



# Forest Thinning & Water Yield

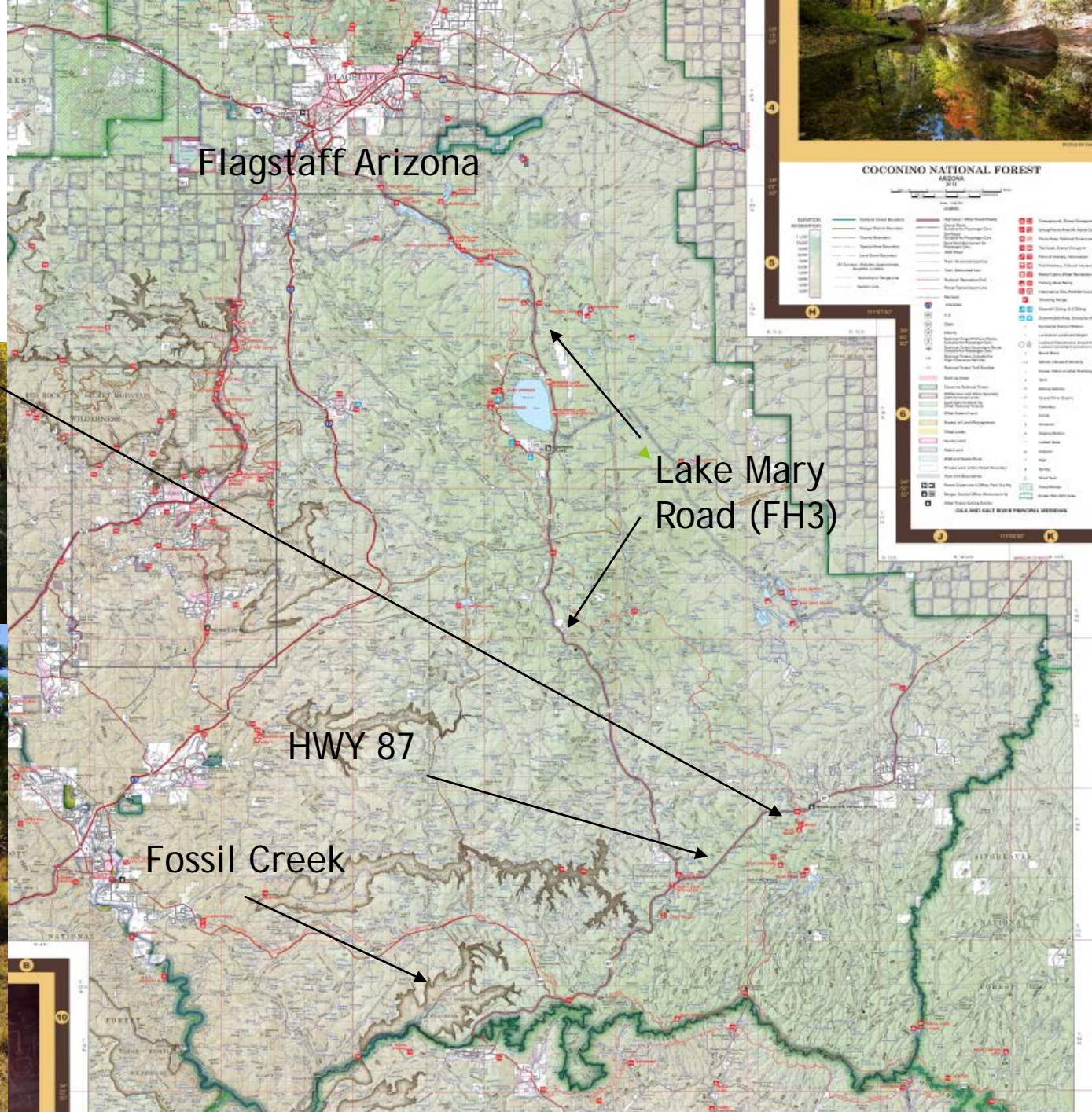
w/in the context of the C.C. Cragin Watershed Protection Project

Scott M. Francis, District Forester

Mogollon Rim Ranger District, Coconino National Forest

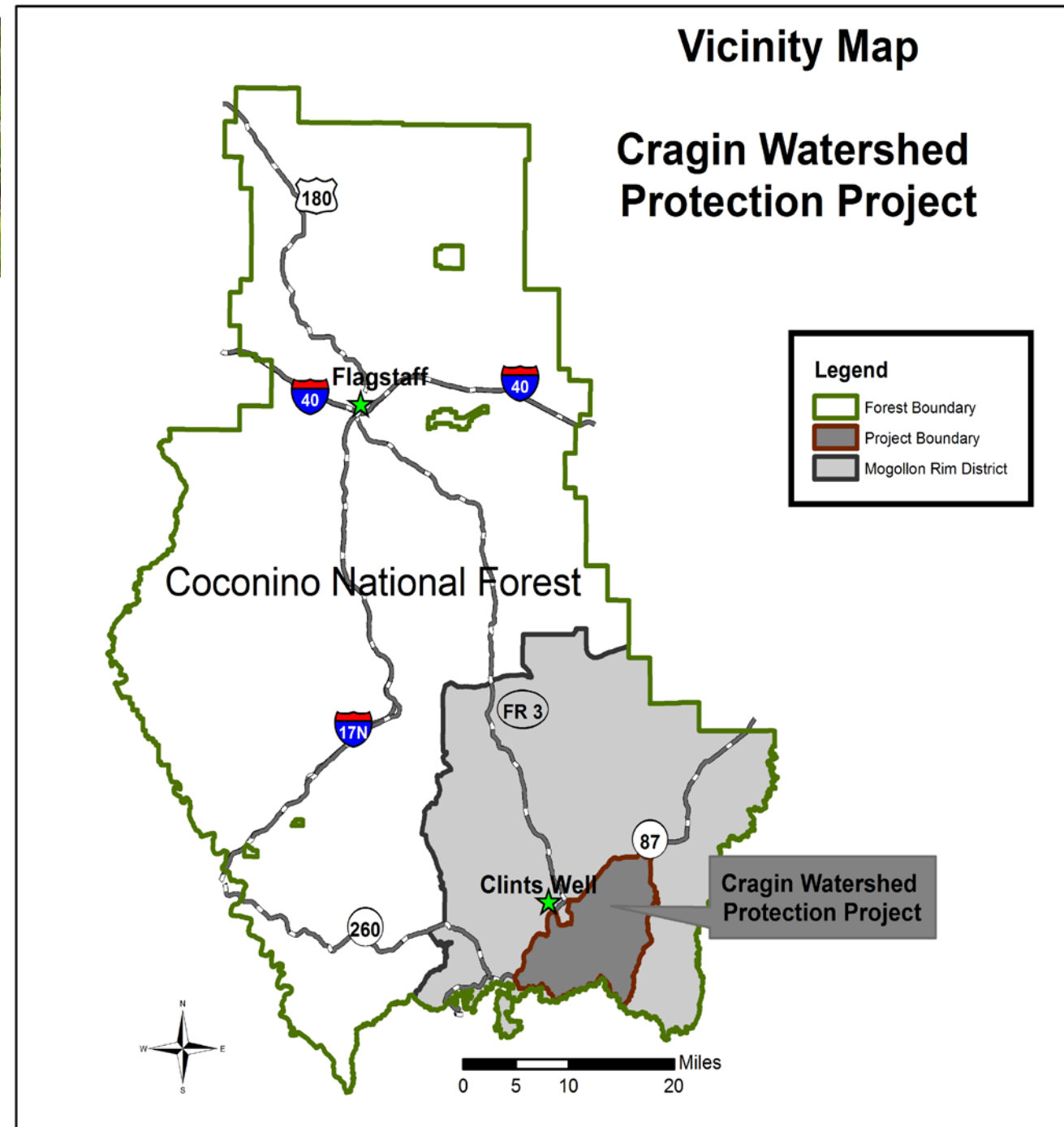
# Coconino National Forest

Mogollon Rim Ranger District  
Happy Jack Arizona

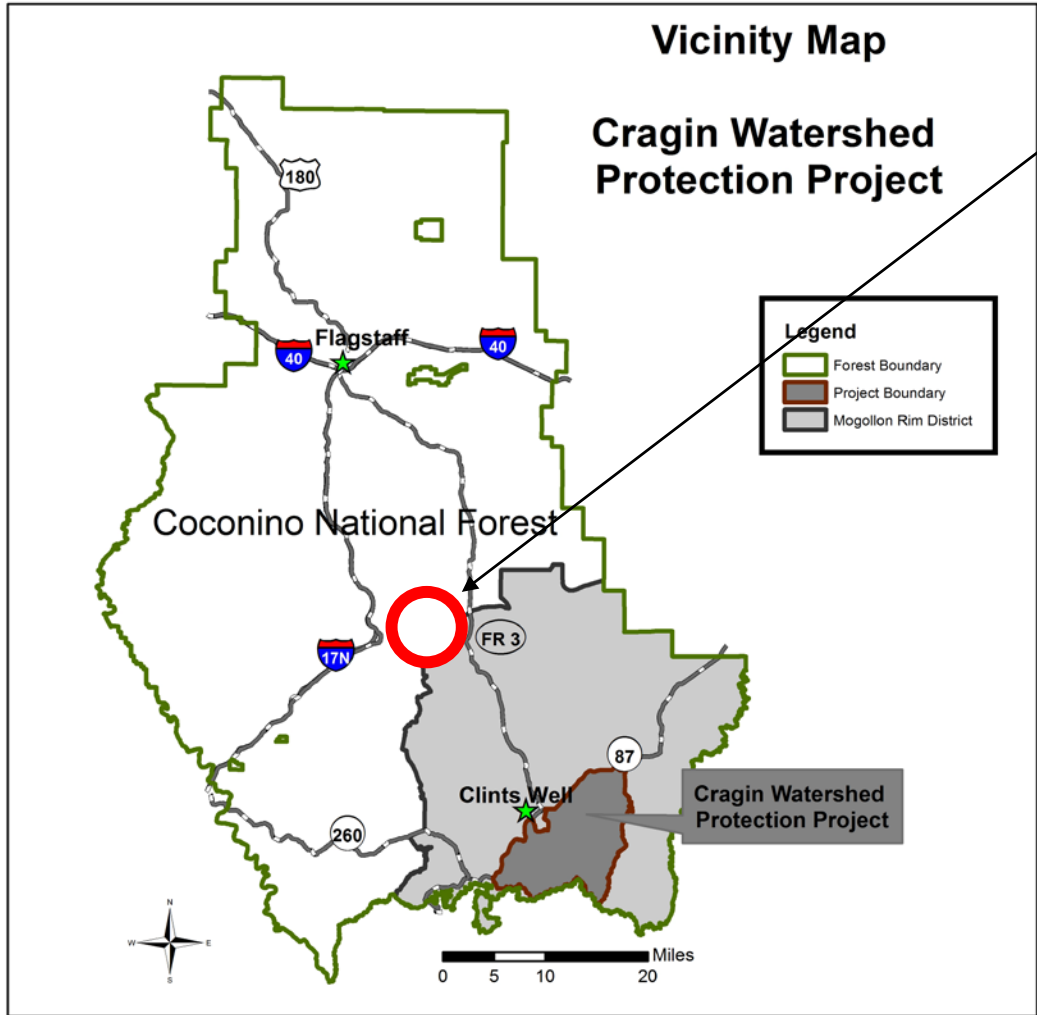




- Baseline water yield knowledge
- How thinning and water yield relates to the CCWPP
- Implementation Challenges
- Solutions to implementation Challenges



Baker, Malchus. Effects of Ponderosa Treatments on Water Yield in Arizona, *Water Resources Research*, Vol 22, No.1, pgs. 67-73, January 1986



- ▶ Long-term paired watershed study
  - ▶ Beaver Creek watershed
  - ▶ Volcanic basalt and Cinder parent material
  - ▶ Uneven aged Ponderosa pine stands
  - ▶ 97% water yield produced in winter (October- April)
  - ▶ 6500-7500 ft elevation
- Where we get our water?

