Forest Service Operational Data Needs:

Hydrology and Soil Moisture

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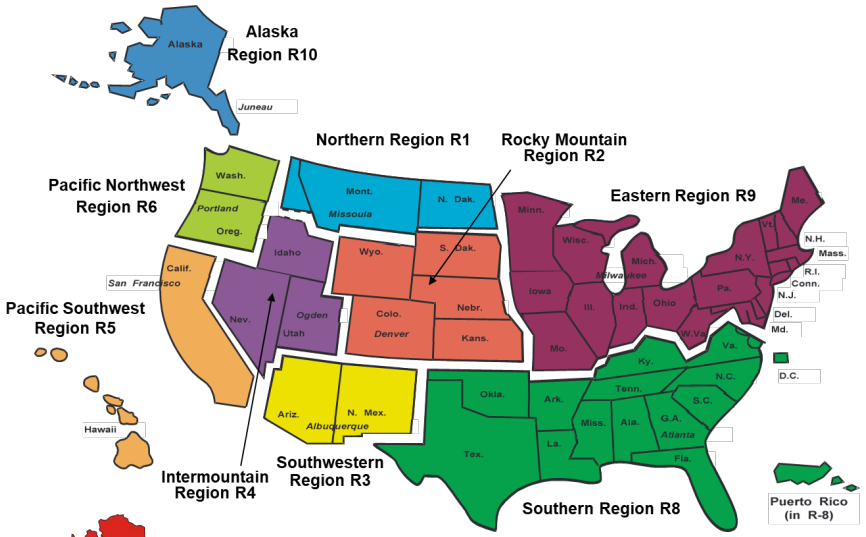
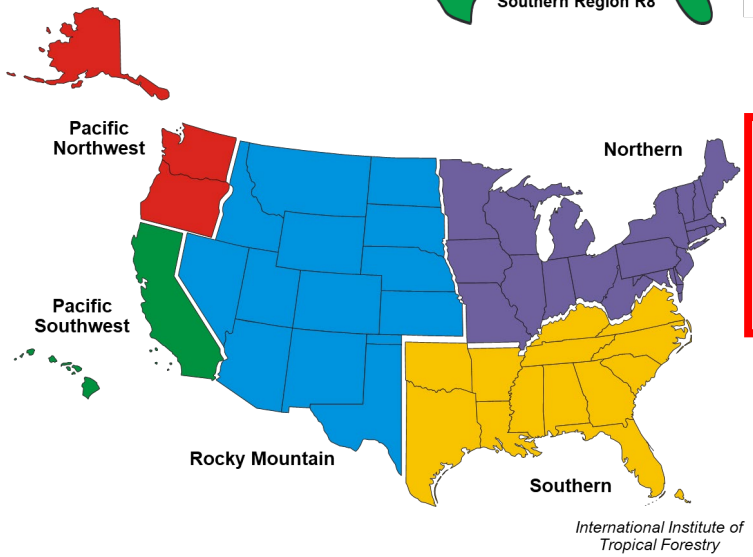
Hydrology and soil moisture definition

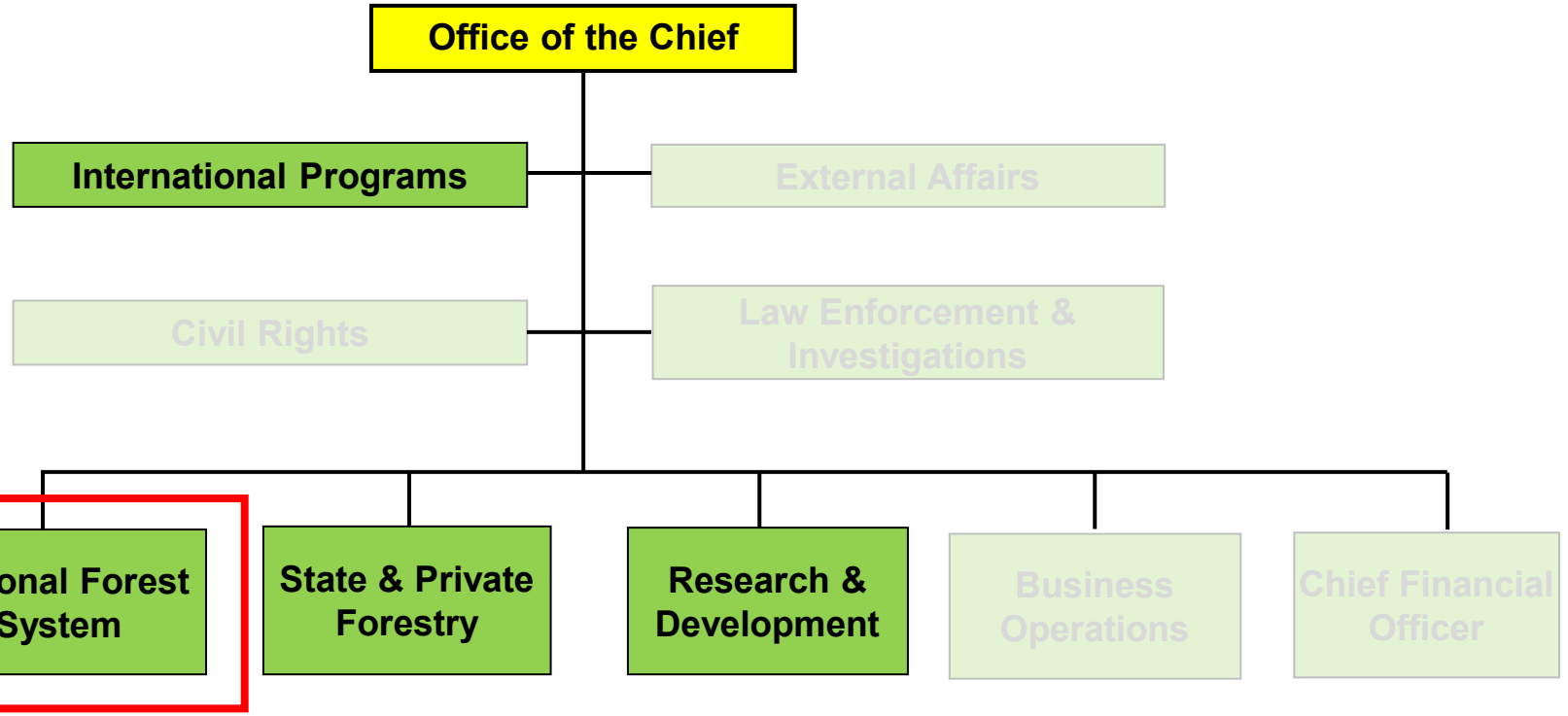
- Soil moisture dynamics
- Soil productivity and erosion
- Inventory and condition of wetland, riparian areas, and groundwater dependent ecosystems
- Aquatic habitat suitability
- Land cover and hydrological change and vulnerability

Where is operational EO data needed?





