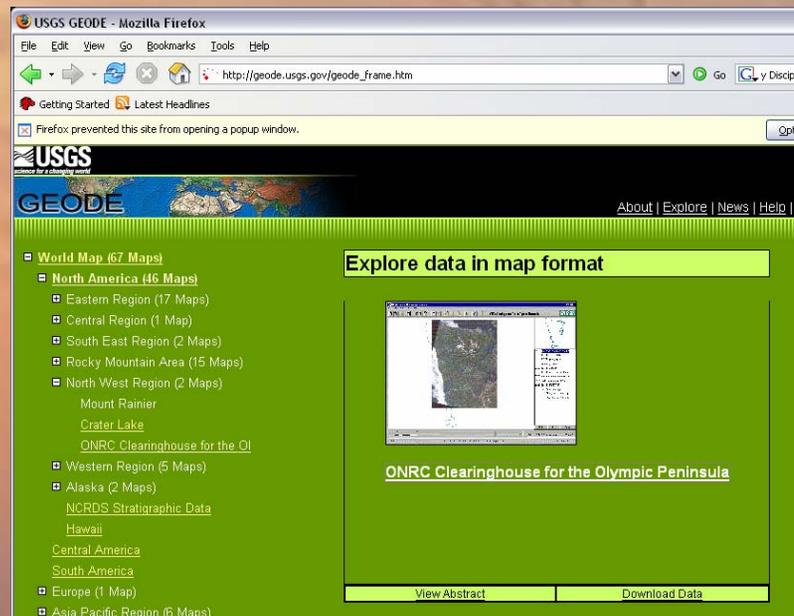
# USGS on Tribal Lands - Biology

- Programs
  - Bioinformatics
  - Contaminant Biology
  - Aquatic Ecosystems
  - Fisheries/Aquatic
  - Invasive Species
  - Status/Trends of Bio
  - Terrestrial/Endangered
  - Cooperative Research Units
- Home page
  - <http://biology.usgs.gov>
- Nat'l Biological Infrastructure (NBII)
  - <http://www.nbii.gov>



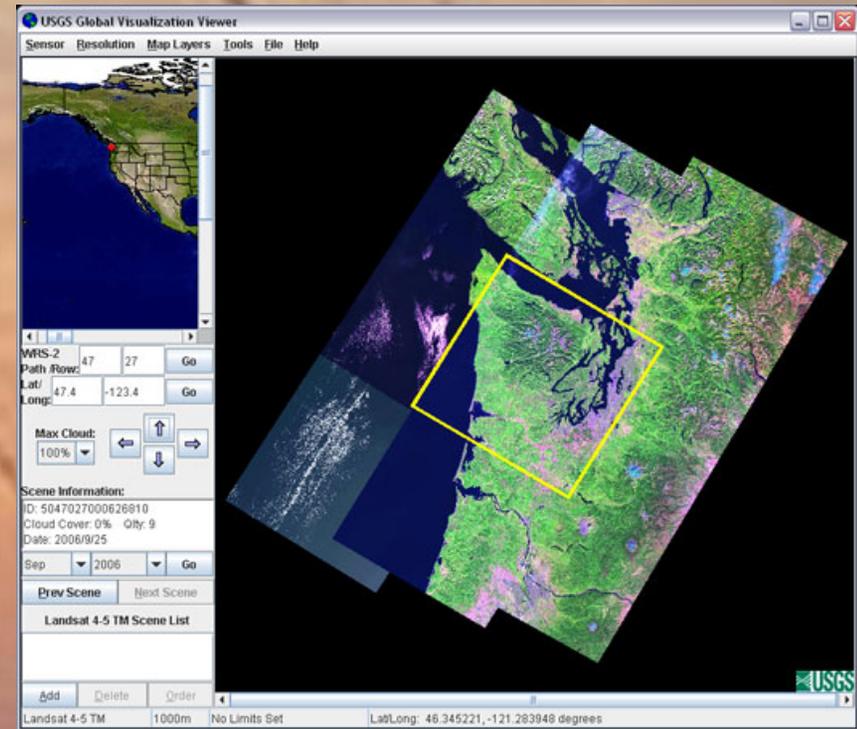
# USGS on Tribal Lands - Geology

- Programs
  - Earth Surface Processes
  - Mineral Resources
  - Earthquake/volcano
  - Cooperative Geologic
  - Energy Resources
  - Coastal/Marine Geology
  - Astrogeology
  - Geomagnetism
  - Geology for Education
    - Ask-A-
  - GEO-Data Explorer
    - <http://geode.usgs.gov>



# USGS on Tribal Lands -

- **Programs**
  - Land Remote Sensing
    - Missions
    - Data Preservation/Access
    - Research & Applications
  - Geographic Analysis and Modeling
  - Science Impacts
- **Earth Explorer**
  - <http://earthexplorer.usgs.gov>
- **Global Visualization**
  - <http://glovis.usgs.gov>



GloVIS

# Geography – Natural Hazards Support

http://hawsproxy.cr.usgs.gov - USGS - Natural Hazards Support System - Mozilla Firefox

**USGS**  
Natural Hazards Support System

USGS Home  
Contact USGS  
Search USGS

Zoom In Zoom Out Last Extent Full Extent Find Place Pan Identify Clear Hyperlink Print Map Help

Map Mode: North America Global  
Menu Mode: Layers Legend  
Active Layer: Earthquakes

Visible Active

- Current Natural Hazards
  - Earthquakes
  - Active Volcanoes
  - NOAA Hurricane Tracking
  - Active Fires
  - Shakemaps
- Boundaries
- Essential Facilities
- Hydrography
- Transportation
- Utilities
- Orthoimagery
- Land Cover
- Elevation
- Cultural
- Geologic Features
- Weather
  - Weather Warnings

Auto Refresh Redraw Map

CA Debris Flow Prototype Resources

U.S. Geological Survey

Accessibility | FOIA | Privacy | Policies and Notices  
U.S. Department of the Interior | U.S. Geological Survey  
URL: <http://nhss.cr.usgs.gov>  
Application Contact: Application Manager  
Last Modification: Tuesday, February 15, 2005 @ 01:29 PM MST

FIRSTGOV  
TAKE PRIDE AMERICA

Frequently Asked Questions

Transferring data from hawsproxy.cr.usgs.gov...



EPA Tribal Forum on Environmental  
Science

# USGS on Tribal Lands – Geospatial Information

- National Spatial Data Infrastructure (NSDI)
  - Coordinates USGS holdings
  - Coordinates with other Federal, State, Local & agencies
    - Holdings: Geospatial Stop ([geodata.gov](http://geodata.gov))
    - Standards: Federal Geographic Data
  - The National Map:
    - <http://nationalmap.gov>
  - USGS Seamless Data Distribution System
    - <http://seamless.usgs.gov>

Seamless Data Distribution System provides DOQQ, SRTM, NED, Orthoimagery, Landsat, elevation and much more for free do

File Edit View Go Bookmarks Tools Help

http://seamless.usgs.gov

Getting Started Latest Headlines

**USGS**  
science for a changing world

USGS Home  
Contact USGS  
Search USGS

Seamless Data Distribution System, Earth Resources Observation and Science (EROS)

Home Background List of Products Frequently Asked Questions Links Contact Us

What this site has to offer:

- Free Data Downloads
- User Defined Datasets and Area
- Acquire Data From Different Hosts
- Elevation Point and Profile Tools
- [Tutorial](#)
- and much more...

News

- **System Status:**
  - The system is running.
- **Important information pertaining to Downloads and XP SP2:**  
Trouble downloading and recently installed XP SP2 -- See instructions in the [General FAQs](#)

(SRTM "Finished") The SRTM "finished" elevation dataset contains a half pixel shift. This is currently in process of being corrected. Caution should be used when doing analysis with this dataset.

[Announcements](#) (updated 08/30/2006)

View and Download United States Data

View and Download International Data

# NAWQA and The National Map

**USGS**  
science for a changing world

USGS Home  
Contact USGS  
Search USGS

NAWQA Data Warehouse Mapper [Back to NAWQA Data Home >>](#)

Zoom To:   Export Results To:

NAWQA Data Warehouse Layer Legend

# USGS on Tribal Lands – Annual



- 1997-2003 available online at [www.usgs.gov/indian](http://www.usgs.gov/indian)
  - 2004 available from USGS booth outside CDROM)
  - Contacts for USGS Native American liaisons at above (and on last slide)

# USGS on Tribal Lands – Annual

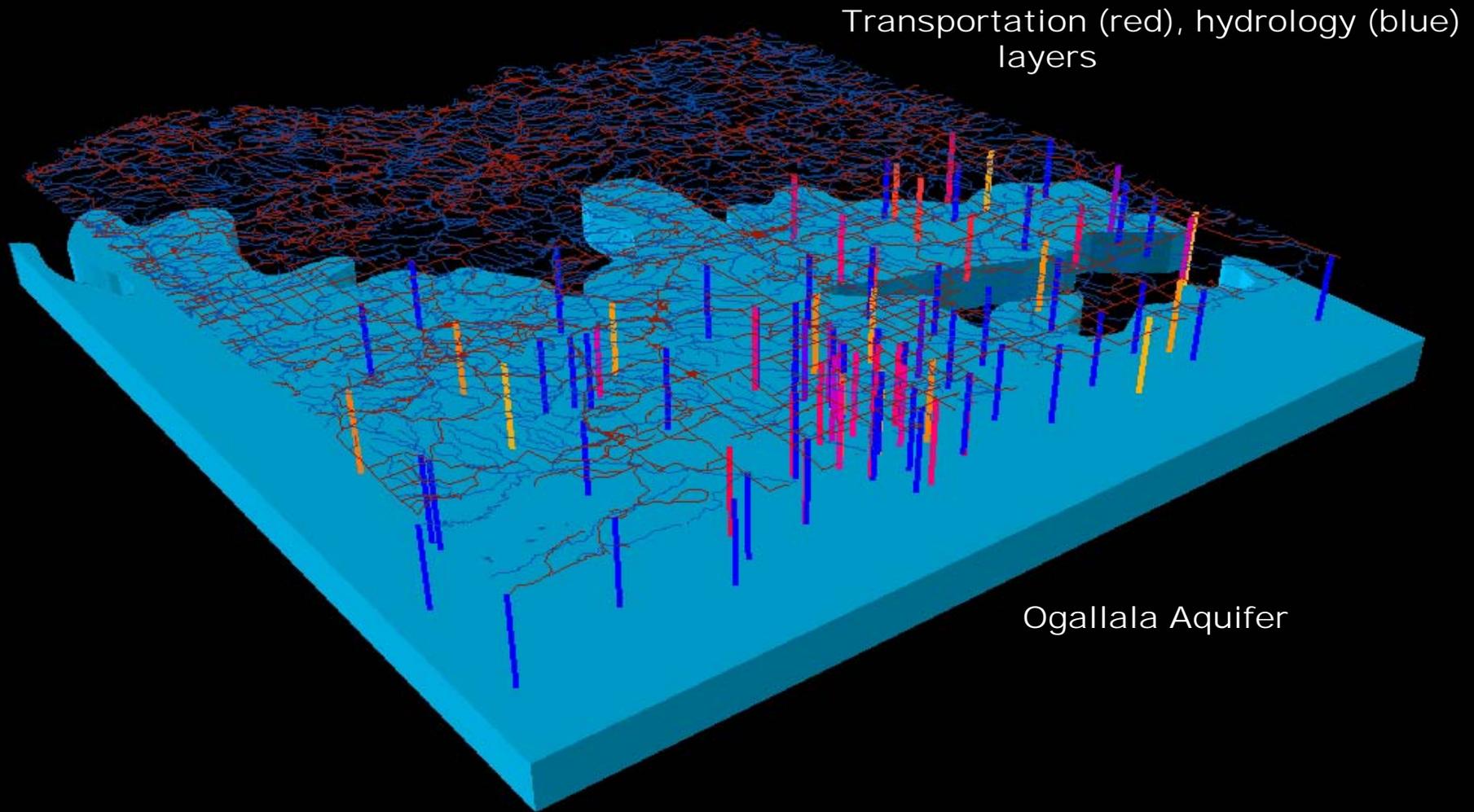


- Searchable by:
  - Tribal Organizations
  - Events
  - Reservation/State
  - Activities:
    - Resource/Environment
    - Education
    - Technical Assistance
    - Coordination/Policy
    - Future Opportunities

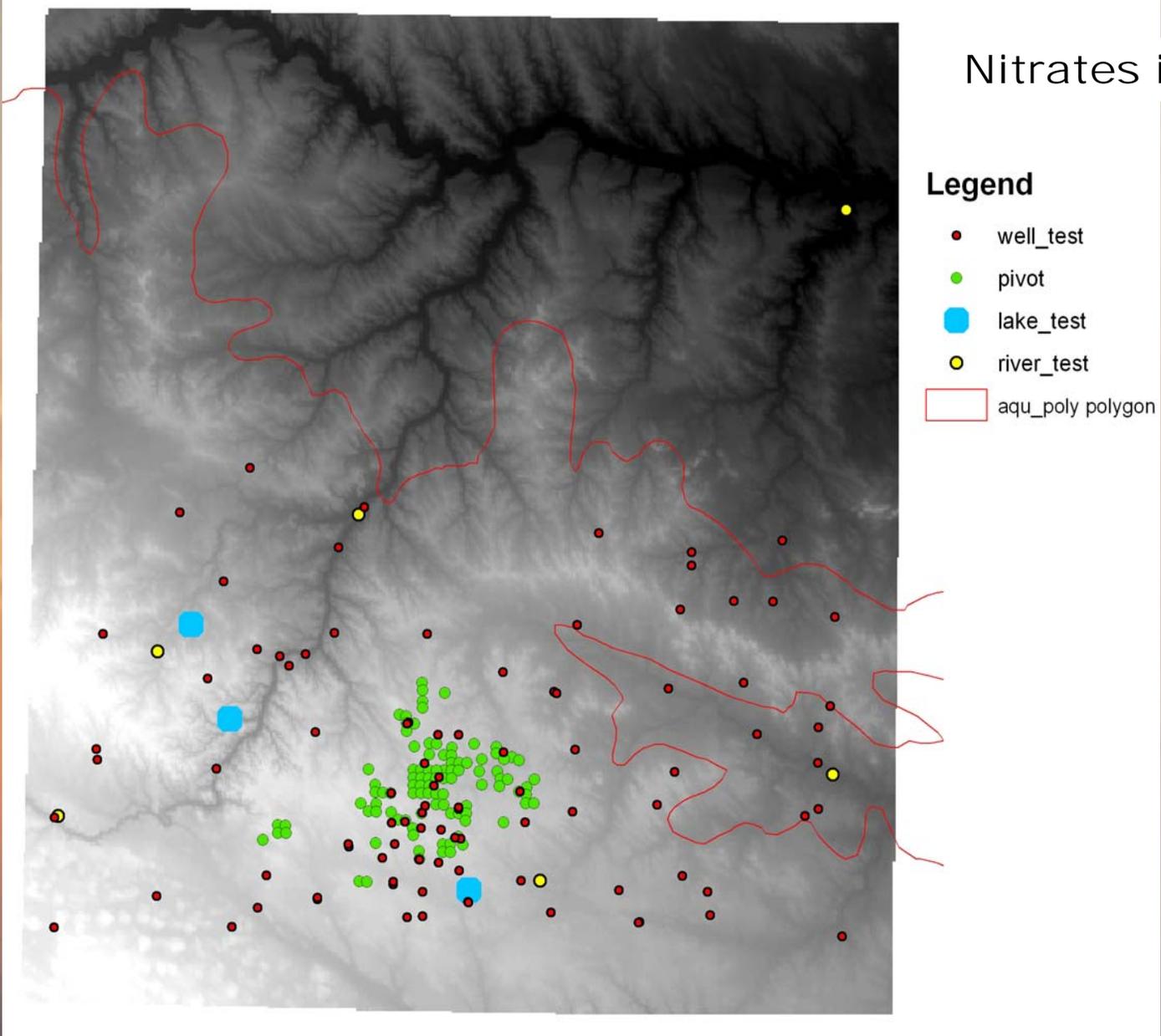
# Sinte Gleska University Example: Infrastructure development

- **Develop pilot projects between Universities, SGU, Rosebud Tribe & USGS**
  - Water/Biology/Geography disciplines
  - Benefit to SGU & Rosebud communities
  - Real world experiences for SGU students
- **Develop spatial analysis lab at SGU**
  - Mapping/geospatial analysis tools/capabilities
  - Training/internship opportunities
  - Spatial database development
- **Pilots:**
  - Water quality
  - Invasive species/ethnobotany
  - Housing
  - Alternative energy (geothermal, wind, microhydro)