# Treatments.

## Annual Stream Flow. (paired measurement)



- ▶ Strip Cut with Thinning
- ▶ Overstory Removal
  - ▶ 100% veg removal
  - ▶ 77% removal
  - ▶ 33% removal
- ▶ 77%; 1yr +35%
- ▶ 33%; 1yr +20%

# Findings and Discussion



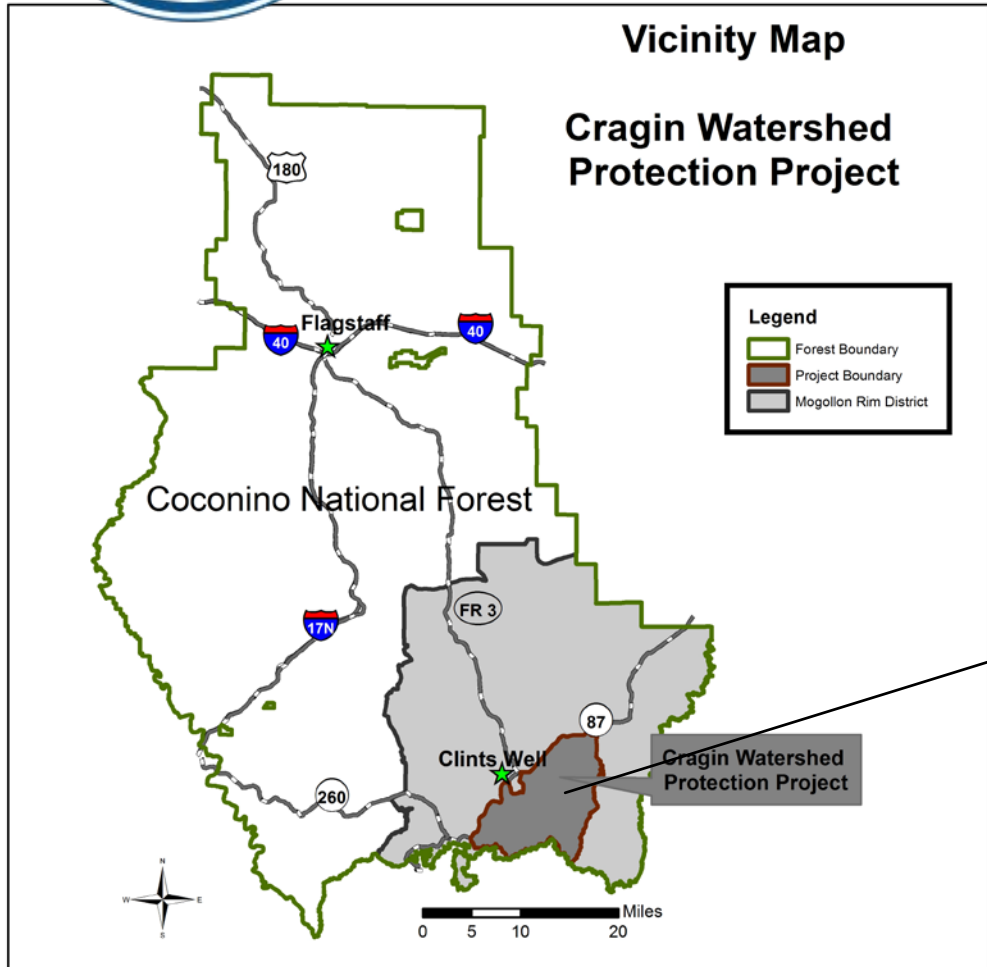
- ▶ Forest cover and precipitation
  - ▶ Interception
  - ▶ Runoff
- ▶ Predicting water yield
  - ▶ Water balance
  - ▶ Aquifer recharge
  - ▶ Soil moisture characteristics
  - ▶ Timing & Variability of precipitation events.

Responses have been observed to decrease w/time after treatment

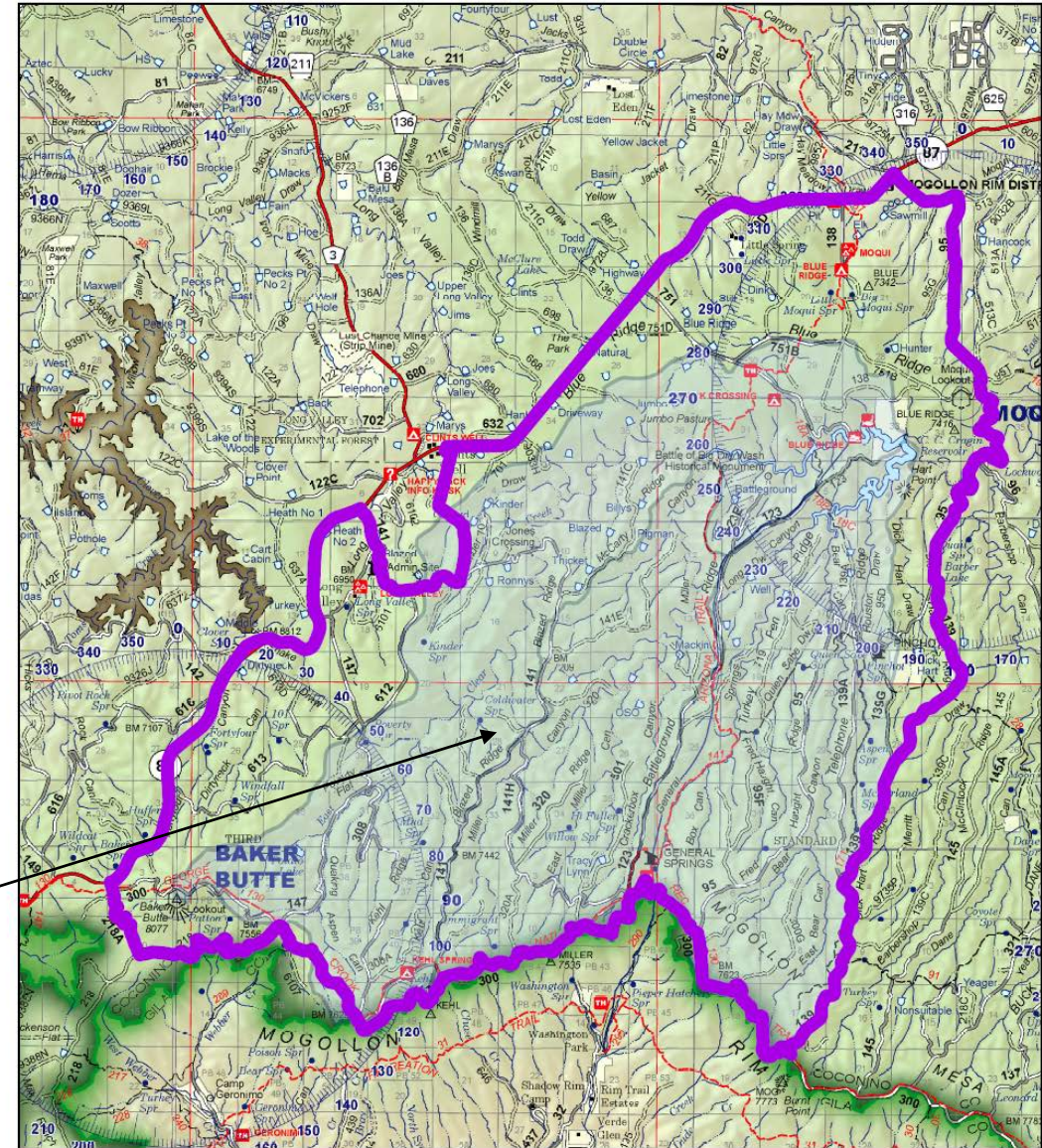


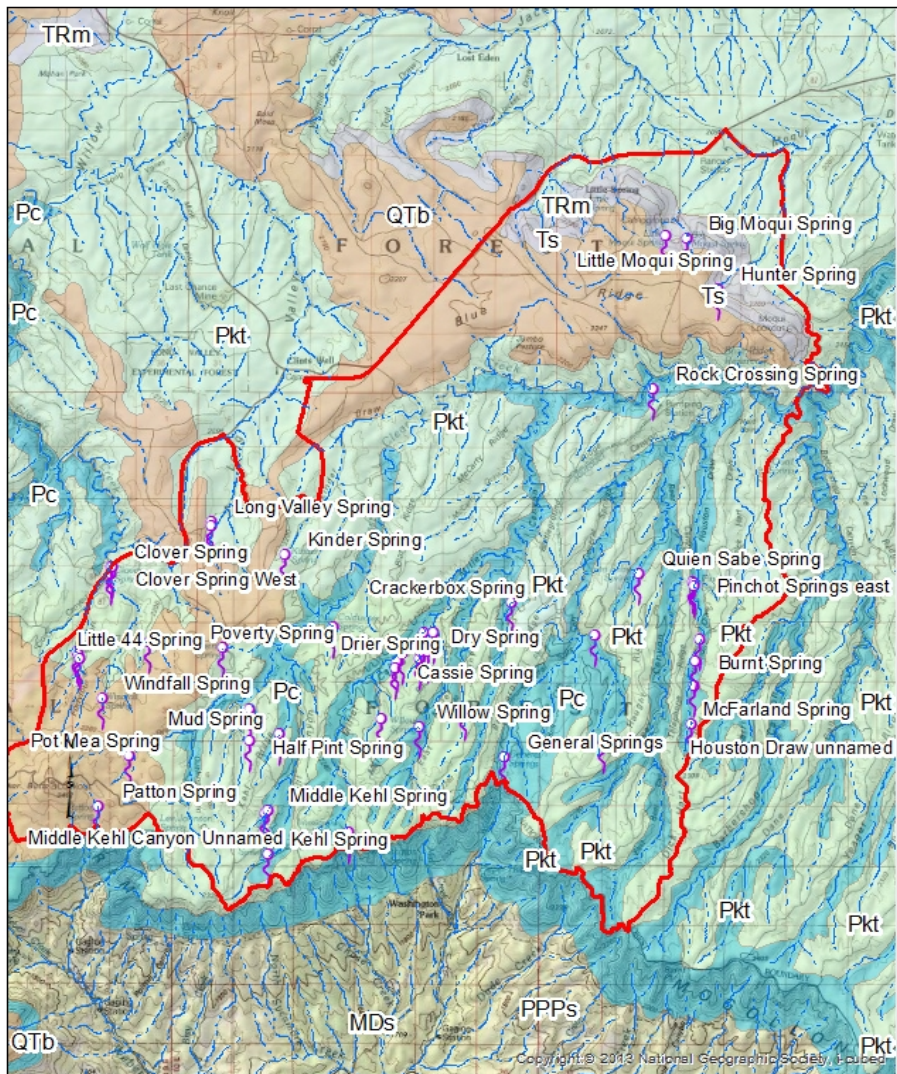
### Vicinity Map

### Cragin Watershed Protection Project

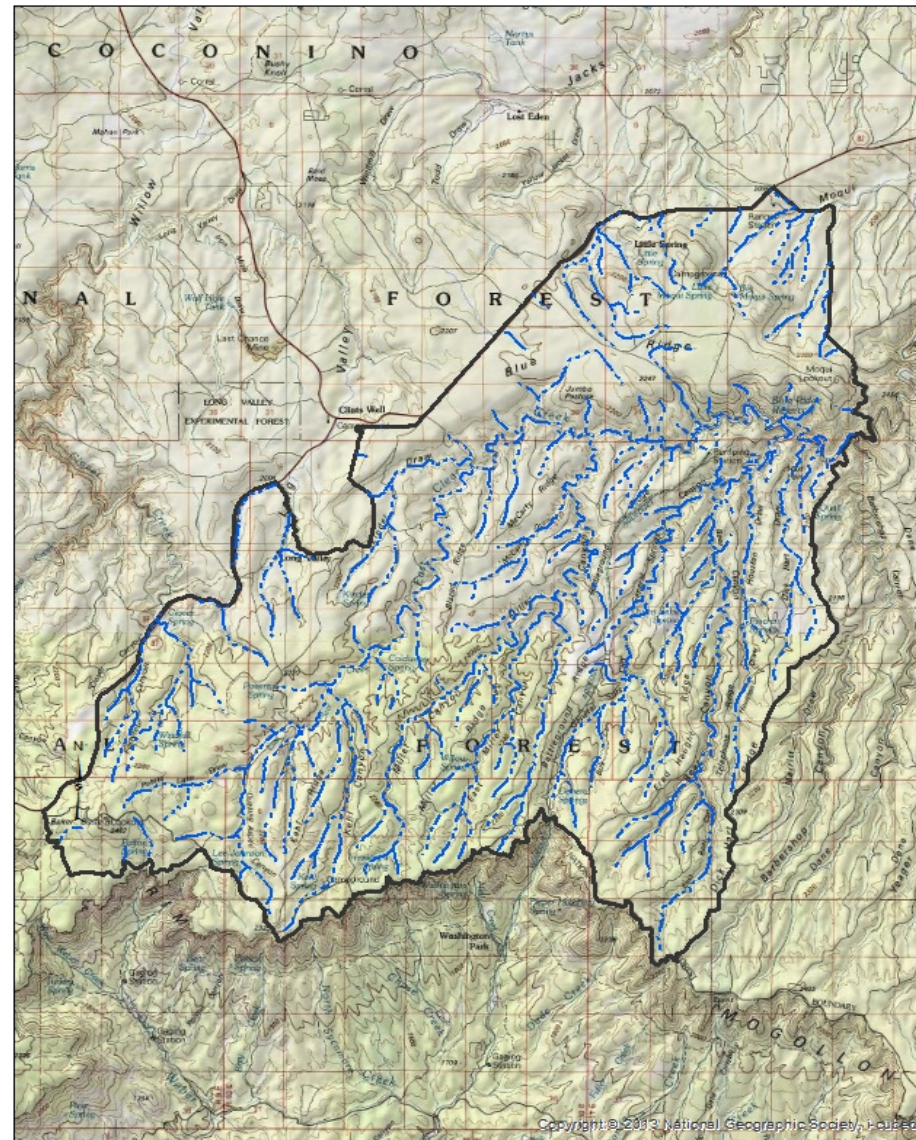


### C. C. Cragin Fuels Reduction Project Boundary Map





- stream channel
- Project Boundary
- Springs
- Geologic Map Unit**
- Pc - Coconino Sandstone
- Pkt - Kaibab Formation
- QTb - Basaltic volcanic rocks
- Qts - Sedimentary rocks
- TRm - Moenkopi Formation
- Ts - Sedimentary rock

