

# Tools for Protected Area Managers: Ecological Forecasting Within NASA



OAS Second  
Coordination Meeting on  
Protected Areas  
Information Systems

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Edgemont  
National Park  
New Zealand

# Overview

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## ❑ Background

## ❑ Tools of interest to PA managers

- **TOPS** (Terrestrial Observation and Prediction System)
- **Protected Area Archive**
- **CBD Sourcebook**
- **SERVIR** (Regional Visualization and Monitoring System for Mesoamerica)
- **FIRMS** (Fire Information for Resource Management System)
- **NatureServe Vista**

# Why is NASA Interested in Biodiversity?

1. Many uses of RS for PA and ecosystem management
2. Lots of data...



# Why is NASA Interested in Biodiversity?

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Model  
predictions

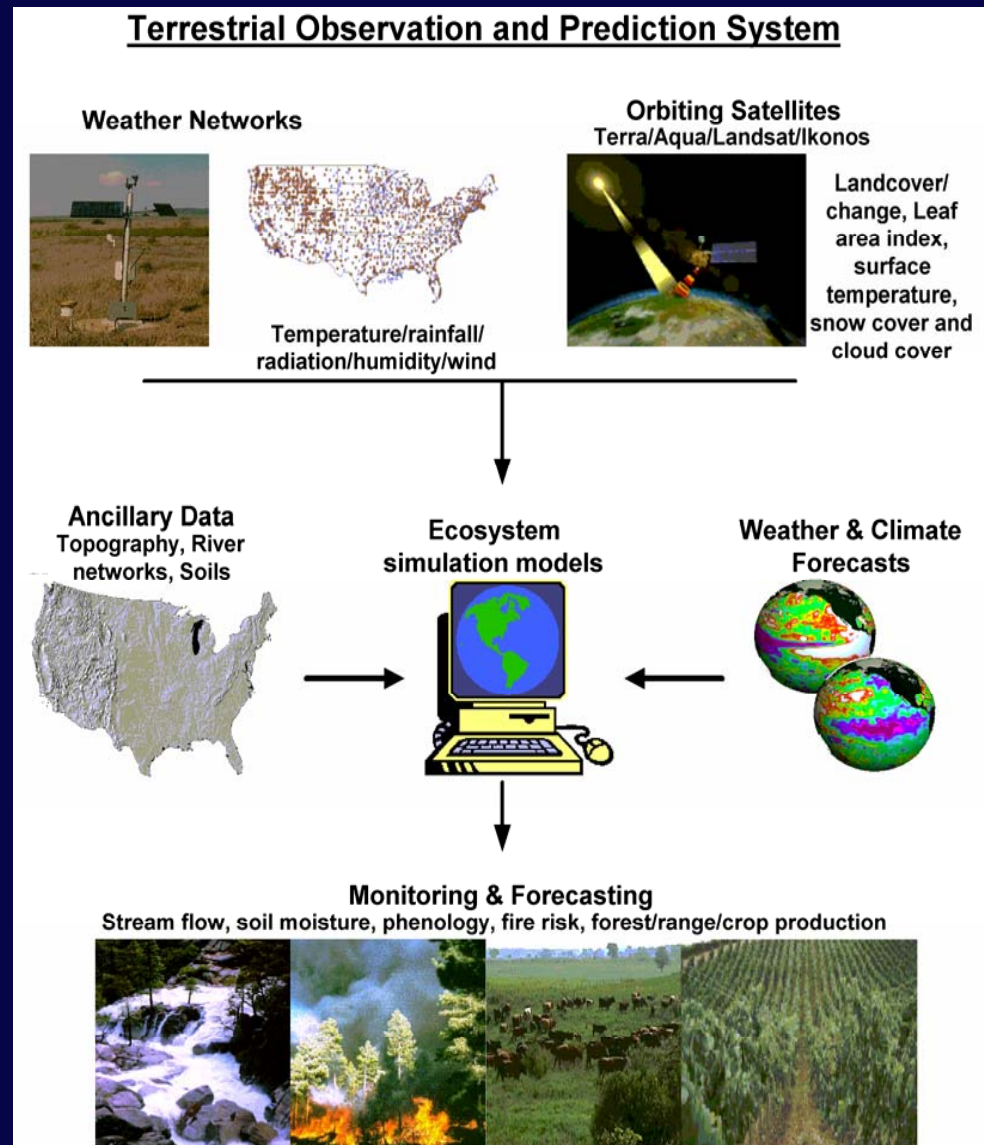
# TOPS: Terrestrial Observation and Prediction System

## ❑ Provides forecasts, nowcasts, and hindcasts

- 30 biological and environmental parameters

## ❑ Help managers

- Understand current state
- Detect disturbance
- Predict consequences of events and activities





# The TOPS-30

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## MODIS (8 day and annual products)

- 1 LAI (Leaf Area Index)
- 2 FPAR (absorbed PAR)
- 3 GPP / NPP (Gross / Net Primary Production)
- 4 LST (Land Surface Temperature)
- 5 NDVI (Normalized Difference Vegetation Index)
- 6 EVI (Enhanced Vegetation Index)
- 7 Landcover (Annual)
- 8 Albedo
- 9 Snow
- 10 Fire

