

# *NPS Uses GPS to Assist GIS and Vegetation Inventory Overview*

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Biological Resources Management Division

US State and Local Subcommittee Aug-Sept 2008



## *Outline*

- *Program Overview*
- *Present Program Status*
- *Approach, Process & Products*
- *Hybrid Techniques & GPS*
- *Available Data / Website*



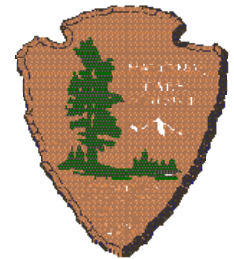
## *What is it?*

- High priority requirement of the NPS I&M Program
- National (Service Wide) Program
- Begins long term vegetation monitoring program
- Has many short term immediate applications



# *NPS I&M Program*

- Base Cartographic
- Soils
- Geology
- *Vegetation*
- Bibliographies
- Species lists
- Air quality
- Water quality



# *Standards*

- NPS management policies, standards & guidelines
- Federal Geographic Data Committee standards
  - metadata, transfer, classification etc.
- Nationally consistent, hierarchical, classification scheme
- National Map Accuracy Standards
- Thematic accuracy >80% per class
- Scale of 1:24,000
- Minimum mapping unit of 0.5 hectare



# *Products from the Program*

- Aerial photography/ imagery (hardcopy / digital, some new DOQQs)
- Field data (hardcopy and database)
- Classification report (Description and Key)
- Photo interp report (Description and Key)
- Accuracy report
- Vegetation map data (digital coverage)
- All appropriate metadata





# *Major Steps for the Park*

- Scoping meeting
- Data review
- Data acquisition
- Field sampling
- Classification characterization
- Photo/ image interpretation, mapping and automation
- Accuracy assessment
- Final product review





# *Preplanning*

- Collection and review of existing information
- Planning and review meeting
- Initial site visit
- Preliminary classification system and sampling approach





# *Photos of Vegetation Associations*

- Taken in conjunction with the fieldwork



Midwest Pondweed  
Submerged Aquatic  
Wetland



Black Spruce /  
Feathermoss Forest



# *FGDC National Vegetation Classification Standard*

## **Specifications and Requirements**

- Based on sound science
- Repeatable
- Based on standard field & data analysis methods
- Broadly accepted
- Classify existing biological associations
- Ecologically meaningful
- Mappable from imagery



### **Prosopis velutina Shrubland Alliance**

(Photograph taken by Aerial Information Systems, Redlands, California)



# *FGDC National Vegetation Classification Standard*

## **Specifications and Requirements**

- Hierarchically organized
- appropriately scaled
- Flexible and open ended
- Well documented
- Can be cross-walked with other frequently used systems



**Shrubland Alliance – Fuel Type  
4 (Chaparrel); or Type 5 (Brush  
– 2ft.)**



# *FGDC National Vegetation Classification System*

## ● A. **PHYSIOGNOMY**

- **Division/Order** - Tree Dominant (dominant life form)
- **Class** - Woodland (spacing & height of dominant form)
- **Subclass** - Evergreen Woodland (morphological & phenological similarity)
- **Group** - Temperate Evergreen Needle-leaved (climate, latitude, growth form, leaf form)
- **Formation** - Evergreen Needle-leaved Woodland with Rounded Crowns (mappable units)

## ● B. **FLORISTICS**

- **Alliance (Cover Type)** - Douglas Fir Woodland (dominant species)
- **Association (Community)** - Douglas Fir / Snowberry Woodland (subdominant or associated species)



# *GPS Challenge Team Canopy Testing and NPS Usage*



● Powell, ID test site







# *GPS Challenge Team Canopy Testing and NPS Usage*



● Lubrecht, MT test site



# Vegetation Types in GPS Tests

- Lubrecht, MT test site



## Field data used ...

- ...to establish the vegetation associations included in the final park based classification system, ...

Community Name (Association)	Common Name (Synonym)	Elcode*	Formation Code*
<b>WETLANDS</b>			
<b>Bogs</b>			
<b>Treed Bogs</b>			
<i>Picea mariana</i> / <i>Ledum groenlandicum</i> / <i>Carex trisperma</i> / <i>Sphagnum</i> spp. Forest	Black Spruce Bog	CEGL002485	IA.8.N.g.
<b>Shrub Bogs</b>			
<i>Picea mariana</i> / <i>Chamaedaphne calyculata</i> / <i>Sphagnum</i> spp. Dwarf-Shrubland	Black Spruce / Leatherleaf Semi-treed Bog	CEGL005218	IV.A.1.N.g.
( <i>Chamaedaphne calyculata</i> ) - <i>Ledum groenlandicum</i> - <i>Kalmia polifolia</i> Bog Dwarf-shrubland	Leatherleaf Bog	CEGL002498	IV.A.1.N.g.
<b>Northern Shrub and Graminoid Fens</b>			
<b>Shrub Fens</b>			
<i>Alnus incana</i> - <i>Salix</i> spp. - <i>Betula pumila</i> / <i>Chamaedaphne calyculata</i> Shrubland	Bog Birch - Willow Shore Fen	CEGL005227	III.B.2.N.g.
<i>Chamaedaphne calyculata</i> - <i>Mirrica asale</i> / <i>Carex</i>	Leatherleaf - Sweet Gale Shore Fen	CEGL005228	IV.A.1.N.g.