# Nitrates in wells



# Nitrates in wells





**Janet Carter, WRD Rapid City, conducts a training workshop at Sinte Gleska Geospatial Applications Center**

## **USGS-funded Workshops conducted at SGU**

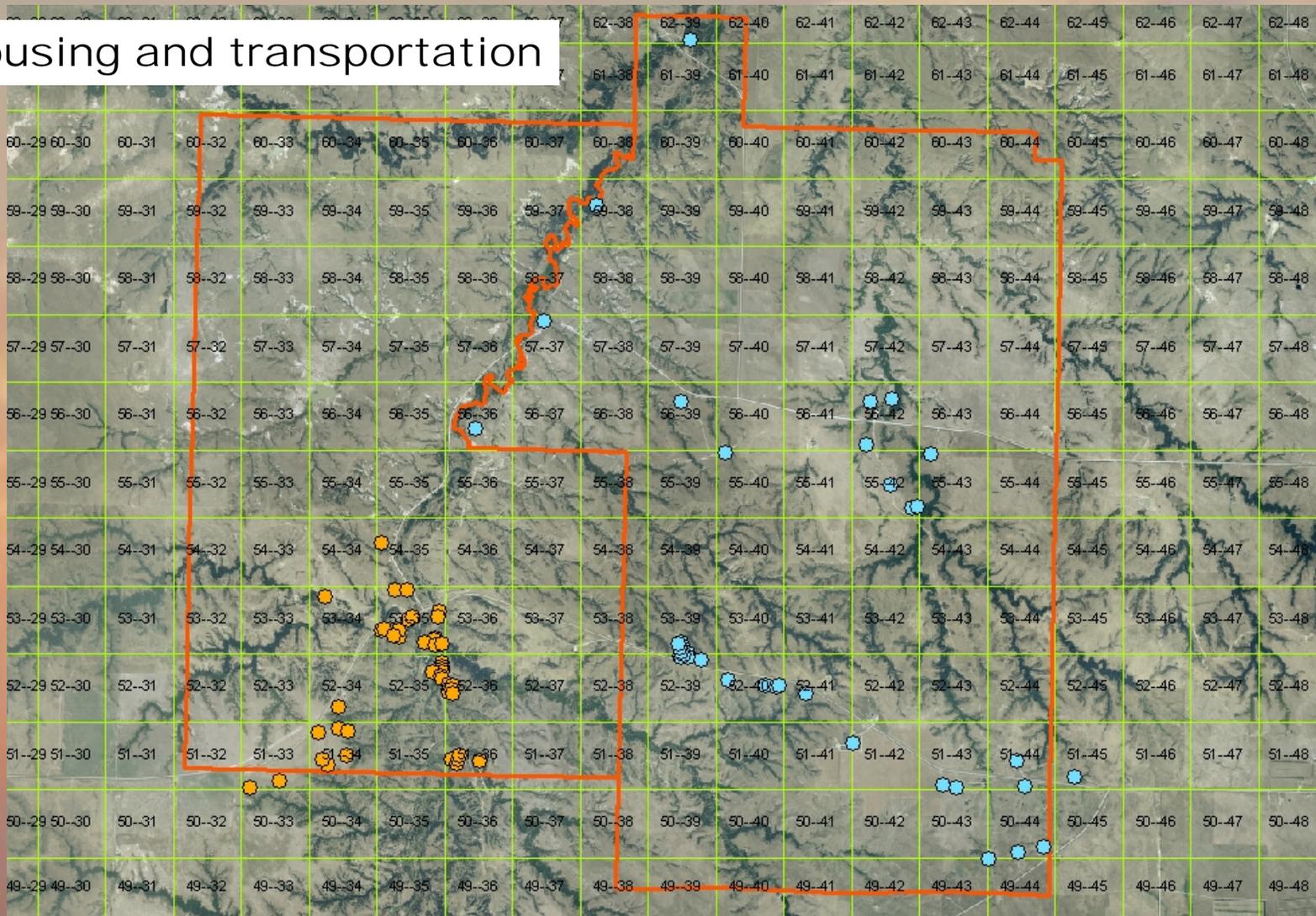
**Geneva Chong, BRD Ft. Collins,  
demonstrates field data  
collection techniques to  
Sarah Wolfe, SGU Lakota Studies**



# Housing and transportation



# Housing and transportation



SoldierCreek & RingThunder

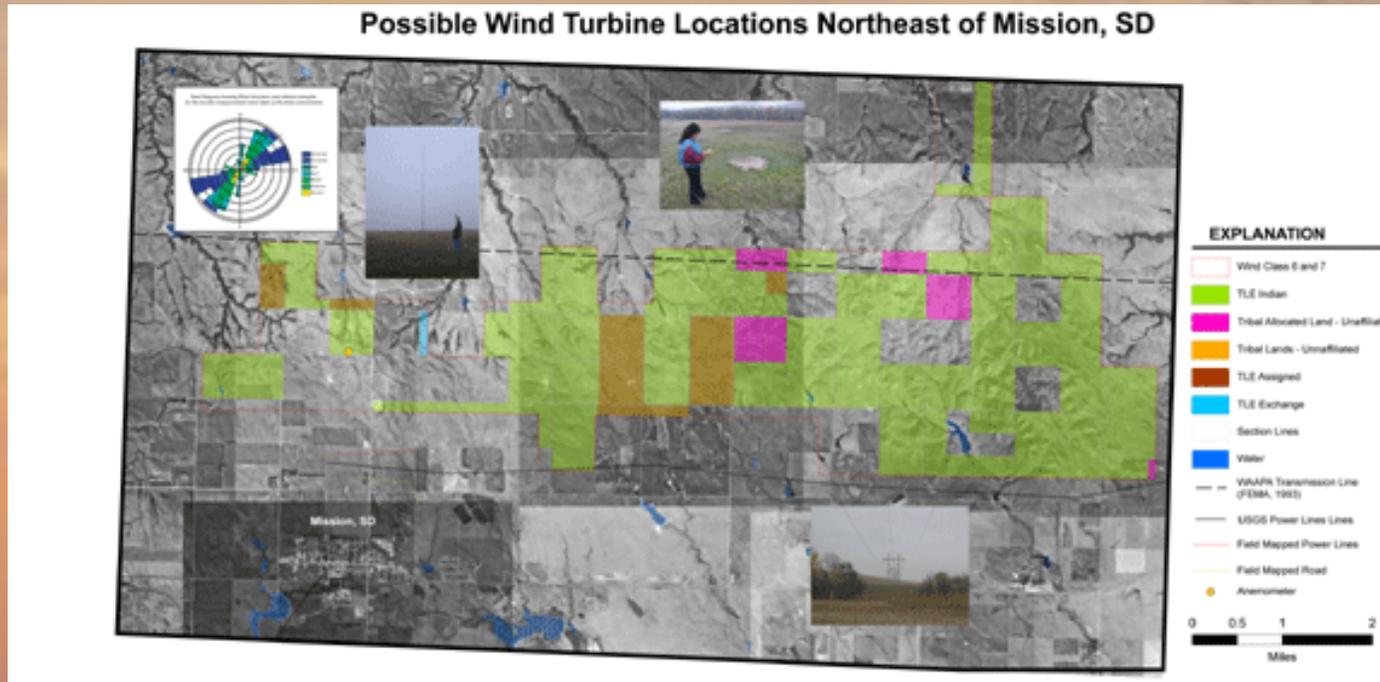
- SoldierCreek
- RingThunder
- ▭ SoldierCreek\_RingThunder
- ▭ RSTgrid

## Soldier Creek & Ring Thunder Boundaries



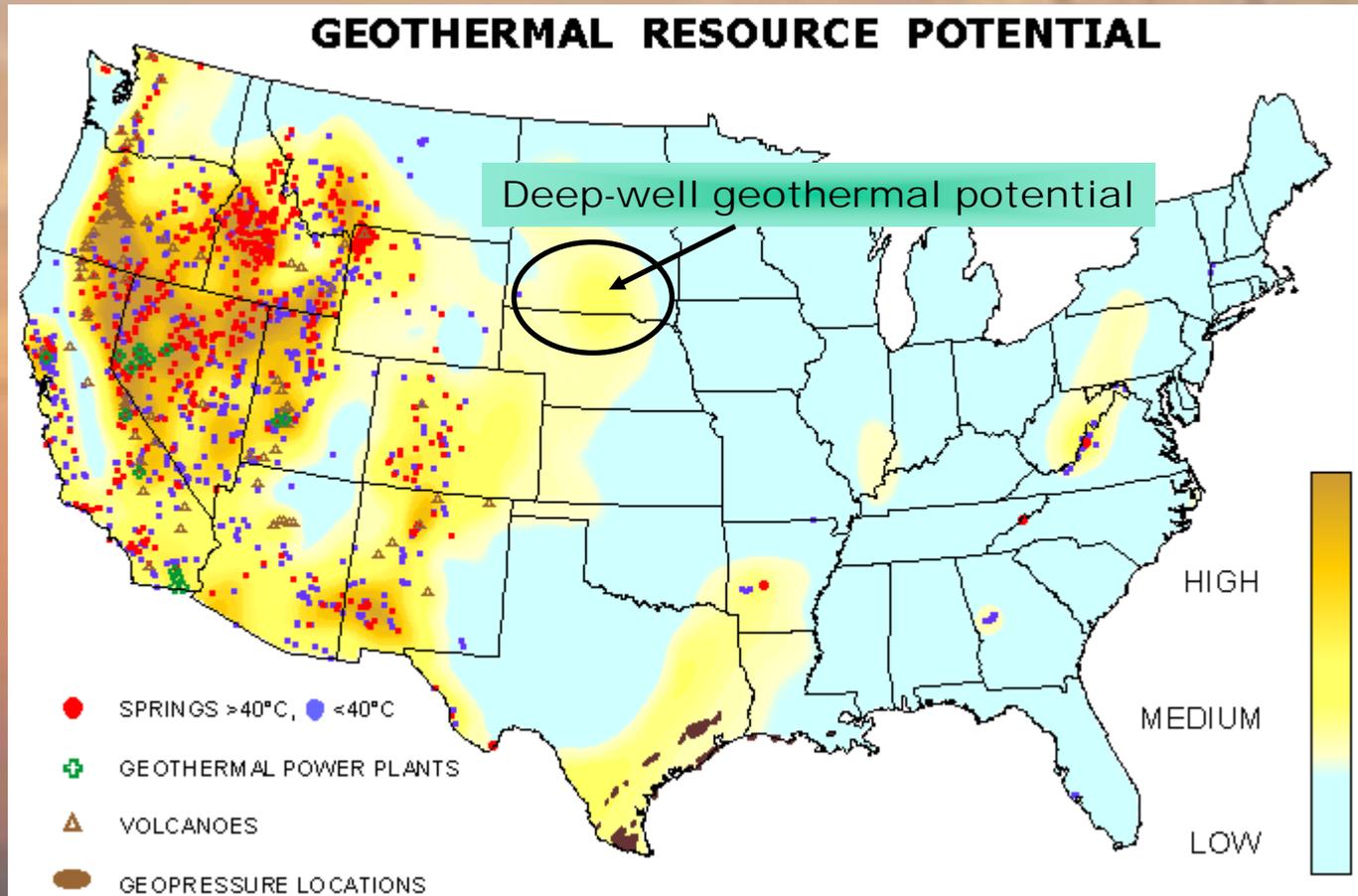
## EPA Tribal Forum on Environmental Science

# Renewable Energy - Wind



Courtesy Pat Kozak, SDSM&T

# Renewable Energy - Geothermal



# USGS Science Impacts – IKCE-SI

- **Indigenous Knowledge Center for Education and Science (IKCE-SI)**
  - In Lakota – Ikce SI means “honoring the common person”
- **Sinte Gleska awarded 5-year grant**
  - Other awards to MIT, Wharton, New Mexico State & Prescott
  - Sarah Wolfe (SGU) is PI, Jhon Goes-in-Center is consulting
- **How to utilize indigenous knowledge to better understand processes?**
  - Social memory learning (“oral traditions”)
  - Knowledge management (capturing knowledge in a retrievable)
  - Decision support to tribal leaders (water resources, land use ecosystem recovery, rangeland management).
  - Education and outreach (also to scientists, who have an learn as well as teach).
- [http://www.usgs.gov/science\\_impact/index.html](http://www.usgs.gov/science_impact/index.html)

# Synergies to support

- **Infrastructure Development**
- **Resource Management**
- **Career Development**
- **Research**
- **Example – rangeland management**
  - **Crosscuts several USGS programs**
  - **Links to Universities (SDSM&T flux towers,**
  - **Links to State (SD/DENR rangeland condition)**
  - **Decision support for tribal resource managers**

# SGU REASoN/CAN - Partners

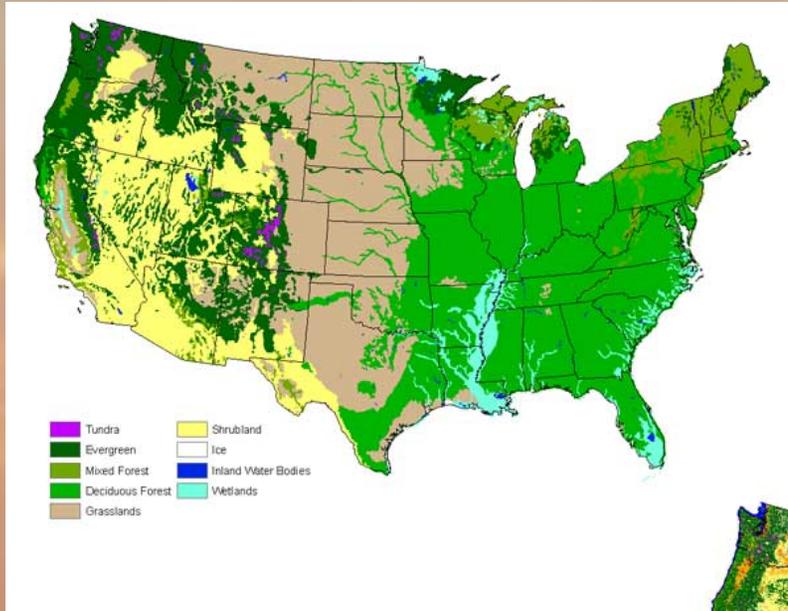
- Sinte Gleska University
- USGS
- Spatial Data Technologies, Inc.
- National Center for Atmospheric Research
- SD School of Mines & Technology

# SGU REASoN/CAN - Objectives

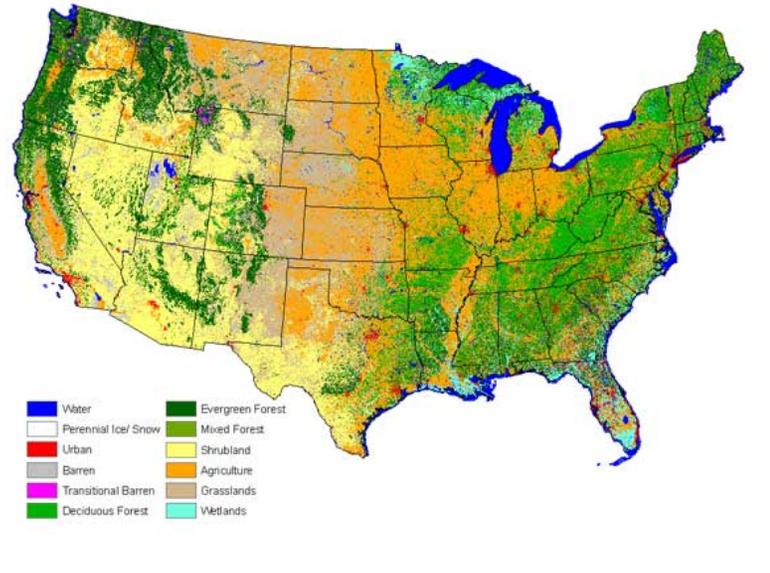
- **Enable Native American to succeed using & NASA technology and innovative math educational programs**
- **Provide decision support tools to tribal promoting economic development and tribal resources**
- **Create an innovative yet practical model uplifting Native American communities on national scale**
- **Application focus – Rangeland**

