A Naturalistic Approach to Watershed Restoration

Garrett Altmann, M.Sc.
Environmental Policy Innovation Center, Western Restoration Manager
Santa Clara Pueblo, Forestry Department, GIS Coordinator & Project Manager

April 18, 2024

Natural Conference on Ecosystem Registration (NCER)

Albuquerque, NM

ENVIRONMENTAL POLICY INNOVATION CENTER

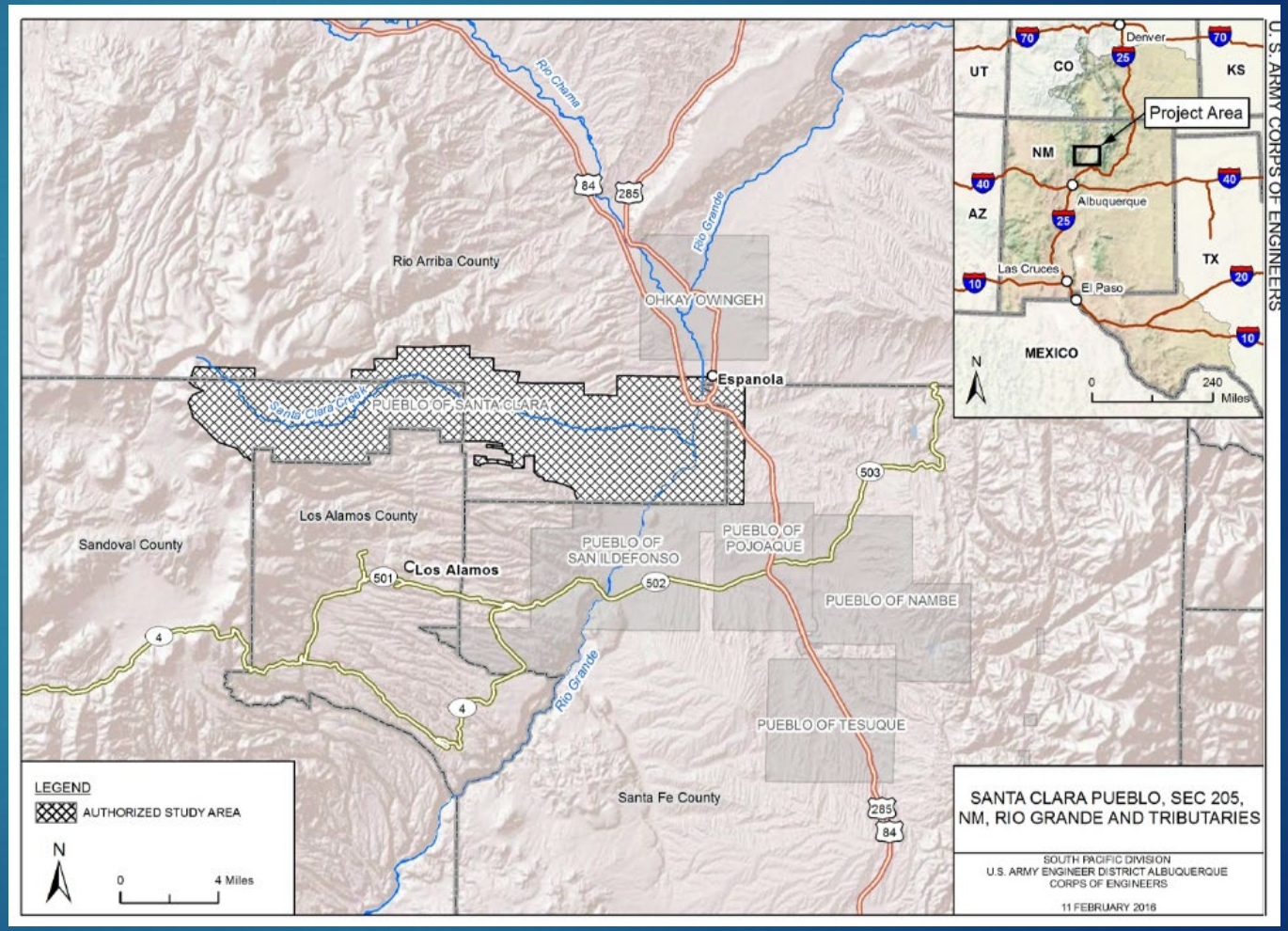
SANTA CLARA PUEBLO

Overview

1. Overview of Santa Clara Pueblo and Watershed
2. Fire History & Flood Events
3. Recovery Strategies
4. Naturalistic Approach Principles
5. Examples
6. Conclusion and path forward