## *Field data used ...*

- ... to develop detailed descriptions of the vegetation associations, ...

**Map Code:** PW  
**Association Name:** Potamogeton spp. – Ceratophyllum spp. Midwest  
Herbaceous Vegetation  
**Association Common Name:** Midwest Pondweed Submerged Aquatic Wetland

**Description:**

Diagnostic features of the type are floating leaf aquatic <10% cover, and dominance by submerged aquatics, mainly *Valissneria americana*, *Potamogeton* spp., and *Myriophyllum sibiricum*. The type is analogous to Ontario's W1 and W3 (Harris et al. 1995). Where floating aquatics, especially *Nymphaea odorata* and *Nuphar variegatum*, increase in cover this community grades into the Northern Water Lily Aquatic Wetland. Beaver floodings most commonly have >10% cover of floating aquatics and are therefore usually colonized by the Northern Water Lily Aquatic Wetland. The stands at Voyageurs are most like subgroup C of the global description.



# Field data used ...

... and to  
create a key  
for  
identifying  
vegetation  
associations  
in the field.

USGS-NPS Vegetation Mapping Program  
Voyageurs National Park

## 5. DICHOTOMOUS KEY TO THE PLANT COMMUNITIES AT VOYAGEURS NATIONAL PARK

Version 3.6

- This is a key to the community types identified in the park. All assessments of plant communities in the field must be done on an area of 625 m<sup>2</sup> (50m diameter around point).
- The term dominance in the context of woodland communities means greater than 25% cover. In the context of forest, shrub and herbaceous communities, dominance means greater than 60% cover.
- Species listed after "a\*" are indicator species for that community type and are often (but not always) present.
- When the term "total tree canopy cover" is used, this refers to the absolute canopy cover. All other cover values refer to relative canopy cover e.g. if total canopy cover is 40%, >25% cover of tamarack refers to 25% of the 40% total cover. The linkages between community types and map units are presented in Table 5, page 37.

1. UPLANDS. Absence of standing water and/or peat soil. Mineral soil that is not saturated throughout the growing season.

2. Well drained soils. Canopy dominated by one or more of the following: *Pinus* spp., *Quercus* spp., *Picea* spp., *Betula* spp., *Populus tremuloides*, *P. grandidentata*. If dominated by *Populus tremuloides* or *P. grandidentata* then *P. balsamifera*, *Thuja occidentalis*, or *Fraxinus nigra* present in canopy or shrub layers at <10% cover.  
\* *Clintonia borealis*, *Corylus cornuta*, *Prunus virginiana*, *Viburnum rafinesquianum*.

3. Dominated by shrubs or herbaceous vegetation. Total tree canopy <25%.

4. Dominated by herbaceous vegetation (shrub cover < 25%). Poverty Grass Granite Barrens (5157)

4. Dominated by shrubs (shrubs > 25% cover). Boreal Hazelnut-Serviceberry Rocky Shrubland (5197)

3. Forest or Woodland. Total tree canopy >25% (or if <25%, dominated by bedrock and lichens, not shrubs).

5. Canopy dominated by evergreen trees or a mixture evergreen and deciduous trees. Percent cover of evergreen trees in canopy > 25%.

6. Canopy dominated by *Pinus banksiana* with or without *Quercus ellipsoidalis* or *Populus* spp.

7. Canopy consisting primarily of *Pinus banksiana*, *Quercus ellipsoidalis* or *Populus* spp. absent or present < 25%.

8. Woodland. Total tree canopy cover <60% and canopy closure prevented by the presence of exposed bedrock.

9. Sparsely vegetated, total tree canopy cover < 25%. Dominated by bedrock and lichens. Jack Pine / Lichen Rocky Barrens (2491)

9. Total tree canopy cover 25-60%. Boreal Pine Rocky Woodland (jack pine phase) (2483)

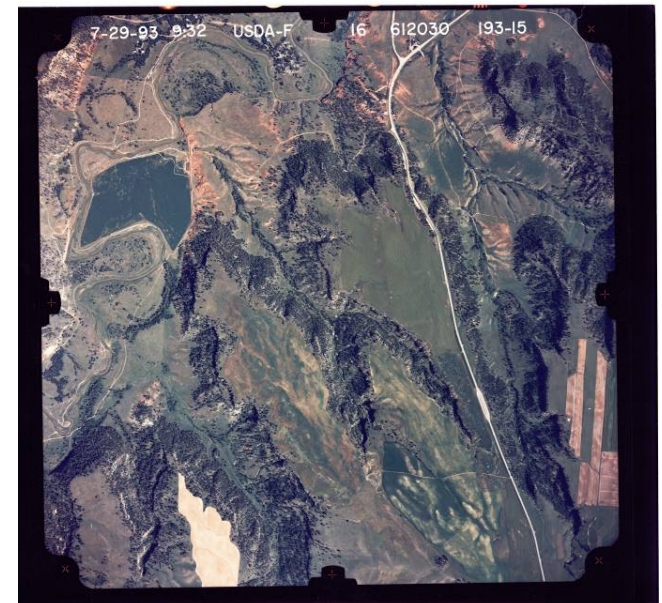
8. Forest. Total tree canopy cover > 60%. Or, if <60%, than canopy closure not prevented by the presence of exposed bedrock. Jack Pine / Balsam Fir Forest (2437)

...