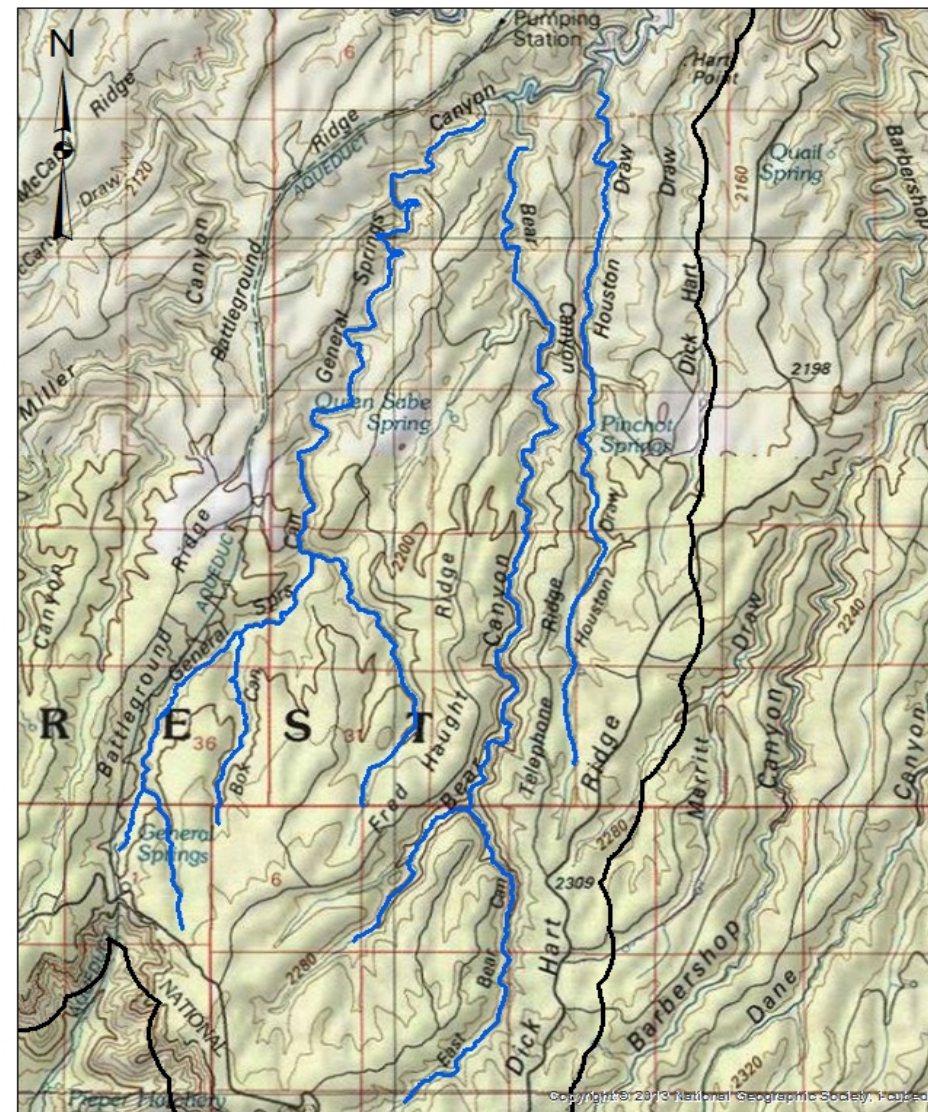
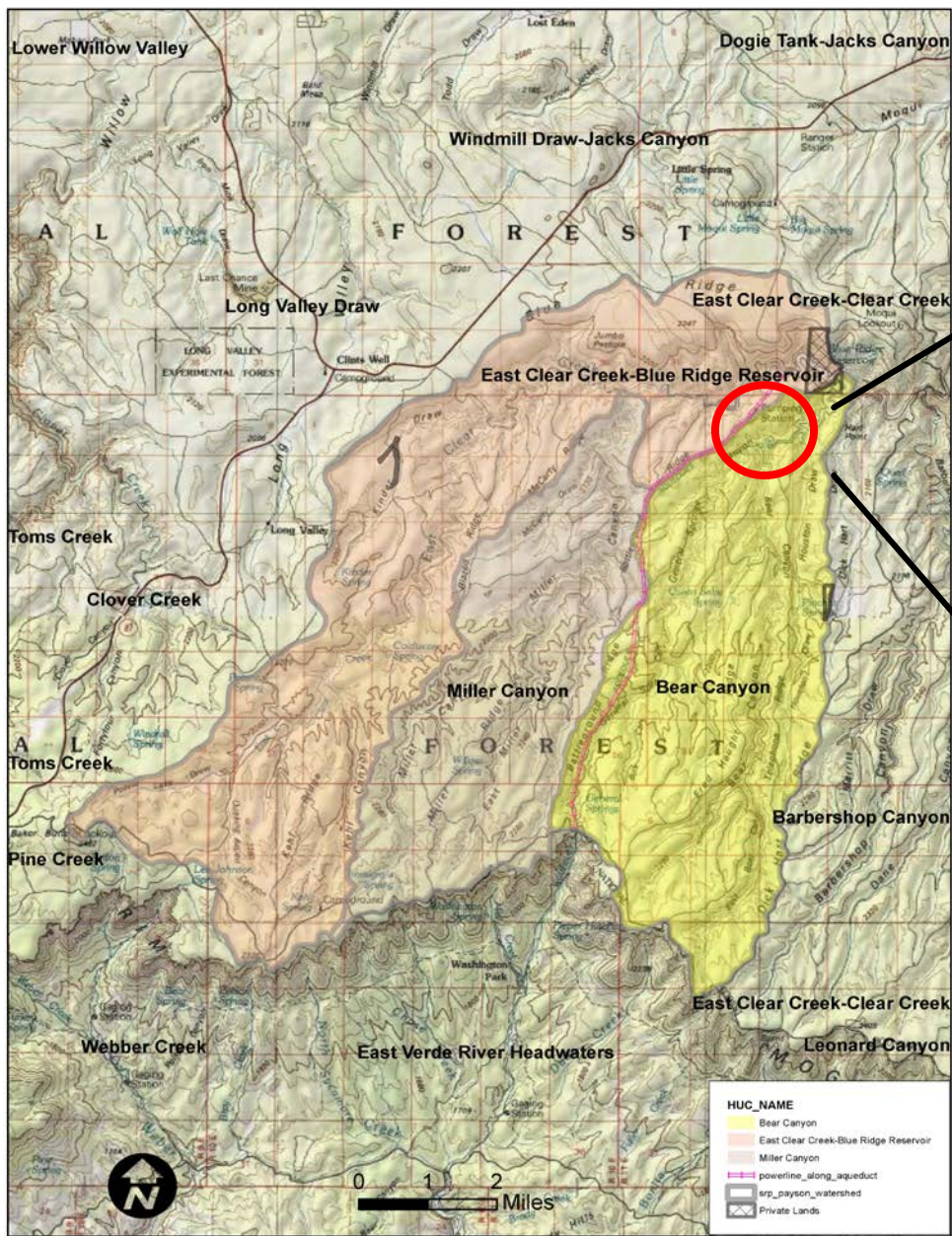


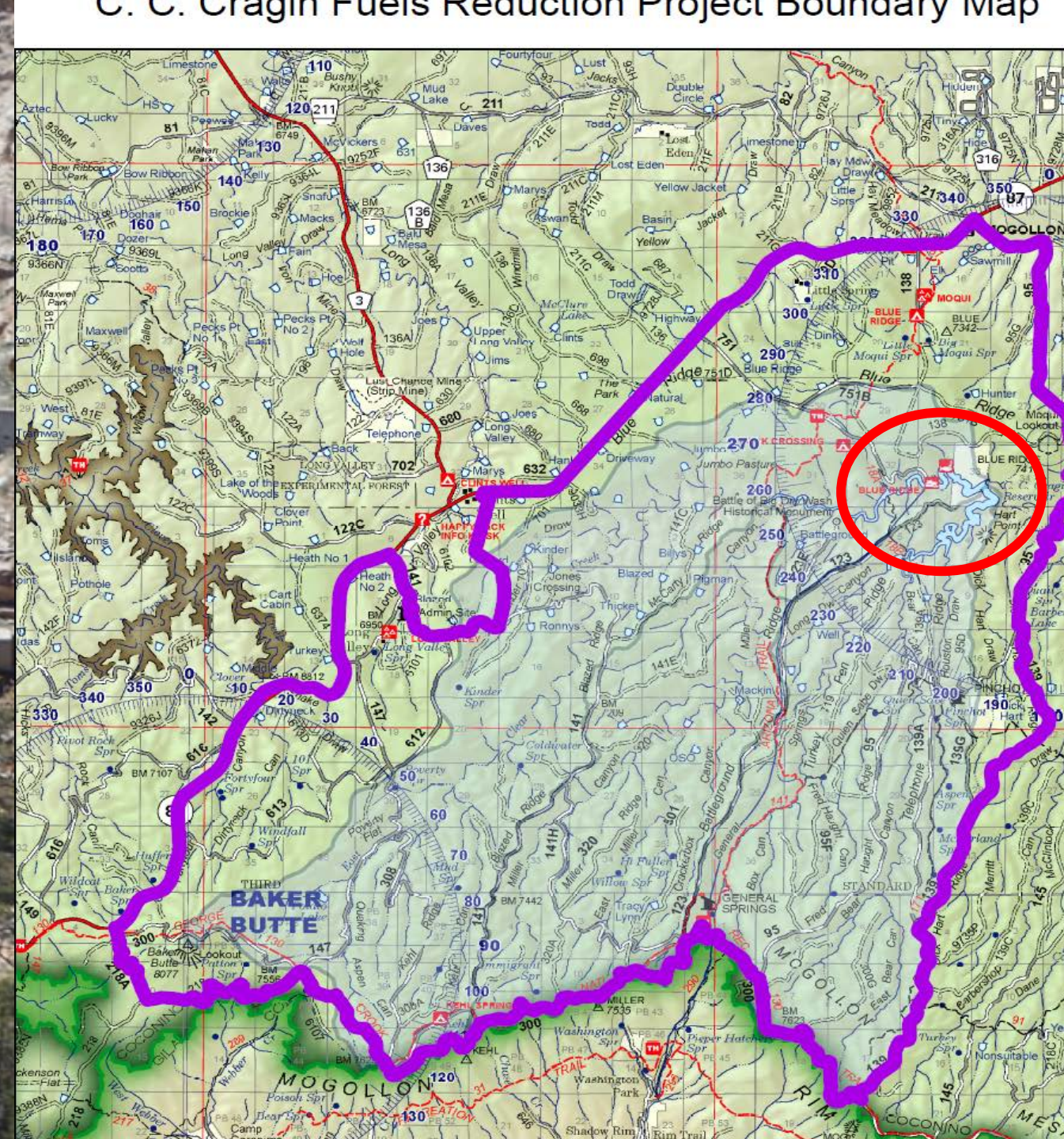
- Stream Channels
- Project Boundary



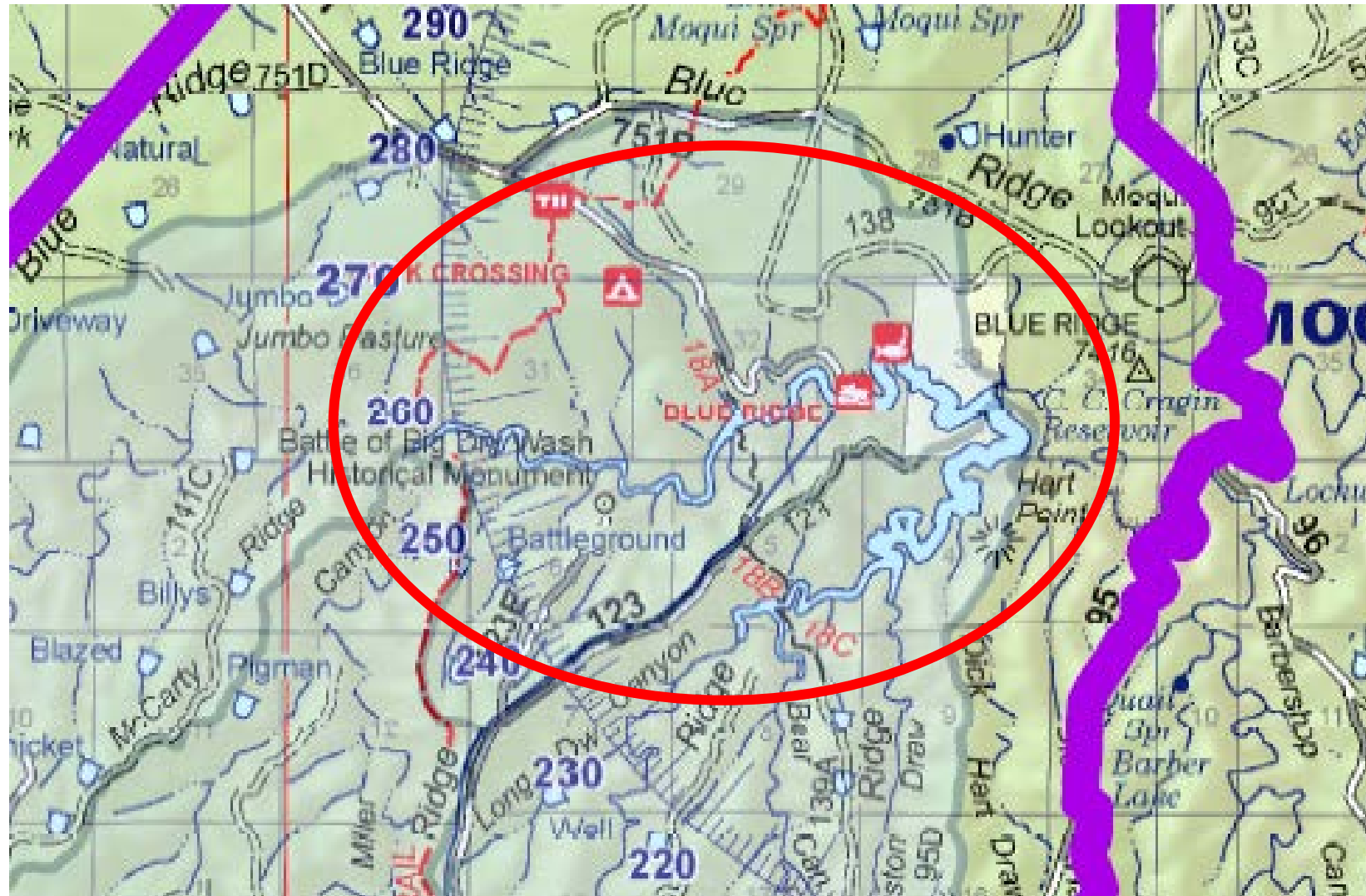
# C. C. Cragin Watershed and HUC 6th Code Watersheds