Santa Clara Pueblo

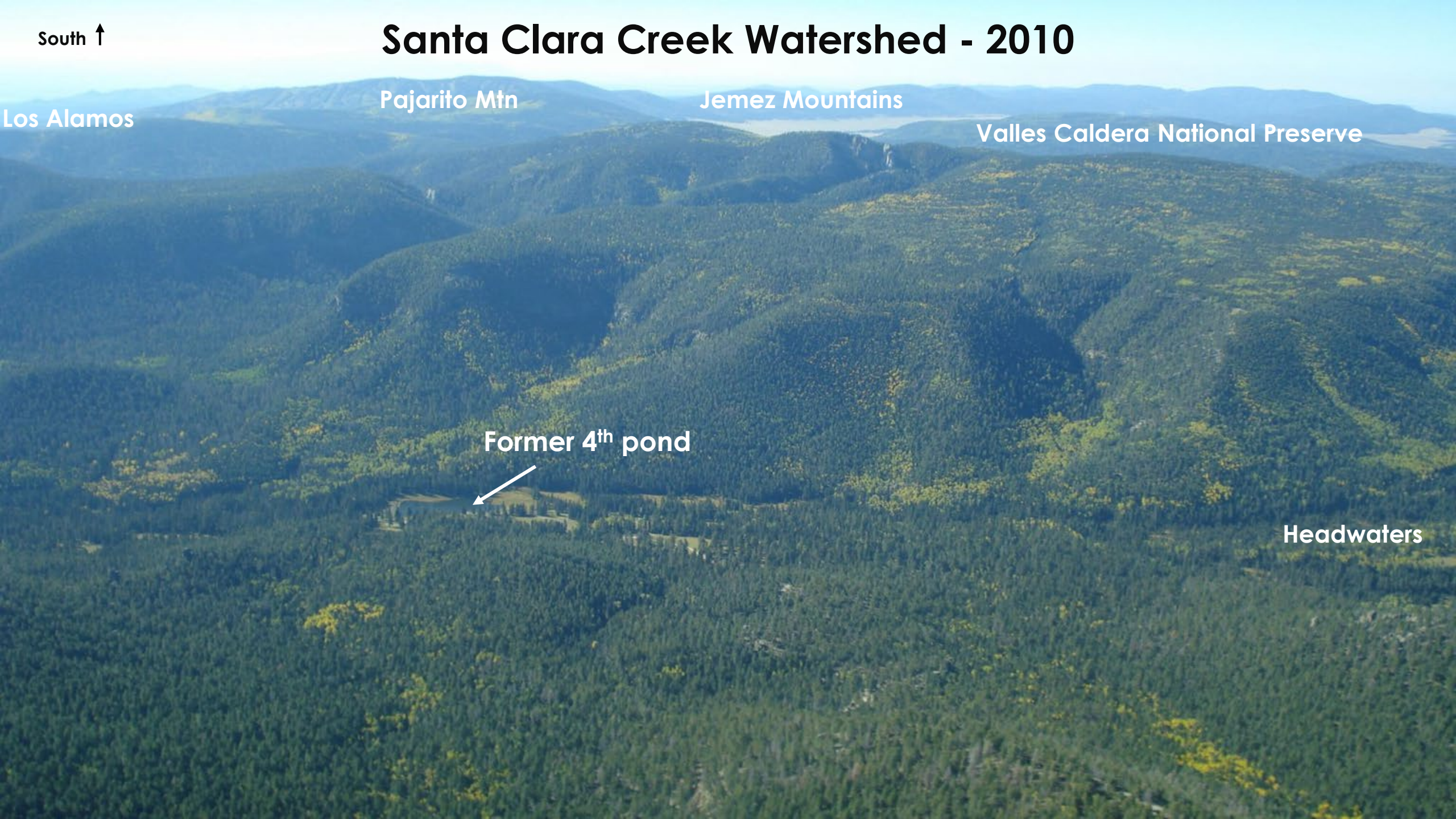
- U.S. federally recognized Native American Tribe
- 1,580 Tribal Members
- Area: 90 square miles
- Pueblo located on ancestral homelands (vs. reservation)



Santa Clara Creek Watershed

"Water is Life"

- 31,480 acres
- Elevation 5,400'– 10,920'
- 23-mi perennial stream
- Central to Pueblo life, physically and culturally
- Rio Grande cutthroat trout
- Four recreational fishing ponds

