Serving raster data through enterprise systems
USDA Forest Service

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USDA Forest Service Organization

- National Headquarters in Washington, DC
- 9 Regional Offices
- National Forest System
  - 155 National Forests and 20 National Grasslands
  - 600 Ranger Districts
  - 78 Million Hectares in CONUS, AK, and PR

- Research
  - 7 stations
  - 50 field offices
- State and Private Forestry
  - Fire and Aviation
  - Forest Health Protection
- International Programs
Business Requirements

1. Visualize large volumes of imagery data from centralized location
   - Image Services ArcServer 10.3

2. Need to serve authoritative data to public
   - Standardized data Raster Data Warehouse
   - Non-standard data ArcGIS Online

3. Need centralized access capabilities for large volumes of raster data (and Lidar data)
   - Large data analysis (server side or cloud options)
   - Public access with basic analysis capabilities
     - Charter to address business requirements
Authoritative Forest Service data as web map services can be hosted as web or map services. Imagery data can also be provided as image services. The forest service can use ArcGIS Online for non-authoritative services and services from other agencies. The T Drive (Citrix Environment) can be used for internal use options. Enterprises can also have data warehouses for raster data.
Advantages 10.3 Services over previous version (9x)

- Dual Function Image services
  - Cached and Dynamic Services
- REST endpoints now available to developers
- Some image processing functionality
  - Raster function templates
  - More pixel based processing functionality
  - Enable temporal analysis for categorical and continuous thematic raster datasets
Description of NAIP

- The National Agriculture Imagery Program (NAIP) acquires aerial imagery during the agriculture growing season in continental US.
- Collection years vary per state based on funding.
  - Current cycle is a 2 year cycle.
- Acquired at 1 meter resolution in true color and color infrared.
- Horizontal Accuracy is 6 meters.
CONUS for each year of NAIP 2004- 2014
FS Image Server ArcServer 10.3

Resource and high resolution satellite - individual services by project

1940 (2000-2014)
Image Services ArcServer 10.2

Other Raster Services...

eTOPO Viewing scale dependent
USGS topo maps at 1:24000,
1:100,000 and 1:250,000 scales

Forest Visitor Maps

Primary Base Series - up-to-date
1:24000 topo maps administered by USFS
ArcGIS for Server - Image Service 10.3

Additional intent is to serve some Lidar derivative products

- Bare earth
- Highest hit hillshade
- Bare earth hillshade
- Canopy height
  .... others
Image Services ArcServer 10.3

Statistics

- Average daily connections: 10416
- Number of active services: 438
- Average daily users: 695
- Number of unique users: 4111 (8319 in last year)

- Percentage use – based on connection to services
  - NAIP 46%
  - Maps (softcopy, FVM, etc) 38%
  - Resource photography/other imagery 11%
  - Terrain 5%
Image Services ArcServer 10.3

Uses of NAIP, Resource Imagery, high resolution satellite imagery

Inventory sampling assessment
FS Image Services ArcServer 10.3

Uses of NAIP, Resource Imagery, high resolution satellite

Heads up digitizing to update or delineate historical features
FS Image Services ArcServer 10.3

Uses of NAIP, Resource Imagery, high resolution satellite

*Change Detection (Waldo Canyon fire - Colorado)*

NAIP 2009 CIR

NAIP 2013 CIR
FS Image Services ArcServer 10.3

Uses of NAIP, resource imagery, high resolution satellite

Reference Data canopy cover maps (example: Medicine Bow Route NF)
Raster Data Warehouse

... As part of the Enterprise Data Warehouse (EDW) to serve this need:

1. To provide public access to authoritative Forest Service produced raster datasets

   - Governance as set by the EDW
   - CONUS level datasets are being processed currently
     - Forest Health Protection Species probability surfaces
     - Monitoring Trends and Burn Severity Data
Enterprise Data Warehouse

... Setup and function
Monitoring Trends in Burn Severity

http://www.forestrygis.com/BurnSeverity/

class thematic burn severity data

- Unburned/Low
- Low
- Moderate
- High
- Increased Greenness
- Non-mappable area
Forest Inventory and Analysis Atlas project

Other services to be produced by Esri for Atlas Project

1. Web based stories for:
   - Forest Communities
   - Fire Management
   - America’s Private Forest Owners
   - Future of Forests

2. User data ingest for value adding
   - Ability to do analysis and create new content

3. User result posting and source linkages
   - Ability to publish ‘value added’ products to portal
Wildland Fire as a Natural Disturbance

Wildfire is a key natural disturbance process that shapes ecosystems throughout the United States. The ecological consequences of wildland fires depend on the type of fire, the type and structure of the ecosystem that burned, and the frequency of repeated fires. All these factors interact to define the fire's effects on an ecosystem and the ecosystem's response to the fire disturbance.

Wildfire is a natural disturbance that has a range of effects on biological and physical aspects of the environment. It creates conditions that temporarily favor some species and exclude others, and it is a major factor in shaping the way the Nation's forests look, especially in the Western United States.

To understand the effects of a wildland fire, it is important to consider the type of fire and the type and structure of the ecosystem in which the fire took place. Fires are generally categorized as ground fires, surface fires, understory fires, or crown fires. A ground fire consumes organic material beneath the surface litter, such as in a peat fire. Surface fires burn along the ground without significant movement into the understory or overstory vegetation. Understory fires burn the small shrubs and seedlings and are more intense than surface fires. Crown fires are normally associated with an understory fire that moves into the tree crowns and spreads from top to top of trees and/or shrubs.
Forest Inventory and Analysis Atlas project

Feature a wide variety of assemblages in the United States
ArcGIS Online Implementation for FS Non-standard data

Welcome to the U.S. Forest Service on ArcGIS Online

The U.S. Forest Service is using ArcGIS Online to share maps, data, and applications for use by other federal agencies as well as the public. Users can find and use map services published by the Agency, together with their own data, to create web maps and mashups.
QUESTIONS?