## Meteorology (Daily)

- 11 Maximum Temperature
- 12 Minimum Temperature
- 13 Rainfall
- 14 Solar Radiation
- 15 Dew Point / VPD (Vapor Pressure Deficit)
- 16 Degree Days

## TOPS Ecosystem

- 17 Snow
- 18 Soil Moisture
- 19 Evapotranspiration
- 20 Stream outflow
- 21 GPP / NPP
- 22 LAI / Phenology
- 23 Vegetation Stress

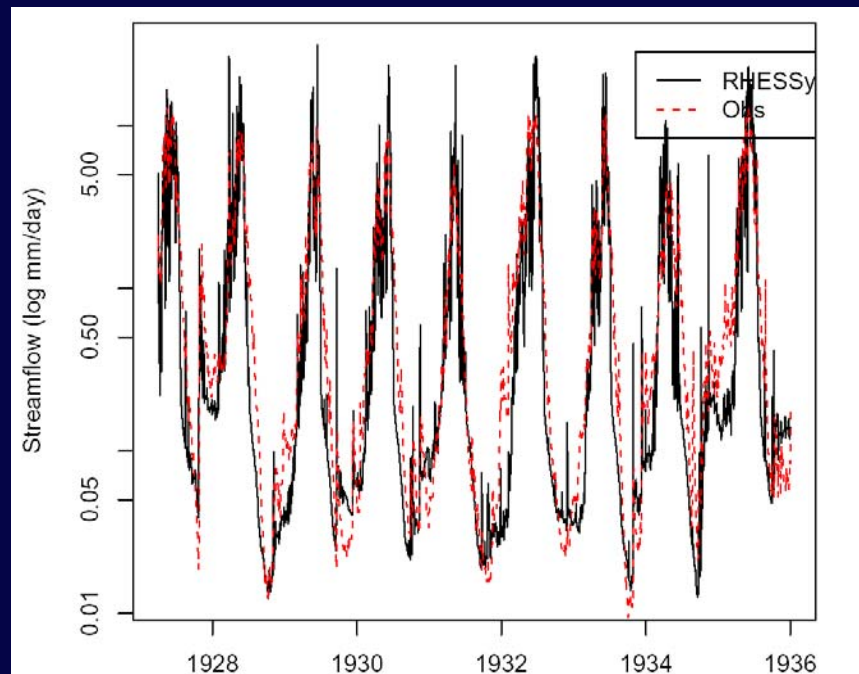
## TOPS Forecasts (5 to 180 day)

- 24 LAI/Phenology
- 25 Soil Moisture
- 26 Outflow
- 27 ET
- 28 Vegetation Stress
- 29 Snow
- 30 GPP / NPP

# Example: Watershed

- What will be the outflow response to
  - A predicted storm event
  - A wildfire or controlled burn
  - Logging

