



The NPS I&M Program's Efforts to Address Rapid Climate Change and Condition-based Management of Parks

Steve Fancy
National I&M Program Leader



Condition-based Management

“The Service will also strive to ensure that park resources and values are passed on to future generations in a condition that is as good as, or better than, the conditions that exist today.” – NPS Management Policies

- Need to know the status & trend in condition for key resources in each park
- Use information about resource condition for management decision-making, planning, interpretation, & other management activities

What the 32 I&M Networks provide:



- Inventory and monitoring data from “boots on the ground” data collection, analysis, and routine reporting
- Compilation, analysis, translation, and delivery of data collected by other programs and agencies (e.g., climate data, air quality)
- Expertise (scientists, modelers, quantitative ecologists, data managers, science communication specialists)
- Connection/communication between land managers and scientists through each network’s Board of Directors and Technical Advisory Committee

Core Duties of I&M Network Staff:



Using shared staff and funding to facilitate core inventories and do long-term monitoring of a modest set of vital signs:

1. **Determine status and trends in the condition of a few key natural resources for each park, and**
2. **Effectively deliver information to park managers, planners, interpreters, scientists, and other key audiences.**

I&M is NOT a Stand-Alone Program
(parks wouldn't get as much if it were)

Minimum Standards

- Peer-reviewed, approved monitoring plan blessed by Board of Directors (park superintendents)
- Peer-reviewed protocols, Oakley et al. 2003 standards
- Data Management Plan (1/3 of resources rule)
- Relational Databases (NRDT) with routine data entry and quality standards
- Routine analysis and reporting of results to parks
- Annual accomplishment reports, work plans, budgets, shared amongst all of the parks in the network
- Appropriate level of peer review on all products

Guidelines for long-term monitoring protocols

Karen L. Oakley, Lisa P. Thomas, and Steven G. Fancy

Abstract Monitoring protocols are detailed study plans that explain how data are to be collected, managed, analyzed, and reported, and are a key component of quality assurance for natural resource monitoring programs. Protocols are necessary to ensure that changes detected by monitoring actually are occurring in nature and not simply a result of measurements taken by different people or in slightly different ways. We developed and present here guidelines for the recommended content and format of monitoring protocols. The National Park Service and United States Geological Survey have adopted these guidelines to assist scientists developing protocols for more than 270 national park units.

Key words format, guidelines, monitoring, national park, natural resources, policy, protocol, sampling

NPS-USGS Protocol Standards **(REQUIRED)**:

Wildlife Society Bulletin 2003 31(4): 1000-1003.



Search A to Z

Nature & Science »

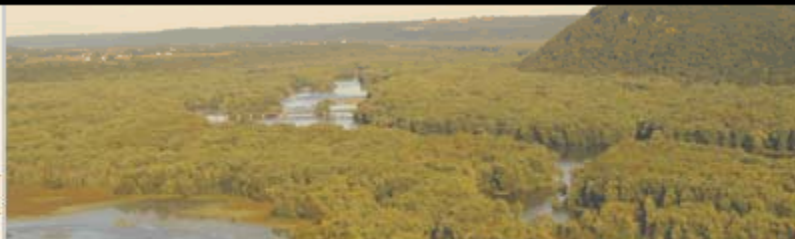
Inventory & Monitoring »

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Network Vital Signs

Air Quality
Aquatic Invertebrates
Black-tailed Prairie Dogs
Breeding Birds
Elemental Contaminants
Fish Communities
Invasive Exotic Plants
Land Use/Land Cover
Local Climate
Missouri Bladderpod
Plant Communities
Prairie Fringed Orchid
Spring Communities
Wetlands
White-Tailed Deer



Heartland I&M Network and Prairie Cluster Prototype Monitoring Program

NPS » Nature & Science » Inventory & Monitoring » Networks » Heartland Network

Heartland Network Inventory and Monitoring Program

The Inventory and Monitoring Program is a major component of the National Park Service's strategy to improve park management through greater reliance on scientific information.



HTLN Newsletter
[1,024k PDF File]

To carry out its mission, the National Park Service (NPS) serves as a steward for the preservation of America's national parks and their resources. The NPS has initiated a service-wide, network-based natural resource inventory and monitoring (I & M) program to address the lack of credible scientific information available to parks. The purpose of the program is to design and implement long-term ecological monitoring and provide information for park managers to evaluate the integrity of park ecosystems and better understand ecosystem processes.