# Perennial Streams that Discharge to C.C. Cragin Reservoir





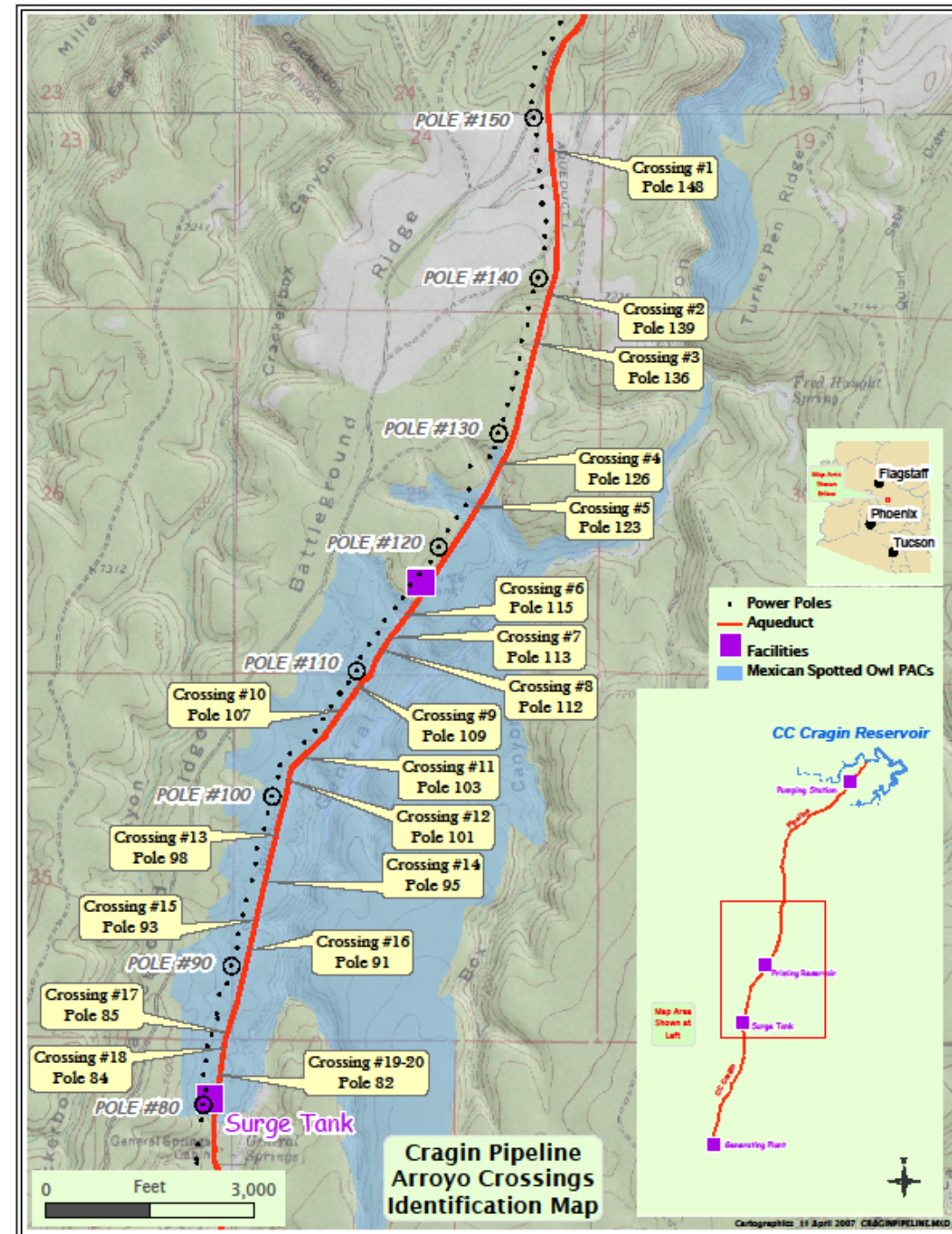
# C.C. Cragin Reservoir



# C.C. Cragin Reservoir



- Delivers water to users (Gila county and others)
- Hydro Electric Plant construction - 2016-17
- Water Treatment Plant - 2017-2018



## C.C. Cragin Background

1962-1965

Phelps-dodge built Dam to capture and exchange water for the Morenci Copper mine

2005

Acquired by SRP (Salt River Project); ownership transferred to US Bureau of Reclamation (SRP contract operator)

Payson acquired 3,000 acre foot rights to C.C. Cragin water.



# Jargon

- ▶ Basal Area (BA): surrogate for volume expressed in  $\text{ft}^2$
- ▶ CCF: hundred cubic feet expressed in  $\text{ft}^3$
- ▶ DBH: Diameter at Breast Height - 4.5' expressed in inches
- ▶ Sawtimber: USFS designation 9.0" + DBH
- ▶ Pulp: USFS designation 6.0" - 8.9" DBH
- ▶ Biomass: USFS designation <5.9" DBH
- ▶ MSO PAC: Mexican Spotted Owl Protected Activity Center
  - ▶ Encompasses nest cores
- ▶ Acre:  $43,560 \text{ ft}^2$  - Basically a football field w/out an endzone
- ▶ NEPA: National Environmental Policy Act
- ▶ Activity Fuels: Material left over after logging operations

# Project Authority: Healthy Forests Restoration Act (HFRA)

- ▶ Passed December 2003
- ▶ Improved process for hazardous fuel reduction projects on certain types of at-risk National Forest System lands.
- ▶ Title I: Hazardous Fuel Reduction
- ▶ Title II: Biomass
- ▶ Title III: Watershed Forestry Assistance



# Treatments (fire)



## Cragin Watershed Protection Project Draft Activity Fuels and Prescribed Burning Treatments October 21, 2015

### Draft Notes:

**Activity Fuels Treatments:** Mechanized harvesting with whole tree yarding to landings is the preferred tree removal method. Biomass removal is the desired activity fuels treatment and would include chipping of limbs and other logging debris and removal from the treatment unit. If whole tree yarding does not occur, other activity fuels treatments that would be analyzed include machine piling and burning and possibly hand piling and burning of slash. Lopping and scattering of activity fuels would occur only as needed to cover skid trails and temporary roads. Lopping and scattering of activity fuels is not a desired activity fuels treatment because it can lead to more tree mortality in future prescribed burning and increased fuel loads after thinning.

**Legend**

**Fuels & Prescribed Burning Treatments**

**Treatment**

- Activity Fuels, Broadcast Burn, Maintenance Burn
- M/SO PAC - Activity Fuels, Broadcast Burn, Maintenance Burn
- Broadcast Burn, Maintenance Burn

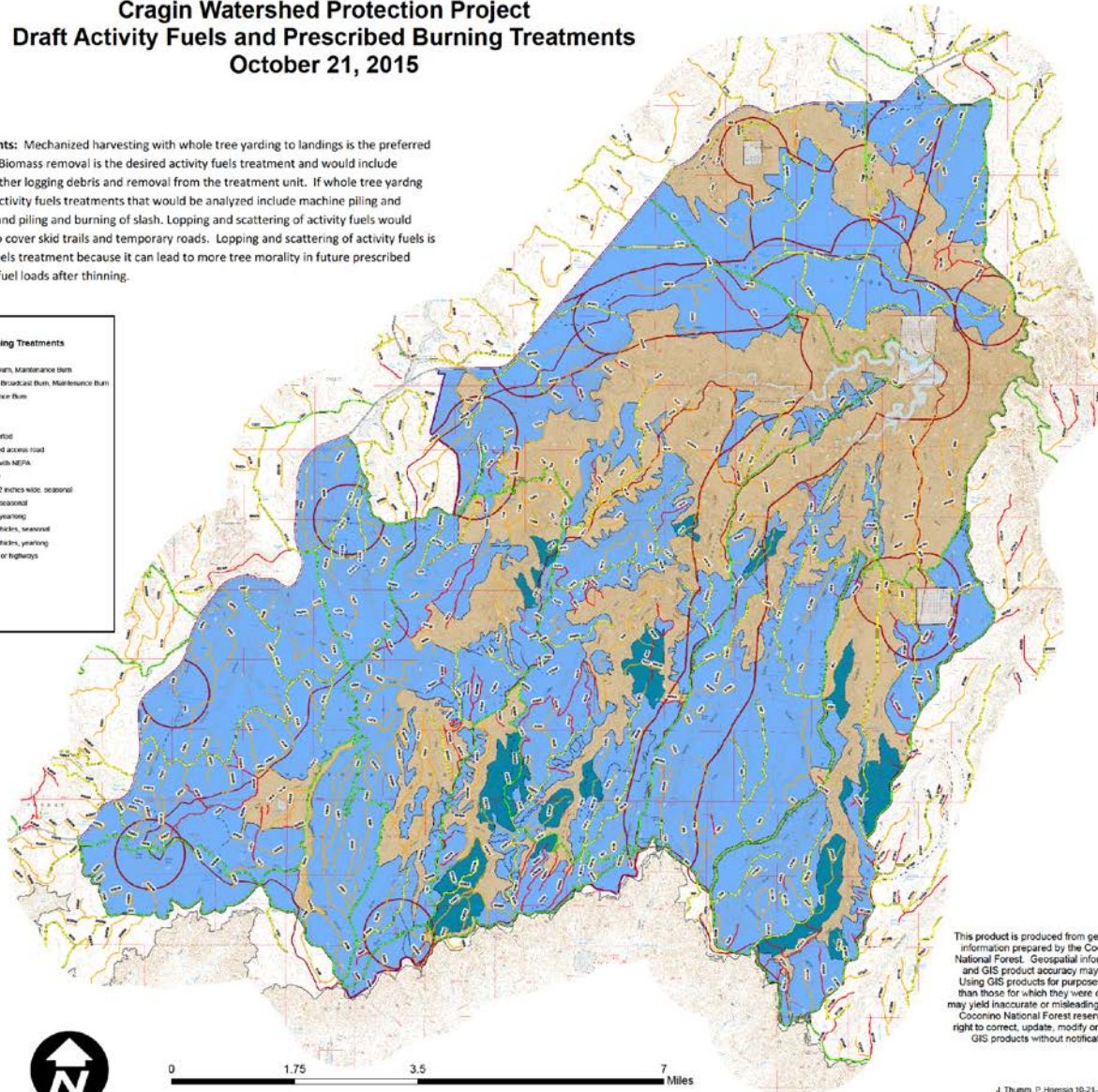
**Road status, 2015**

**Status**

- Decommissioned or controlled
- Private, limited, or restricted access road
- Classified vehicle in operation with NEPA
- Limited FS access use only
- M/VUM open, vehicles < 62 inches wide, seasonal
- M/VUM open, all vehicles, seasonal
- M/VUM open, all vehicles, yearlong
- M/VUM open, heavy legal vehicles, seasonal
- M/VUM open, heavy legal vehicles, yearlong
- M/VUM open, public roads or highways

**OWNER**

- FWS
- PRIVATE
- Boundary/Buffer
- 20110210\_projectboundary



This product is produced from geospatial information prepared by the Coconino National Forest. Geospatial information and GIS product accuracy may vary. Using GIS products for purposes other than those for which they were created may yield inaccurate or misleading results. Coconino National Forest reserves the right to correct, update, modify or replace GIS products without notification.