Stream outflow  
Merced watershed, Yosemite  
Predicted vs measured



# Example: Monitoring

## □ Look for anomalies

- Compare current conditions to historical average

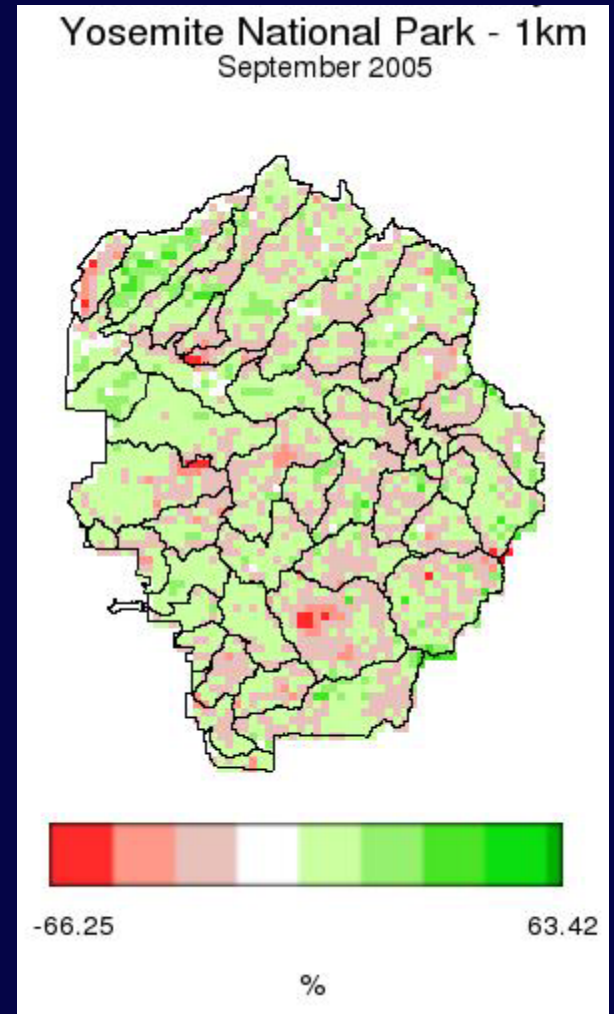
**Productivity**



Spatial anomaly

**Can indicate disturbance**

- Logging
- Fire





# Protected Area Archive

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## ❑ Problem

- Tools to provide access to satellite images are for remote sensing experts