The goals of Inventory and Monitoring networks are:

- inventory the natural resources and park ecosystems under National Park Service stewardship to determine their nature and status;
- monitor park ecosystems to better understand their dynamic nature and condition, and to provide reference points for comparisons with other, altered environments;
- establish natural resource inventory and monitoring as a standard practice throughout the National Park

Parks in this Network

Please select a park



Park Map

National I&M Map

HTLN Quick Links

Monitoring Plan

Data Management Plan

Contact Us

National Park Service Inventory & Monitoring

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Network Vital Signs

- Air Quality
- Aquatic Invertebrates
- Black-tailed Prairie Dogs
- Breeding Birds
- Elemental Contaminants
- Fish Communities
- Invasive Exotic Plants
- Land Use/Land Cover
- Local Climate
- Missouri Bladderpod
- Plant Communities
- Prairie Fringed Orchid
- Spring Communities
- Wetlands

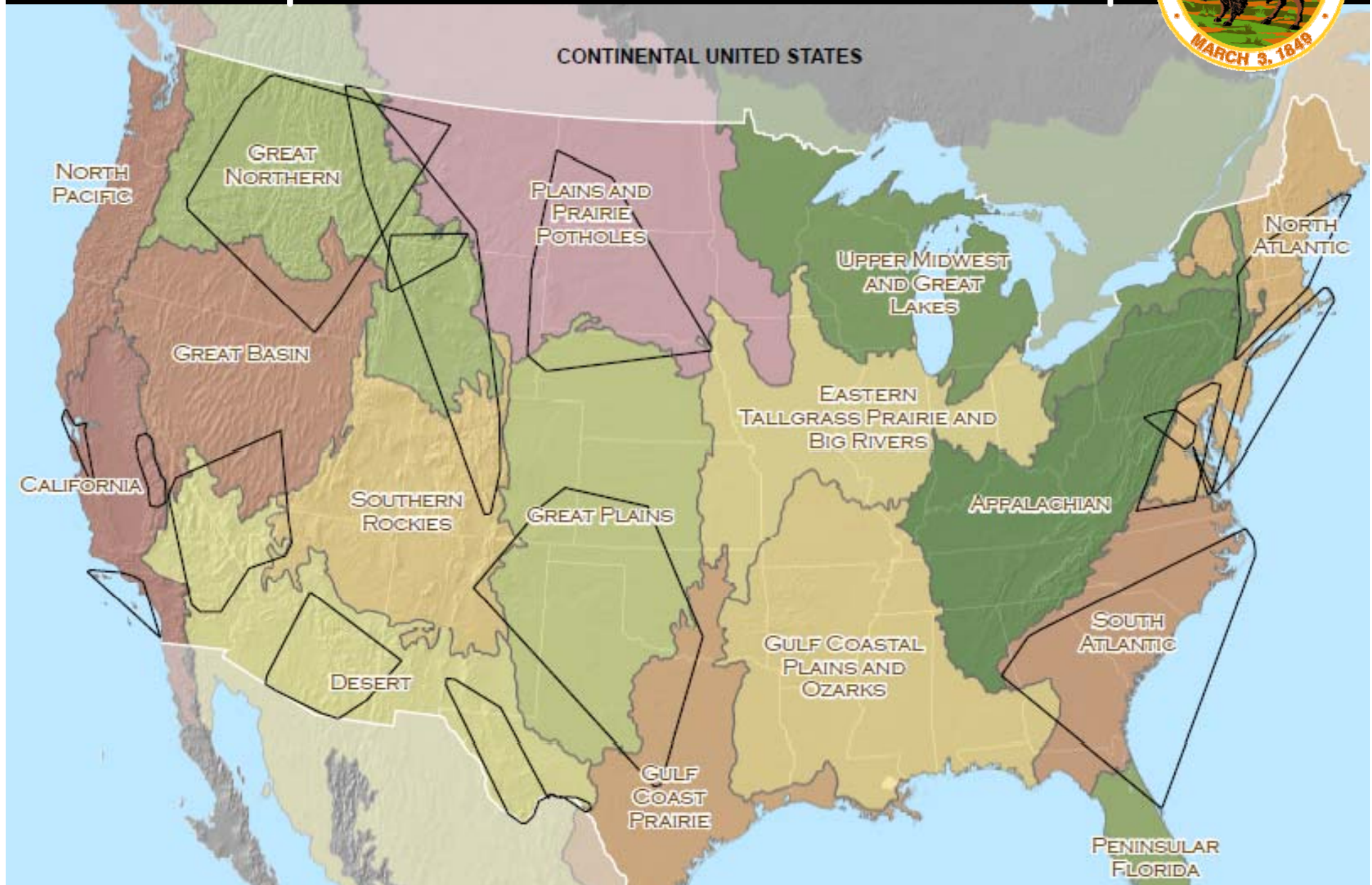
■ Plant Community Monitoring

- Summary | James, K. 2008. Forest Community Monitoring Baseline Report, Pea Ridge National Military Park. Natural Resource Technical Report NPS/HTLN/NRTR—2008/082. National Park Service, Fort Collins, Colorado.
- Summary | James, K. 2008. Forest Community Monitoring Baseline Report, Hot Springs National Park. Natural Resource Technical Report NPS/HTLN/NRTR—2008/081. National Park Service, Fort Collins, Colorado.
- Summary | James, K., and DeBacker, M. 2007. Plant Community Monitoring Trend Report, Homestead National Monument of America. Natural Resource Technical Report NPS/HTLN/NRTR—2007/028. National Park Service, Fort Collins, Colorado.
- Summary | James, K., and DeBacker, M. 2007. Plant Community Monitoring Trend Report, Pipestone National Monument. Natural Resource Technical Report NPS/HTLN/NRTR—2007/029. National Park Service, Fort Collins, Colorado.
- Summary | James, K., and DeBacker, M. 2007. Plant Community Monitoring Trend Report, Tallgrass Prairie National Preserve. Natural Resource Technical Report NPS/HTLN/NRTR—2007/030. National Park Service, Fort Collins, Colorado.
- Summary | Williams, M.H., S.A. Leis, and P. Christiansen. 2007. Evaluation of fire effects and restoration progress through 21 years of prairie vegetation monitoring at Herbert Hoover National Historic Site, 1982-2005. Natural Resource Technical Report NPS/HTLN/NRTR—2007/052. National Park Service, Fort Collins, Colorado.
- Sasseeen, A., and DeBacker, M. 2006. Baseline Plant Community Monitoring Report, Tallgrass Prairie National Preserve. Natural Resource Technical Report NPS/HTLN/NRTR—2006/019. National Park Service, Fort Collins, Colorado.
- 2005 Agate Fossil Beds NM & Scotts Bluff NM Report