International Institute of Tropical Forestry



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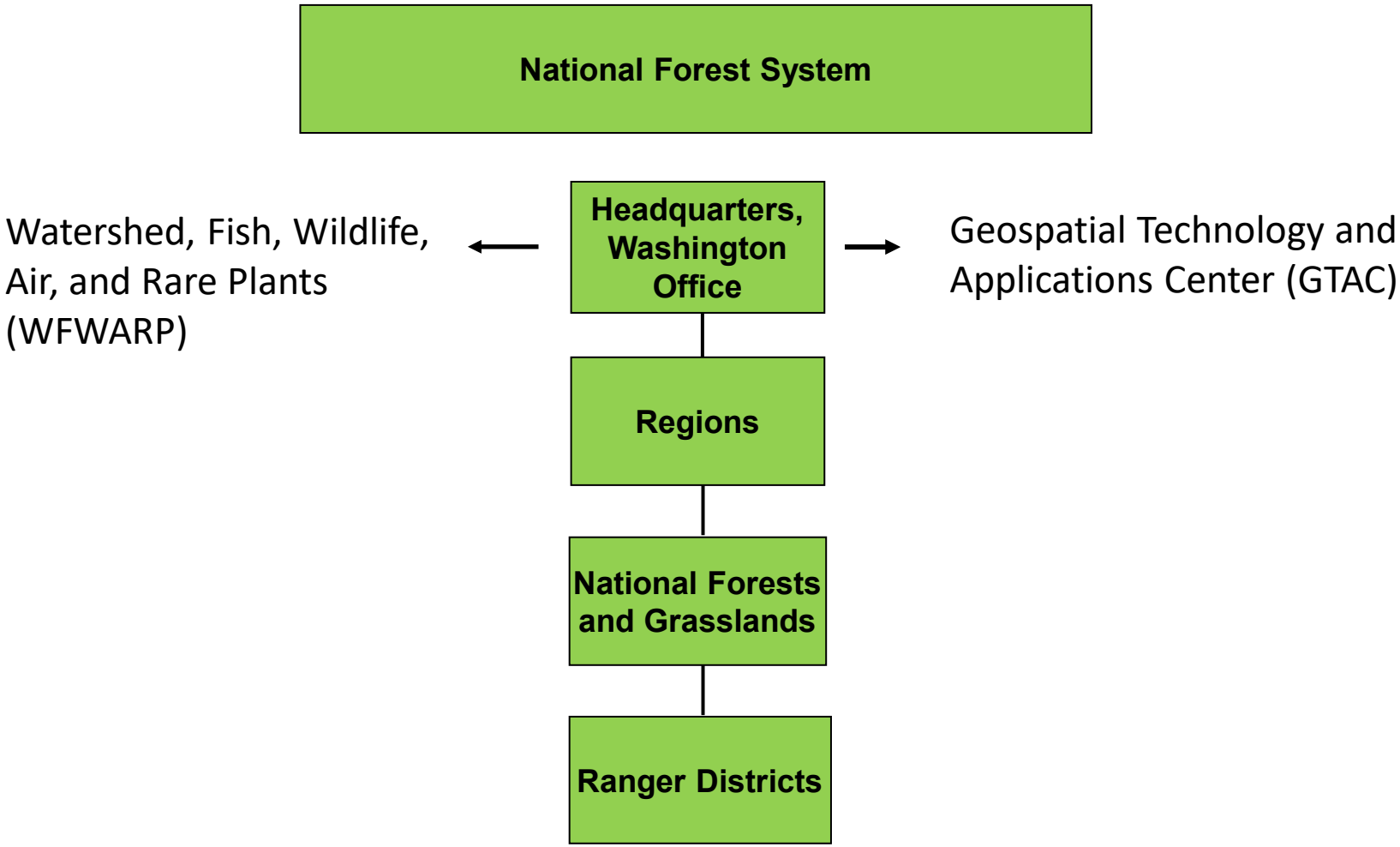

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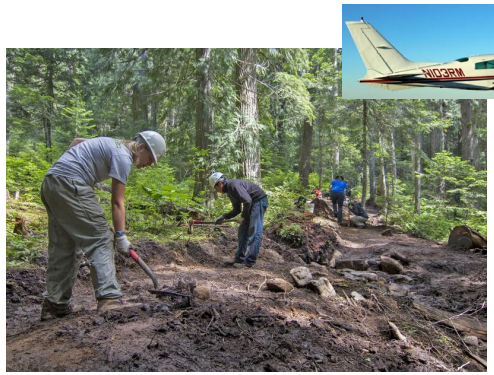
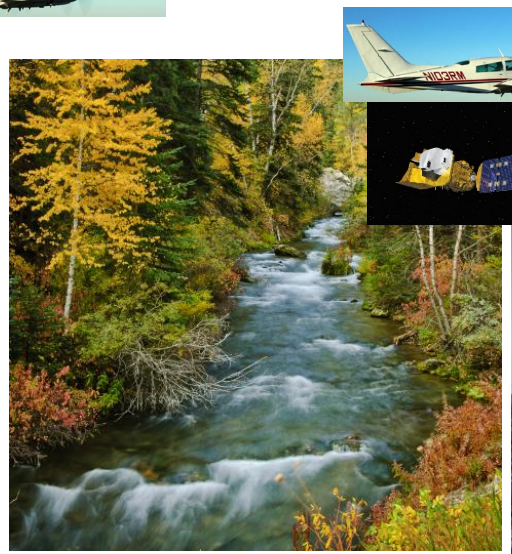


