

**Change analysis of reforestation
techniques on surface mines in
West Virginia**

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Remote sensing for re-vegetation

- A. Modern remote sensing
- B. Geo-Imagery
- C. Historic remote sensing
- D. Analysis of reforestation over time
 - Hobet 21 (pre-ARRI)
 - White Flame IV (early ARRI hybrid)
 - Pounding Mill (early ARRI forestland)
 - JH Sovine Farm (type locality)

What is ARRI ?

- Appalachian Regional Reforestation Initiative



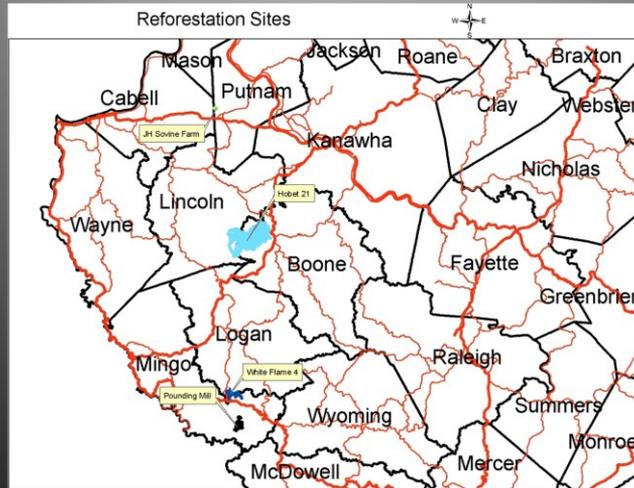
Modern Remote Sensing

- High resolution multi-spectral imagery
- DEM data allow orthorectification
- Vegetative spectral finger printing

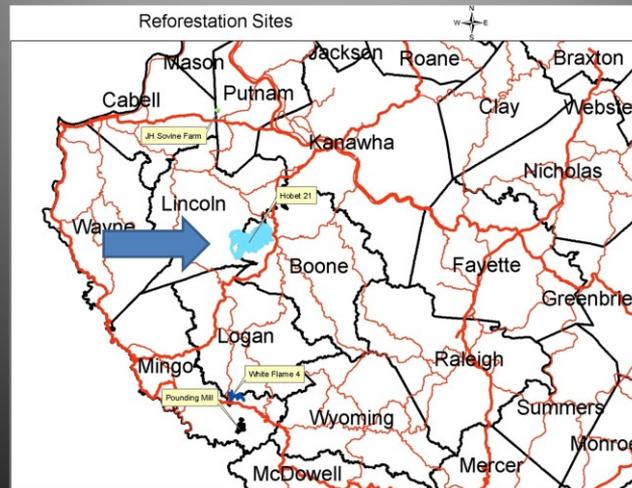
Geo Imaging with a RICOH Caplio GPS/camera



Sample Reforestation Sites



Hobet 21



1. Mined over the last 40 years.
2. Over 10,000 acres.
3. Mostly a mixture of Rangeland and Fish and Wildlife post mining land use.