# Loss of Grasslands (grey)

Pre-contact



Post-contact



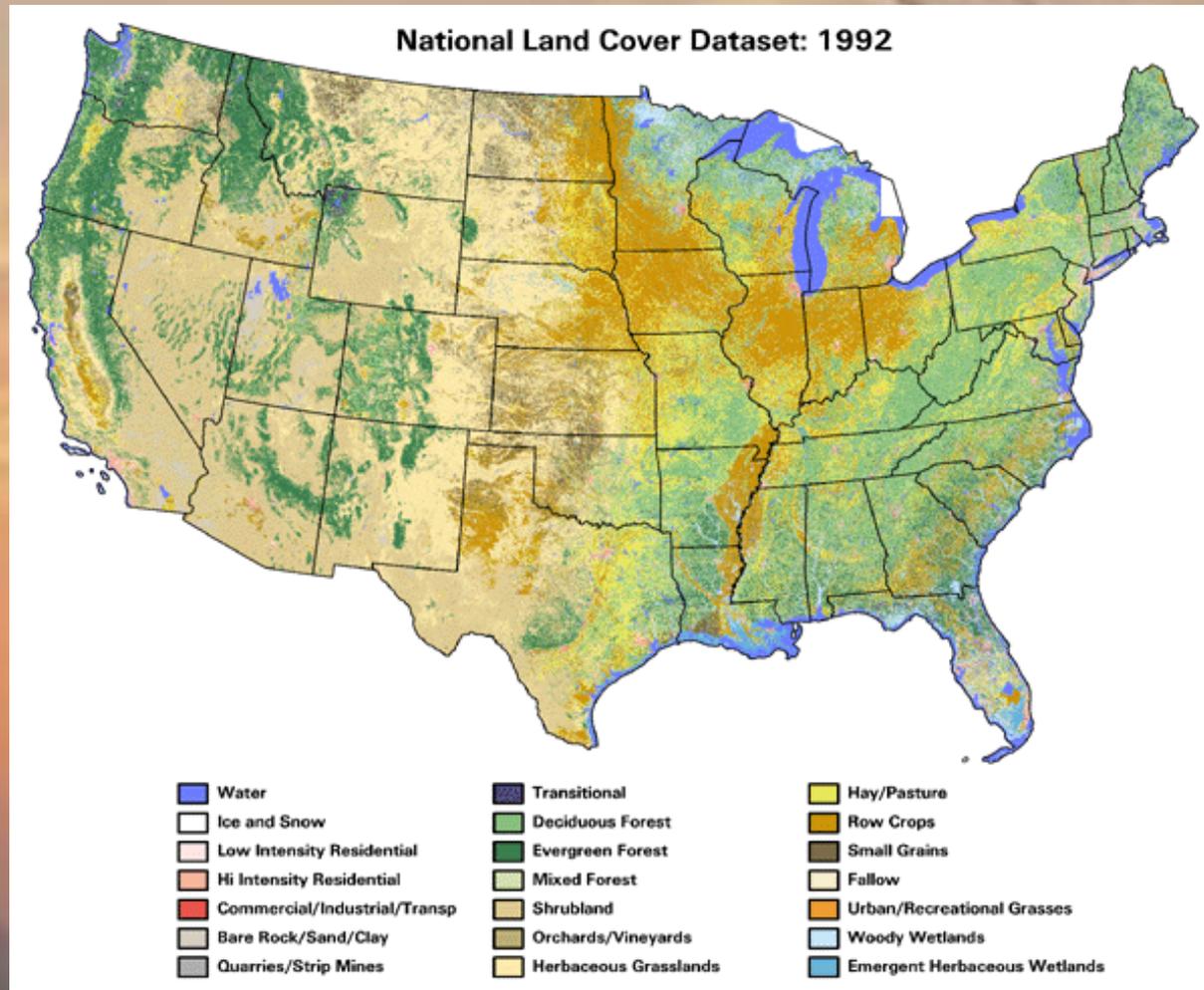
# Rangeland Management – Culture

- **Over the last 150 years, N. Plains grasslands have reduced to 40% of their original size**
  - east – crops, pastures replace native grasslands
  - west – introduction of “exotic” plants for/by cattle
  - profound disruption of Lakota life ways
- **Often, management practices have adversely abundance and distribution of species important culture**
- **How can we document the transition from grasslands to current system and articulate its**
- **Is it possible to restore indigenous ecosystems ranges)?**

# An Integrated Approach to Rangeland Management

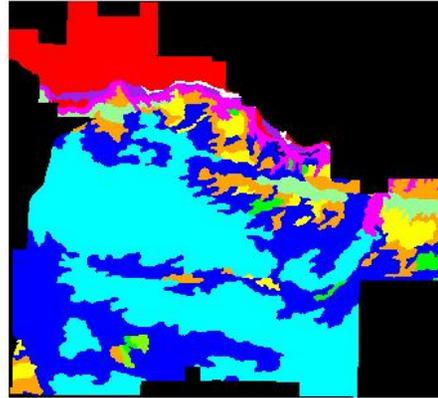
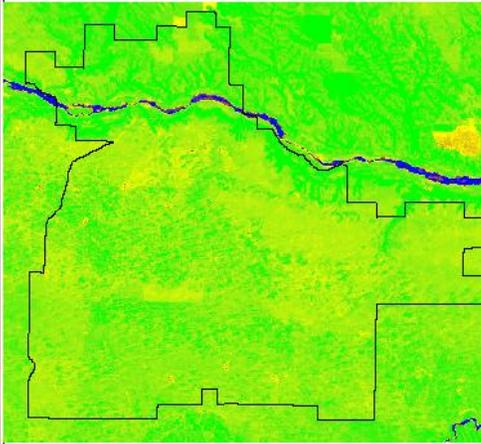
- **How to support economic development maintaining cultural integrity?**
  - **Ranching is an important economic activity, commercial practices over the long term can both range productivity and biodiversity**
  - **Alternative management practices have been balance both economic and ecosystem (“Savory”, “holistic”, etc.)**
  - **Reintroduction of bison on the N. Plains also role in grassland ecosystem recovery &**
  - **Such practices are consistent with the Lakota working within (not in spite of) natural systems**

# National Land Cover Classification

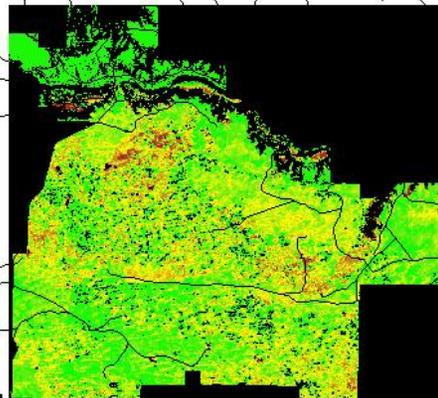
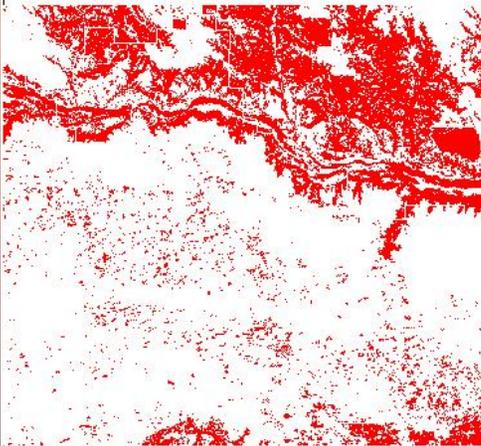


NDVI June 94

Range Sites



Rangelands

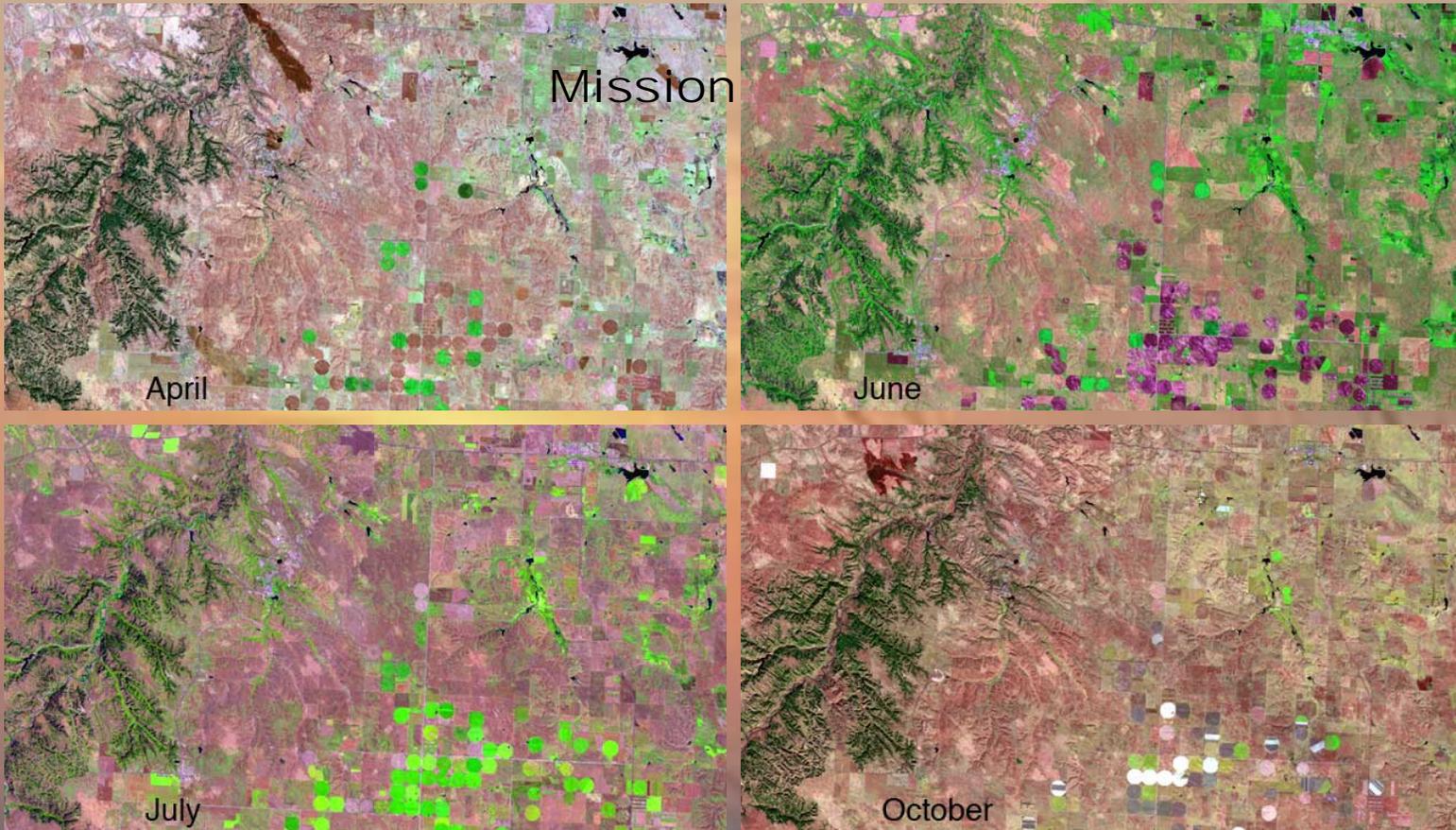


# Landscape Scale Monitoring

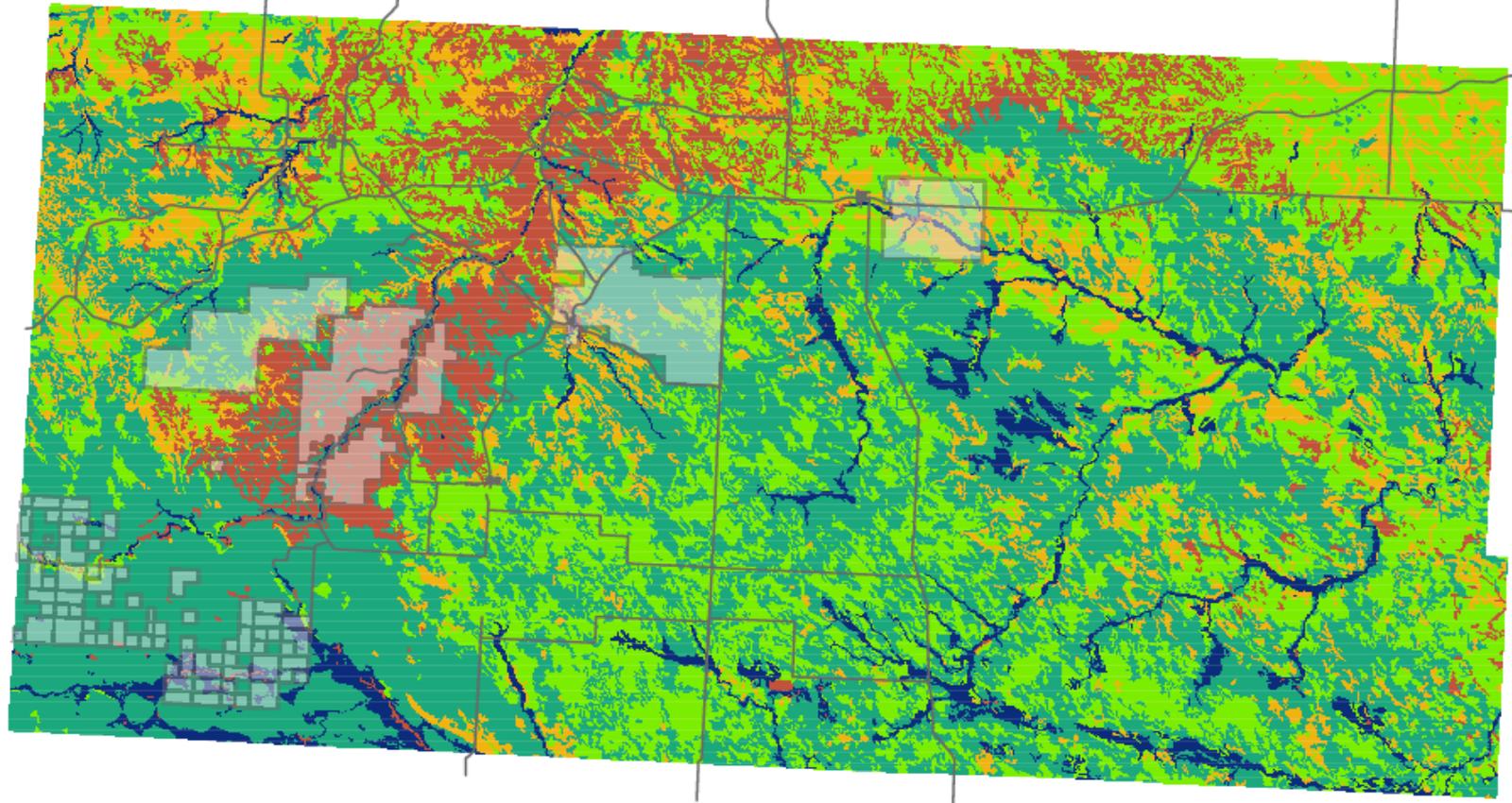
## Niobrara TNC Rangeland Productivity 1994 SPOT/HRV