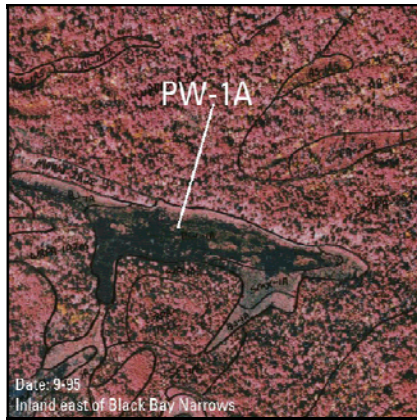


# *Aerial Photo Interpretation*

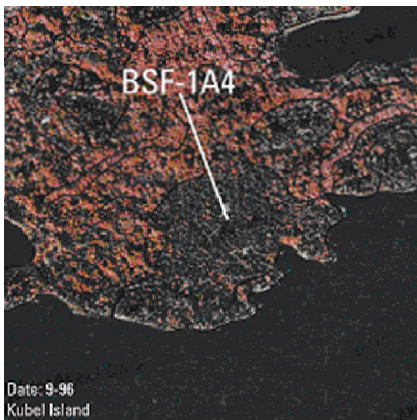
- Once the vegetation classification system is established, interpretation of the aerial photographs can be finalized.



# *Photointerpretation Key*



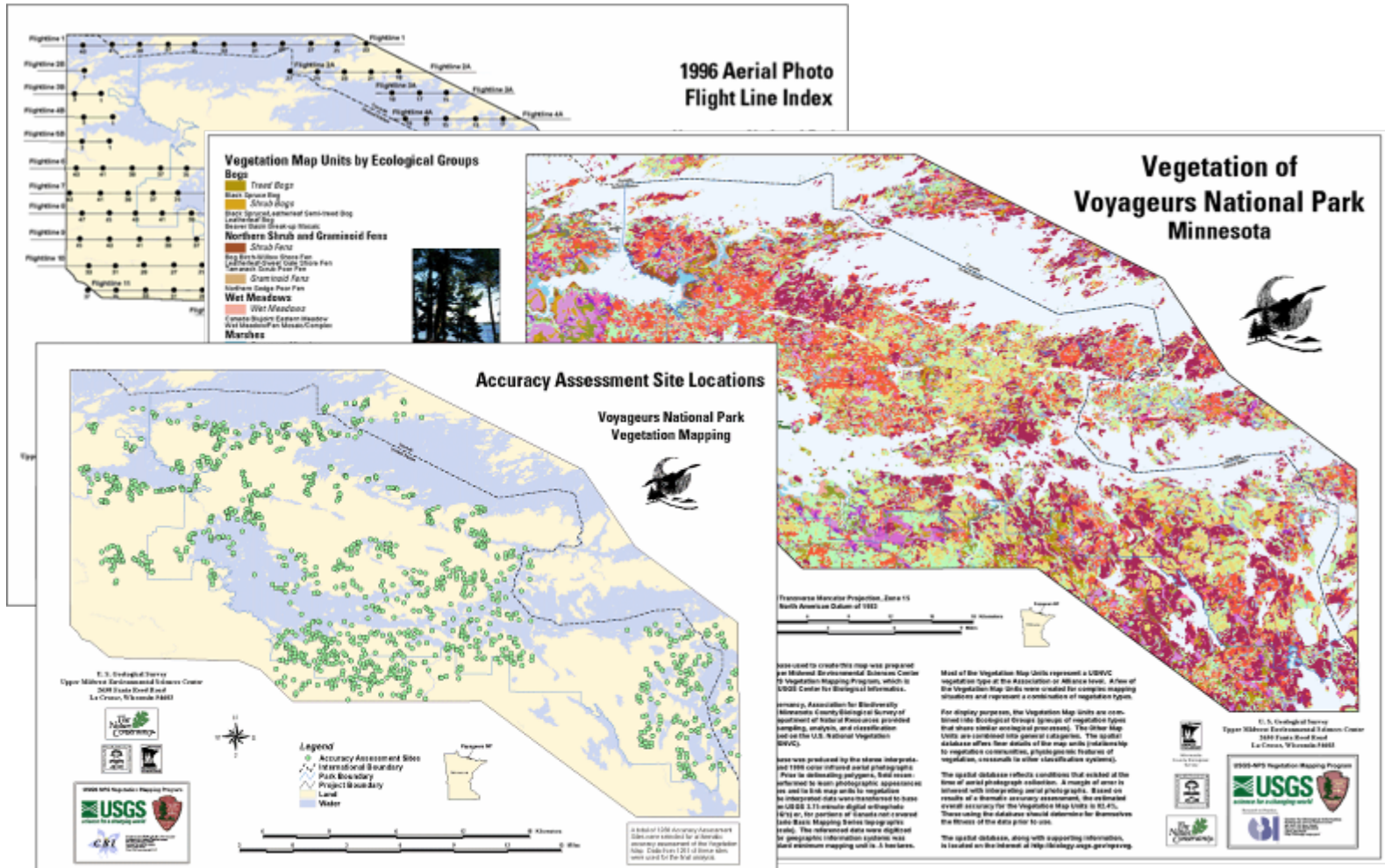
Midwest Pondweed Submerged Aquatic Wetland (PW-1A) appears as dark patches against the darker water. Although difficult to see on this photo, the coverage is continuous and evenly dispersed. There are small inclusions of herbaceous vegetation within the polygon (orange-pink patches). The photo was taken in September 1995.