## ❑ Result

- Data not accessible to many conservation managers → underutilization

## ❑ Solution

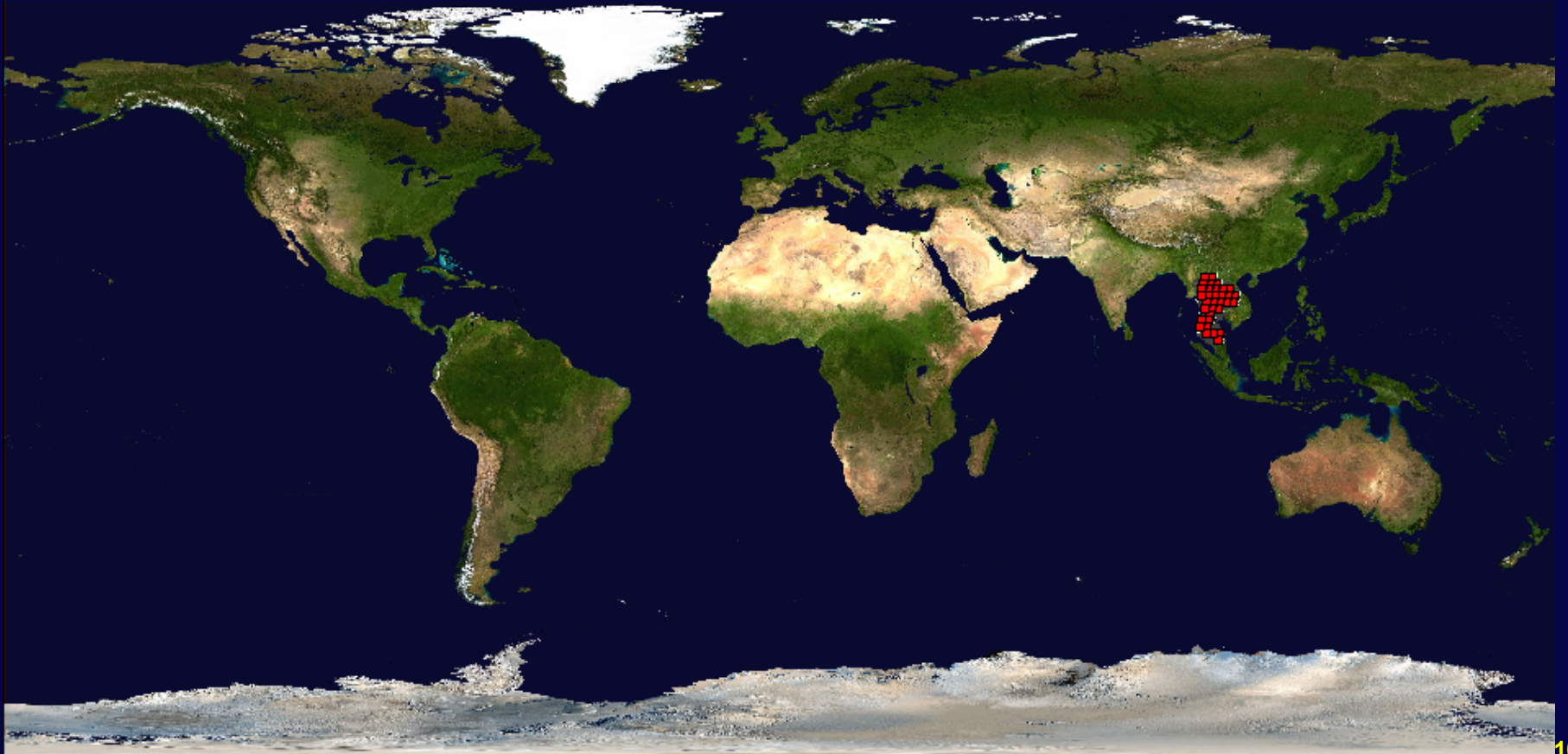
- Devise a system that is easy to use



# Protected Area Archive

## □ Combines

- Collections of images
- Simple tools to view and use them



# Selected PAs In South America

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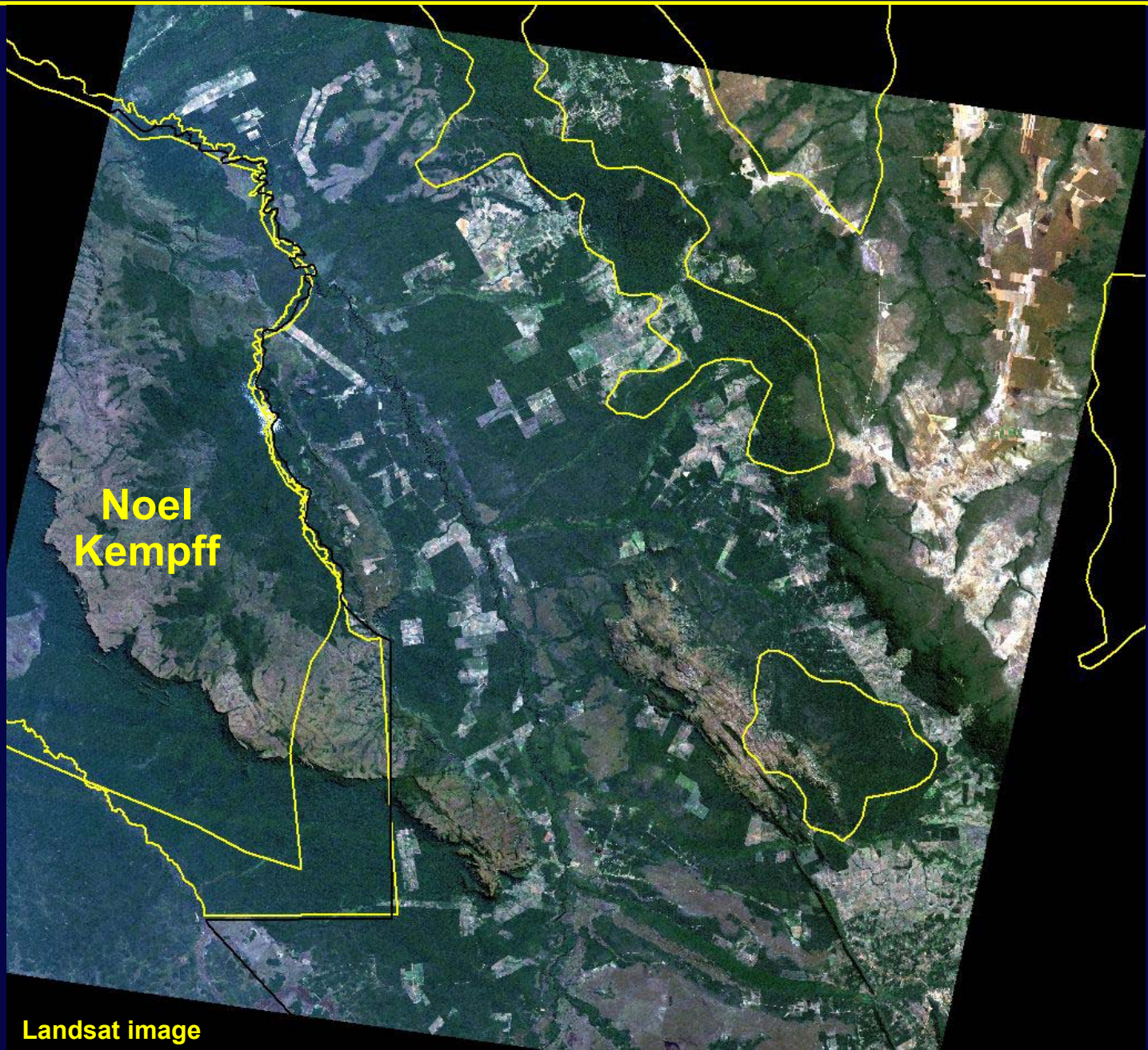