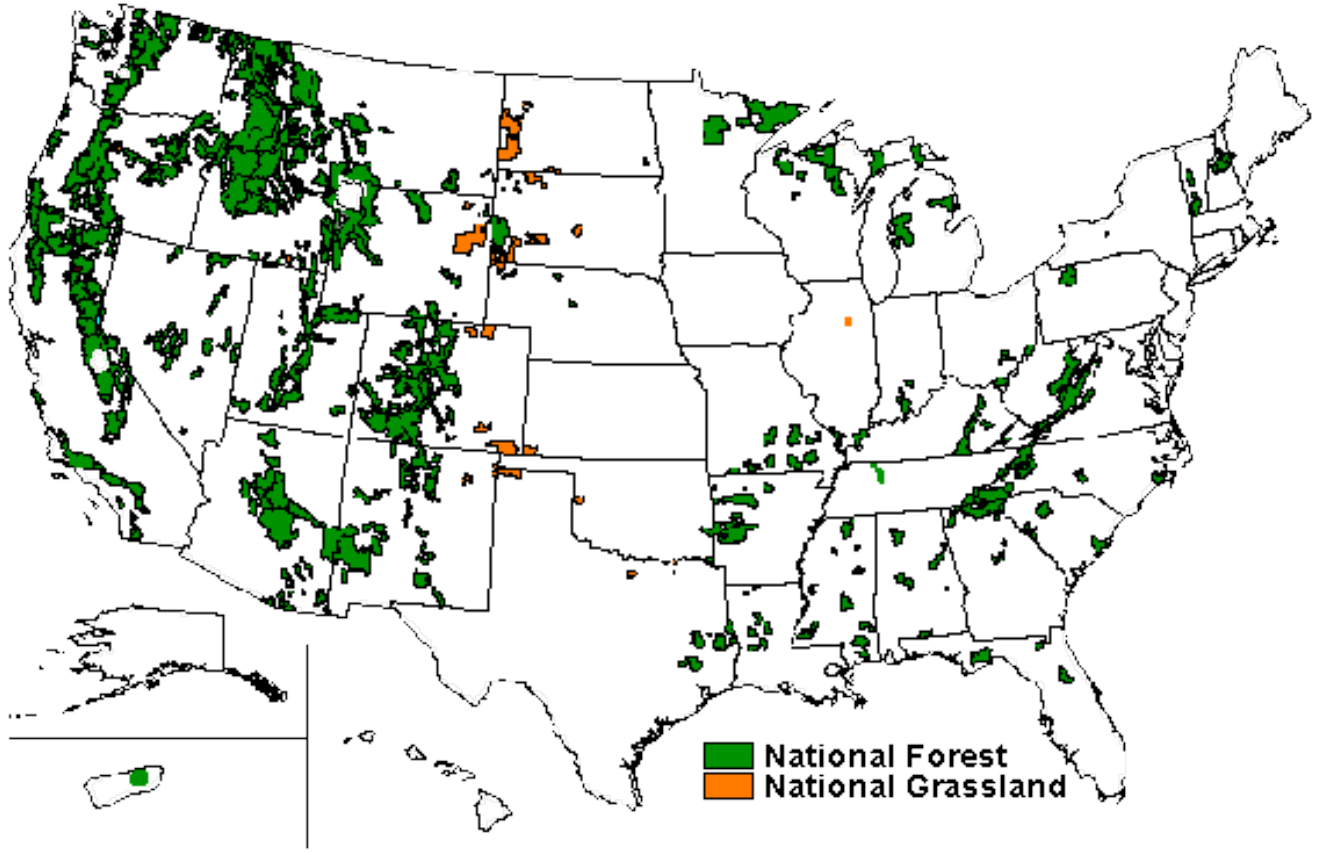
Project Scale



Watershed Scale

Regional Scale

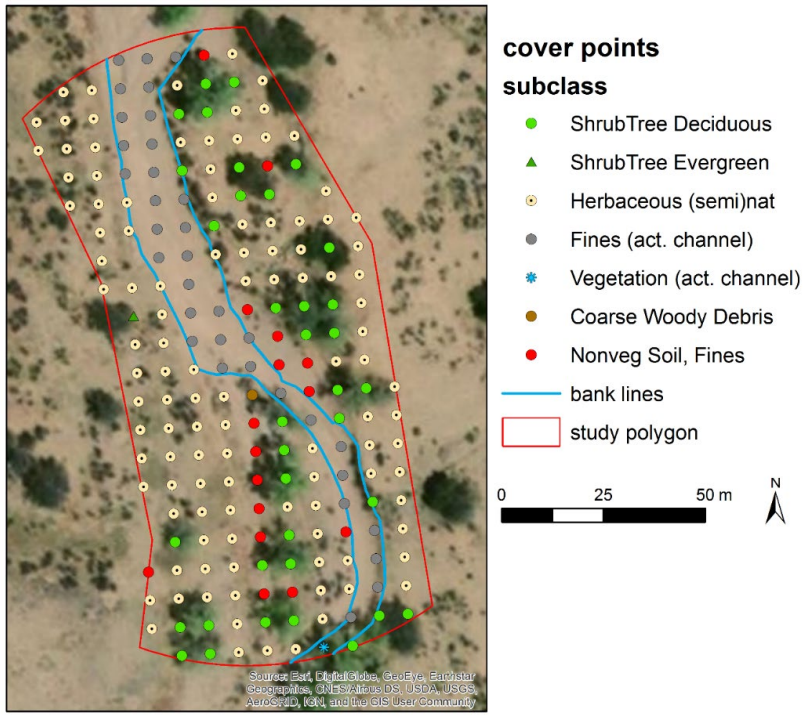
Where is operational EO data needed?