J. Thumm, P. Haessig 10-21-2015

## Legend

### Fuels & Prescribed Burning Treatments

#### Treatment

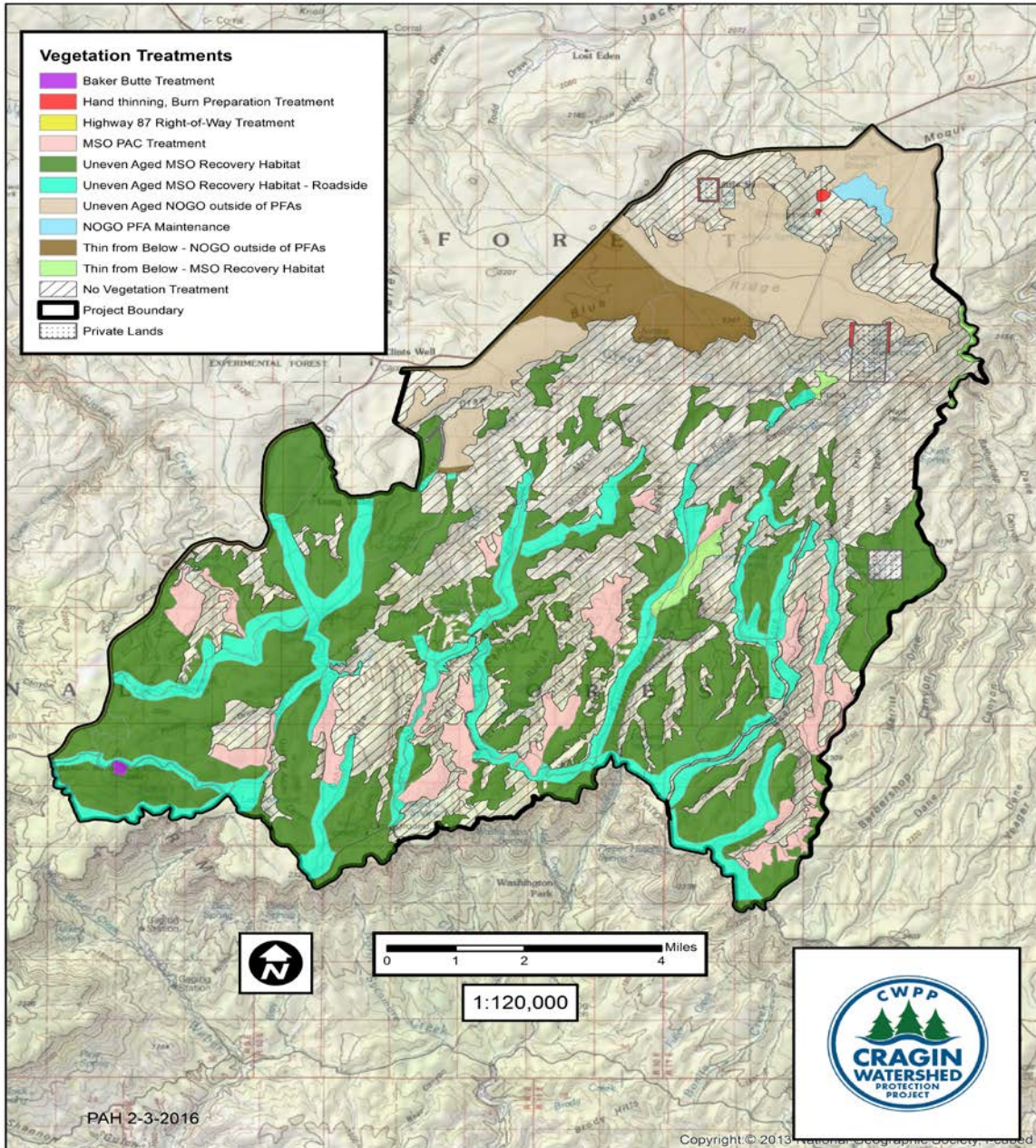
- Activity Fuels, Broadcast Burn, Maintenance Burn
- M/SO PAC - Activity Fuels, Broadcast Burn, Maintenance Burn
- Broadcast Burn, Maintenance Burn







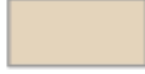


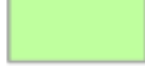



➤ 64,000 ac

➤ Treatment timing with mechanical treatments



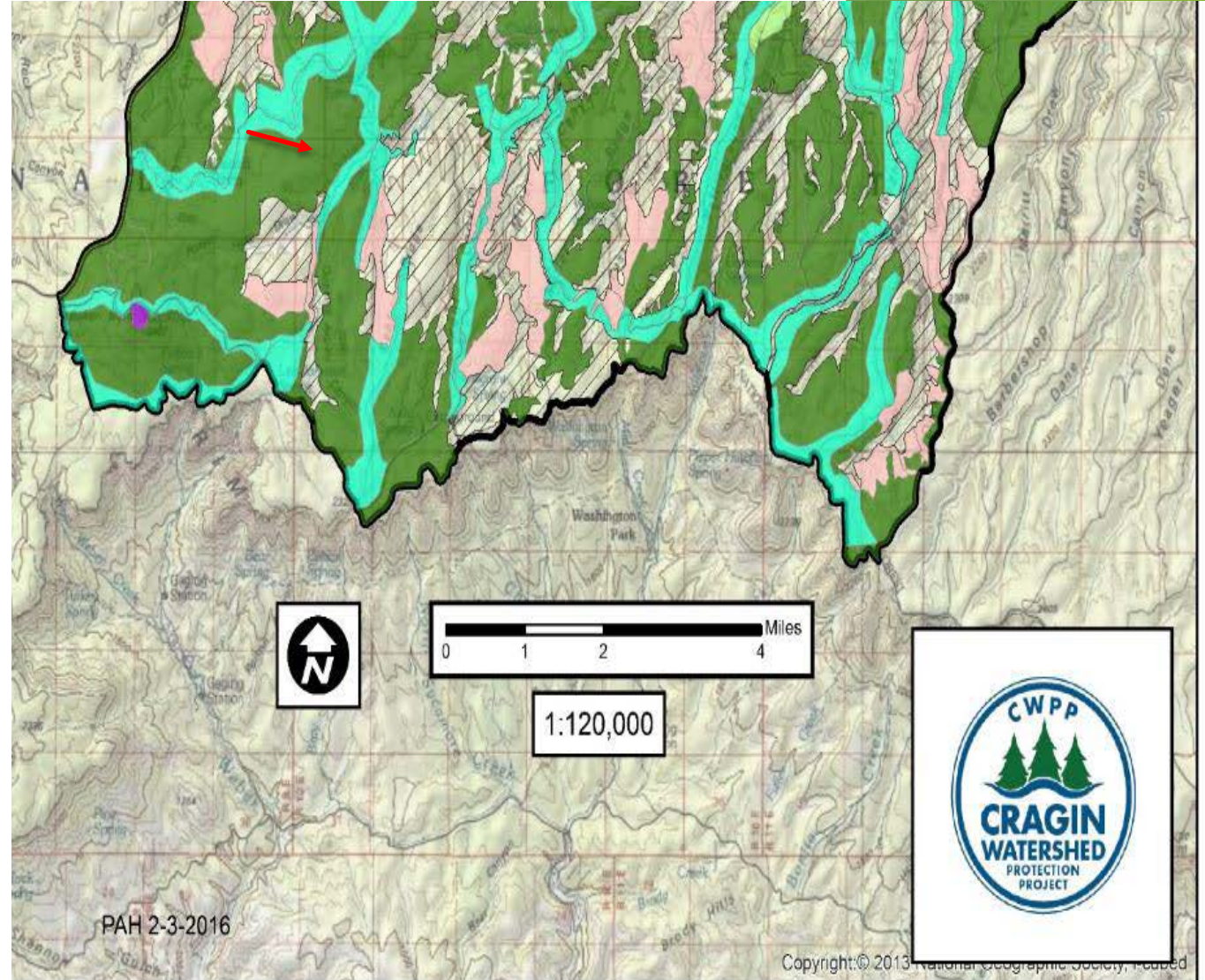
# Vegetation Treatments (mechanical harvest)



-  Baker Butte Treatment
-  Hand thinning, Burn Preparation Treatment
-  Highway 87 Right-of-Way Treatment
-  MSO PAC Treatment
-  Uneven Aged MSO Recovery Habitat
-  Uneven Aged MSO Recovery Habitat - Roadside
-  Uneven Aged NOGO outside of PFAs
-  NOGO PFA Maintenance
-  Thin from Below - NOGO outside of PFAs
-  Thin from Below - MSO Recovery Habitat
-  No Vegetation Treatment
-  Project Boundary
-  Private Lands

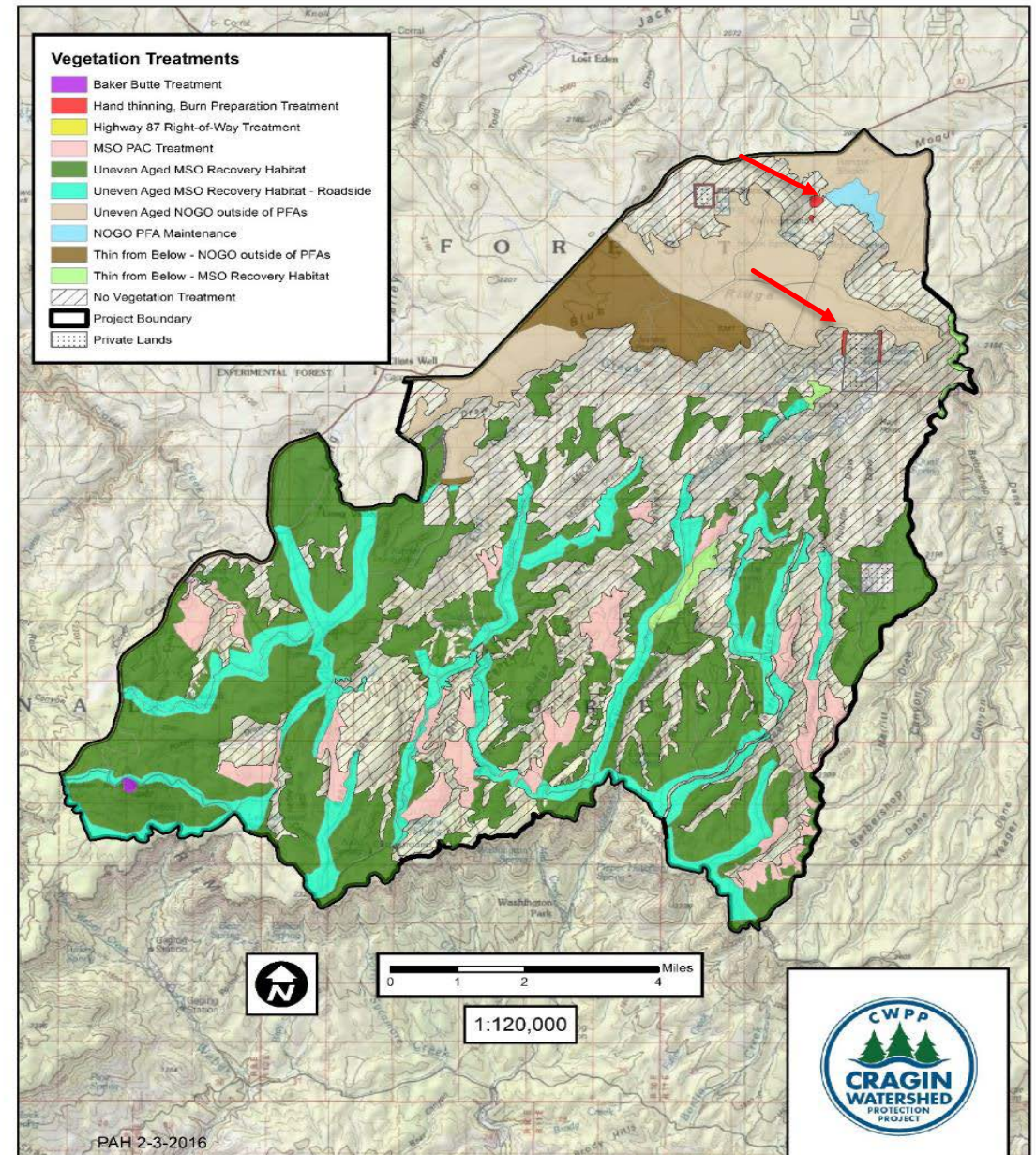
# Baker Butte Treatment

- 27 acres
- Remove trees blocking views from the tower and reduce fuels
- Residual basal area per acre: 80 to 100 ft<sup>2</sup>
- May cut up to 35 conifers > 24.0" diameter
- Includes periodic maintenance treatment to remove trees blocking the view from the tower.