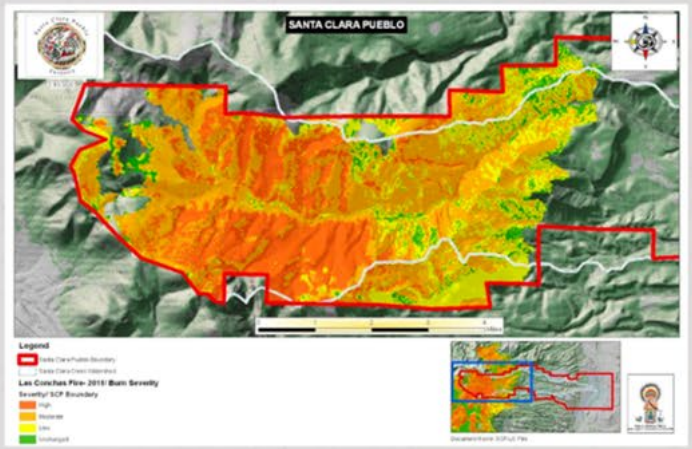

South
Santa Clara Creek Watershed - 2010
Los Alamos
Pajarito Mtn
Jemez Mountains
Valles Caldera National Preserve
Former 4th pond
Headwaters

Fire History

Since 1998, three devastating wildfires have impacted Santa Clara Pueblo

More Frequent and Severe Fires

Over the past 20-years, three large wildfires have impacted more than 90% of Santa Clara forests. During the 2011 Las Conchas Fire, at the time the largest in New Mexico state history, 90% of tribal forest burned with roughly 50% of the Santa Clara Creek watershed burned by high intensity fire.



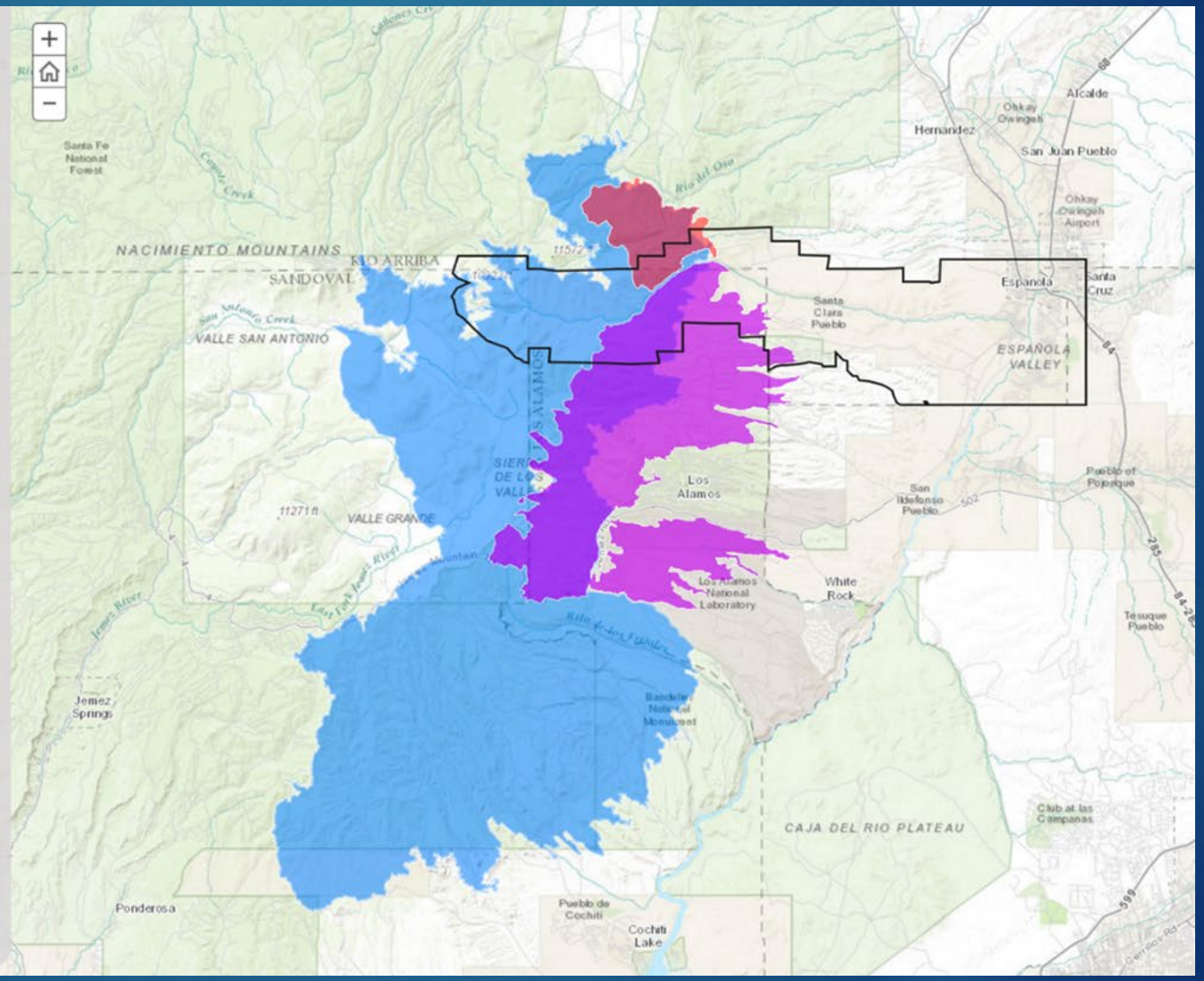
Burn severity map of Santa Clara lands impacted by the 2011 Las Conchas Fire.