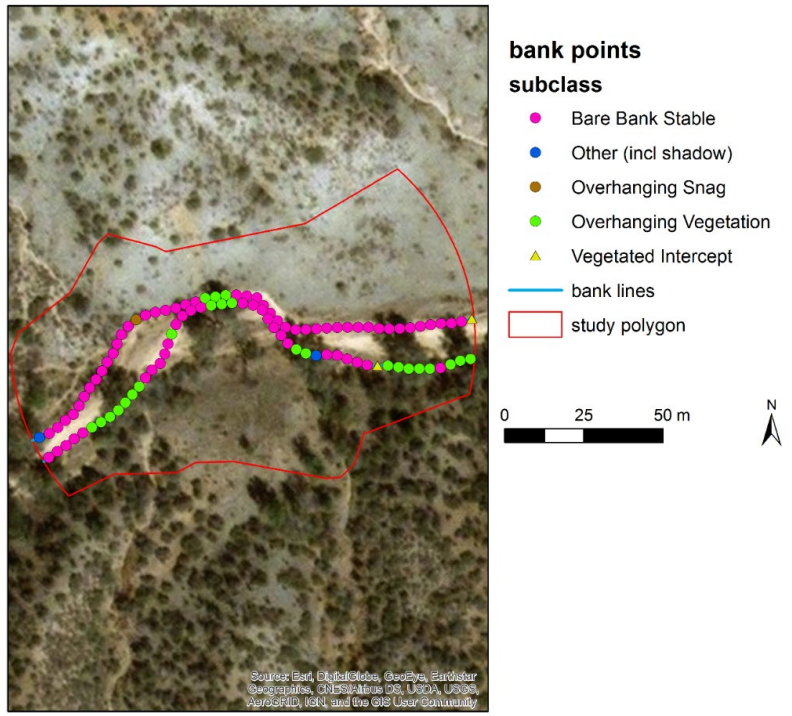


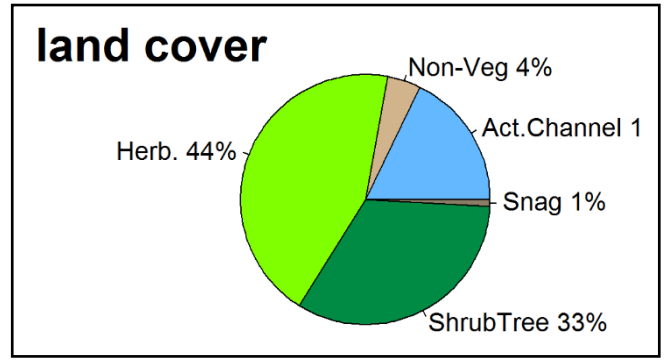
National Scale

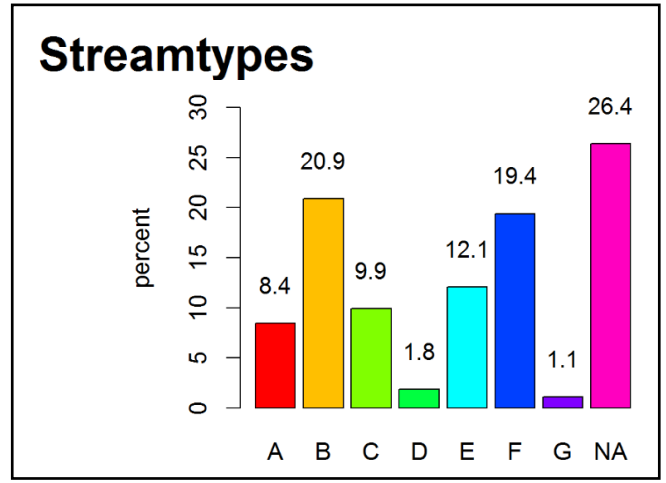
Aquatic Riparian Inventory from Aerial Imagery

- **Goal**: systematic inventory of riparian corridors based on remote sensing imagery
- **Input data**: sample site polygons, 4-band stereo imagery in 5-9 cm resolution
- **Products**: land cover, stream bank status and stream conditions for 1 ha plots
- This data provides information on riparian resources and a baseline inventory for future monitoring









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GTAC Geospatial Technology and Applications Center

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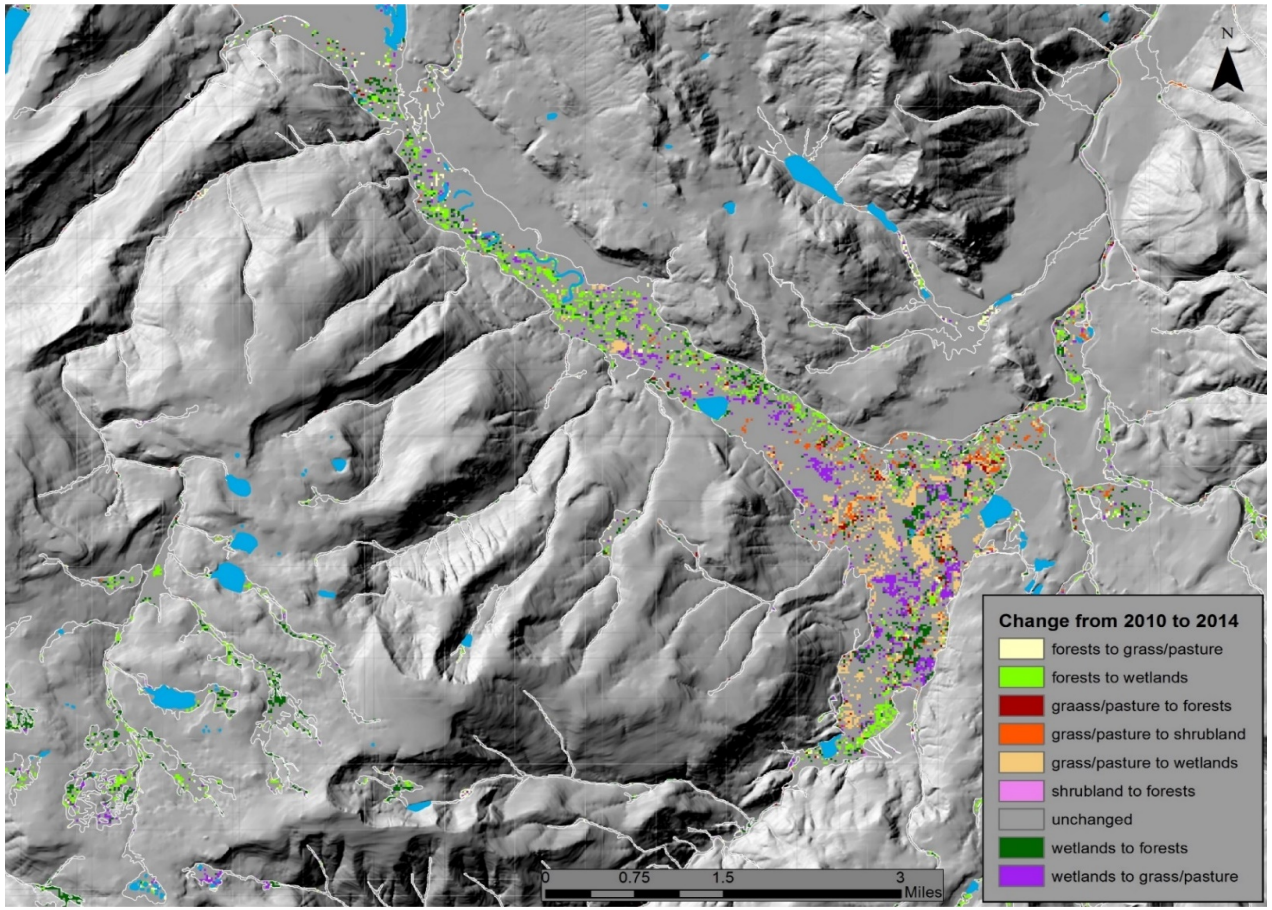
Riparian Areas Inventory & Assessment

Input Data	Sources	Type
Streams	**USGS National Hydrology Dataset (NHD)**	**Required**
Lakes	USGS National Hydrology Dataset (NHD)	Optional
National Wetlands Inventory	National Wetlands Inventory (NWI)	Optional
gSSURGO	Natural Resources Conservation Service (NRCS)	Optional
Elevation (10m DEM)	**The National Map**	**Required**
Land Cover	National Land Cover Database Cropland Data Layer	Optional
50-Year Flood Height	**50-year flood height value is calculated using Mason (2007) approach utilizing available USGS water gauges**	**Required**



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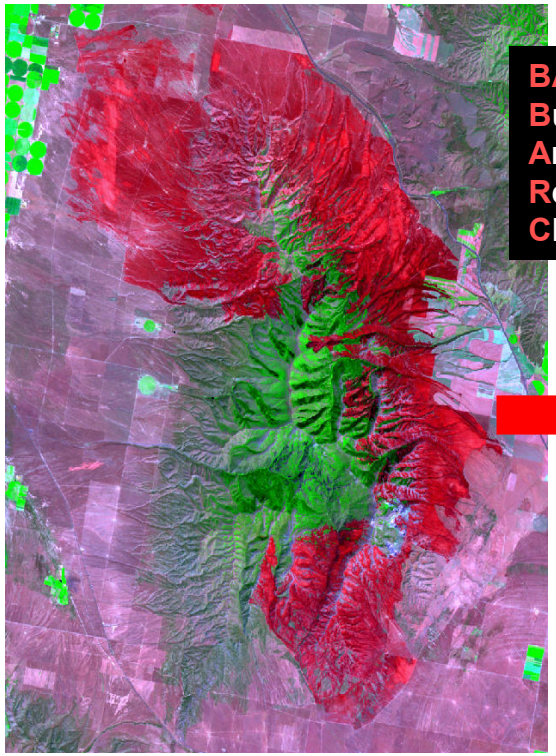
BAER and BARC