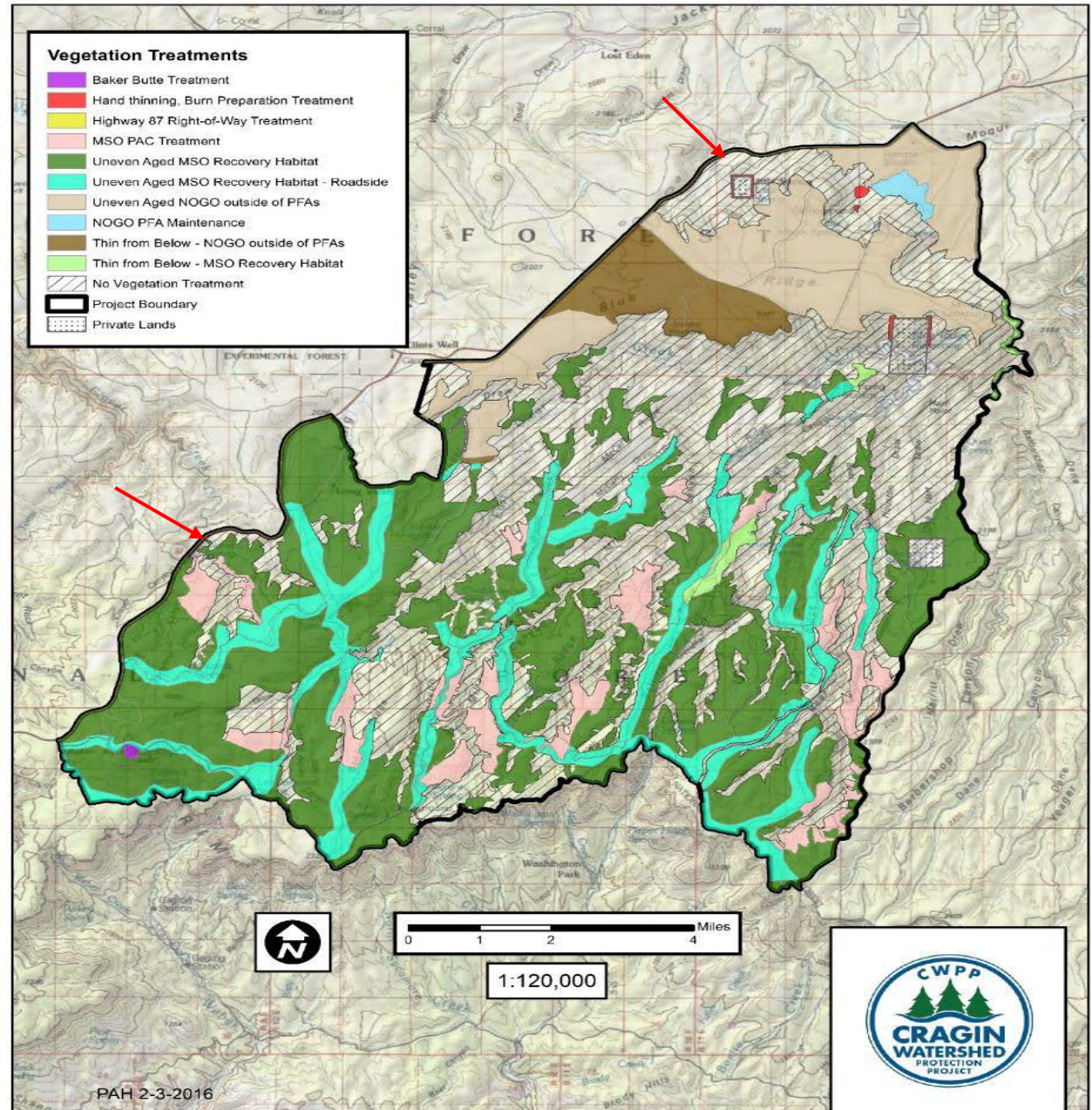
# Hand Thinning, Burn Preparation

- 77 acres
- Reduce ladder fuels and areas of dense trees on steep slopes next to selected private lands and within and around Moqui and Blue Ridge Campgrounds to prepare the area for safe implementation of prescribed burning



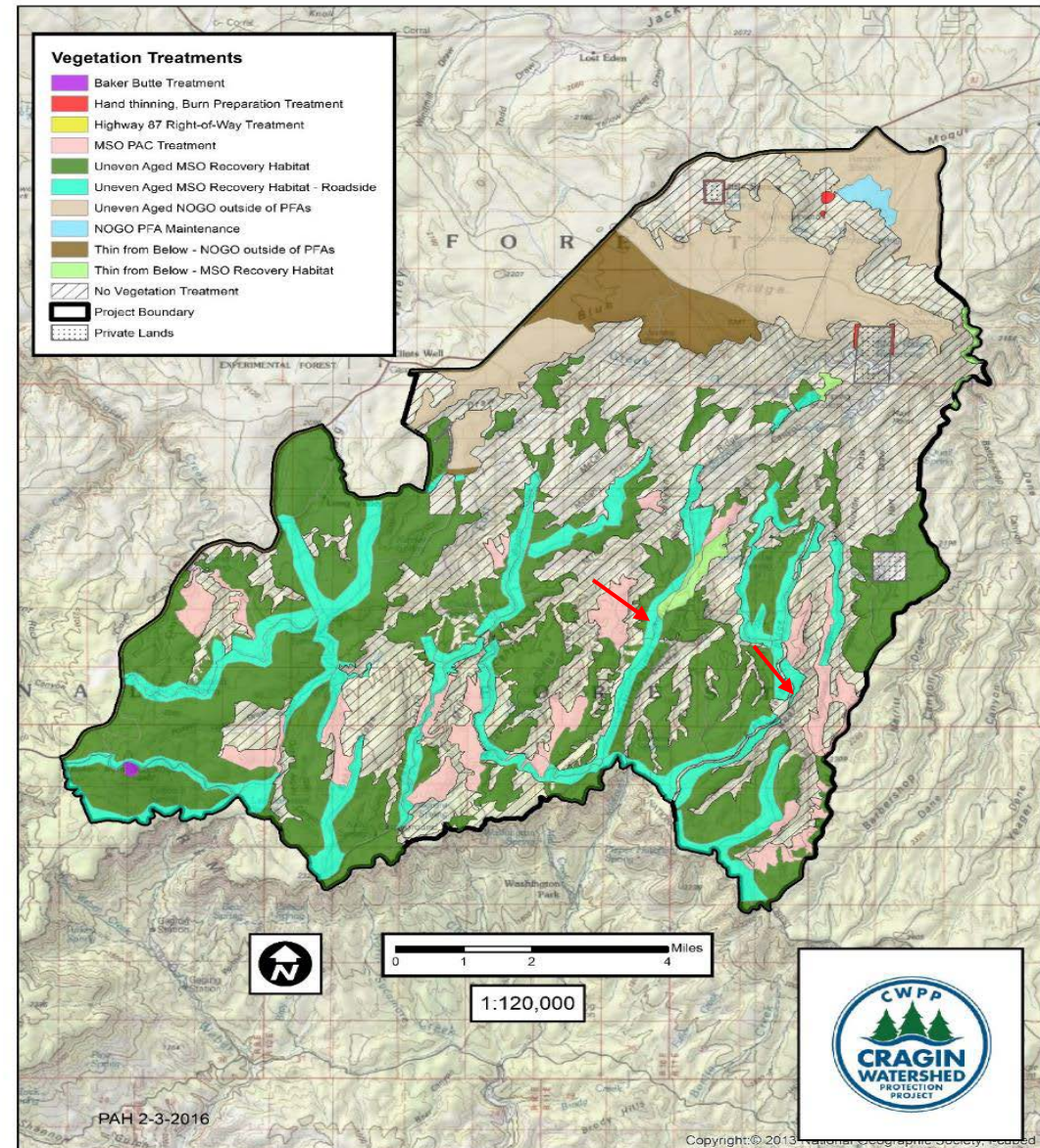
# Highway 87 Right-of Way Treatment

- 200 acres
- Allow drivers increased time to stop or recover before hitting an obstacle
- Removal of trees and vegetation within the recovery zone (30 ft. from the white line)
- Fuel reduction within the remainder of the ROW (generally 100 ft. from the white line)



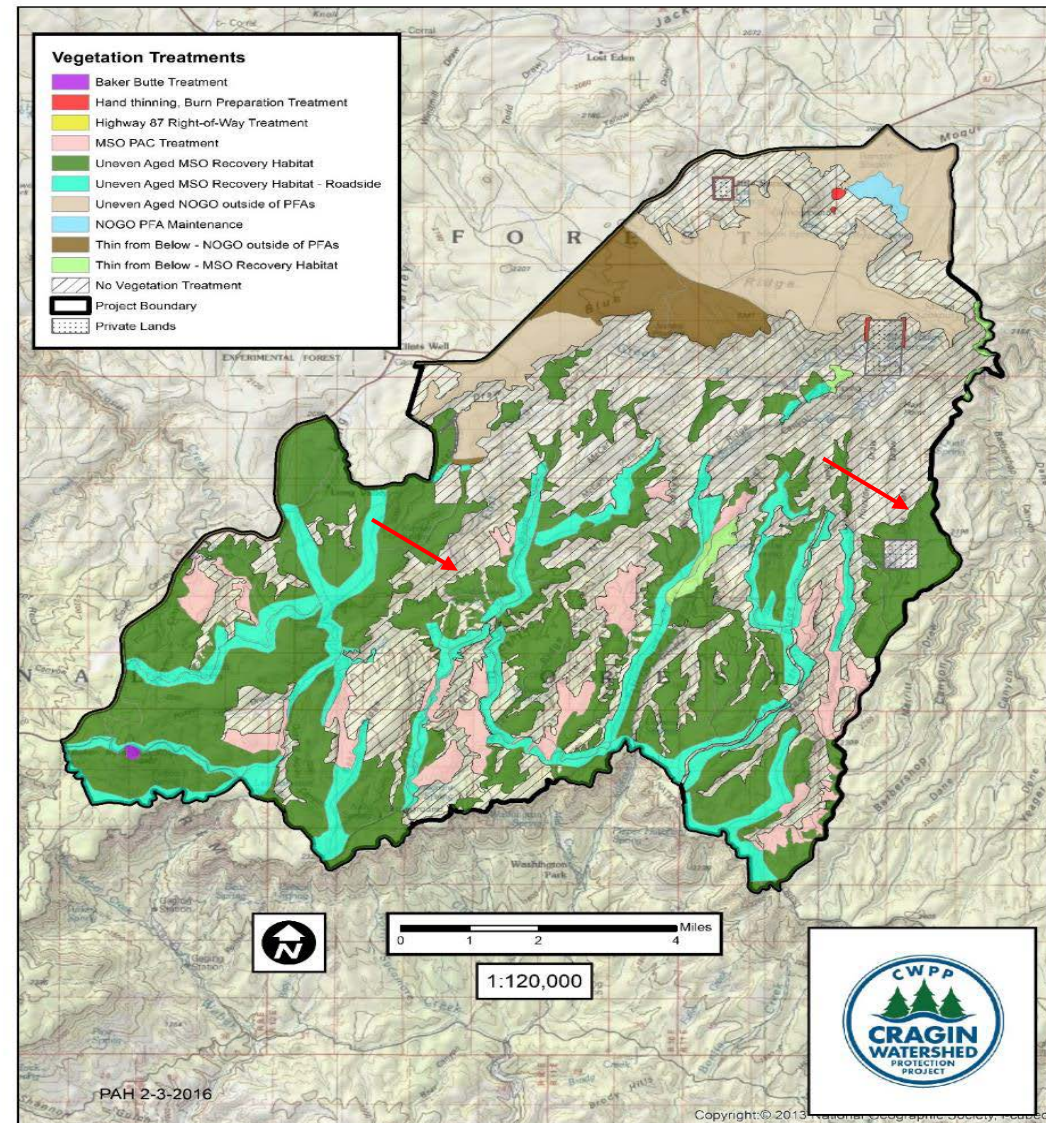
# MSO PAC Thinning

- 3,018 acres
- Fourteen PACs identified for treatment to reduce fire hazards while maintaining habitat conditions
- Mechanical thinning and prescribed fire
- Minimum basal area 120 ft<sup>2</sup>/acre in mixed conifer and 100 ft<sup>2</sup>/acre in pine-oak
- Maintain 60% canopy cover in dry mixed conifer and 40% in pine-oak
- Created openings would range from 0.1 to 2.5 acres