# Selected PAs In South America





1988

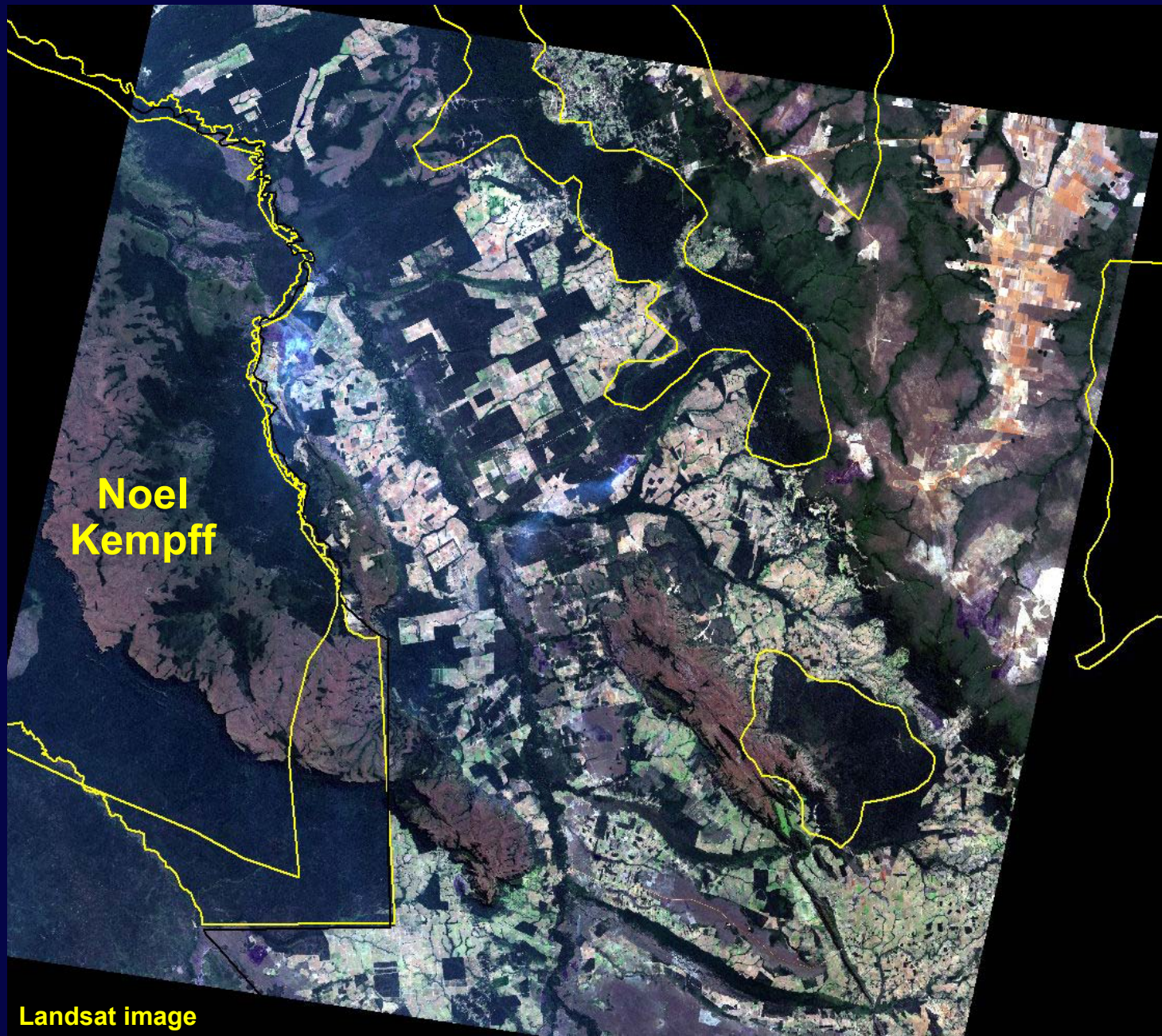


Noel  
Kempff

Landsat image



2000



Noel  
Kempff

Landsat image



# Collections

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- ❑ All countries in Central America
- ❑ Ecuador
- ❑ Peru
- ❑ Bolivia
- ❑ Venezuela (partial)
- ❑ Colombia (partial)
- ❑ Eventually: all of Amazon Basin



# CBD Sourcebook

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- ❑ “Sourcebook on Remote Sensing and Biodiversity Indicators”
- ❑ Developed for CBD--and a non-RS audience
- ❑ Purpose: help countries utilize RS to meet their CBD obligations
- ❑ Discusses
  - Basic RS concepts
  - RS-based health/status indicators
- ❑ Now undergoing final revisions



# SERVIR

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- ❑ **Regional Visualization and Monitoring System for Mesoamerica**
- ❑ **Purpose**
  - **Provide geospatial information for natural resource and disaster management**
- ❑ **Supported by USAID, NASA, the seven participating countries (and others)**
- ❑ **Operating, and expanding**

Iguazu Falls National Parks  
Brazil, Argentina



# Four Main Components

**SIAM-SERVIR** The Central America Monitoring and Visualization System

MON, DEC. 6, 2004

○ Español  
○ English

Mesoamerican Data | Interactive Maps | Decision Support | Visualizations

Home  
About SIAM-SERVIR  
What's New  
Calendar  
Workshops  
Library  
Related Links  
Directory  
Internal (Restricted)  
Forums  
Gallery  
User Comments  
Contact Us

Your "One Stop Shop" for Regional Decision Support, and Interactive Visualizations of Mesoamerica Today, Monday, December 6, 2004

Decision Support Products

- Fires
- Red Tides
- Hurricanes
- Floods
- Food Security EWS
- Earthquakes
- Climate Change
- GOES Fire and Rain

Decision Support Products **What's New!**  
Click [here](#) to visit the "What's New" page to read SIAM-SERVIR news articles, and to see new products and features being added to this Web site.

**SIAM-SERVIR Movies**  
Time Lapse of Fires (MPEG 17.89 MB)  
Click image to view movie.

**Central American Fly-Throughs**  
Includes Landsat and Ikonos data. [Click here](#) to fly.

Below are scenes from SERVIR fly-throughs. [Click images](#) to view larger versions.

**In the News**

- CCAD Environmental News
- Disaster News
- Mesoamerican Biological Corridor
- Regional Newspapers
- NASA News
  - NASA en Español
  - Ciencia@Nasa
  - EO Natural Hazards

**For Kids**

- NASA for Kids
- S'COOL (en Español)
- The Space Place
- Rincón en el Espacio

Search this site  
  
Go ▶

Latest GOES Image. [Click here for more](#)

Latest MODIS Terra Image. MODIS Terra - Dec. 5, 2004 8:50, 10:25, and 10:30 CDT  
1200 X 1200 Image, 2700 X 2700 image

<http://servir.nsstc.nasa.gov>

1. Mesoamerican data
2. Online maps
3. Decision support
4. 3-D visualizations

# 1. MesoStor Regional Data Store

**Purpose: Provide geospatial data for download**

- ❑ **One-stop data store**
- ❑ **Provides vector (“shapefiles”) and raster (image) data covering all of Mesoamerica**
- ❑ **Web-based system for data selection and delivery**