- 2005 George Washington Carver NM Report
- 2005 Scott's Bluff NM USGS Grazing Research Report
- 2004 Effigy Mounds NM Report
- 2004 Herbert Hoover NHS Preliminary Report
- 2003 Wilson's Creek NB Report on Tornado Damage to Vegetation
- 2003 Woodland Vascular Plant Inventory at Homestead NM of America

■ Prairie Fringed Orchid Monitoring - PIPE

- Summary | Young, C.C., L.W. Morrison, J.L. Haack, and G. Wagner,. Summary Report: Western Prairie Fringed Orchid Monitoring at Pipestone National Monument, 1993-2007. Natural Resource Technical Report NPS/HTLN/NRTR—2007/059. National Park Service, Fort Collins, Colorado. (NPS Only)

DOI Geographic Areas and examples of I&M Networks overlap



Data Sets that we have available to share w/ others:

Land Cover

Enhanced NLCD 1992
NLCD 1992
NLCD 2001
NLCD Change Product
NLCD Impervious Surface
NLCD Tree Canopy
Historic Natural Fire Regime
LandFire - all products
Land cover diversity (Simpson's)
NatureServe Ecological Systems
GAP/ReGAP
Land cover characteristics
Forest fragmentation
Morphological pattern metrics
Forest cover types
Converted and natural landcover

Landform

DEM - 10, 30, and 120 meter
Slope and aspect
Depth to bedrock
Sand, silt, clay fractions
Crop capability
Geology

Climate

Precipitation
Temperature (min/max, variability)
Growing season days
NDVI
Sea surface temperature

Transportation

Roads (Multiple data sources)
Railroads (U.S. and Canada)
National Waterways

Population

Nighttime lights (1992/93, 2000)
Populated places
U.S. cities
U.S. urban areas
1990, 2000 Census, block group
Population projections by county
SEDAC census grids
Housing density (1940-2040)
Inventoried roadless area
Agriculture census by county
Water use by county
Conservation risk index
Wildland Urban Interface

Boundaries

Omernick Ecoregions (and CEC)
Bailey Ecoregions
Physiographic Provinces
UNEP Large Marine Ecosystems
States
Counties
NPS Units (with various buffers)
NPS Vital Sign Networks
Protected Areas Boundaries
Federal Lands
National Wilderness Preservation System
Continental Divide
NCDC Climate Divisions
NEON Domains

Hydrology

Hydrologic Units (4, 6, 8, 12-digit)
NHD (med and high resolution)
Impoundments
Aquifers
Ground water climate response network
Sea ice (North America)



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NPScape: Analysis of Park Landscape Dynamics

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Relevance of Project: Key Themes

- *Putting science* (landscape-level data/analyses) *into hands of park managers and planners* - contribution to park planning such as adaptation plans
- *Inter-agency climate change response* - applicable to vulnerability assessments, conservation planning
- Takes a *common, systemic approach* to a high-priority vital sign for I&M Networks