Landsat 7, Landsat 8, Sentinel

BARC =
Burned
Area
Reflectance
Classification

GTAC

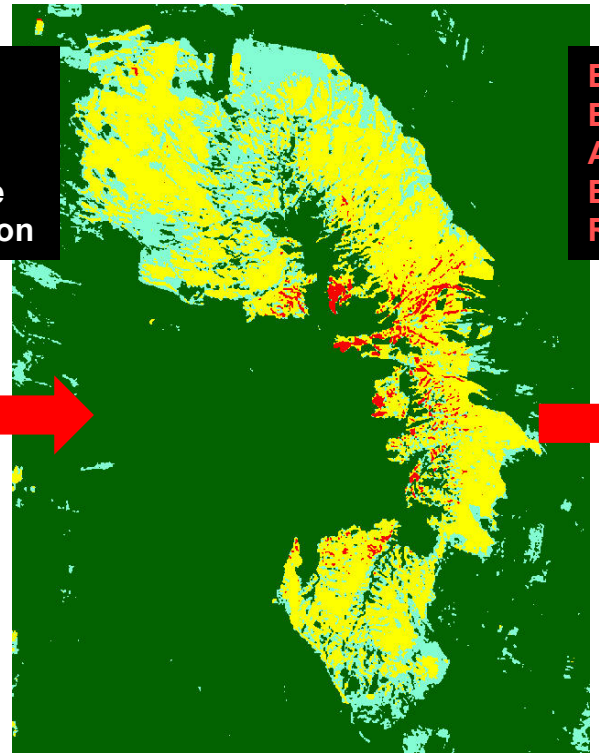


Image processing and interpretation

BAER =
Burned
Area
Emergency
Response

BAER Team

Calibration on the ground is used to validate the product and create the Soil Burn Severity dataset

- BARC Provides a preliminary assessment of ground conditions; used by BAER team

For more information: Cara Farr| Regional Soil Scientist| cara.farr@usda.gov

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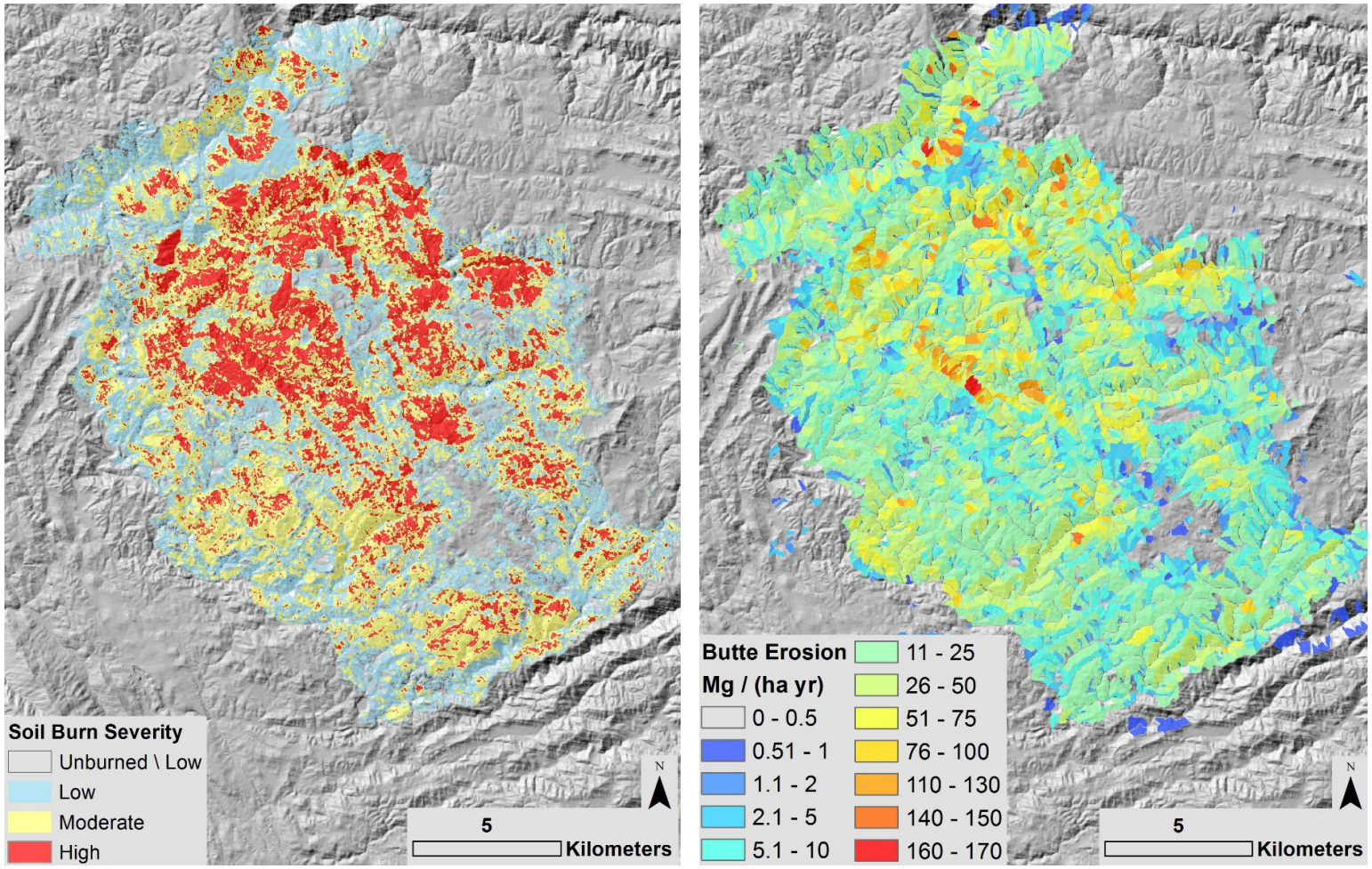
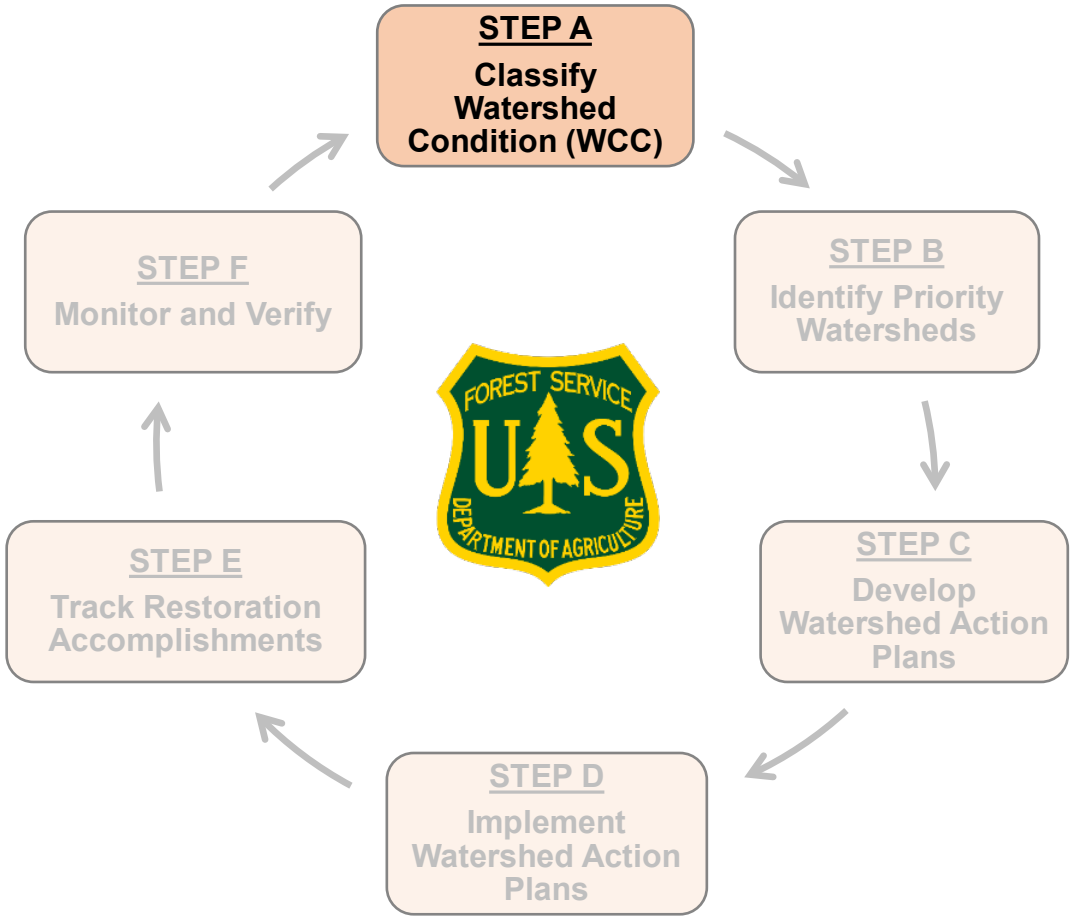
BAER Rapid Response Erosion Database