Black Spruce/Feathermoss Forest (BSF-1A4) appears as dark blue-gray with a fine nubby texture. The canopy is continuous and evenly dispersed. The tree height falls within the 5-12 meter range. The photo was taken in September 1996.



# Maps and Spatial Data







# *Metadata*

## **Voyageurs National Park, Accuracy Assessment Metadata**

Identification\_Information:

Citation:

Citation\_Information:

Originator:

U.S. Geological Survey

Environmental Sciences

Road, La Crosse, Wisconsin

Publication Date: 20001

Title:

Accuracy Assessment S

Voyageurs National Park

Geospatial Data Present

## **Metadata for Voyageurs National Park, Spatial Vegetation Data: Cover type / Association level of the National Vegetation Classification System**

Identification\_Information:

Citation:

Citation\_Information:

## **Metadata for Voyageurs National Park, Field Plots Data Base for Vegetation Mapping**

Identification\_Information:

Citation:

Citation\_Information:

Originator:

U.S. Geological Survey, Inner Midwest

ject

rogram

Mapping Project

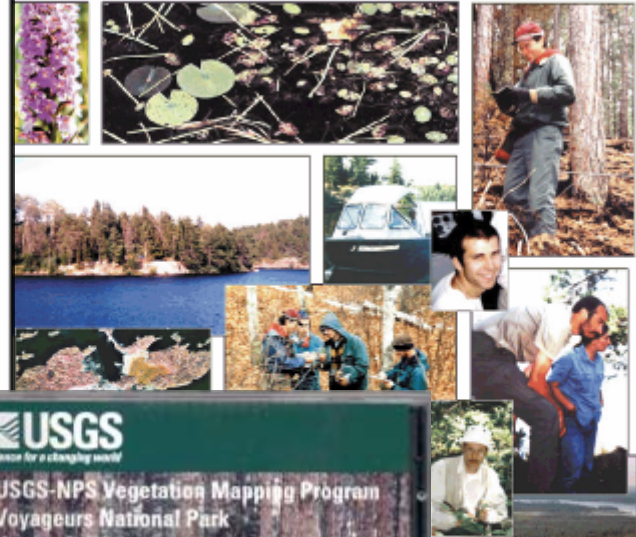


# Reports

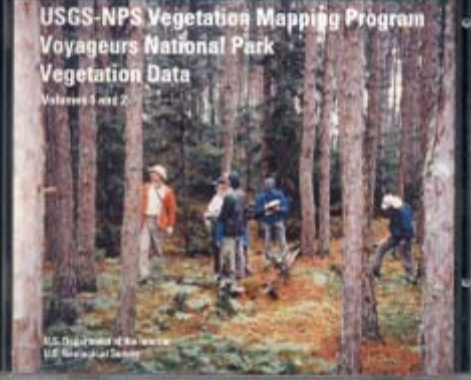
## Appendix F: Interpretation Mapping Conventions And Visual Key