## 2. Online Maps

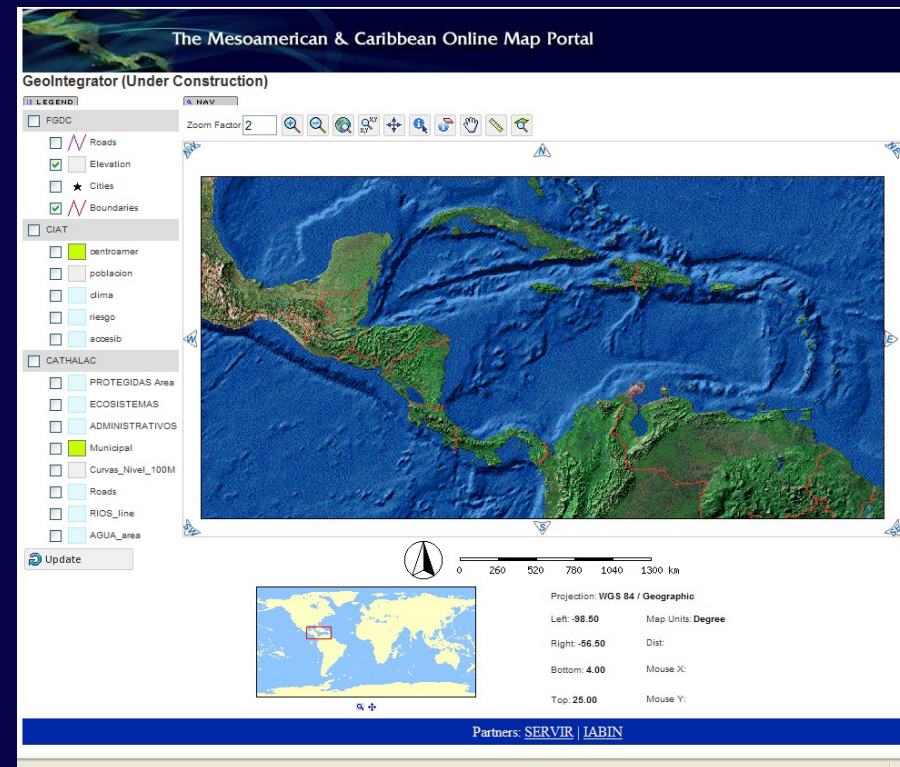
**Purpose: Provide tools and data to generate maps in an interactive browser window**

**❑ Data can come from any participating organization**

- E.g., country environment agencies

**❑ Thematic areas--biological, protected areas, etc.**

**❑ GeoIntegrator—tool that helps combine the data onto a single map**





# 3. Decision Support

**Purpose: Provide/link to various Decision Support Tools**

- Fires**
- Red tides**
- Climate change scenarios**
- Short term weather prediction**
- Land cover and land use change for carbon inventories**
- Floods**
- Other**



# 4. Visualization Tools for Decision Support

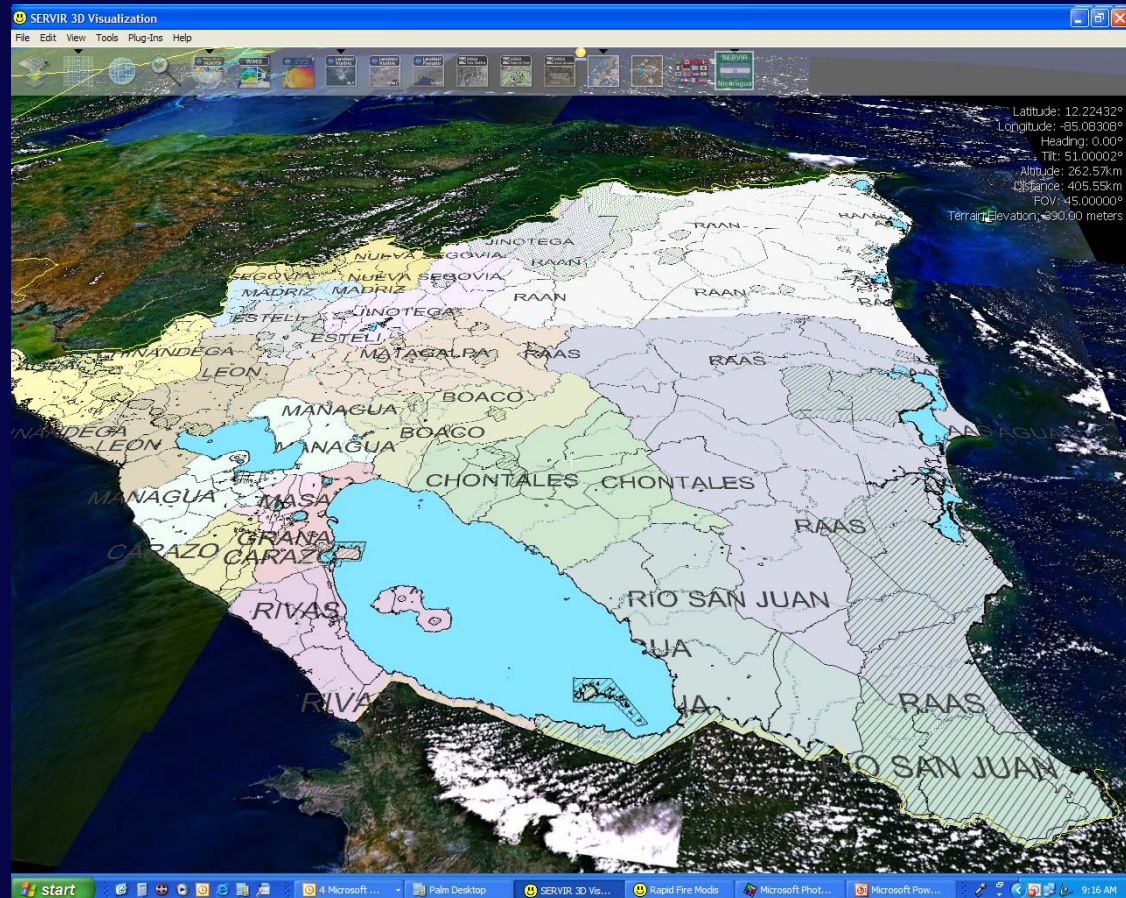
**Purpose: Provide easy access to data and 3-D visualization tools**