Deviation of productivity from preserve average

# Seasonal Change over Rosebud



2000

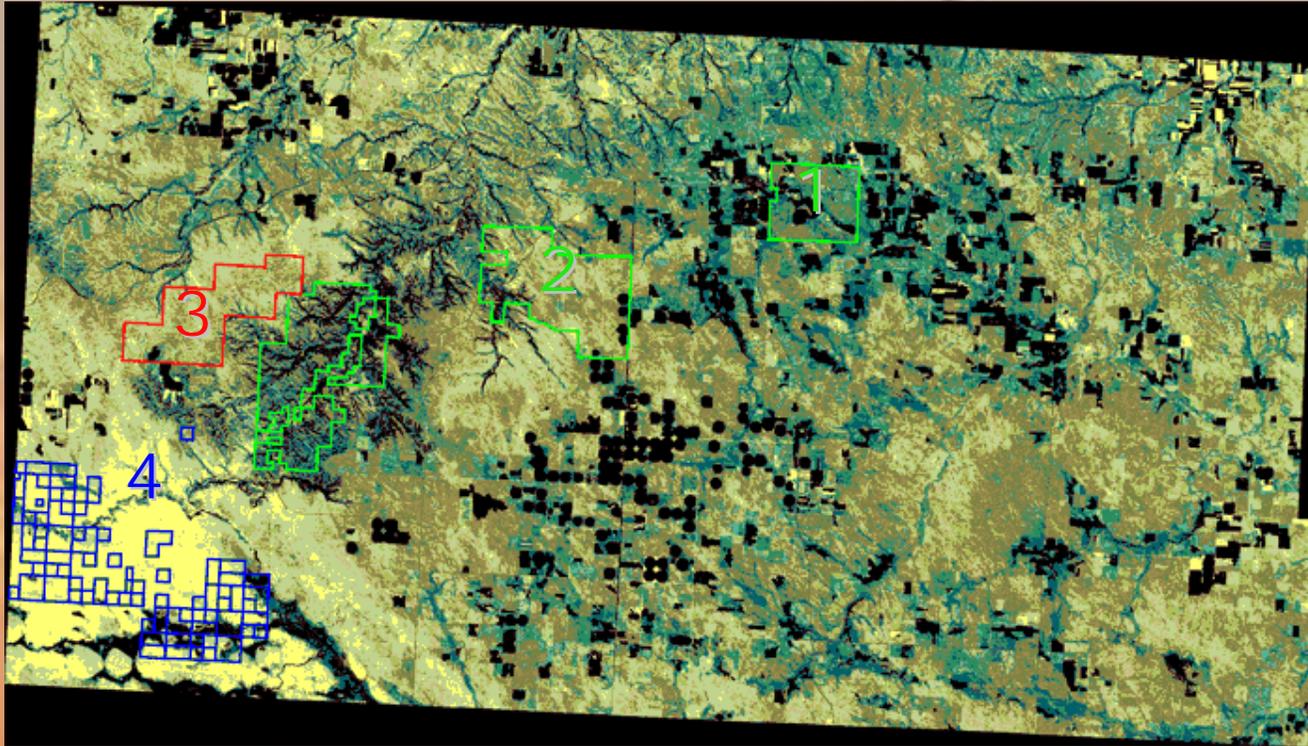


**SSURGO\_Todd**  
Rangesite productivity - low range (#/acre)

- 0 - 400
- 600 - 1300
- 1400 - 1900
- 2000 - 3000
- 4200 - 5200

Soil types -  
Baseline NRCS estimates of  
range site productivity used  
to identify areas having similar  
production potential

# Rosebud Rangeland Productivity Mapping - Landsat 2000



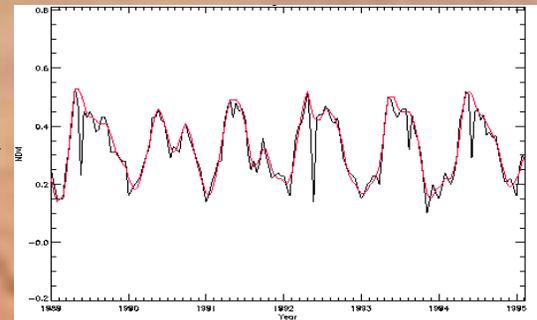
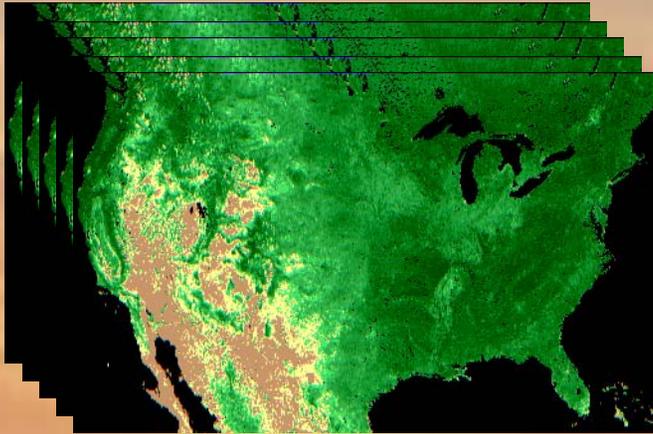
## Test Range Sites

- 1 Antelope (SGU bison pasture)
- 2 Rosebud (cattle to bison conversion)
- 3 Iron Shell Flats (black-footed ferret re-introduction)
- 4 Mustang Meadows (recent acquisition)

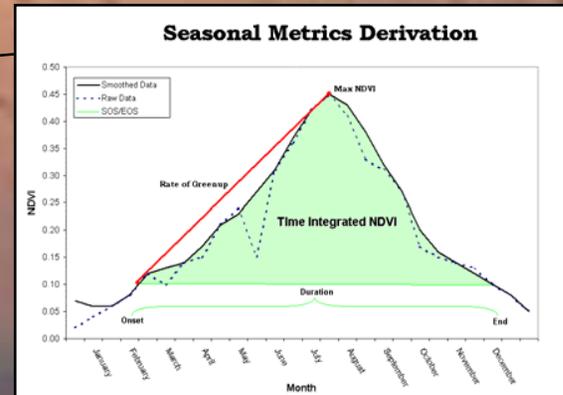
## Rangeland Productivity (2000):

high	low	other:
	 warm	 sand hills
	 mixed	 mesic-hydric
	 cool	 non-range

# 15+ years of satellite (AHVRR) data permits study of relative condition of land surface



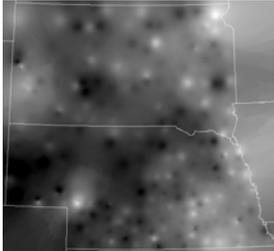
Start of Season  
End of Season  
Length of Season  
Growing season greenness  
Greenness "to-date"



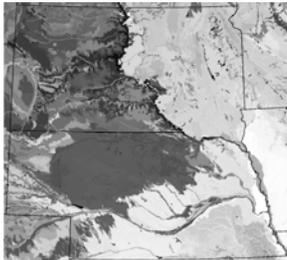
# Methodological Approach

## Model Input

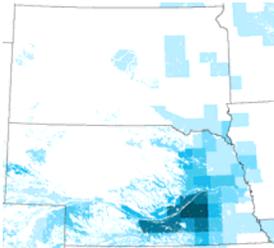
SPI 7/18/02



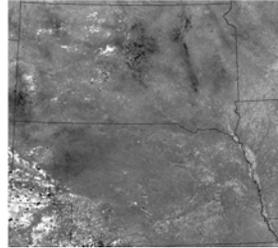
Available Water Capacity



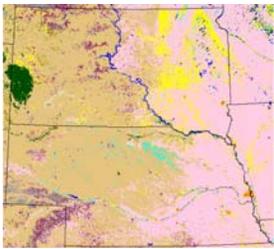
% Irrigated Farmland



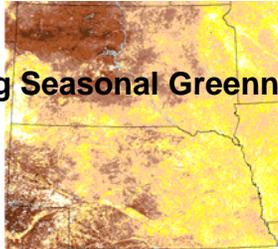
Start of Season Anomaly



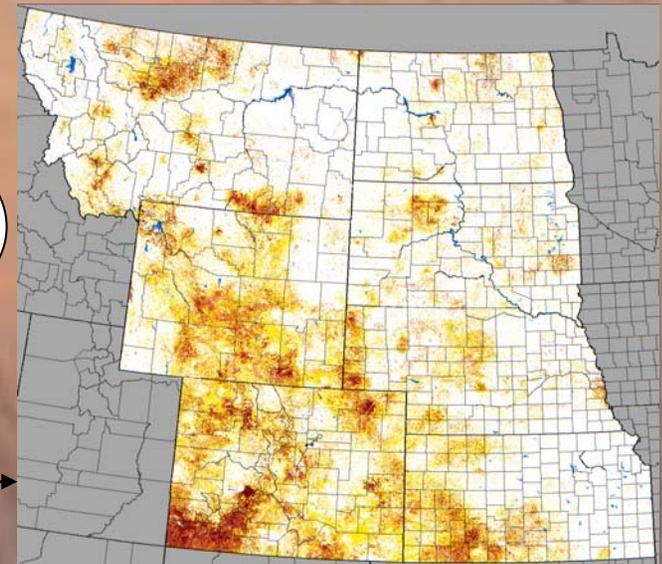
Land Cover



% Avg Seasonal Greenness

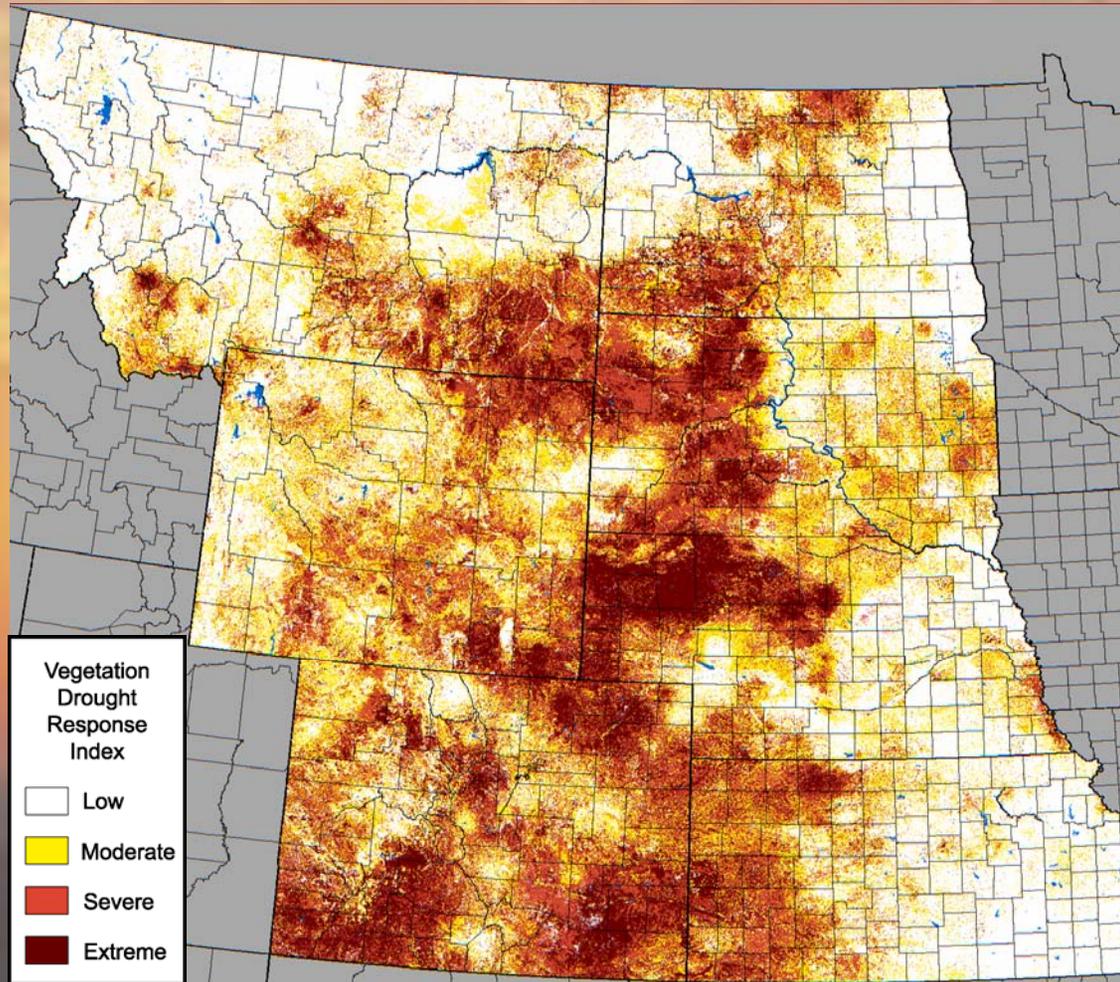


Regression Tree Modeling

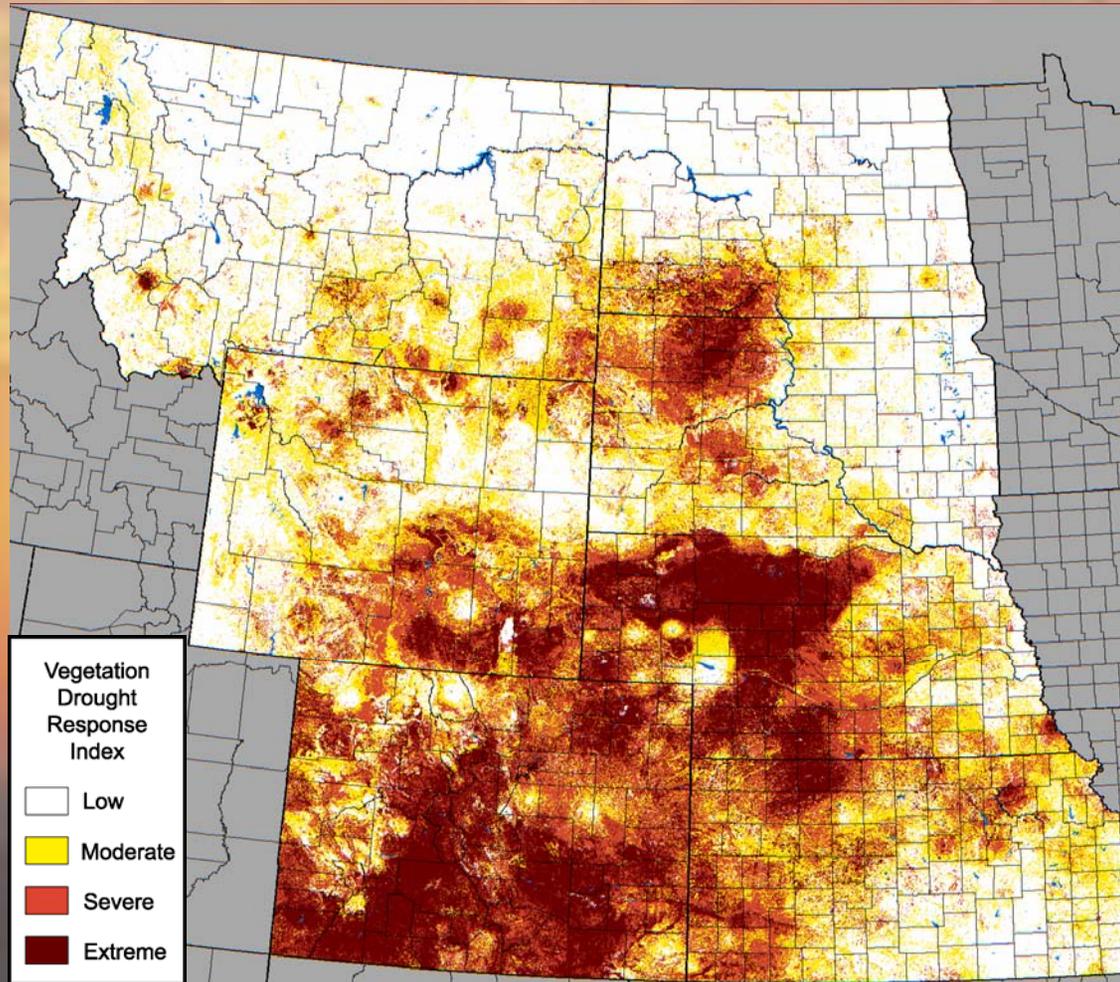


VegDRI (Vegetation Drought Response Index)