USGS-NPS Vegetation Mapping Program  
Voyageurs National Park, Minnesota



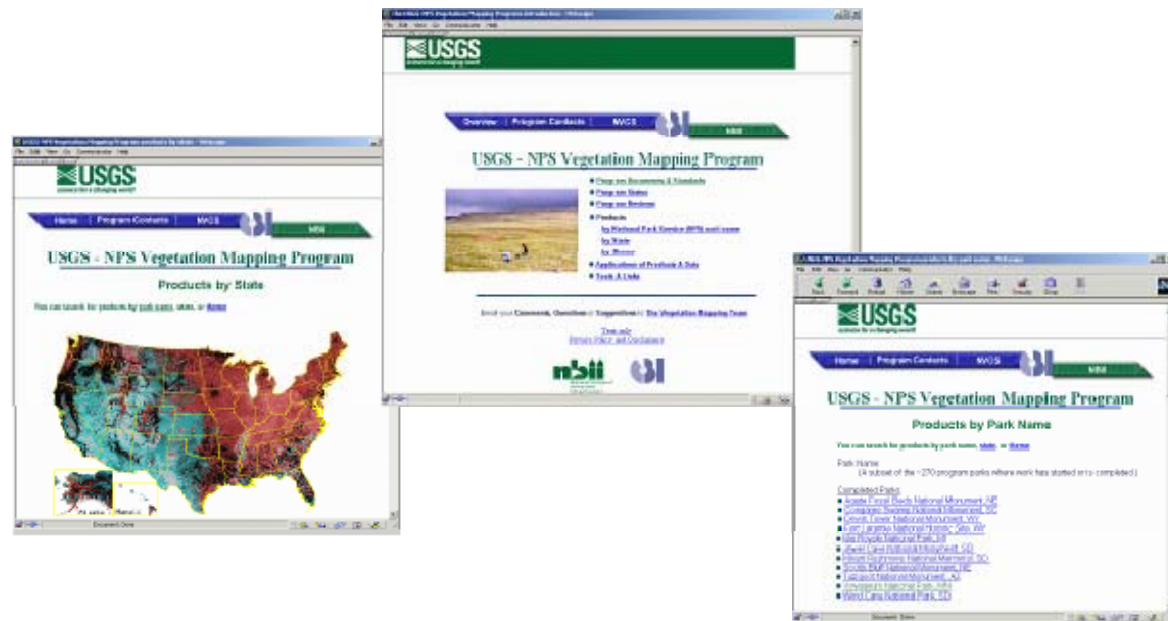
USGS-NPS Vegetation Mapping Program  
Voyageurs National Park  
Vegetation Data  
Volume 1 and 2



Mapping Program  
VOYAGEURS  
NATIONAL PARK  
February 2001



# Data Availability



- All products are made available via a public internet website:

<http://biology.usgs.gov/npsveg/>

- USGS and NPS Data Store serving of datasets
- Archiving of datasets; Data Store & EROS Data Center



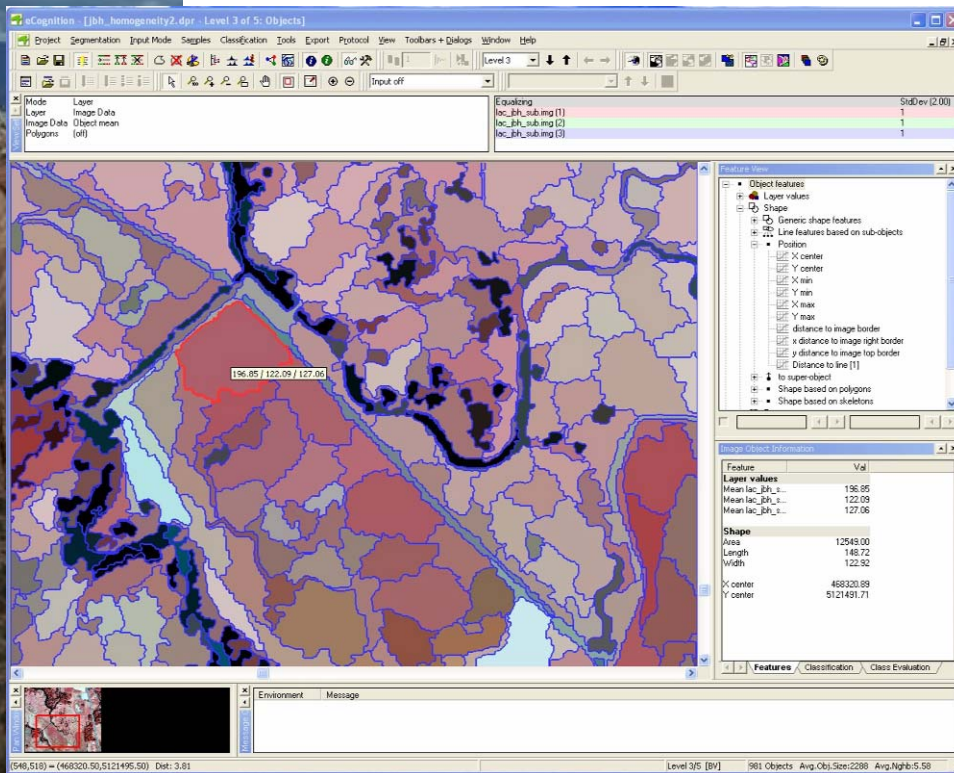
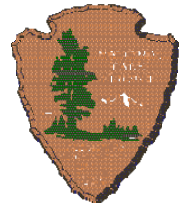
# *New Models*

- “New/other” technologies
  - High Resolution Remote Sensing
  - eCognition segmentation
  - Project Management model
  - Laser Rangefinder Remote GPS positioning
  - Mobile handheld mapping
- Sister Bureau hybrid techniques
  - FWS Lower cost Veg Map “Light”
  - Savings from reduced field collection



# Hybrid Techniques

## Hybrid techniques – summary of current efforts



- Mixed imagery and Sister Bureau eCog segmentation and skeleton polygon sampling (GRSA)
- PI / eCog linework and model verification (MEVE) / ground reference; add attributes (field & automation savings)
- Classical accuracy assessment (AA) or small park protocol (census of MMU @ GRKO, LIBI, KNRI, FOUN)
- Verify eCog gradient test against completed AA (ROMO)
- Machine classification and PI field sample verification (LAVO)



The National Park Service

USGS-NPS Vegetation Mapping Program

## National Park / Environs – data successes

- Consider areas of interest for small park protocol
- Evaluate sparse vegetation protocol need and sample sizes
- UCBN 9-park example of project management and multi-park planning efficiencies
- Fire and fuels protocols may integrate fuels stratification in sample design
- Develop fuel model polygons from NVCS vegetation polygons / photos
- Other fire and monitoring program data needs...