Analysis of reforestation Geo-referenced ground images

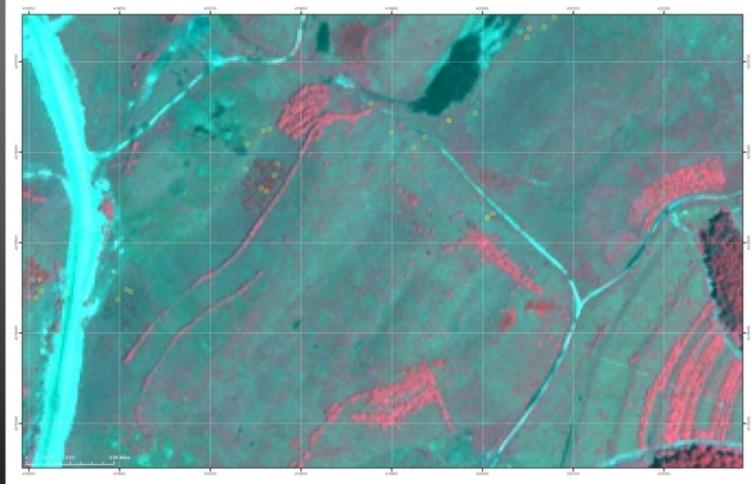


1. Site visit 2007
2. Air photo 2007

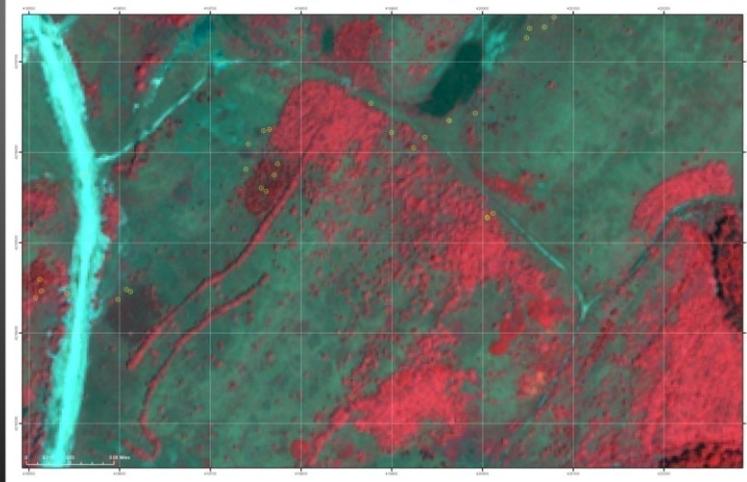
Picture 81, Autumn Olive



2003



2007



Notice the Autumn Olive grown along specific habitat aspects.

White Flame 4



1. White Flame 4 was mined from 1990 to 1998.
2. A mixture of Forestry and Fish and Wildlife post mining land use were used.

White Flame 1996



White Flame 2003



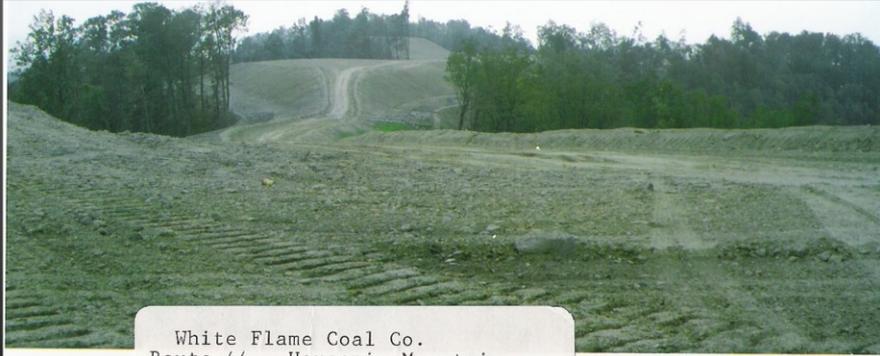
White Flame 4 show early commercial woodland policy, it had no productivity standard.

White Flame 2007



Using ArcPAD the same point can be located in the field in 2008.

White Flame 1998



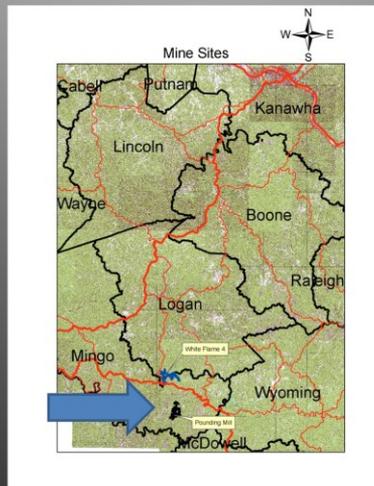
This site is unique in extensive on the ground photograph was taken in 1998 just after reclamation.

White Flame 2008



Note the flat area were over compacted and show now tree growth even after 10 years.

Pounding Mill



1. Pounding Mill Surface Mine was over 300 acres of proposed Forestland post-mining land use.
2. It was mined from 1990 to 1996.

Digital Air photo database

USGS
science for a changing world

Earth Explorer

Results

[Viewing or ordering a single frame from a Photo Index](#)

[Medium-resolution rol production request](#)

Show Map Pop-out of
The up to date Google map is not for purchase or for download; it is to be used as a guide for reference and search purposes only.