# Prototype Veg-DRI July 25, 2002

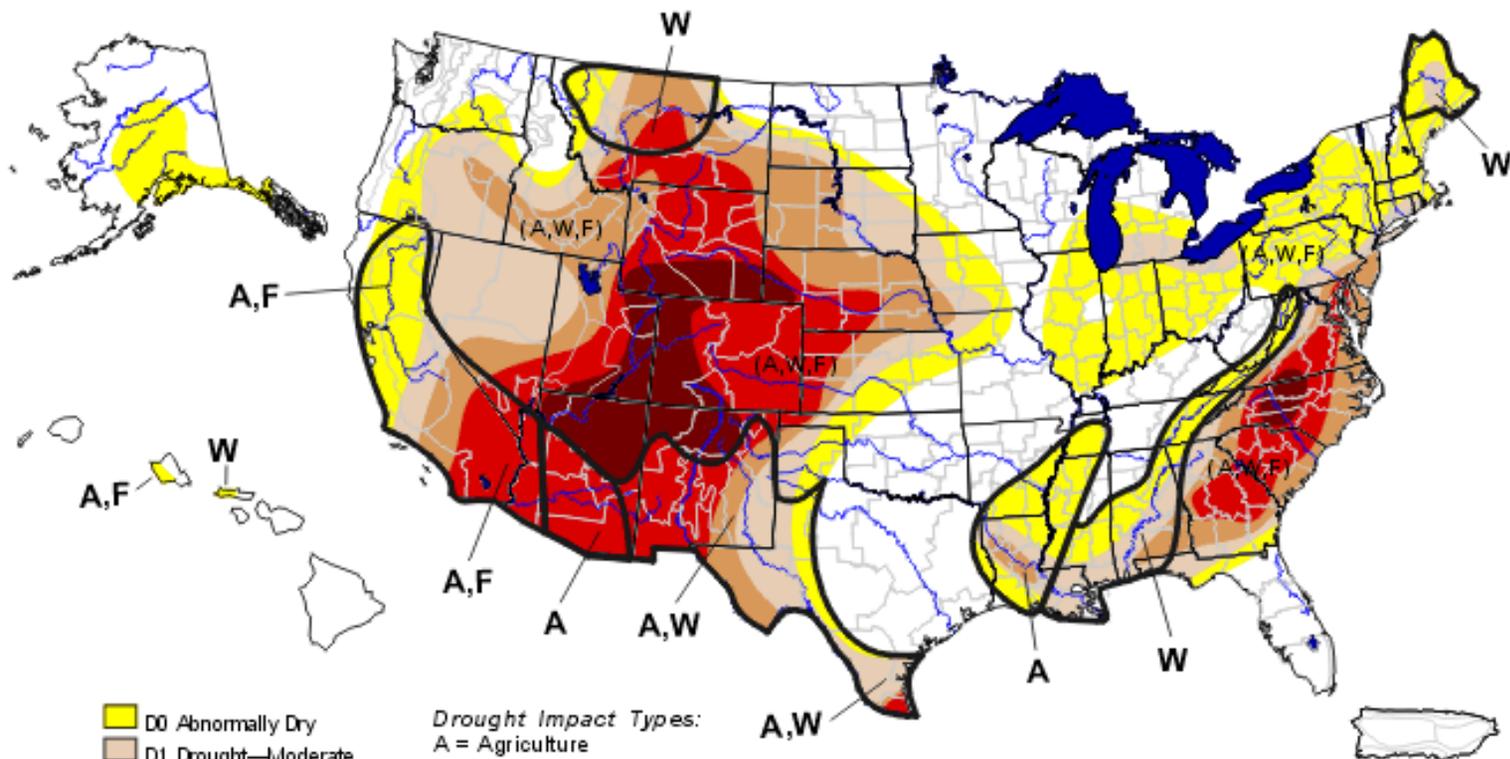


# Prototype Veg-DRI September 5, 2002



# U.S. Drought Monitor

July 23, 2002  
Valid 8 a.m. EDT



-  D0 Abnormally Dry
-  D1 Drought—Moderate
-  D2 Drought—Severe
-  D3 Drought—Extreme
-  D4 Drought—Exceptional

*Drought Impact Types:*  
A = Agriculture  
W = Water (Hydrological)  
F = Fire danger (Wildfires)  
— Delineates dominant impacts  
(No type = All 3 impacts)

*The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.*

<http://drought.unl.edu/dm>



Released Thursday, July 25, 2002

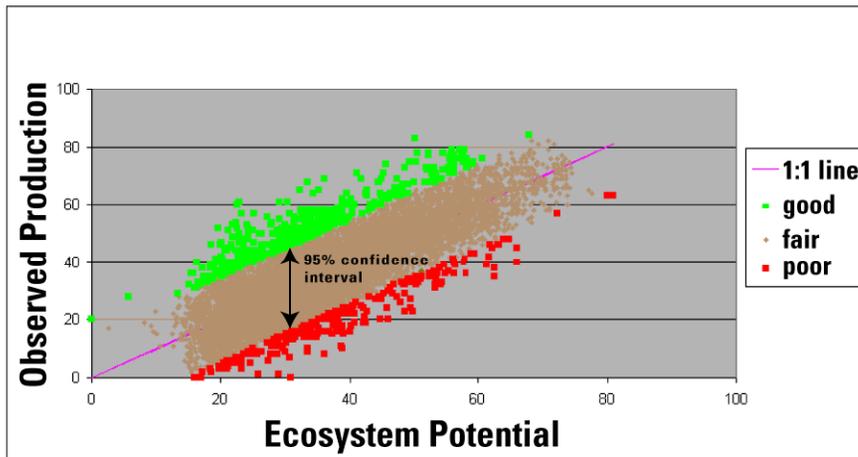
Author: Brad Rippey, USDA

# Decision Support Framework

- Utilize satellite observations, soils data and meteorological data to observe past performance predict future performance.
- Isolate climatic/meteorological influences from management influences
- Field data collection – calibrate, validate models (collaboration with Tribes, universities,
- Decision Support Time Scales
  - Interannual – long-term performance improvement or
  - Within season – stocking rate decisions based on short-forecast.

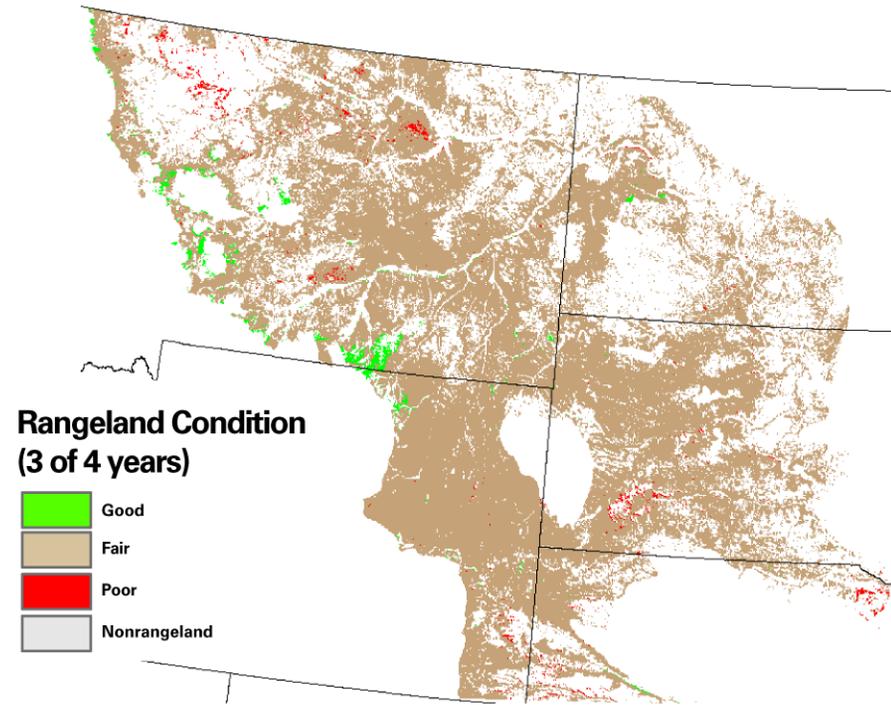
# Rangeland Condition in the Northern Great Plains

## Rangeland Ecosystem Services (Ecosystem Potential - Observed Production)



**Good** - The rangeland is more productive than expected:  
Good management practices

**Poor** - The rangeland is less productive than expected:  
Degraded or overgrazed rangeland



# Quantification of Climate and Human Impacts on Ecosystem Services

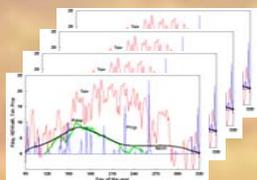
Satellite Imaging, GIS, Dynamic Monitoring, and Modeling

## Inputs

Dynamic:



Time Series NDVI

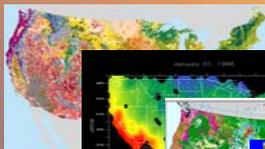


Daily Carbon Flux



Daily Meteorology

Static: Land Use/Cover



Climate

Soils

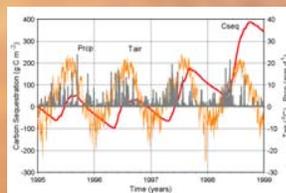
Elevation



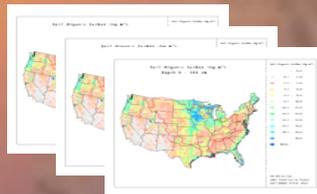
## Products



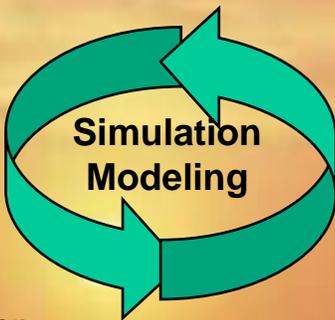
Time Integrated Veg Index



Carbon Sequestration



Carbon Sources and Sinks



## Application

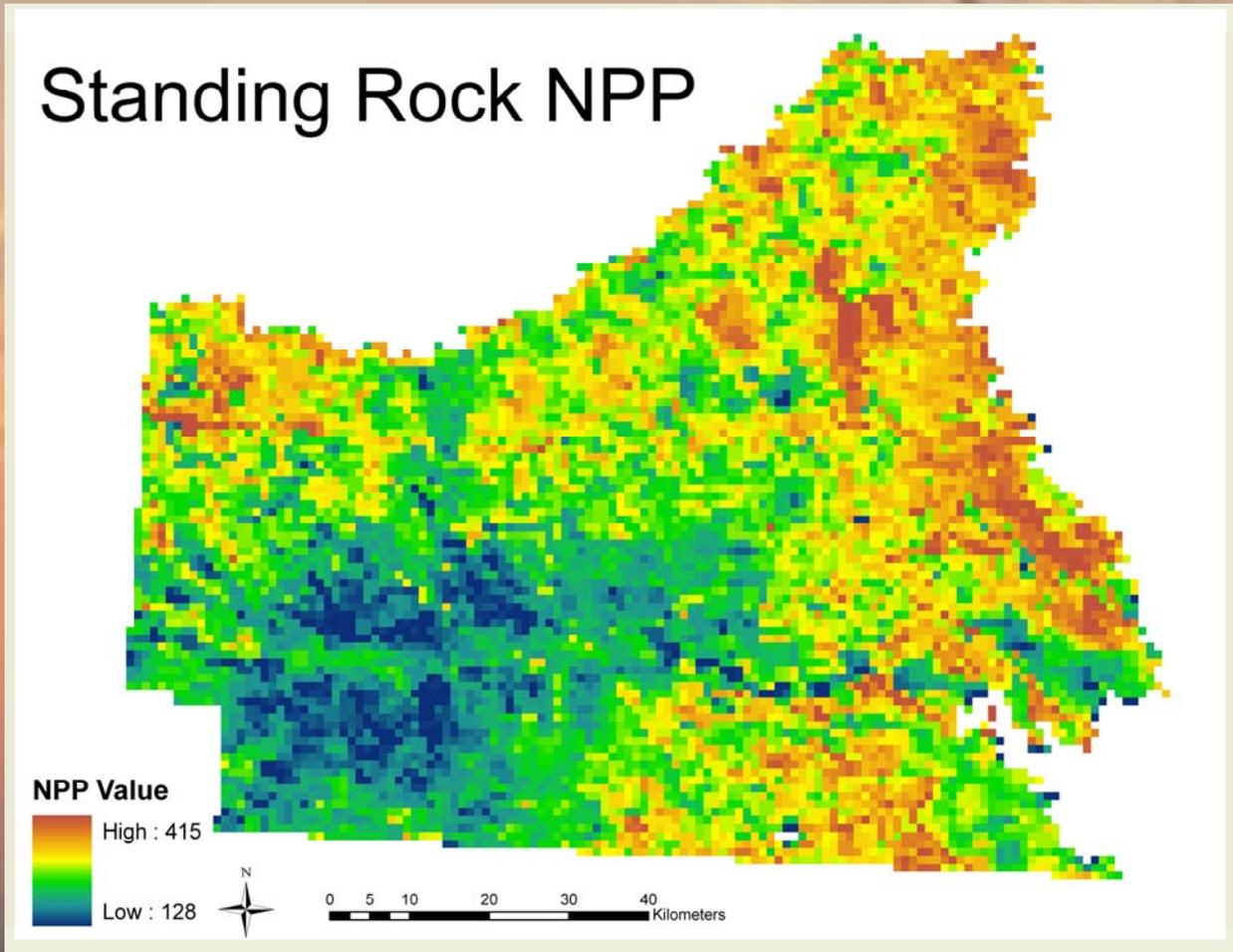
### Global Change

- Real Time Monitoring
- Climate Change
- Land Use/Cover
- Hydrologic Cycling
- Carbon Cycling
- Ecosystem Services
- Biocomplexity

### Policy Formulation

- Management Impacts
- Climate Change Mitigation
- Carbon Sequestration
- Greenhouse Gas Emissions
- Economic Assessment

# Net Primary Production on Tribal

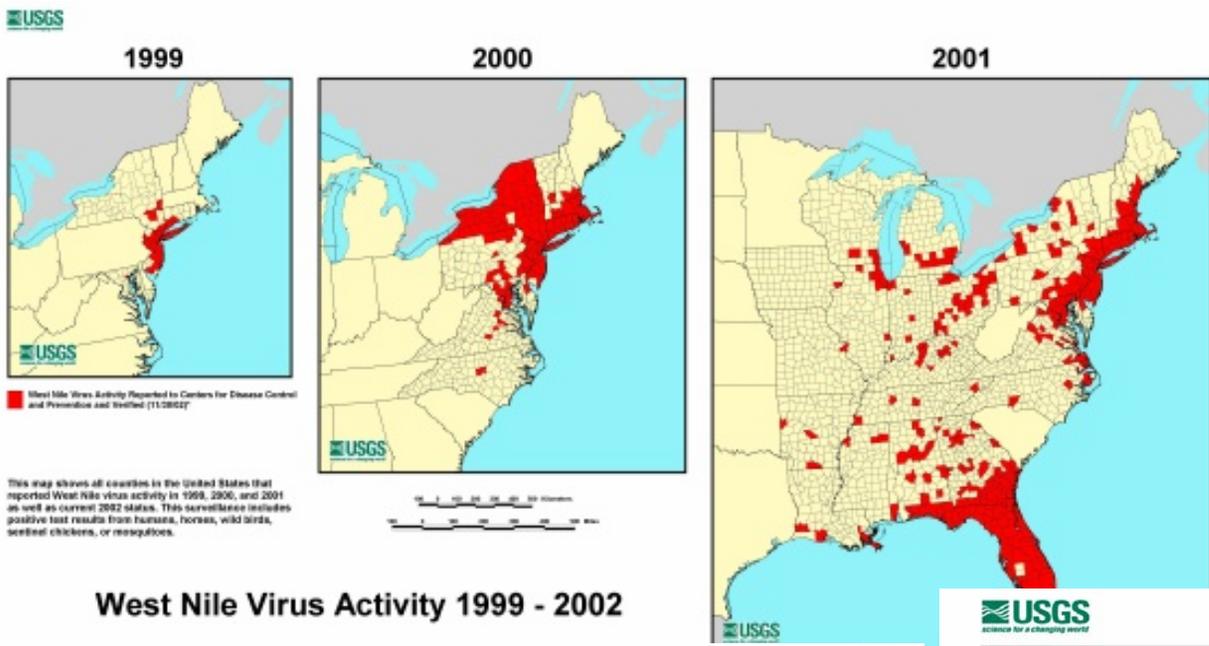


# Landscape Epidemiology

By knowing the conditions necessary for maintenance of specific pathogens in nature, one use these characteristics identify the spatial and temporal distribution of disease risk.