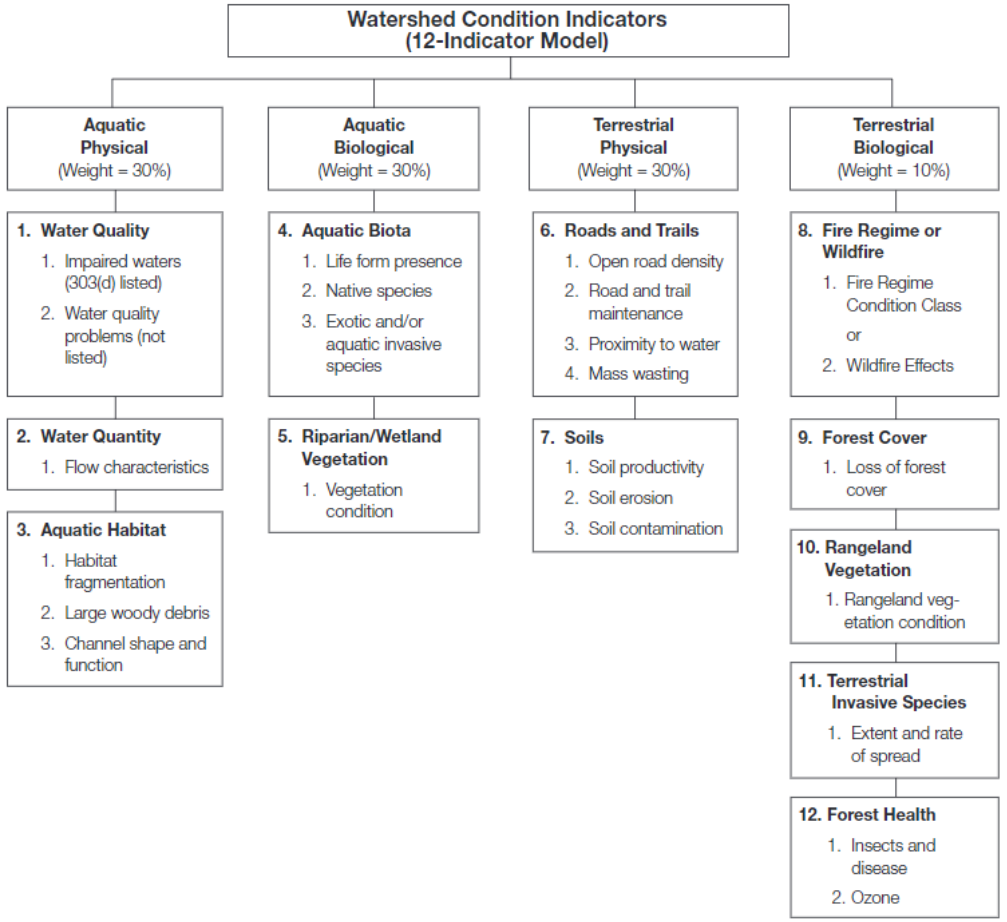


- Rapid Response Erosion Database – incorporates spatial data on vegetation, soils and elevation to **depict changes in land cover and soil properties caused by wildland fire**
- Mapping enables modeling effectiveness of treatments to prevent **flooding, erosion and landslides under a range of weather scenarios**
- Data can be used to develop recommendations for emergency stabilization treatments or modifications to drainage structures to protect values-at-risk following a wildland fire