Aerial Photo Mosaics
6 of 6 metadata records retrieved. Showing 1 - 6

| Previous Image | Show Footprint | Show All Fields | Exclude | Entity ID | Show Full Resolution Frame | View or Order Frame | Acquisition Date | Image Type | Scale | Resolution In/Out | Center Coordinates | NW Coordinates | NE Coordinates | SW Coordinates | SE Coordinates | Agency | Frame | Image Quality | Cloud Cover |
|----------------|----------------------|----------------------|--------------------------|-------------------|----------------------------|-------------------------------|------------------|---------------|-------|--------------------------|------------------------------------|------------------------------------|------------------------------------|------------------------------------|------------------------|--------|-------|---------------|-------------|
| 1 | Show | Show | <input type="checkbox"/> | ARDGA50210440532 | Show | View or Order | 1956/05/28 | Black & white | 30000 | Vertical Cartographic | 38° 19'00.00" N 82° 19'00.00" W | 38° 20'00.00" N 82° 20'00.00" W | 38° 00'00.00" N 82° 00'00.00" W | 38° 00'00.00" N 82° 00'00.00" W | Army Map Service | 15021 | 8 | 0 to 9% | Cloud Cover |
| 2 | Show | Show | <input type="checkbox"/> | ARDC1VFP000370178 | Show | View or Order | 1926/06/18 | Black & white | 31000 | Vertical Cartographic | 38° 21'30.00" N 82° 07'30.00" W | 38° 28'00.00" N 82° 07'30.00" W | 38° 19'00.00" N 82° 00'00.00" W | 38° 19'00.00" N 82° 00'00.00" W | U.S. Geological Survey | VMP000 | 8 | 0 to 9% | Cloud Cover |
| 3 | Show | Show | <input type="checkbox"/> | ARDC1VFP000370173 | Show | View or Order | 1957/04/21 | Black & white | 31000 | Vertical Cartographic | 38° 22'20.00" N 82° 07'30.00" W | 38° 28'00.00" N 82° 07'30.00" W | 38° 19'00.00" N 82° 00'00.00" W | 38° 19'00.00" N 82° 00'00.00" W | U.S. Geological Survey | VMP000 | 8 | 0 to 9% | Cloud Cover |
| 4 | Show | Show | <input type="checkbox"/> | ARDC1VFC000649983 | Show | View or Order | 1976/04/09 | Black & white | 80000 | Vertical Cartographic | 38° 22'30.00" N 82° 07'30.00" W | 38° 30'00.00" N 82° 07'30.00" W | 38° 19'00.00" N 82° 00'00.00" W | 38° 19'00.00" N 82° 00'00.00" W | U.S. Geological Survey | VECK00 | 8 | 0 to 9% | Cloud Cover |
| 5 | Show | Show | <input type="checkbox"/> | ARD8893600900078 | Show | View or Order | 1960/05/09 | Black & white | 40000 | Vertical Cartographic | 38° 20'00.00" N 82° 00'00.00" W | 38° 28'00.00" N 82° 00'00.00" W | 38° 00'00.00" N 82° 00'00.00" W | 38° 00'00.00" N 82° 00'00.00" W | U.S. Air Force | 893600 | 8 | 0 to 9% | Cloud Cover |
| 6 | Show | Show | <input type="checkbox"/> | | Show | View or Order | | | | | | | | | | | | | |