## □ Tools

- World Wind - NASA
- Skyline
- Space Time Toolkit

## □ Users

- Decision Makers
- Media
- Educators
- Students



# Websites

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- ❑ **TOPS** <http://ecocast.arc.nasa.gov/>
- ❑ **Protected Area Archive** <http://asterweb.jpl.nasa.gov/paa>
- ❑ **SERVIR** <http://servir.nsstc.nasa.gov/home.html>
- ❑ **Vista** <http://www.natureserve.org/prodServices/vista.jsp>

# NatureServe Vista

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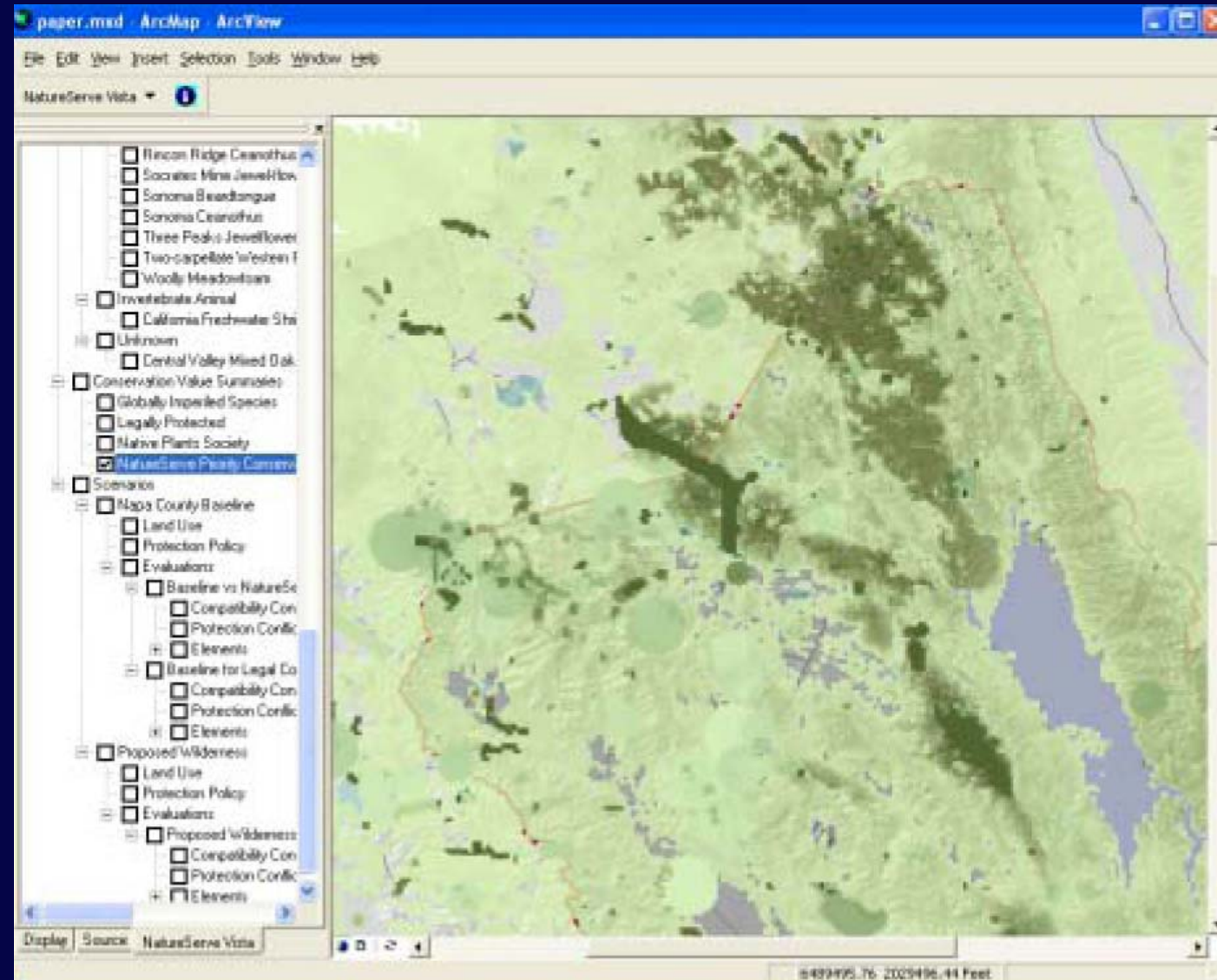
- ❑ **Toolset to assist in “Smart Growth”**
- ❑ **Helps integrate biodiversity information into planning efforts**
- ❑ **Provides ability to optimize a land use strategy for multiple goals**
- ❑ **Can answer questions such as**
  - **Where can we place new development to best protect our environment?**
  - **Where can we best invest funds for conservation land?**
- ❑ **Pilot is for Greater Yellowstone Area**