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NPScape Products & Deliverables

- Development of *Measures* and respective *Metrics*
- For initial effort activities were focused on six measures:
 - Conservation Status
 - Housing
 - Landcover
 - Pattern
 - Population
 - Roads

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Current Metrics

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Measure - Metric
Conservation Status – Area Protected
Conservation Status – Ownership Area / Category
Conservation Status – Ownership
Housing – Current Density
Housing – Recent Change (1990-2000) in Density
Housing – Historic Density (100m cells)
Housing – Projected Density (100m cells)
Landcover – Percent Natural vs. Converted
Landcover – Change in Natural vs. Converted
Landcover – Area / Category
Landcover – Percent Impervious
Pattern– grassland morphology; # = edge width scale
Pattern – forest morphology; # = edge width scale
Pattern – patch size (grassland); # = edge width scale
Pattern – patch size (forest); # = edge width scale
Pattern – grassland density; # = moving window size
Pattern – forest density; # = moving window size
Population –Total; # = 1990, 2000
Population – Density; # = 1990, 2000
Population – Recent Change 1990-2000 (% total and density)
Population – Historic Change, by County
Population – Projected Change, by County (% total and density)
Roads – Road Density
Roads – Distance from Roads
Roads – Area without Roads

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NPScape Products & Deliverables

- Documented procedures for data processing and metric calculation (SOPs)

SOP: Acquire and Process 2000 Census Data Version: October 28, 2009

Inventory and Monitoring Program National Park Service U.S. Department of the Interior

Population Measures Processing SOP
Acquiring and Processing 2000 Census Data at the Block Group Level – Detailed Instructions for Access 2007

Suggested Citation: NPS-OWM (2009). NPScape Population Measures Processing SOP - Acquiring and Processing 2000 Census Data at the Block Group Level – Detailed Instructions for Access 2007. Office of Inventory, Monitoring, and Evaluation - National Park Service, Fort Collins, CO

Revision #	Date	Revision Summary	Revised by
0.1	20090324	Initial version	Brent Rakes
0.2	20090602	Updates	Brent Rakes and Lisa Nelson
0.3	20090609	Corrections	Lisa Nelson
0.4	20090616	Updates for spatial feature corrections	Lisa Nelson
0.5	20090617	Streamlined processing	Lisa Nelson

Population Density and Recent Population Density Change Metrics Version: October 28, 2009

Inventory and Monitoring Program National Park Service U.S. Department of the Interior

Population Measures Processing SOP
Population Density and Recent Population Density Change Metrics

Suggested Citation: NPS-OWM (2009). NPS Landscape Dynamics Project Population Measures Processing SOP – Population Density and Recent Population Density Change Metrics Office of Inventory, Monitoring and Evaluation-National Park Service, Fort Collins, CO

Revision #	Date	Revision Summary	Revised by
0.1	20090324	Initial version	LN
0.2	20090330	Revisions	BP
0.1B	20090416	Cleanup	LN

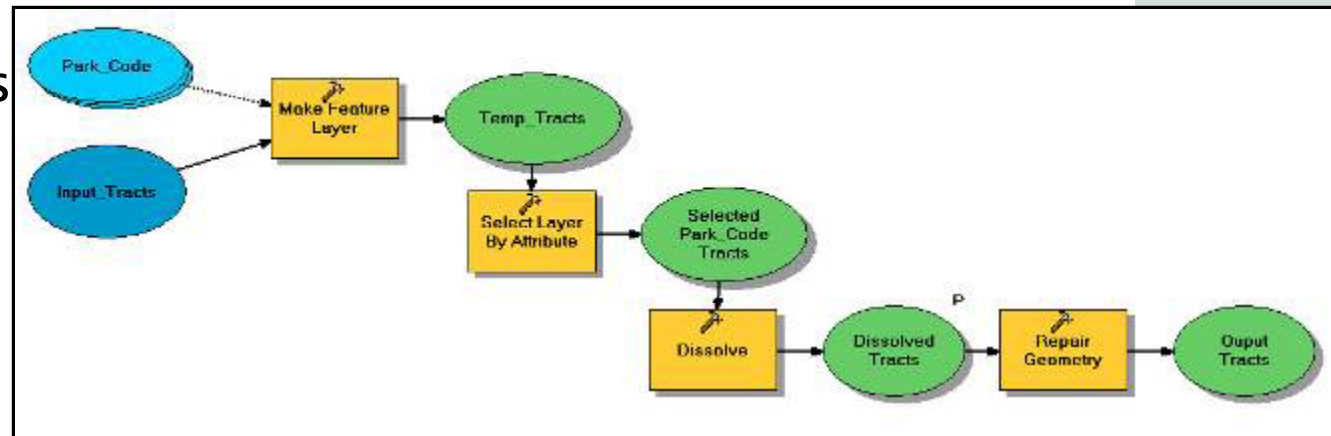
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- Geoprocessing tools and scripts



```
# Load required toolboxes...
gp.AddToolbox("C:/arcgis/ArcToolbox/Toolboxes/Analysis Tools.tbx")
gp.AddToolbox("C:/arcgis/ArcToolbox/Toolboxes/Conversion Tools.tbx")
gp.AddToolbox("C:/arcgis/ArcToolbox/Toolboxes/Data Management Tools.tbx")

Output_Feature_Class = Output_Workspace_or_Feature_Dataset + "\\\" + NPS_Unit_Code + "_AOA_" + Layer_Suffix
nps_bound_all_albers_Layer = "nps_bound_all_albers_Layer"

# Process: Make Feature Layer...
Argument = "[UNIT_CODE] = '" + NPS_Unit_Code + "'"
gp.MakeFeatureLayer_management(Input_NPS_Feature_Class, nps_bound_all_albers_Layer, Argument, "", "UNIT_CODE UNIT_CODE VISIBLE NONE")

# Process: Create 30km Buffer...
gp.Buffer_analysis(nps_bound_all_albers_Layer, Output_Feature_Class, BufferArea, "FULL", "ROUND", "NONE", "")

# Process: Add AOA_SQKM (4)...
gp.AddField_management(Output_Feature_Class, "AOA_SQKM", "DOUBLE", "8", "3", "", "", "NULLABLE", "NON_REQUIRED", "")
```