For more information: Cara Farr| Regional Soil Scientist| cara.farr@usda.gov

USFS Watershed Condition Classification





WCC helps field units identify priority watersheds to focus restoration actions

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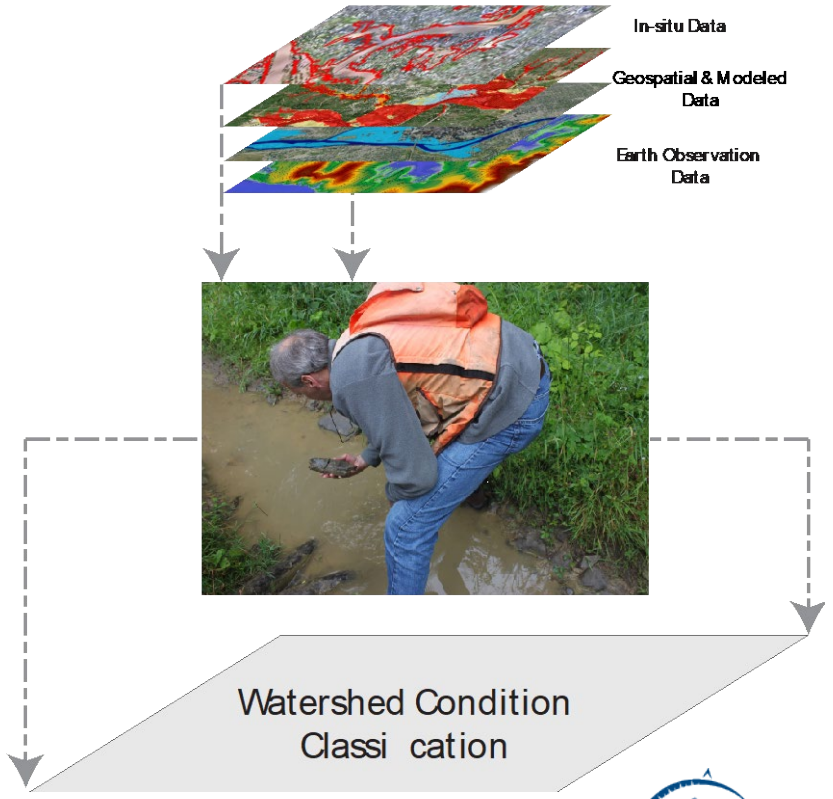
USFS Watershed Condition Classification

	Indicator/Attribute	EO/GIS feasibility	USFS field data
Aquatic Physical	Impaired waters (303d)	**High**	
	Water quality problems	Low	X
	Flow characteristics	Medium	
	Habitat Fragmentation	Medium	X
	Large Woody Debris (LWD)	Low	X
	Channel shape and function	Low	X
Aquatic Biological	Life form presences	NA	X
	Native species	NA	X
	Invasive/exotic specie	NA	X
	Riparian vegetation	Medium	X
Terrestrial Physical	Open road density	**High**	
	Proximity to water	**High**	
	Mass wasting	Low	
	Road maintenance	NA	X
	Soil productivity	Low	X
	Soil Erosion	Low	X
	Soil Contamination	NA	X
Terrestrial Biological	Fire regime condition class	**High**	
	Wildfire effects	**High**	X
	Loss of forested cover	**High**	
	Rangeland vegetation condition	Medium	X
	Terrestrial invasives	Low	X
	Insects and disease	**High**	
	Ozone	Medium	

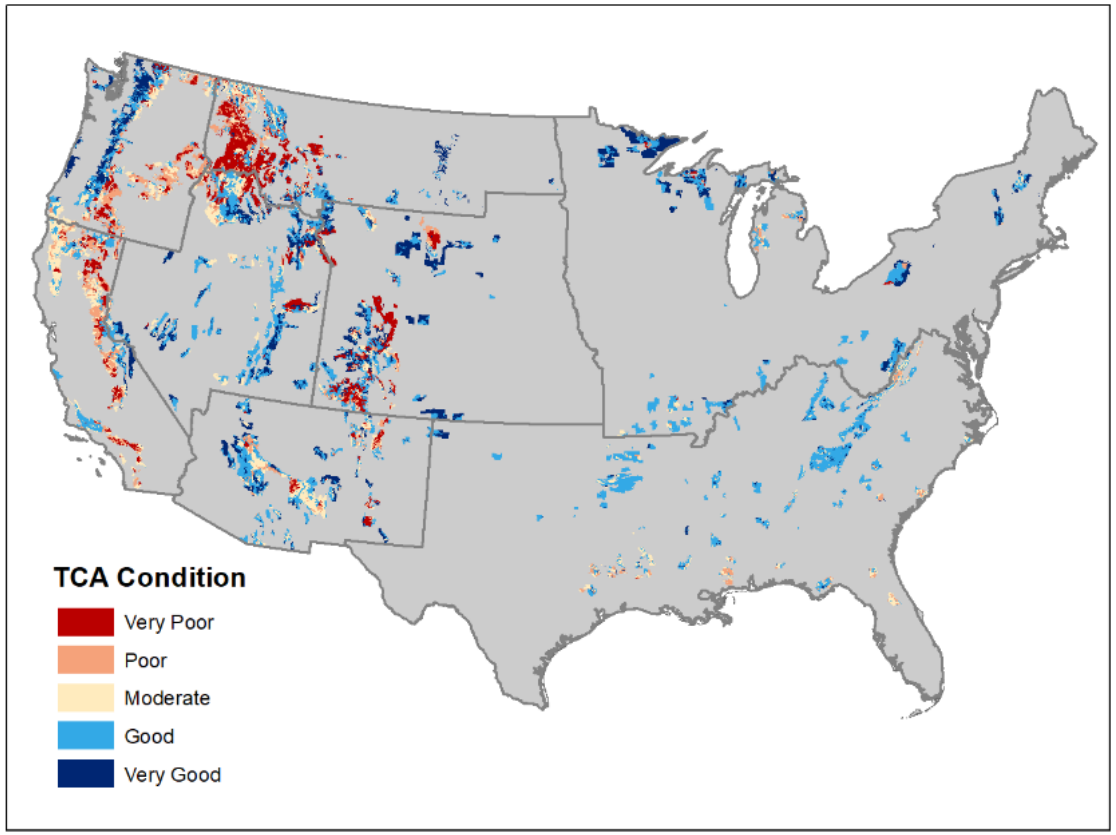


CONSERVATION SCIENCE PARTNERS

USDA FOREST SERVICE

For more information: Raha Hakimdavar| National Hydrologist| raha.hakimdavar@usda.gov

TCA | Terrestrial Condition Assessment



The **T**errestrial **C**ondition **A**ssessment (TCA) is a management tool that provides a mid-scale assessment of resource conditions across the National Forest System (NFS) lands based on mapping and interpreting key indicators of ecological integrity.