# NatureServe Vista

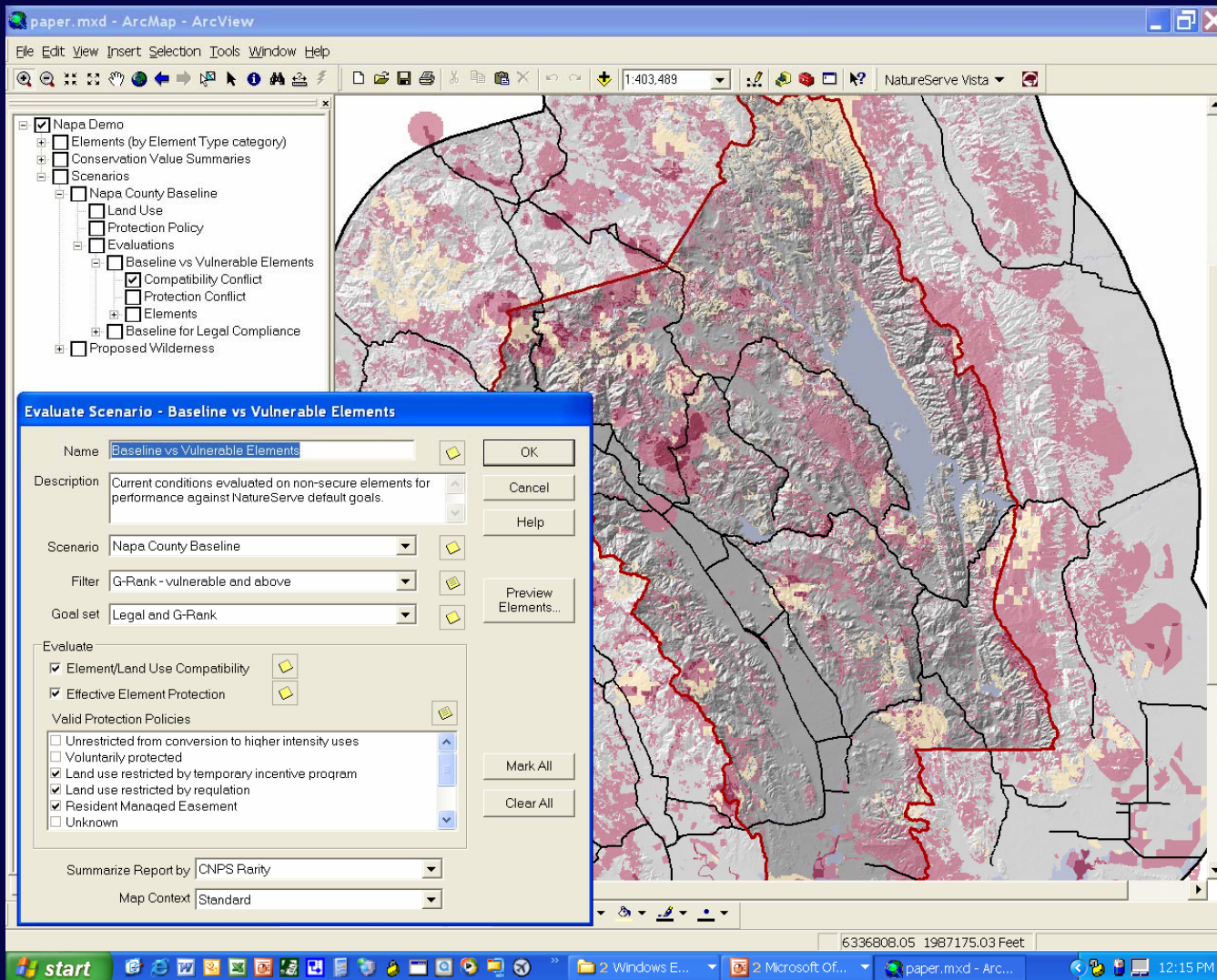
## Example: Conservation value assessment

Intensity of green indicates overall conservation value (hotspots of biodiversity)



# NatureServe Vista

## Example: Land use conflict analysis



Intensity of red indicates level of conflict between different potential uses (“hotspots of incompatibility”)



# Conceptual Organization

## NASA Earth Science

Research

Applications

Ecology, Biodiversity,  
Land Cover...

Ecological  
Forecasting