### *NPS / Environs – fire data summary*

- **Network** / Park Fire Management team field verify / photo reference fuel model types
- Evaluate **Network** Landfire data potential; Accuracy Assessments at GRTE / GLAC
- How **Network/Park** map classes improve Landfire /other models
- Research **partnering for a hybrid approach**, as needed
  - Fire fuel classes / types
  - Fuel loadings (1/10/100 hr...)
  - Fire Regime Condition Class
  - Landfire update as appropriate and as supported by partnership





## *Summary of Efforts in 2008*

- Fund ongoing projects in 25+ networks
- Provide technical support and planning assistance to parks, networks, and regions
- Prioritize candidate projects with VMP team
- Facilitate new leveraged starts with shared funding in networks using hybrid innovations
- Action plan for creation / migration of NPS data, and USGS-NPS archiving
- Test GPS capabilities in park mapping efforts, and mobile mapping for accuracy assessments



# The Federal Civilian Agencies

- Safety-of-Life operations – Search-and-Rescue, Fire, Homeland Security, Transportation, etc.
- Law Enforcement
- Natural and Cultural Resource data collection and monitoring
- Facilities management
- Navigation for many other activities

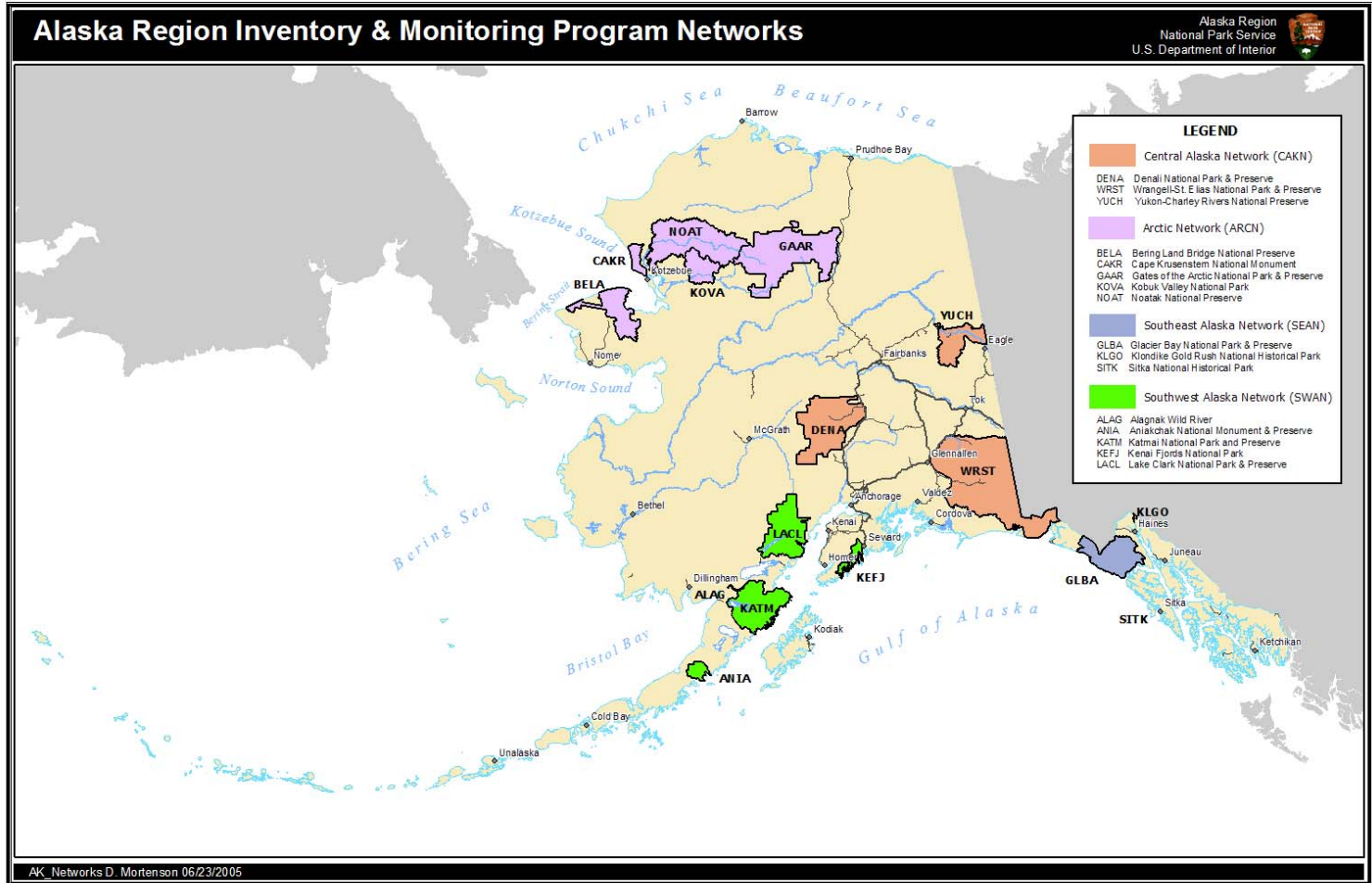


# The NDGPS and Alaska WAAS

- Coastal coverage with US Coast Guard NDGPS
- Improved WAAS in open
- Coverage and canopy challenges to WAAS delivery; getting better
- Interior NPS lands coverage issues
- Navigation for I&M activities

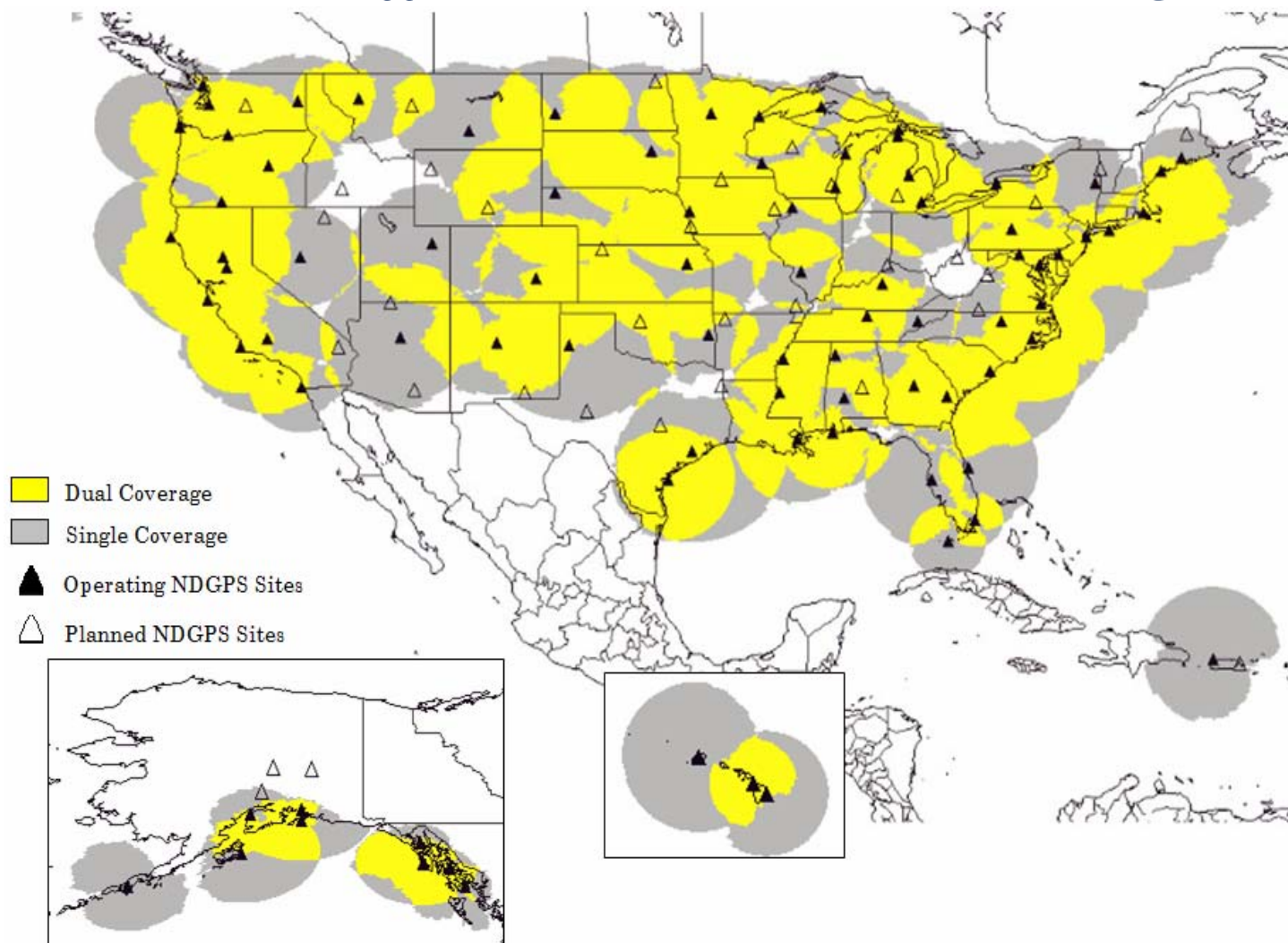


# The 4 Alaska Networks of Parks



# NDGPS

## *Nationwide Differential Global Positioning Service*



# The Geospatial Task Group



[http://gis.nwccg.gov/training\\_gps.html](http://gis.nwccg.gov/training_gps.html)