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NPScape Products & Deliverables

- Geoprocessing tools and scripts ready to run iteratively!

```
#YOU WILL NEED TO EDIT THE FOLLOWING PATHS
Unit_Code = "ACAD"
Input_AOA_Feature_Class = "C:\\NPSCAPE\\Reference\\AOA_Features_Preliminary.gdb\\AOA_30km\\ACAD_AOA_30km"

NLCD_1992_Dataset = "C:\\NPSCAPE\\Landcover\\SourceData\\lac_nlcd1992_conus.img"
NLCD1992_Reclass1 = "C:\\NPSCAPE\\Landcover\\SourceData\\lac1992_recode_level1classes.dbf"
NLCD1992_Reclass2 = "C:\\NPSCAPE\\Landcover\\SourceData\\lac1992_recode_level2classes.dbf"

NLCD_2001_Dataset = "C:\\NPSCAPE\\Landcover\\SourceData\\NLCD_USA.img"
NLCD2001_Reclass1 = "C:\\NPSCAPE\\Landcover\\SourceData\\lac2001_recode_level1classes.dbf"
NLCD2001_Reclass2 = "C:\\NPSCAPE\\Landcover\\SourceData\\lac2001_recode_level2classes.dbf"

LCC_Dataset = "C:\\NPSCAPE\\Landcover\\SourceData\\lcc_conus.img"
LCC_ReclassTable = "C:\\NPSCAPE\\Landcover\\SourceData\\lcc_recode_nc_change.dbf"

LNC_Reclass_Table = "C:\\NPSCAPE\\Landcover\\SourceData\\lnc_recode_2classes.dbf"

LPI_Dataset = "C:\\NPSCAPE\\Landcover\\SourceData\\LPI_conus.img"
LPI_Reclass_Table = "C:\\NPSCAPE\\Landcover\\SourceData\\lpi_recode.dbf"

NPScape_LandcoverProduct_Template_xml = "C:\\NPSCAPE\\Landcover\\SourceData\\NPScape_LandcoverProduct_Template
LogFile = "C:\\NPSCAPE\\Landcover\\LandcoverLogfile.txt"
Output_Workspace_or_Feature_Dataset = "C:\\NPSCAPE\\Landcover\\ProcessedData"

#END OF REQUIRED MODIFICATIONS
#####

from lac_AOACalculate_AreaPerCategory import lac_AOACalculate_AreaPerCategory
from lcc_AOACalculate_ChangeNaturalConverted import lcc_AOACalculate_ChangeNaturalConverted
from lnc_NaturalConverted import lnc_NaturalConverted
from lpi_AreaPerCategory import lpi_AreaPerCategory
from NPScape_Uutilities import *
```