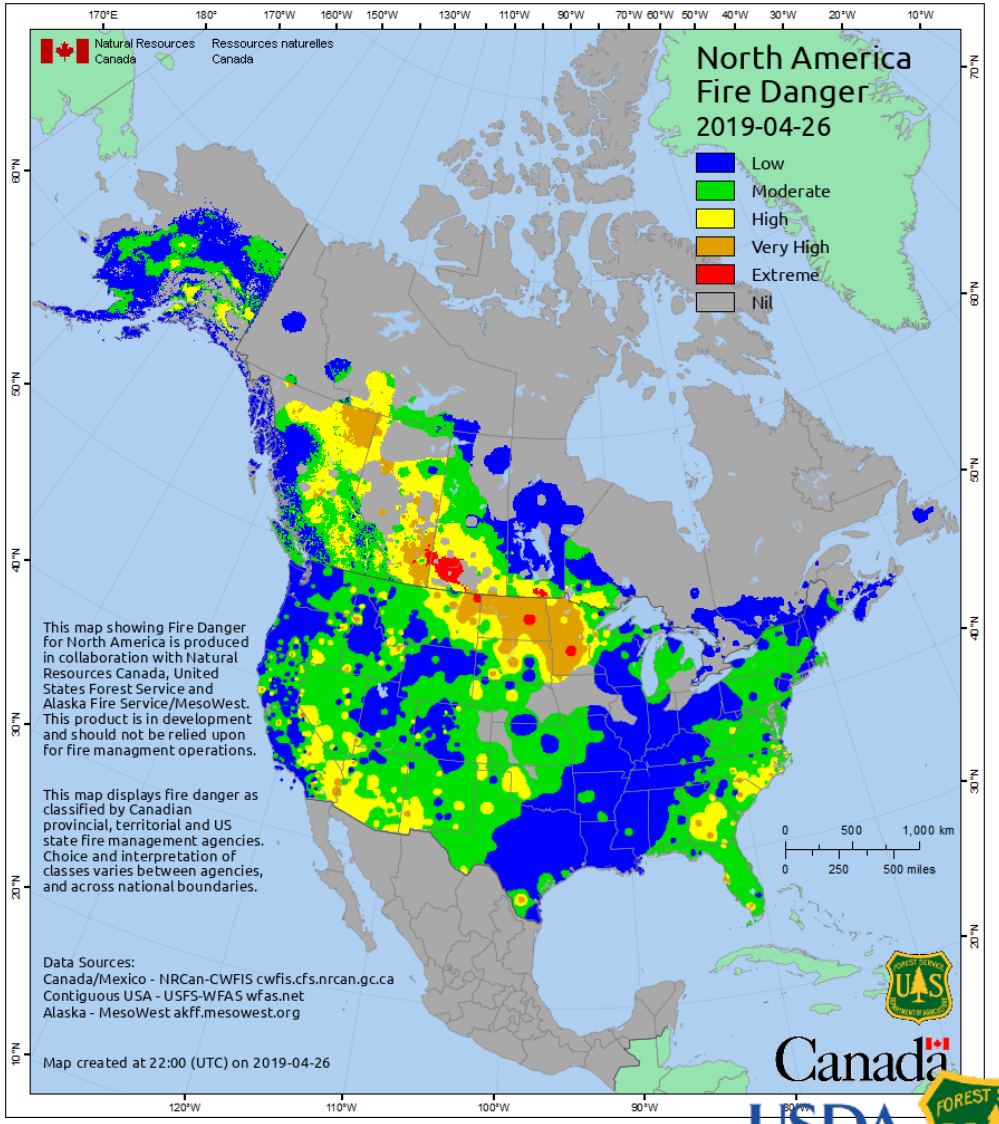
Key data sources:

- LANDFIRE (Landsat)
- MTBS (Landsat)
- Wildland Hazard Potential (Landsat)
- Insect and Disease Hazard (Landsat)
- Productivity (MODIS)
- NLCD (Landsat)

For more information: Larry Laing| National Soils Program Leader| 602-570-0190 | larry.laing@usda.gov

Fire Danger

- Soil moisture is not directly used in fire danger rating
- Several drought indices (e.g. Palmer, Keetch-Byram) are used as well as ancillary weather information and live vegetation and dead material fuel moisture
- Dead fuel moisture for large woody particles is typically modeled based on weather observations because of the long time lag
- Moisture is an important part of danger rating and fire behavior, so remotely sensed soil moisture could be an asset (scale remains a challenge)

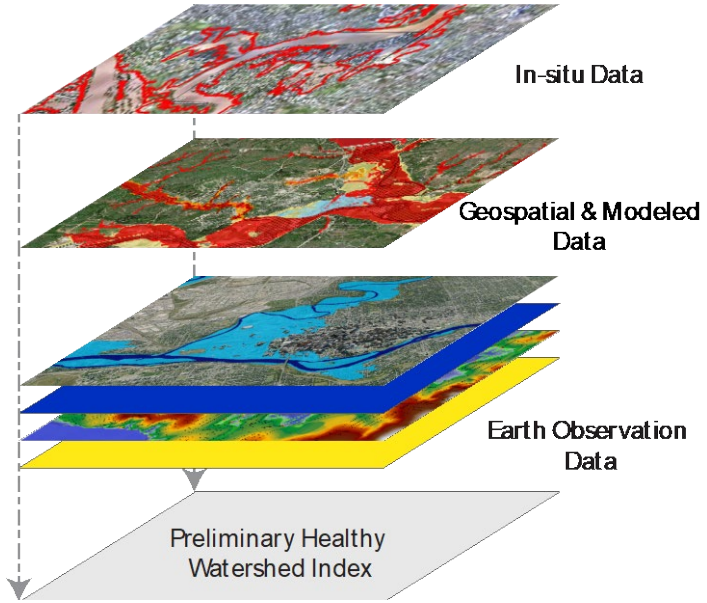


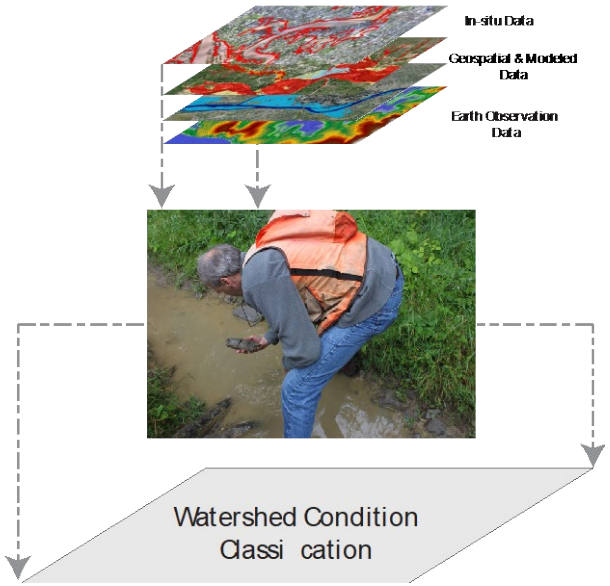
For more information: Mark Finney| Research Forester, RMRS| mark.finney@usda.gov

EO Data Integration

Fully Data Driven

Fully Expert-Knowledge Driven





Future Outlook

Opportunities

- Flexible data-to-decision architecture that uses multiple data sources/types
- “Filling in the gaps” where higher resolution data is not available or necessary
- Targeting integration w/ national or regional data products
- S2S forecasting
- Soil moisture (scale is a challenge)

Challenges

- Spatial resolution and scale
- Access and incentive
- Interoperability w/ existing decision support approaches
- Operational capacity across scales
- Transparency and validation
- Trust

Questions and Comments

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Jack Triepke, Regional Ecologist, Region 3
Sinan Abood, Research Scientist, WFWARP
Matt Reeves, Research Ecologist, RMRS Forestry Sciences Laboratory Missoula