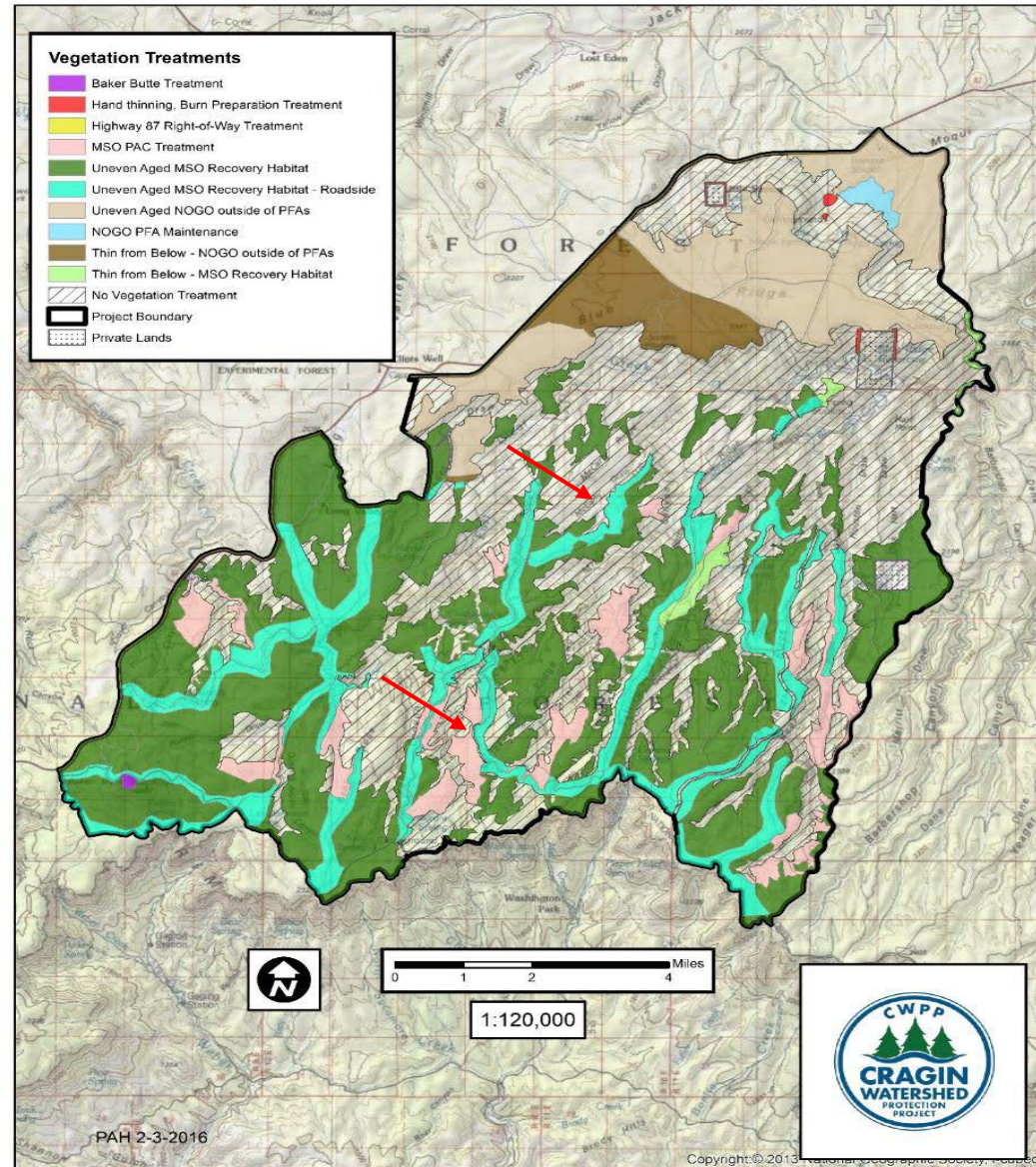
# MSO Recovery Habitat, Uneven Aged Management

- 19,637 acres
- Retain key habitat elements while reducing fuels
- Develop an uneven-aged structure, with a mosaic of openings and tree groups of variable size
- Openings would be less than 2.5 acres
- Basal Area/acre: 80-120 ft<sup>2</sup>



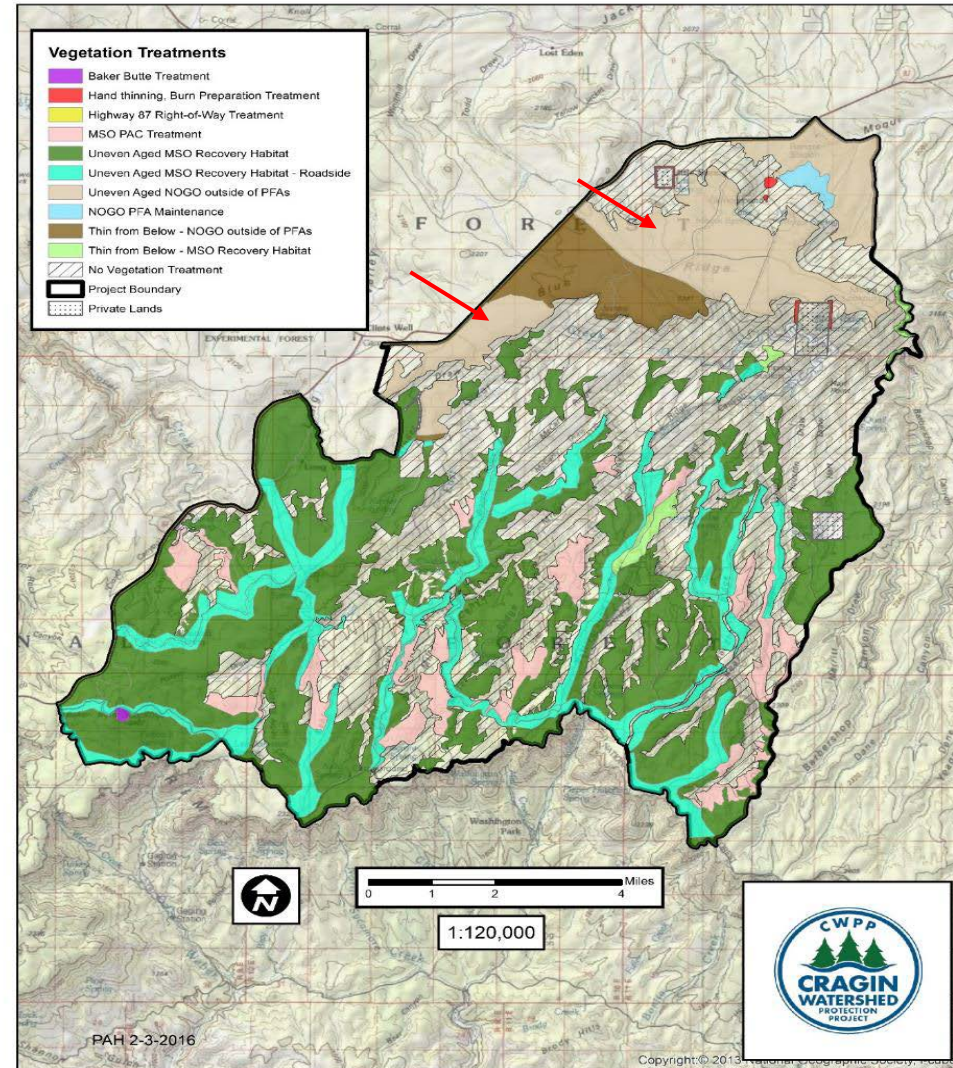
# MSO Recovery Habitat, Uneven Aged Management - Roadside

- 7,099 acres
- Reduce fire hazards along roads by reducing the number of small trees or thickets of small trees
- Create defensible fuel profile along roads
- Priority treatment along roads
- Develop an uneven-aged structure, with a mosaic of openings and tree groups of variable size
- Openings would be less than 2.5 acres
- Basal Area/acre: 80-120 ft<sup>2</sup>



# Uneven Aged Management, Northern goshawk habitat outside of PFAs

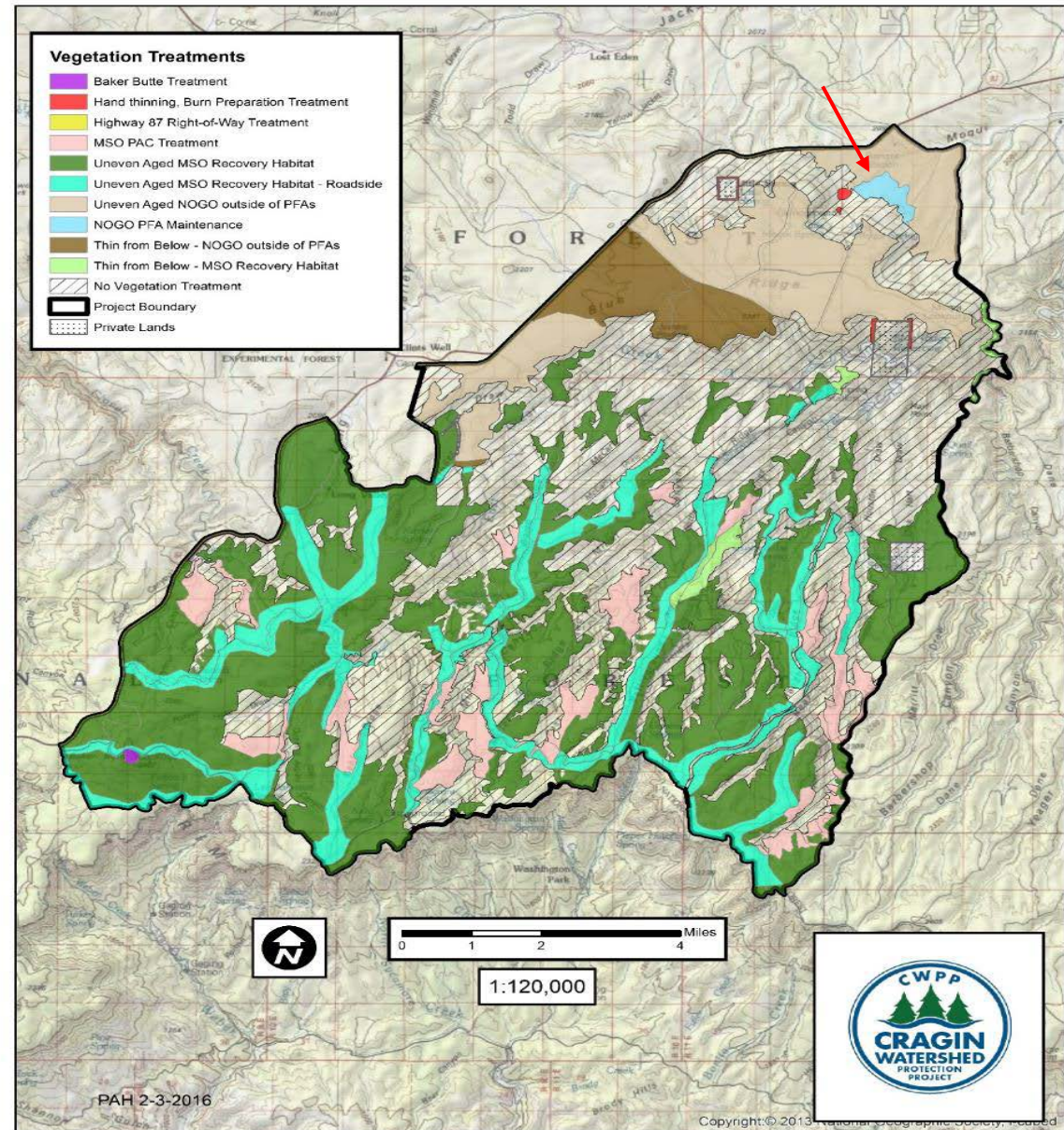
- 6,136 acres
- Achieve/maintain a balance of uneven-aged structure in terms of the vegetation structural stages (VSS)
- VSS 1 (openings) 10%
- VSS 2 (seedling/sapling) 10%
- VSS 3 (young forest) 20%
- VSS 4 (mid-age forest) 20%
- VSS 5 (mature forest) 20%
- VSS 6 (old forest) 20%
- Basal area/acre: 60-90 ft<sup>2</sup>





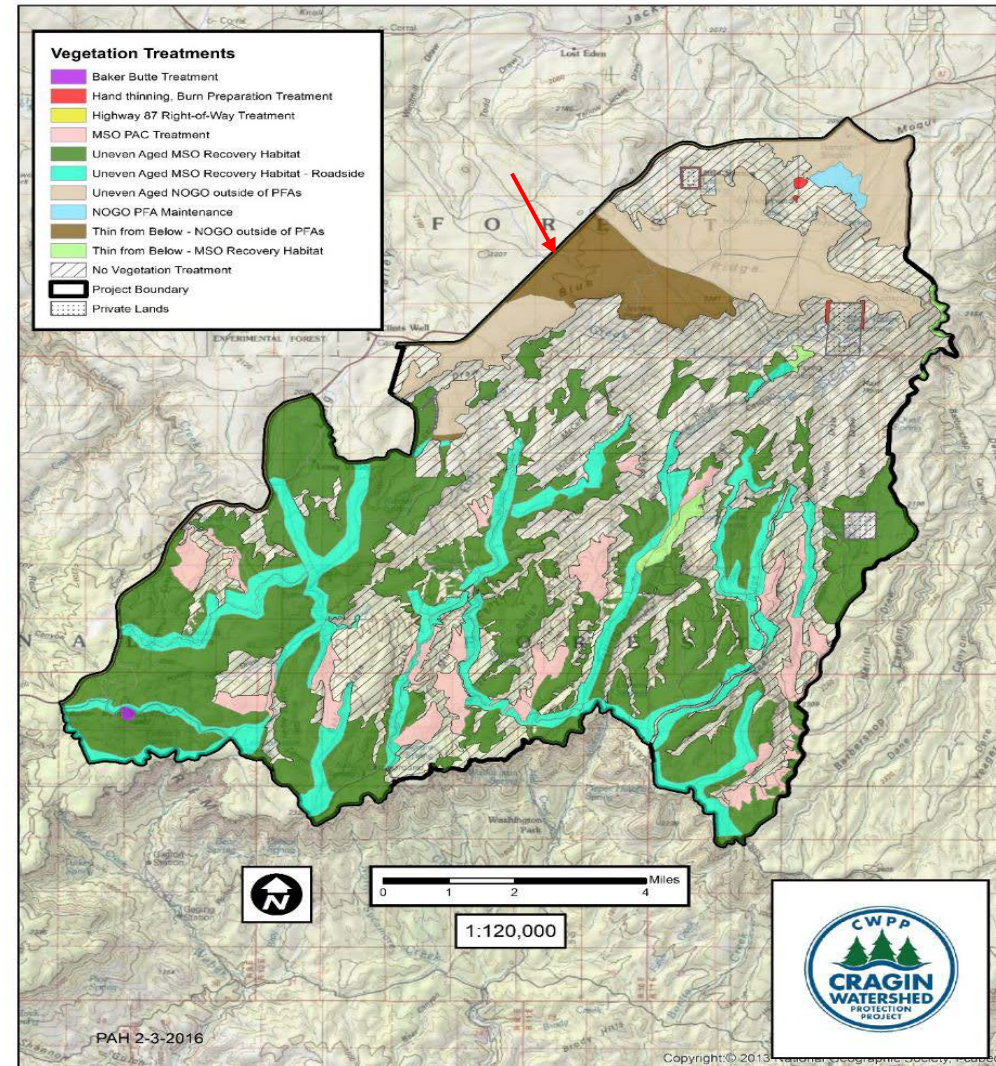
# Northern goshawk PFA Maintenance

- 211 acres
- Manage for uneven-aged conditions
- Higher Canopy Cover and smaller openings (less than 2.0 acres) than goshawk habitat outside of PFA
- Basal area/acre: 100-120 ft<sup>2</sup>