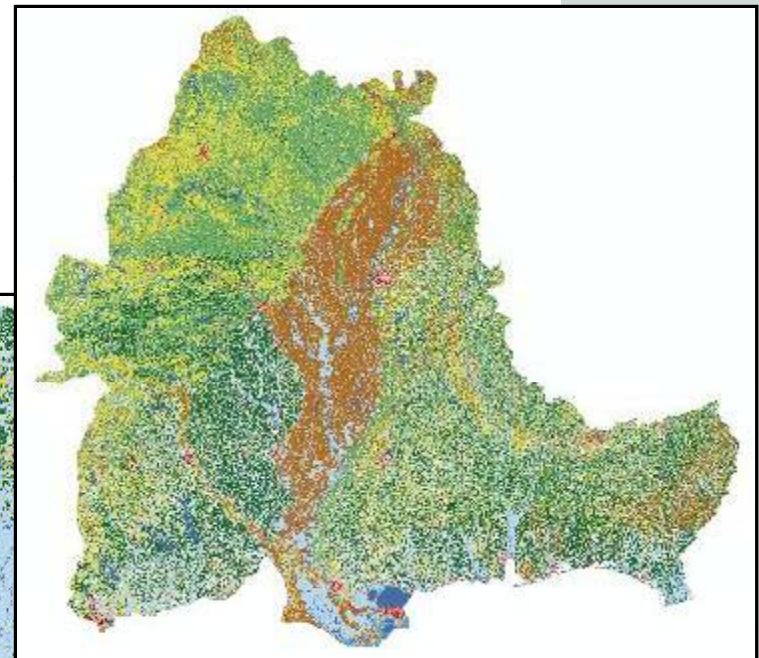
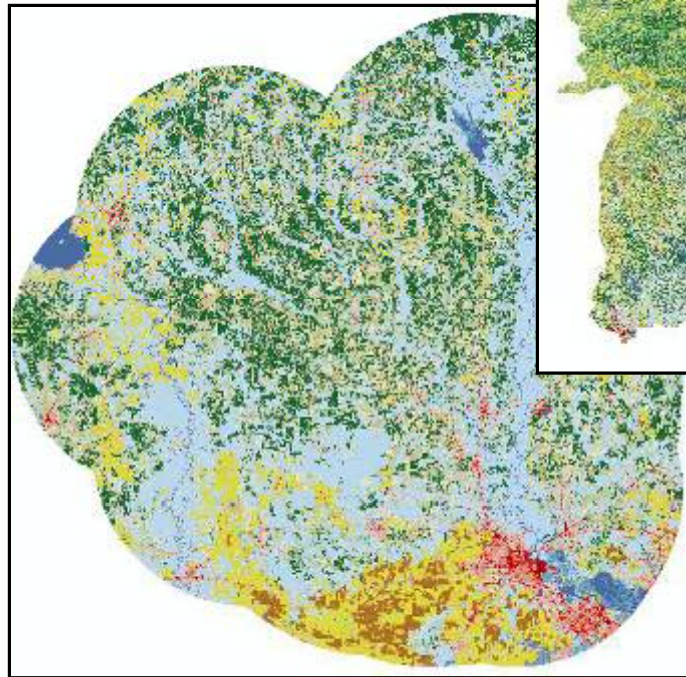
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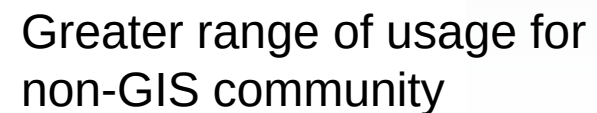
NPScape Products & Deliverables

- Procedures replicated for two distinct geographies, i.e., 30 km, and DOI LCC Geographic Areas



NPScape Products & Deliverables

-
- The map displays the Beaumont, Texas area. A large green shaded region covers the majority of the map, representing the 'Beaumont Area'. A smaller red shaded region is located in the center of the green area, representing the 'Beaumont Area'. The map includes a compass rose in the top right corner and a scale bar below it. The text 'Beaumont' is visible on the map. The bottom of the map features a copyright notice: 'Image U.S. Google Map Server', '© 2009 Google', 'Image USDA Farm Service Agency', and '© 2008 Terra Technologies'. The Google logo is also present in the bottom right corner.