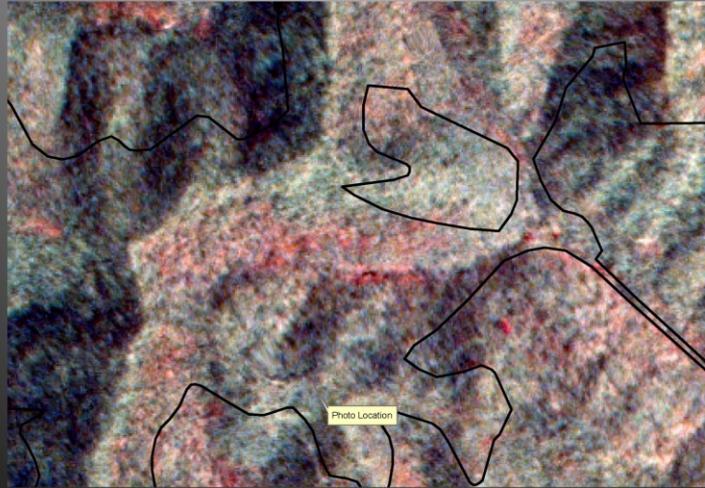
USGS raw map



ERDAS Imagine

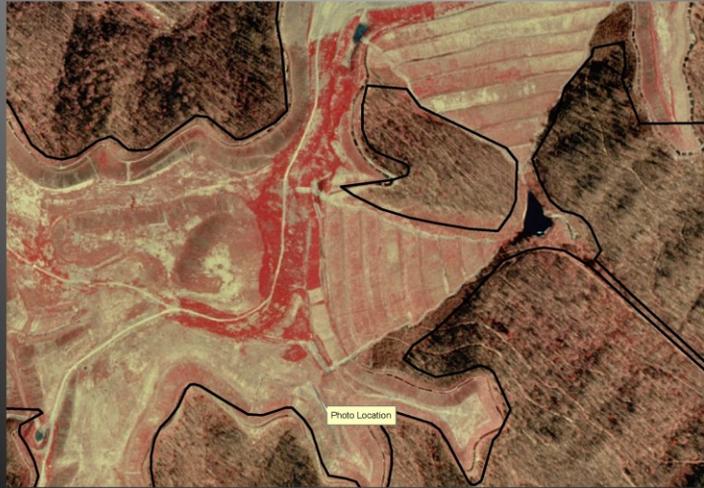
- Lense statistics
- Focal length
- Fiducial marks
- Correct for topography using a modern DEM

Pounding Mill 1990



1. Spatially correct historic image for use in any spatial analysis.
2. If paired images are available a historic DEM can be created, in this case prior to disturbance.

Pounding Mill 1996



Just after re-grading as shown in 1998 photo.

Pounding Mill 2003



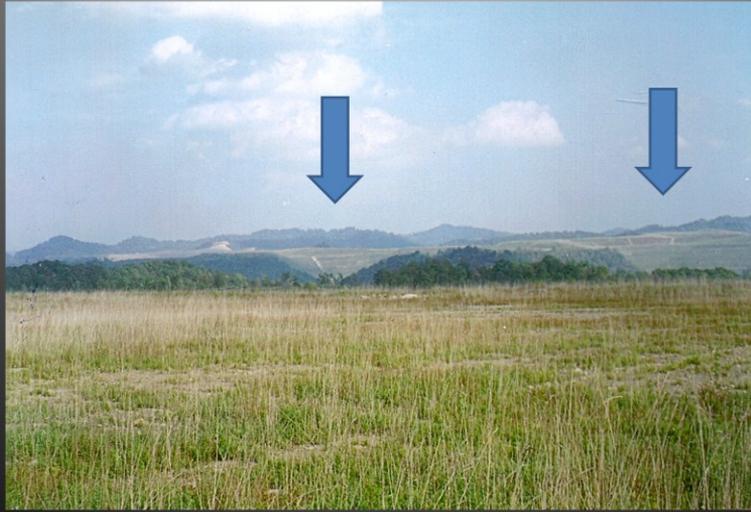
Post Mining land use of forestland. But influenced by Tim Provert, who studied under Dr. Jim Burgger.

Pounding Mill 2007



An actual stem count is possible.

1998



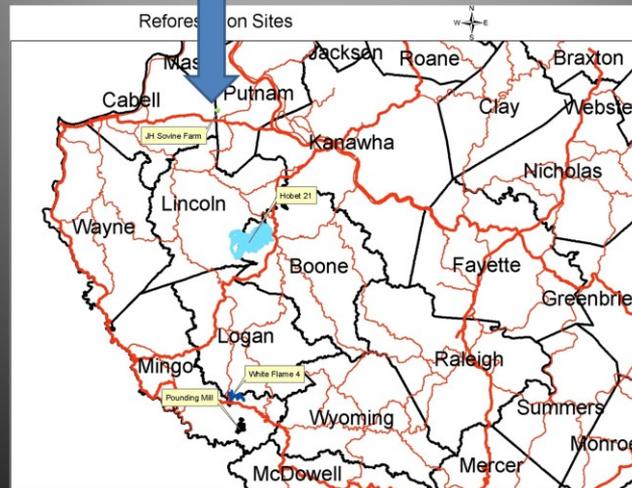
Note valley fills in the distance that serve geographic location features.