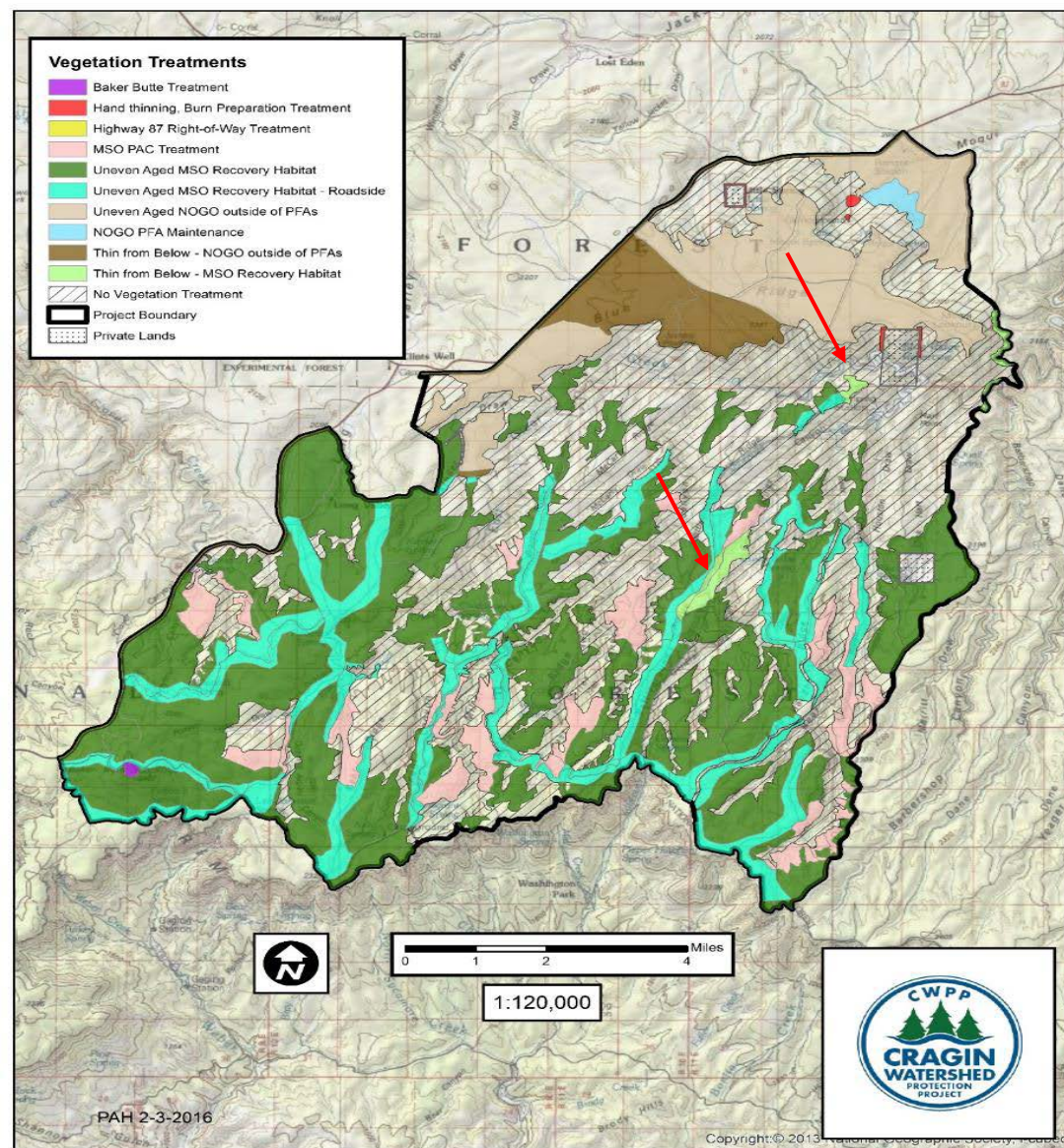
# Thin from Below, Northern goshawk habitat outside of PFAs

- 2,081 acres
- Thin conifers less than 9.0" DBH
- Irregular tree spacing
- Basal area/acre: 40-80 ft<sup>2</sup>



# Thin from Below, MSO Recovery Habitat

- 394 acres
- Thin conifers less than 9.0 DBH
- Irregular tree spacing
- Basal area/acre: 100-120 ft<sup>2</sup>



# Mechanical Treatments



- Less than 40% slope
- Whole-Tree yarding
- Log decks
- In-woods processing
- Soil remediation from logging activity
- Road Maintenance
- Erosion Control
- Invasive weeds control

# Activity Slash Treatments (chipping)



- pulp and biomass material
- Dirty vs. Clean chips
- Operational Challenges
- Transportation challenges

# Activity Slash Treatments (machine pile and burn)



- At landing
- Skid trail distribution
- Utilization requirements
- Size
- Placement
- Burn timing

# Challenges in achieving desired conditions

\*\* CUBIC BULLETIN \*\*\*\*\* CUBIC BULLETIN \*\*\*\*\* CUBIC BULLETIN \*\*  
 (Convert to mbf by doubling R3 Cubic Appraisal Averages)

## T.E.A. APPRAISAL BULLETIN NO. 07 CY 16 (JUL)

BASIC DATA PERIOD (2nd Qtr CY 2014 – 1st Qtr CY 2016)	358.03	358.03	493.52	503.86	358.03
SPECIES CODE	(025) (204)	(093)	(122)	(100)	(740)
SPECIES	WF & DF	ES	PP 12+	PP1 9-11.9"	AS
WWPA June 2016 (12-13 basis)	361.32	361.32	475.29	475.29	361.32

### R-3 APPRAISAL AVERAGES

BASE PERIOD PRICE (ccf)	3.00	3.00	5.00	3.00	1.00
-------------------------	------	------	------	------	------

#### BASE COSTS (ccf):

<b>HAUL</b>	64.48	64.48	64.48	64.48	N/A
Rd. MAINT.	2.22	2.22	2.22	2.22	N/A
SLASH	5.87	5.87	5.87	5.87	N/A
<b>SKID</b>	74.08	74.08	74.08	74.08	N/A
TEMP RD	0.32	0.32	0.32	0.32	N/A

NOTE: Averages above are for the DATA PERIOD (2nd Qtr. CY14 – 1st Qtr. CY 16)

MARKET ADJ. (/ccf)	-0.15	-0.15	-0.01	0.59	N/A
<b>MINIMUM RATE</b>	3.00	3.00	5.00	3.00	1.00
<b>BASE RATE</b>	3.00	3.00	5.00	3.00	1.00

- Market prices
- Infrastructure
- Industry
- Renewable energy vs. Non-Renewable energy
- Harvest limitations
- Wildlife Habitat (timing)
- Harvesting Costs

# Possible Solutions



- Material Drying
- Processing sites
- City/County Road Weight Restrictions
- Haul during MSO breeding season
- Timber Sale Design
- Subsidy
- Stewardship Contracting



# Collaboration w/Stakeholders



- 48 stakeholders
- Federal
- State
- Wildlife groups
- Industry reps
- Interested citizens
- Environmental non-profits
- Local businesses
- Local governments



# CCWPP timeline

Project Initiation	March 2015
Proposed Action Development*	April - November 2015
Public Scoping Proposed Action**	December 2015
Issues Analysis and Alternative Modification/Development	January-February 2016
Environmental Analysis, Specialist Reports and EA Preparation	January - August 2016
IDT and FS Reviews of Preliminary EA & Incorporation of Review Comments	September - November 2016
Preliminary EA Public Comment Period, Legal Notice**	December 2016
Consultation, Decision Notice & Final EA Preparation, Final Specialist Report Revisions, Internal Reviews	January - June 2017
Draft Decision, Legal Notice/30 Day Objection Period	July 2017
Objection Resolution	August 2017
Final Decision Notice, Final EA	September 2017
Implementation	September 2017

# Cragin Watershed Protection Project Planning Page

<http://www.fs.usda.gov/project/?project=46075>

## Cragin Watershed Protection Project

Fuels reduction over about 64,000 acres within and adjacent to the watersheds that drain into the C. C. Cragin (formerly known as Blue Ridge) Reservoir.

### Location Summary

Within all/parts of East Clear Creek-Blue Ridge Reservoir, Miller Canyon, Bear Canyon, Webber, Pine Creek, Windmill Draw-Jacks Canyon, Long Valley Draw and East Clear Creek - Clear Creek watersheds.

**District:** Mogollon Rim Ranger District

### Project Documents

	<i>Date Published</i>
► <b>Pre-Scoping</b>	
• <a href="#">CraginProjectMap20150629_8X11</a> (PDF 440kb)	09-09-2015
• <a href="#">20150903CraginWPPIntroLtr</a> (PDF 182kb)	09-09-2015
• <a href="#">CraginVicinityMap08112015</a> (PDF 205kb)	02-04-2016
• <a href="#">20160204CraginWPPDRAFTProposedAction</a> (PDF 2563kb)	02-04-2016
This document is a DRAFT Project Proposal for Stakeholder Review. 2-4-2016. Formal public scoping is anticipated later in February.	
• <a href="#">20160205Draft PAVegetationTreatmentsMapLarge</a> (PDF 7016kb)	02-09-2016
This map is a DRAFT Proposed Action Vegetation Treatment Map, dated 2-5-2016	
• <a href="#">20160205DraftPAFuelsPrescribedBurningMapLarge</a> (PDF 6964kb)	02-09-2016
This map is a DRAFT Proposed Action Fuels Treatments Prescribed Burning Map, dated 2-5-2016	

### Project Navigation

[Project Overview](#)

[Project Detail](#)

[Project Location](#)

### Get Connected

[Request More Info](#)

[Comment on Project](#)

### Forest Links

[SOPA Reports](#)

[Appeal Responses](#)

[Objection Responses](#)

### NEPA Resources

[FS NEPA Procedures and Guidance](#)

[NEPA Links](#)

[CEQ's NEPA.net](#)

[CEQ's Guide to NEPA](#)

# Comment on Project

<http://www.fs.usda.gov/goto/coconino/CWPP>



The screenshot shows the USDA Forest Service website for the Coconino National Forest. The header includes the USDA logo, "United States Department of Agriculture Forest Service", and "Coconino National Forest" with a "UAS" logo. A navigation bar contains "Forest Service Home", "About the Agency", and "Contact the National Office".

The main content area is titled "Projects" and features the "Cragin Watershed Protection Project". A circular logo for the "CWPP CRAGIN WATERSHED PROTECTION PROJECT" is displayed above a photograph of a river flowing through a forested landscape. Below the photo, the text reads: "Reducing the risk of wildfire and post-fire flooding in the watersheds that lead to C.C. Cragin (formerly Blue Ridge) Reservoir." A link for "FAQs" is provided.

On the left side, there is a search bar and a "Go" button. Below it is a "Site Map" section for "Coconino National Forest" with a list of links: Home, Special Places, Recreation, Alerts & Notices, Passes & Permits, Maps & Publications, Land & Resources Management (with sub-links for Planning, Projects, and Resource Management), Learning Center, Working Together, About the Forest, and News & Events. At the bottom left is a "Contact Information" section for "District Offices with addresses & phones".

On the right side, there are two sections: "Alerts & Warnings" with a link for "Winter prescribed burn season" and a "View All Forest Alerts" link; and "Featured Events" with three items: "Red Rock: Wilderness Visitor Education at Boynton Canyon" (Jan 22, 2016 - Apr 30, 2016), "Red Rock Country Public Events Schedule" (Feb 1, 2016), and "Fee-Free Weekend: Presidents Day Weekend, February 13-15, 2016" (Feb 13, 2016 - Feb 15, 2016).

A "Recent Activity" section at the bottom right states: "The draft project proposed action (dated 2/4/2016) is available for review on the Cragin Watershed Protection Project planning page. Formal public scoping is anticipated to begin later in February. If you would like more information on the project, contact Polly Haessig, the project manager at phaessig@fs.fed.us or 928-477-5007."

Comments may also be sent by e-mail to: [FS-comments-southwestern-coconino-mogollon@fs.fed.us](mailto:FS-comments-southwestern-coconino-mogollon@fs.fed.us).



NAU Climate Library



Scott M. Francis, Forester  
Mogollon Rim Ranger  
District, Coconino National  
Forest  
(928)-477-5013