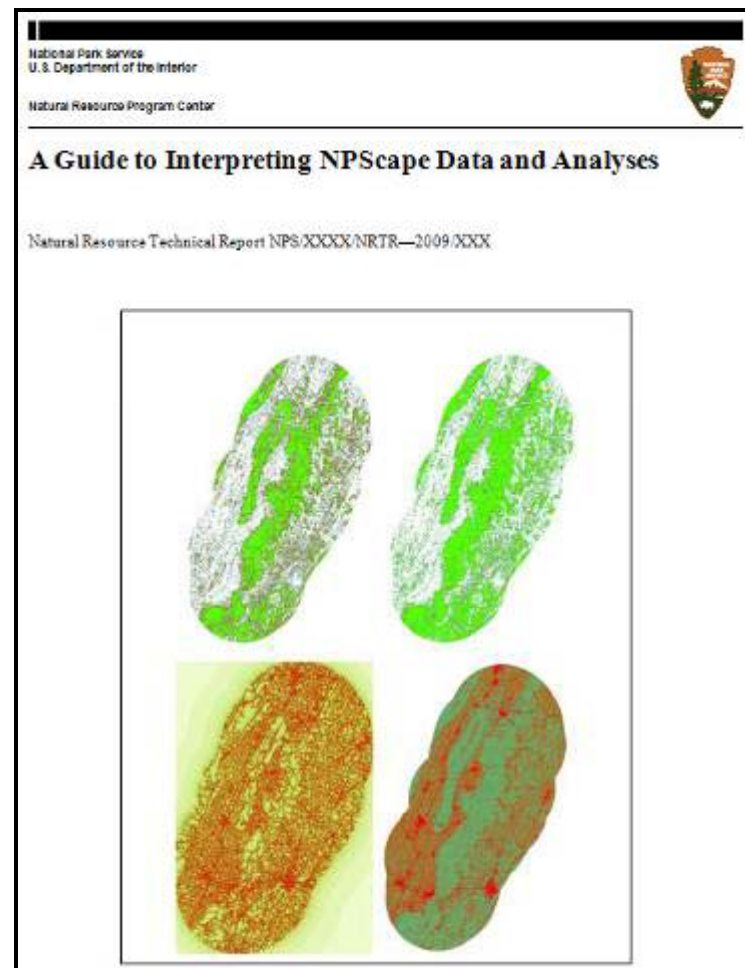
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NPScape Products & Deliverables

- Interpretive Guide: describes the scientific underpinning of NPScape measures and provides literature summaries, citations, and examples to put results in broader context



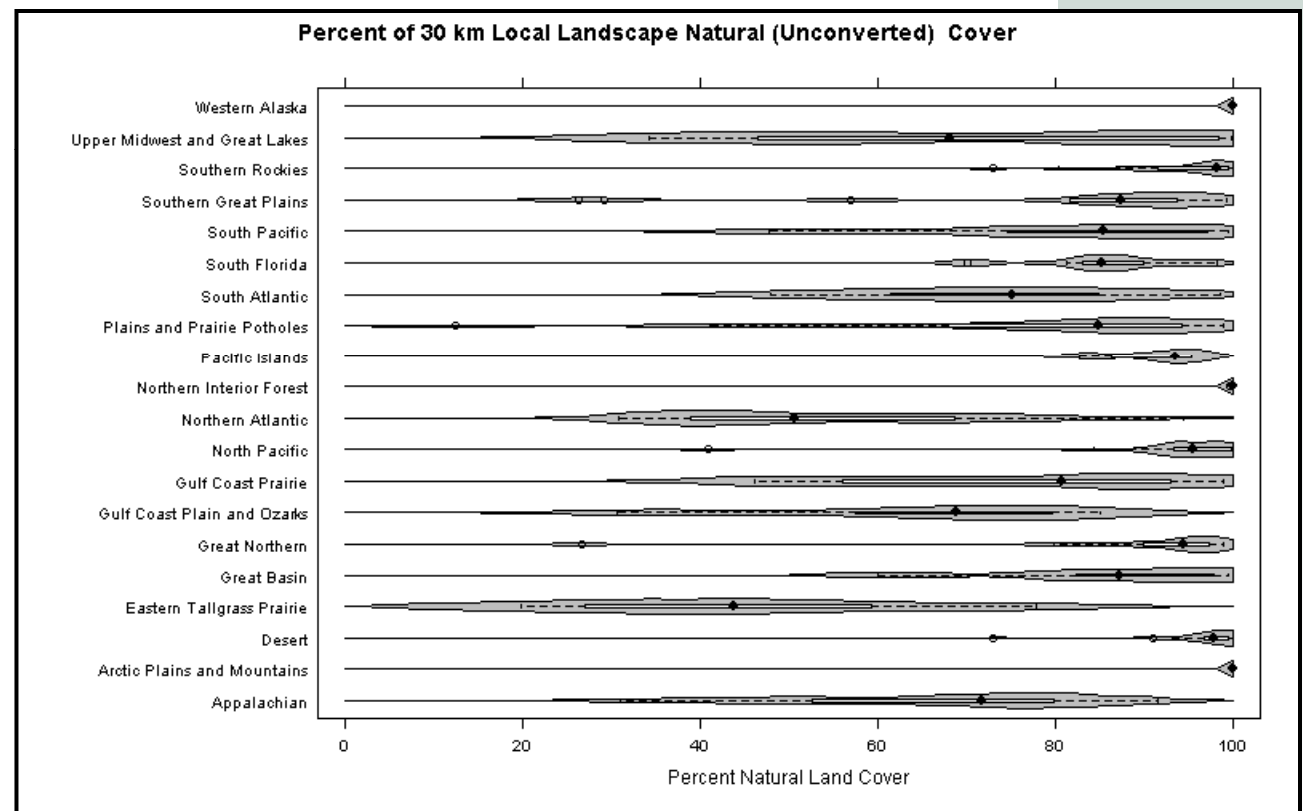
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NPScape Products & Deliverables