GPS for Fire Management & ICS - 2008

Held: Vernal, UT: 3/17/08 - 3/21/08

Asheville, NC: 4/14/08 - 4/18/08





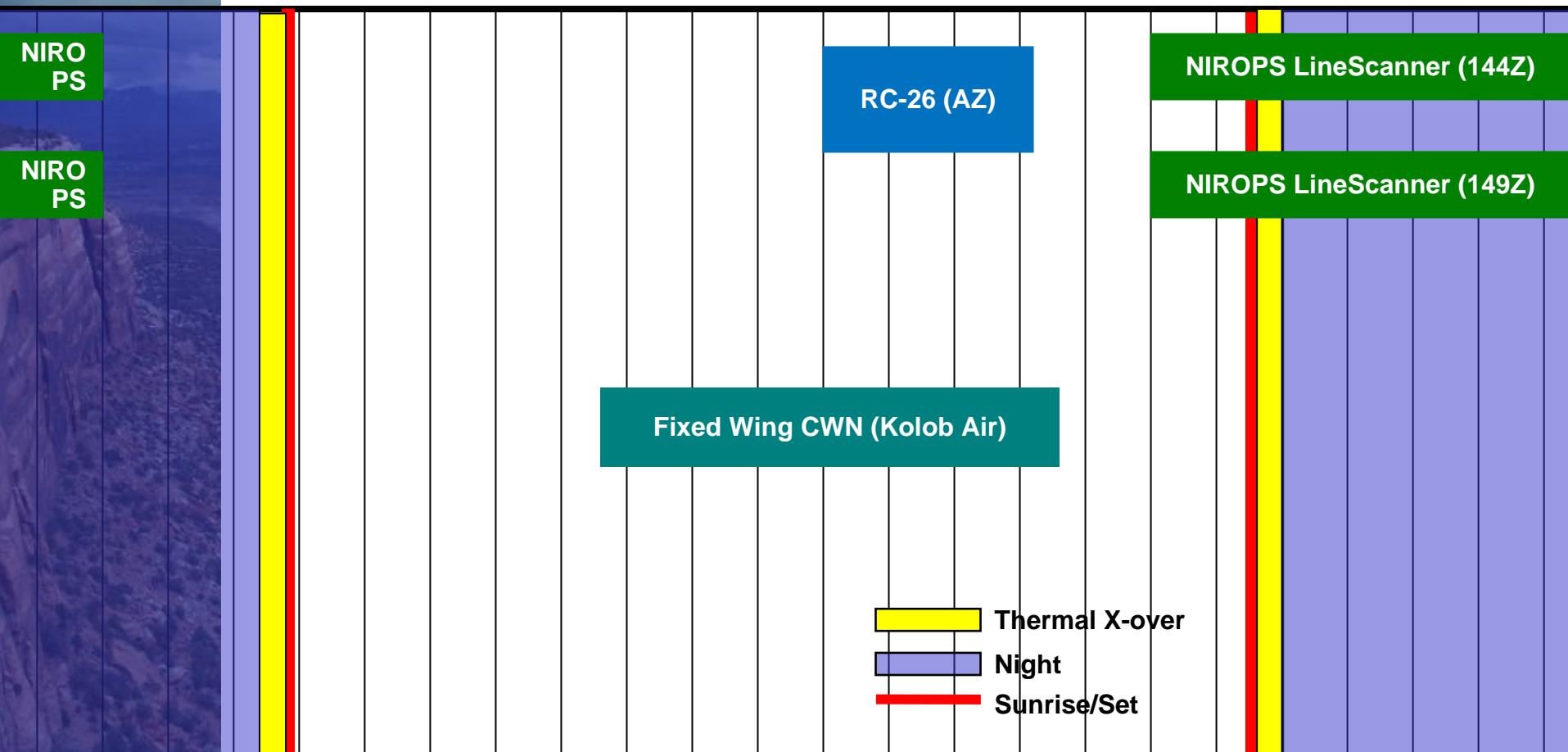
# California Interagency/CNG



## Wednesday July 9, 2008

Times shown Pacific DST

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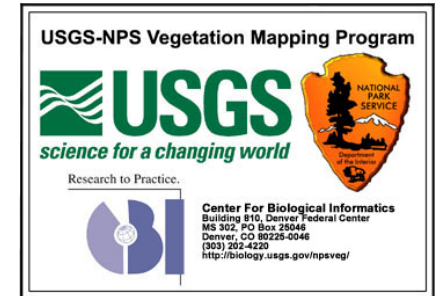


The National Park Service

USGS-NPS Vegetation Mapping Program

# More Information

- Visit the USGS-NPS Vegetation Mapping Website:  
<http://biology.usgs.gov/npsveg>



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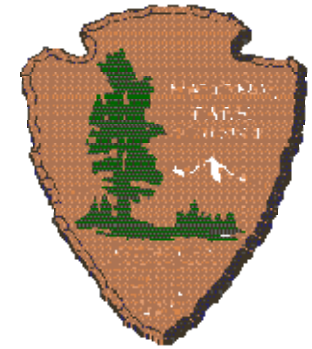
theresa\_singh@usgs.gov







# Thanks



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