# Geographic Spread of WNV

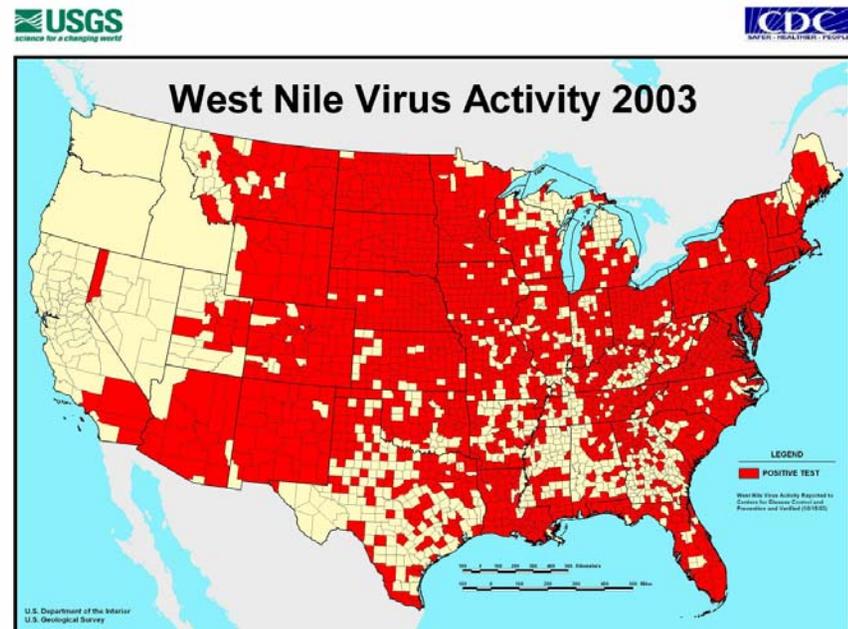
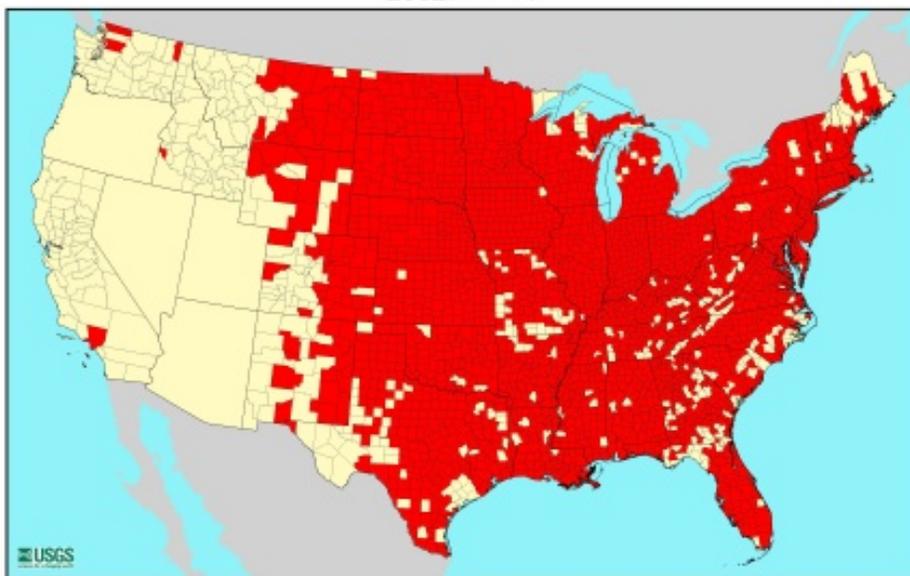


## Human Cases

1999	62
2000	21
2001	66
2002	4161 (2,930 NI)
2003	9377 (2,678 NI)

West Nile Virus Activity 1999 - 2002

2002(to date\*)



This map shows all counties in the United States that reported West Nile virus activity thru October 15, 2003. This surveillance includes positive test results from humans, horses, wild birds, sentinel chickens, or mosquitoes.

# **Control of West Nile Virus: Using Spatial Data, Writing Grant Proposals, and Tribal Networking**

Ramkota Inn, April 9, 2004, 8:00 - 4:30 ,  
Pierre, South Dakota

## **8:00 Registration**

## **8:30 Welcome and Introductions**

- Prayer
- Jennifer Giroux , Medical Epidemiologist, Northern Plains Tribal Epidemiology Center
- Eric Wood, USGS/EROS Data Center, NativeView Program

## **9:00 West Nile in South Dakota**

- Lon Kightlinger, SD State Epidemiologist

## **9:30 South Dakota State Mosquito Control Grant (\$700k)**

- Kevin Forsch, Director, Health Systems and Regulation, SD Department of Health

## **11:00 Tribal Mosquito Control Management Plans**

- Randolph Runs After, Sanitarian, Cheyenne River Sioux Tribe

# **2003 West Nile 101 day epidemic**

**9 April 2004**

## **West Nile -- Mosquito Control Tribal Health Conference**

**Lon Kightlinger, MSPH, PhD  
State Epidemiologist  
South Dakota Department of Health**



**EPA Tribal Forum on Environmental  
Science**

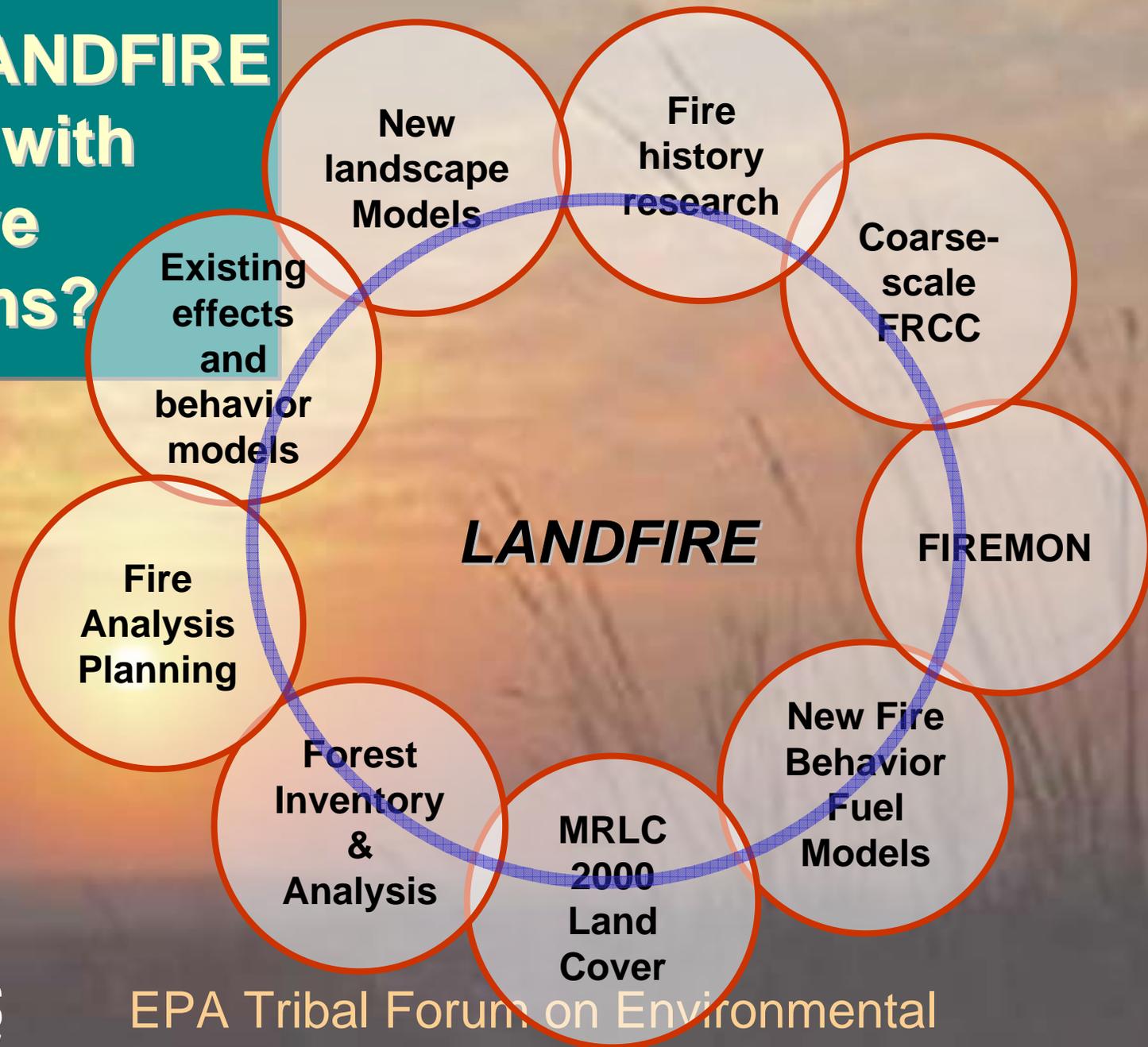


# What is LANDFIRE?

A **database** containing maps, models, GIS layers, and tools describing fire regime condition class, fire behavior and effects, and fire potential.

A **science effort** to develop nationally consistent, scaleable, comprehensive, robust, and peer-reviewed methodology, providing data and tools for fire management through the 21<sup>st</sup> Century.

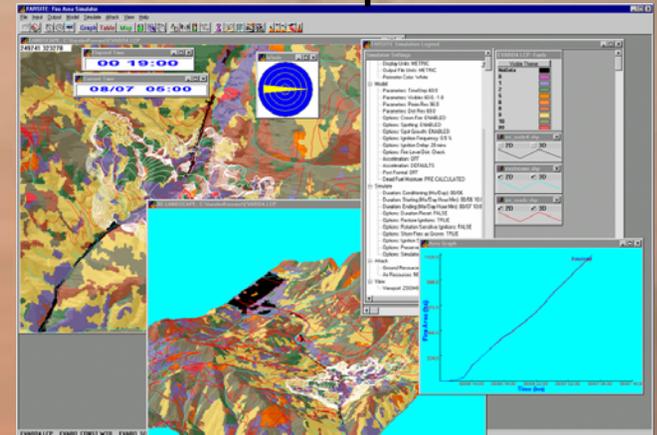
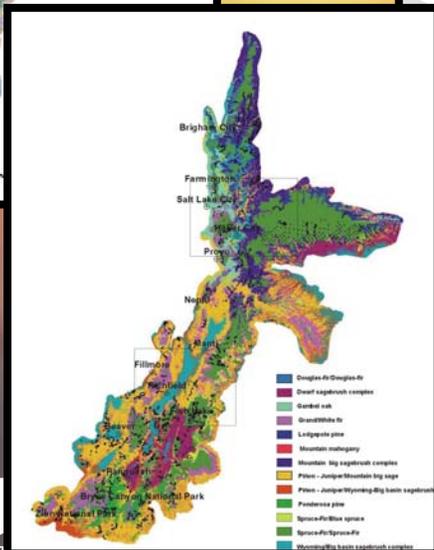
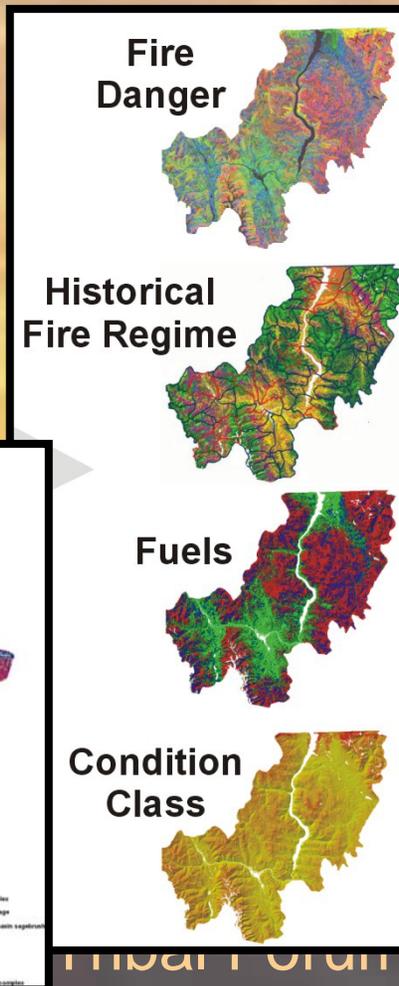
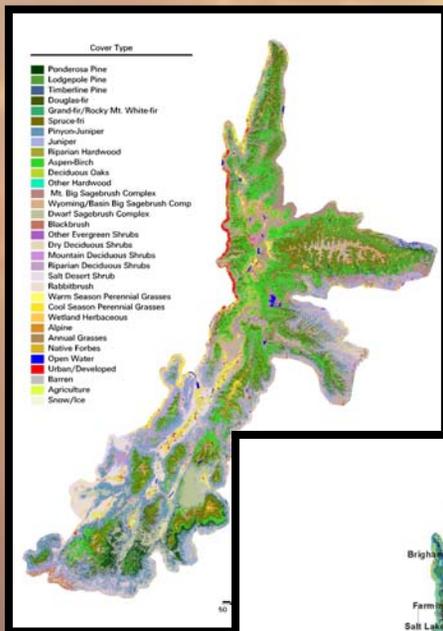
# Does LANDFIRE overlay with other fire programs?



# Primary LANDFIRE Deliverables

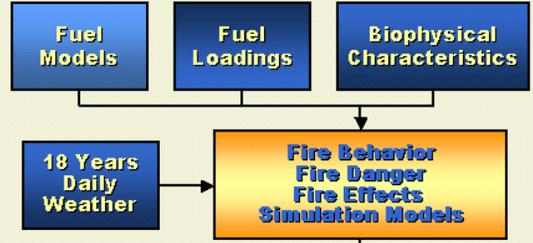
Various vegetation, fuels, and risk maps and data sets

Various computer models and other products



## FARSITE Layers

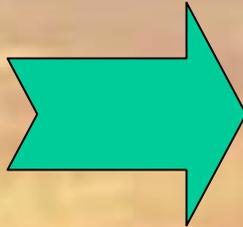
### FIRE Hazard Rating Model



Probability Maps of Specified Fire Events  
(Used in Science-Based Assessment of Fire Hazard and Potential Status)



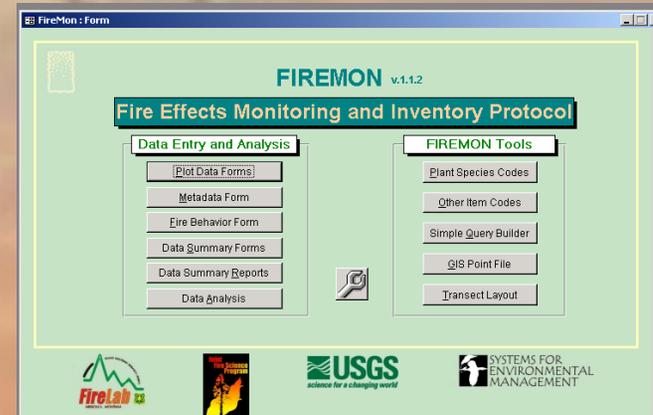
# Intended use and potential



- Modeling insect and disease spread
- Rangeland productivity monitoring
- Biodiversity conservation
- Biomass/carbon modeling
- Ecosystem healthy and functions
- .....

# LANDFIRE and Tribes

The Coeur d'Alene Tribe has developed to get Bureau of Indian Affairs forest information into the FIREMON database. Populating this database is one of the to feeding data into the LANDFIRE sensing process. Providing LANDFIRE accurate ground information will aid the LANDFIRE products to better represent ground conditions. The lessons learned Coeur d'Alene Tribe have the potential to applied across other Tribal lands in the States.