- Interpretive Guide and accompanying Appendix allows for comparison of metrics among LCC areas



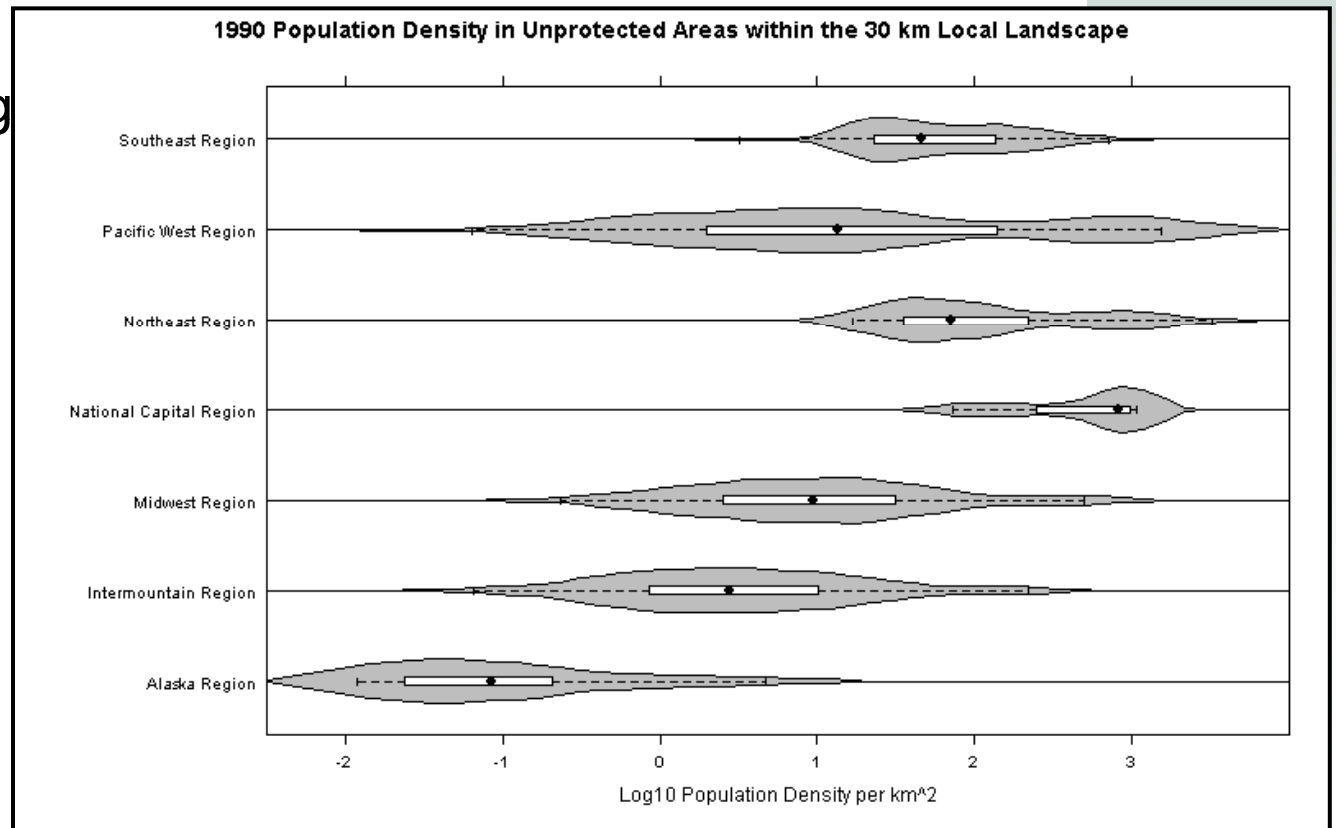
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NPScape Products & Deliverables

- Interpretive Guide and accompanying Appendix also allows for comparison of metrics by Region



NPS - USFWS I&M Programs Collaboration

The NPS and USFWS manage many of the largest, most intact natural areas in the nation, and through our connection and popularity with visitors and the public, will play an increasingly important role in promoting conservation and providing hope in a changing world.

The FWS will be co-locating the national staff for their new I&M Program with our national staff in Fort Collins, CO; our two agencies will be working closely together on I&M and data systems