Photo 2008



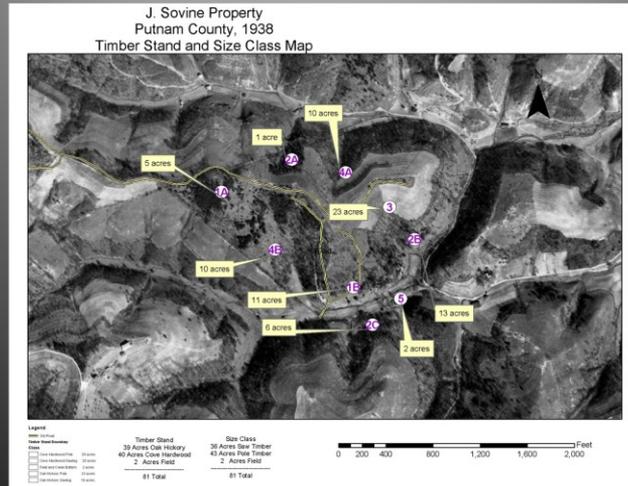
Same location with a Ricoh camera.

JH Sovine Farm



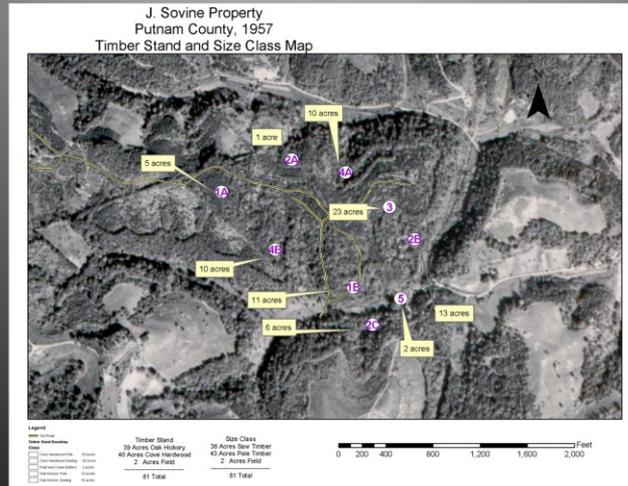
1. 81 Acres in Putnam County West Virginia
2. Historic remote sensing data was gathered for 70 time period, starting in 1938.

1938



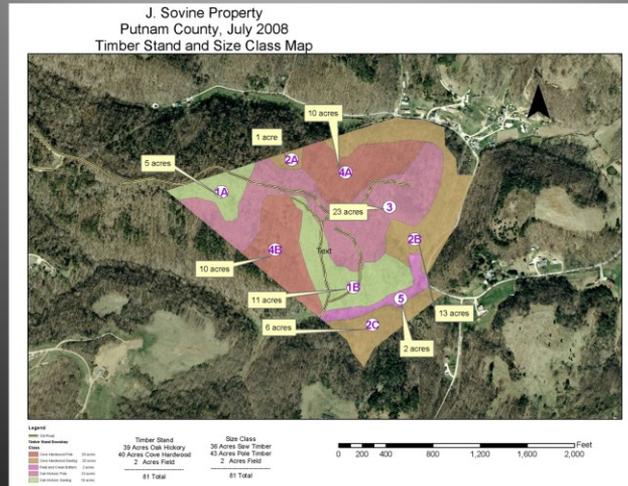
Prior to World War almost the entire farm is disturbed most is row crop.

1957



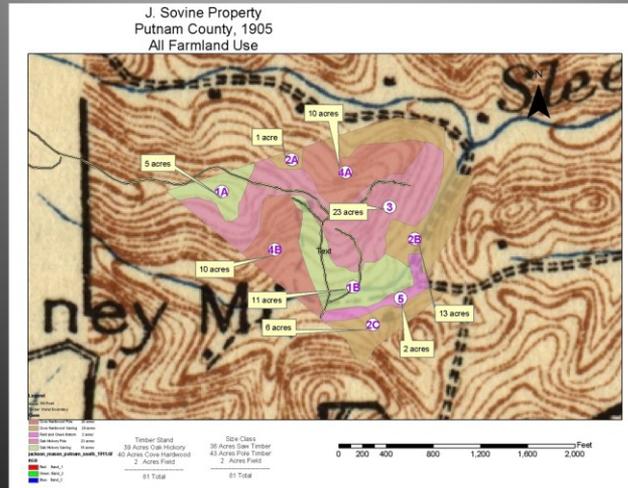
During World War II (1941) large scale farming of the steep slopes ceased. Note the cleared areas are coming back differently then the row crop areas.

2008



Modern forestry survey shows the 1938 disturbance patterns overlain by slope and aspect impacts.

Older Still



GIS Land Use/Land Cover Data is available back to 1905 in WV

Non-standard remote sensing

- Can go back 60 years or more
- Show reforestation trends
- Guide timber stand analysis
- When tied to located site photos can do much more...