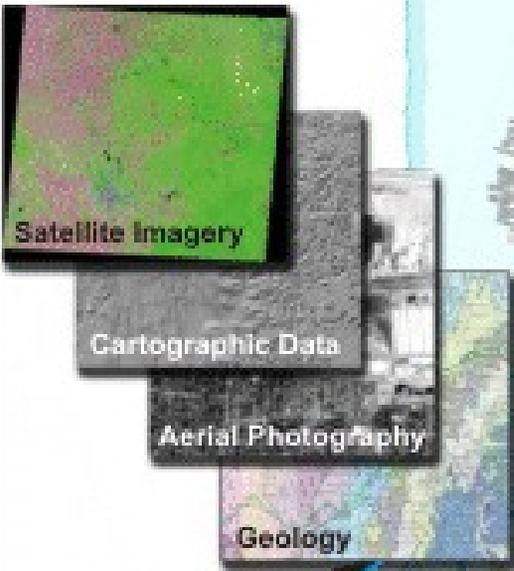


*Indian Lands in the United States*

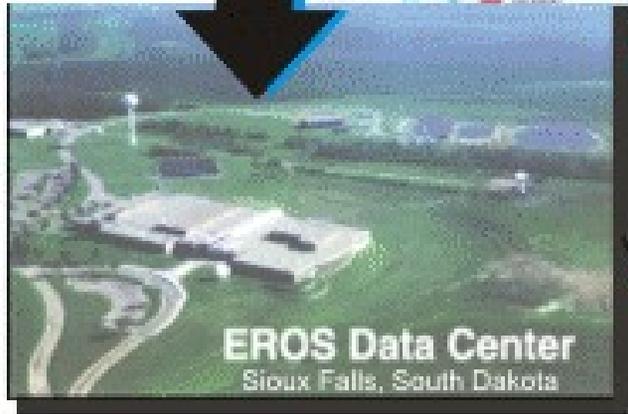


# NativeView

**33 Native American Tribal Colleges**



Satellite Imagery  
Cartographic Data  
Aerial Photography  
Geology



**EROS Data Center**  
Sioux Falls, South Dakota

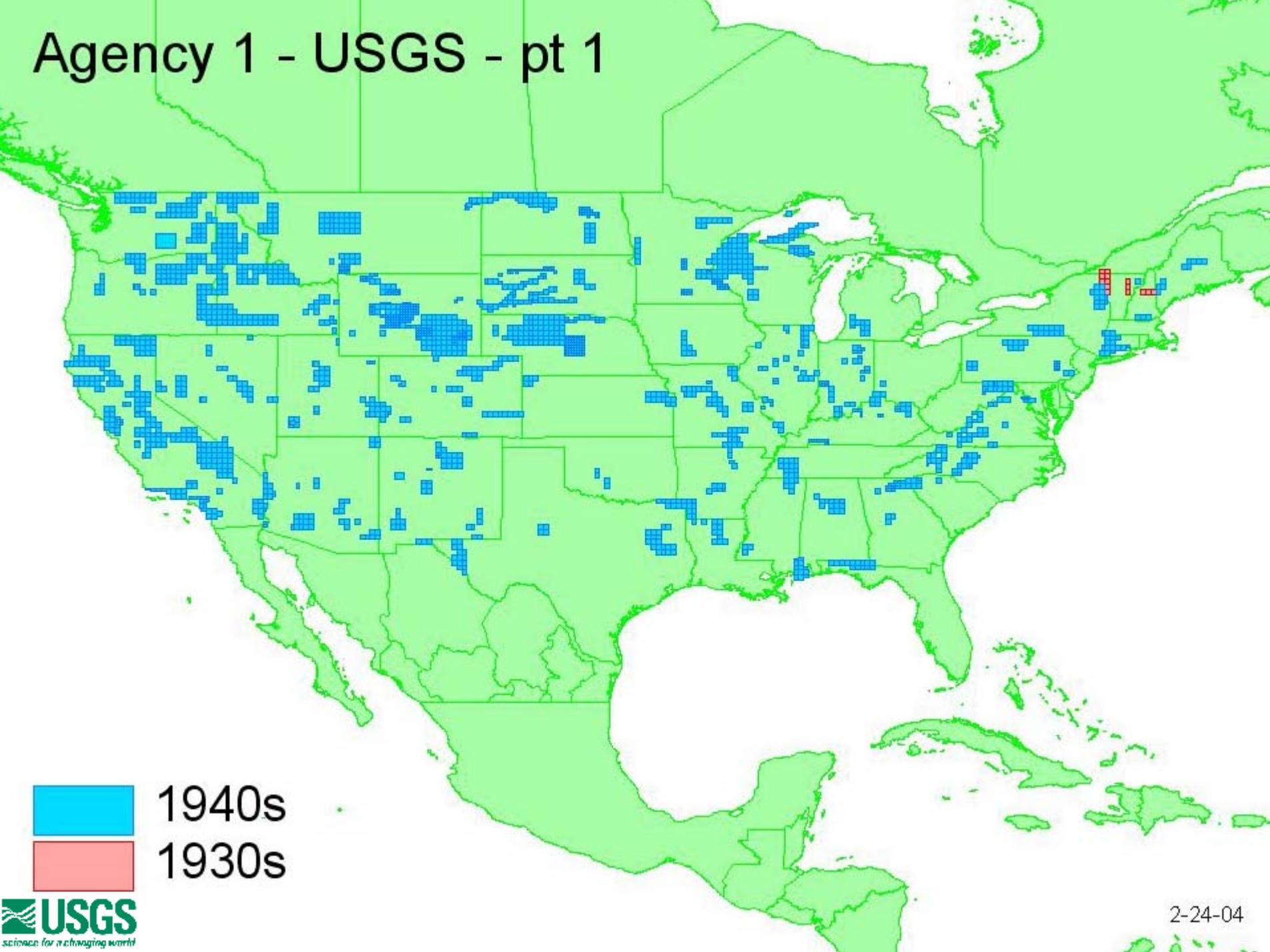


- Applications:**
- ✓ Education
  - ✓ Community Development
  - ✓ Treaty and Trust Responsibility
  - ✓ Economic Development
  - ✓ Natural Resource Management
  - ✓ Cultural Resource Management
  - ✓ Disaster Management
  - ✓ Collaborative Research

# Archival Imagery & Maps

- **Aerial Imagery dating back to the 1930's**
- **Maps dating back into the late 1800's**
  - **SGU – Lakota Studies “Father Buchel study”**
- **Multi-agency (USGS, BLM, USDA, BIA, BOR, etc.)**

# Agency 1 - USGS - pt 1

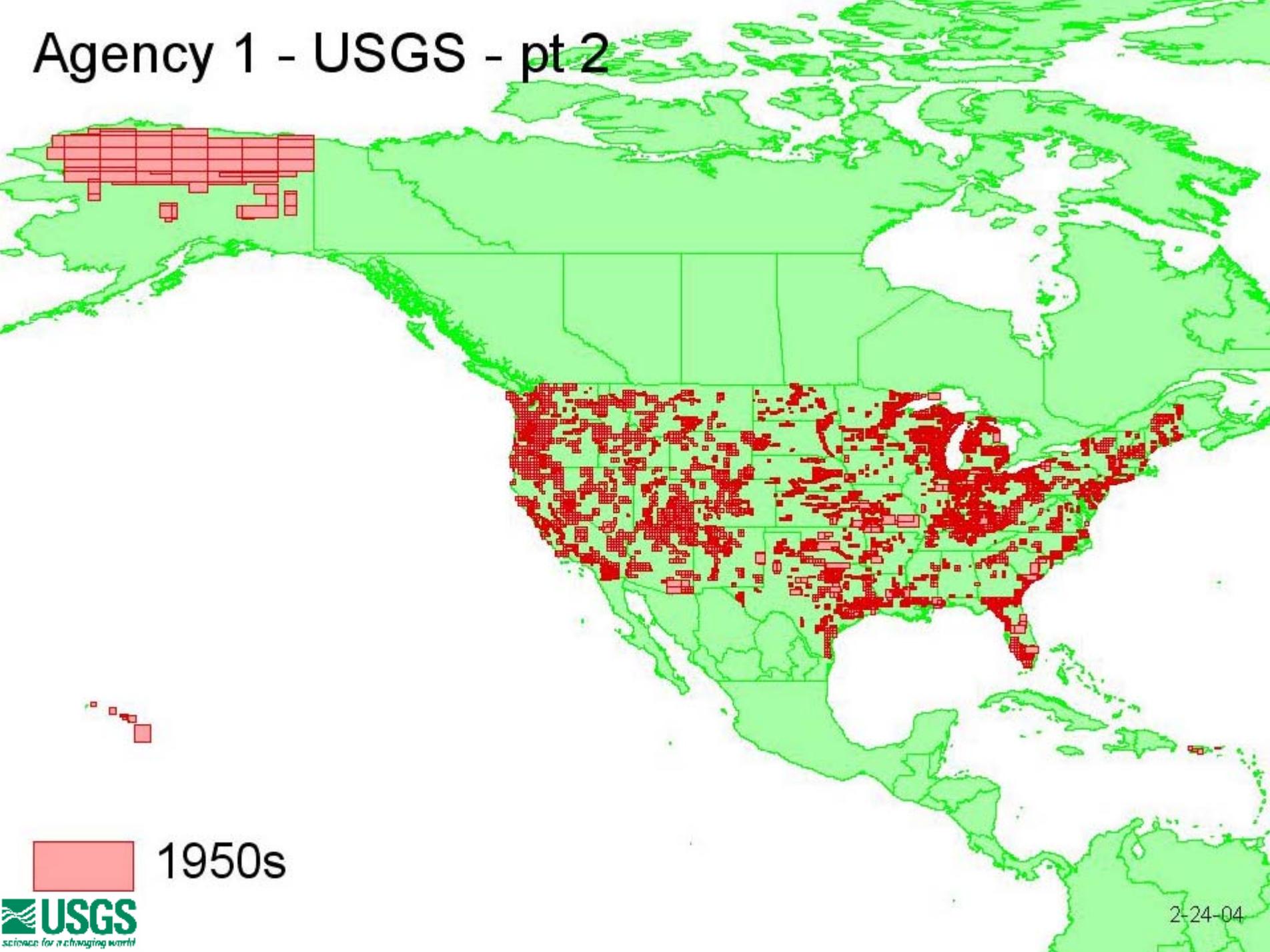


1940s



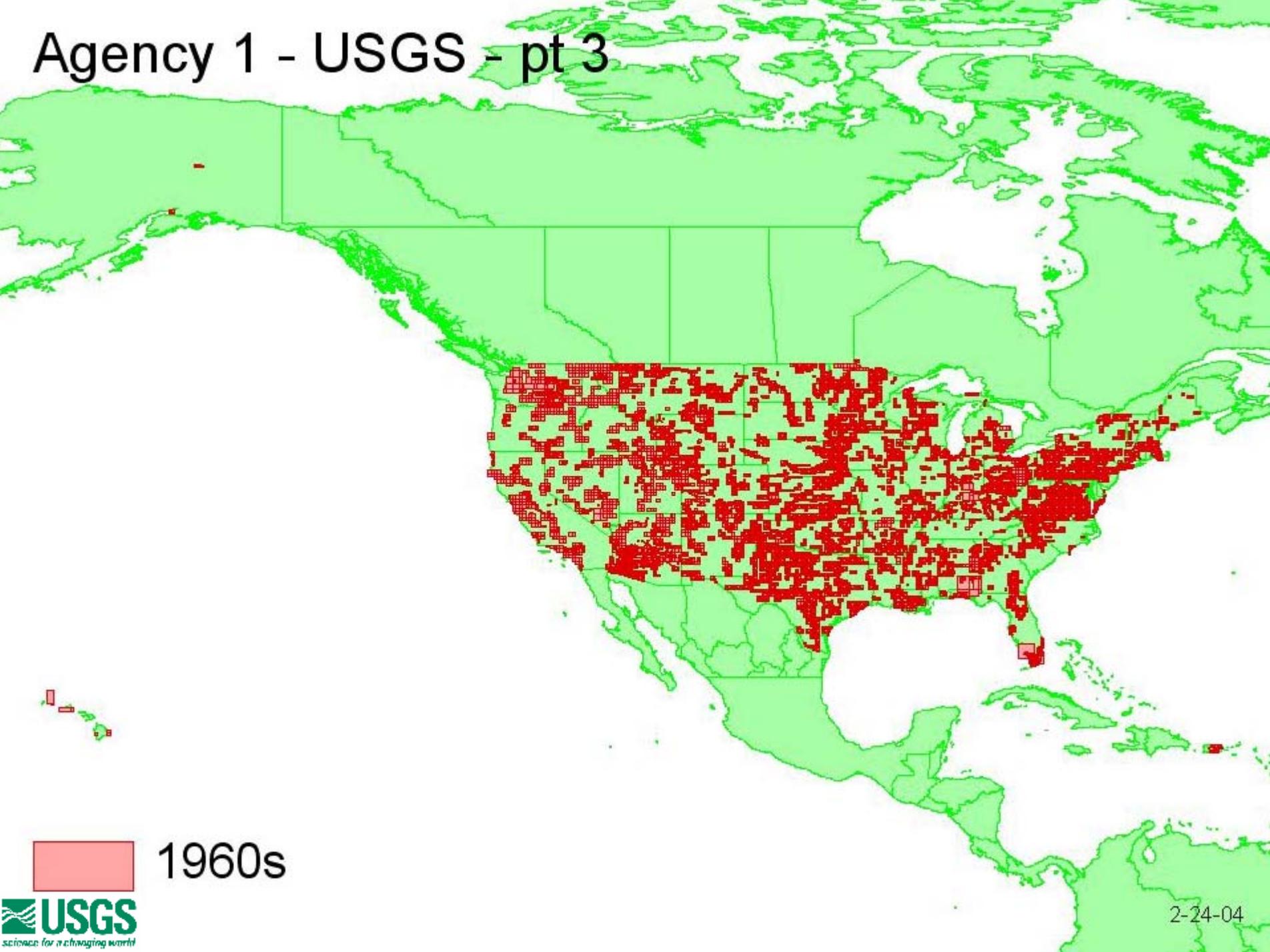
1930s

# Agency 1 - USGS - pt 2



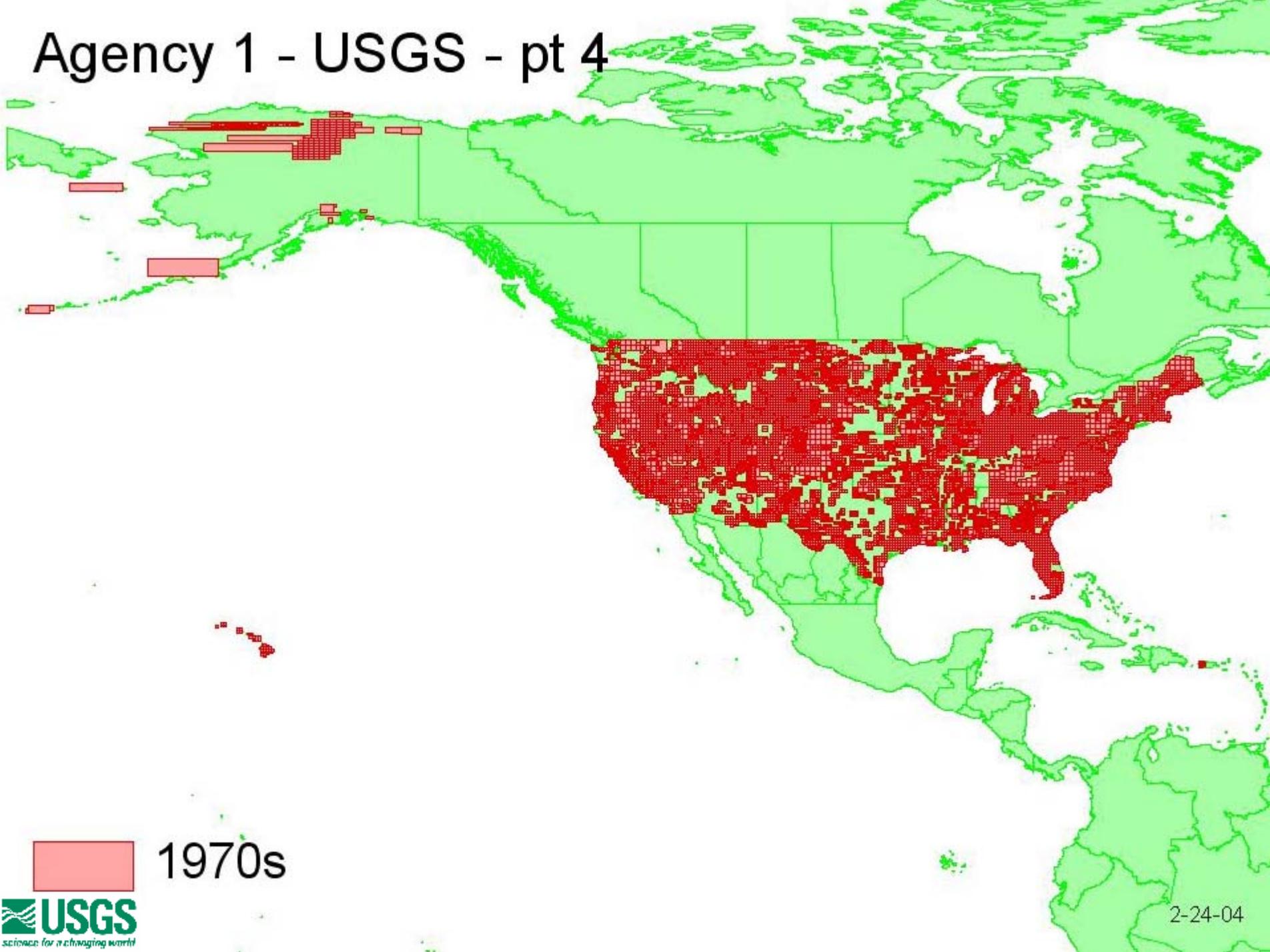
1950s

# Agency 1 - USGS - pt 3



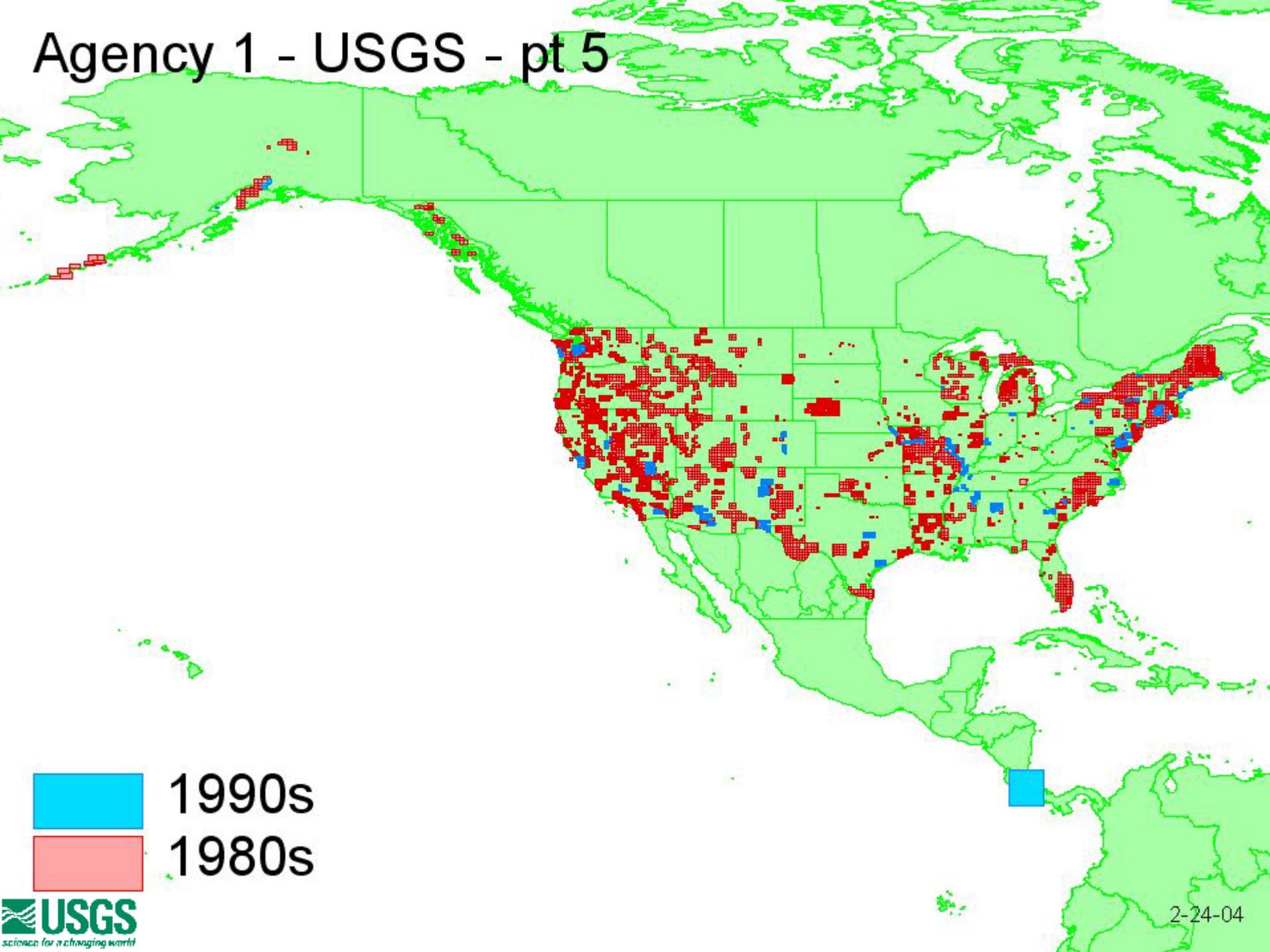
1960s

# Agency 1 - USGS - pt 4



1970s

# Agency 1 - USGS - pt 5

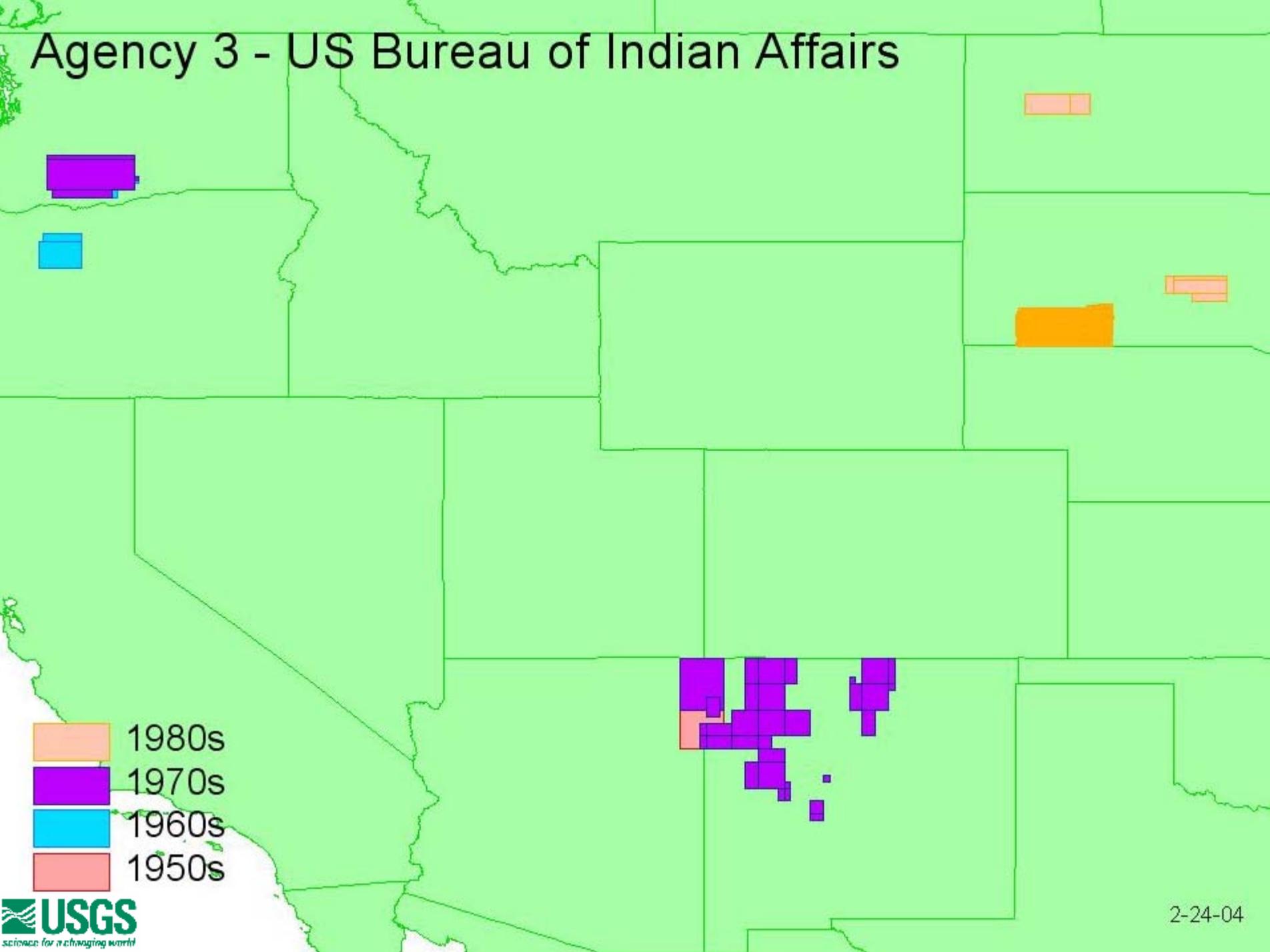


1990s



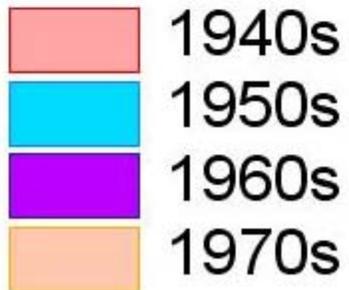
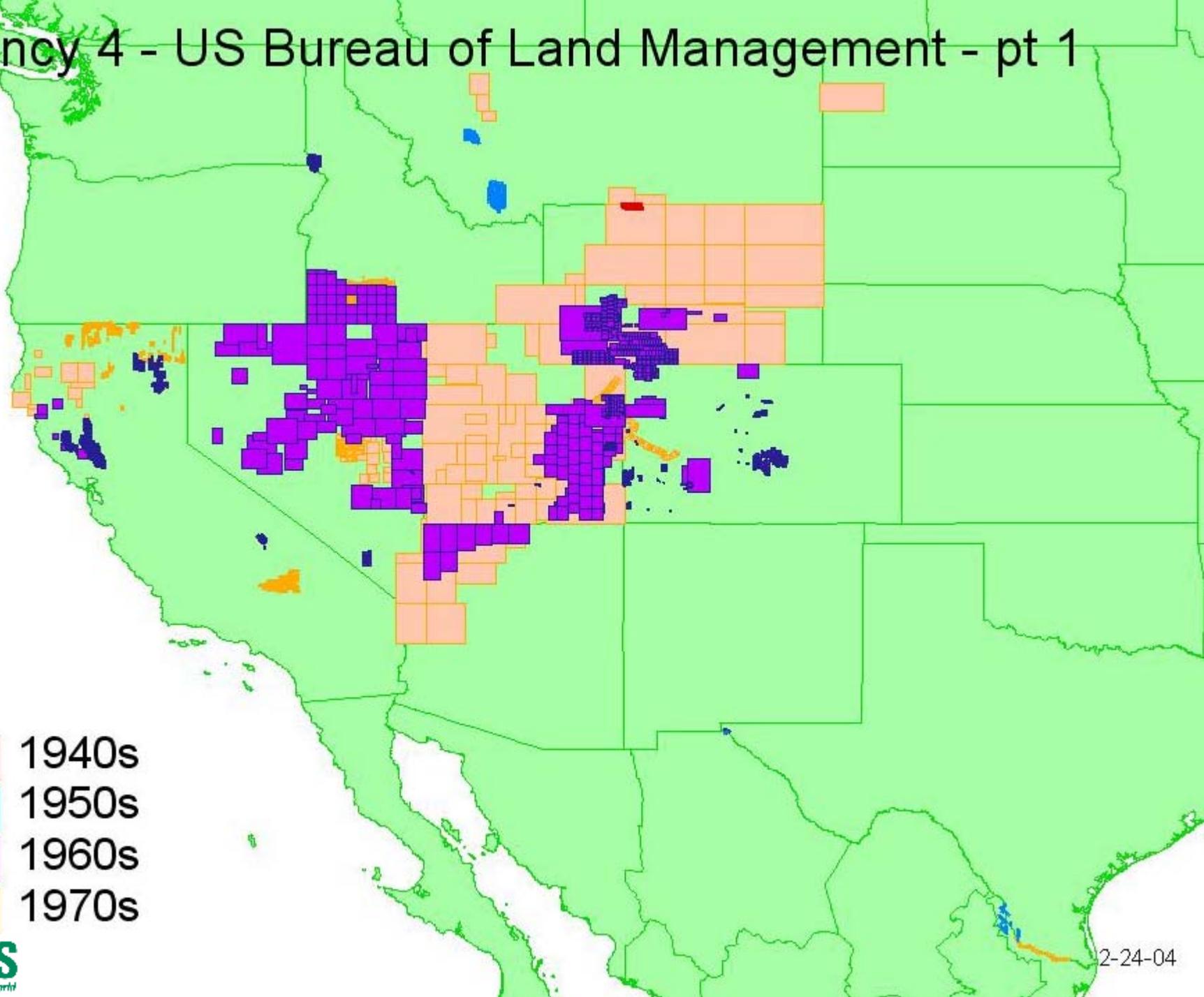
1980s

# Agency 3 - US Bureau of Indian Affairs



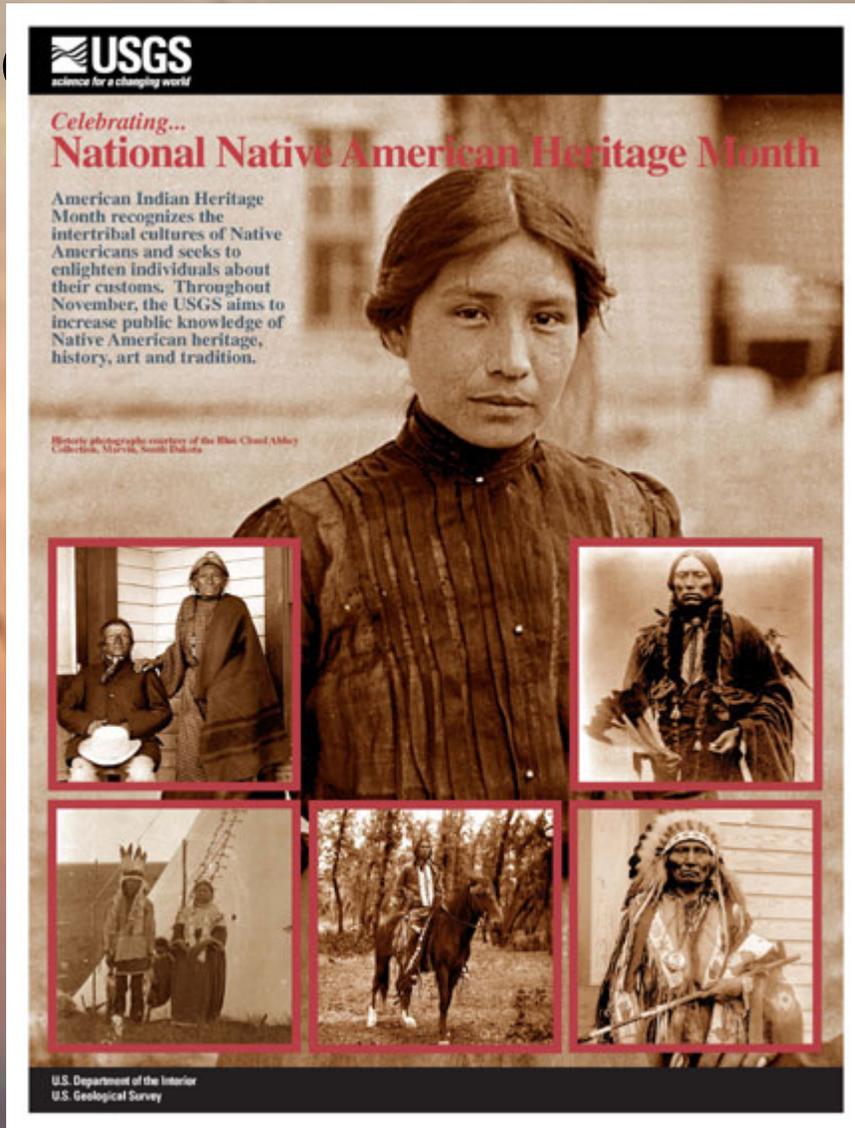
- 1980s
- 1970s
- 1960s
- 1950s

# Agency 4 - US Bureau of Land Management - pt 1



# Cultural Preservation

- **Blue Cloud Abbey Archive**
  - 1000's of images in N. Plains
  - Silver plates scanned, restored, printed
  - Collaboration with Sisseton/Wahpeton Tribe



# USGS Contacts

- **Susan Marcus**  
Director's Office: American Indian/Alaska Native  
U.S. Geological Survey  
104 National Center  
12201 Sunrise Valley Drive  
Reston, Virginia 20192  
703-648-4437; fax 703-648-5470; [smarcus@usgs.gov](mailto:smarcus@usgs.gov)
- **Gene Napier**  
Central Region and Geography Discipline: American Indian/Alaska Native Liaison  
EROS Data Center  
Sioux Falls, South Dakota 57198  
605-594-6088; fax 605-594-6154; [enapier@usgs.gov](mailto:enapier@usgs.gov)
- **Cyndee Matus**  
Western Region: American Indian/Alaska Native  
U.S. Geological Survey  
909 First Ave., Suite 700  
Seattle, WA, 98104  
206-220-4547; fax 206-220-4570;
- **Gayle Sisler**  
Eastern Region: Program Planning Advisor  
U.S. Geological Survey  
150 National Center  
12201 Sunrise Valley Drive  
Reston, Virginia 20192  
703-648-4412 fax 703-648-4588; [gsisler@usgs.gov](mailto:gsisler@usgs.gov)
- **Bonnie Gallahan**  
Information: American Indian/Alaska Native Liaison  
U.S. Geological Survey  
590 National Center  
12201 Sunrise Valley Drive  
Reston, Virginia 20192  
703-648-6084; fax 703-648-5755; [bgallahan@usgs.gov](mailto:bgallahan@usgs.gov)
- **Kevin Whalen**  
Biological Resources: American Indian/Alaska Native  
U.S. Geological Survey  
301 National Center  
Reston, Virginia 20192  
703-648-4062; fax 703-648-4238; [kwhalen@usgs.gov](mailto:kwhalen@usgs.gov)
- **Sharon Swanson**  
Geology: American Indian/Alaska Native Liaison  
U.S. Geological Survey  
913 National Center  
12201 Sunrise Valley Drive  
Reston, Virginia 20192  
703-648-6453; fax 703-648-6683;
- **John Szemraj**  
Equal Opportunity Office: American Indian/Alaska Liaison  
U.S. Geological Survey  
602 National Center  
Reston, Virginia 20192  
703-648-7011; fax 703-648-4445; [jszemraj@usgs.gov](mailto:jszemraj@usgs.gov)