Santa Clara Pueblo Boundary

Oso_Fire_1998

Cerro_Grande_2000

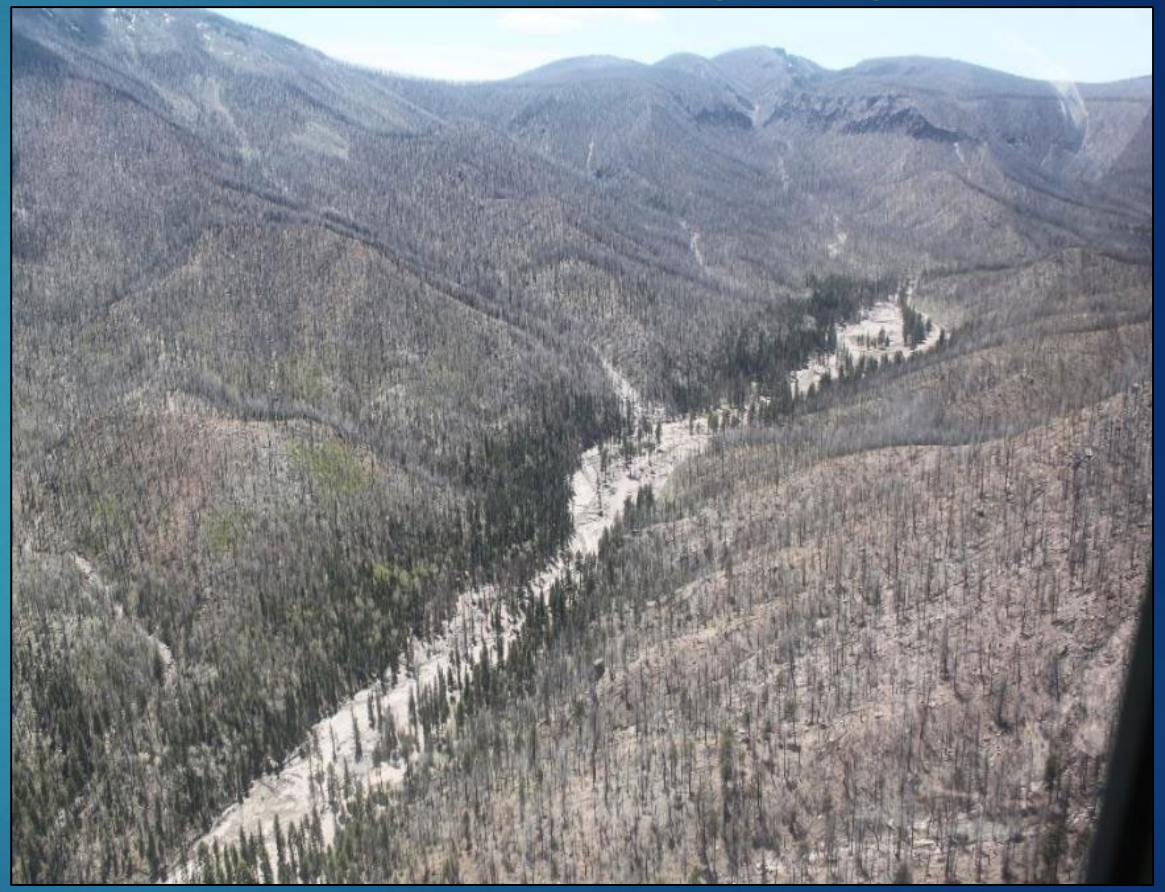
Las_Conchas_Fire_2011



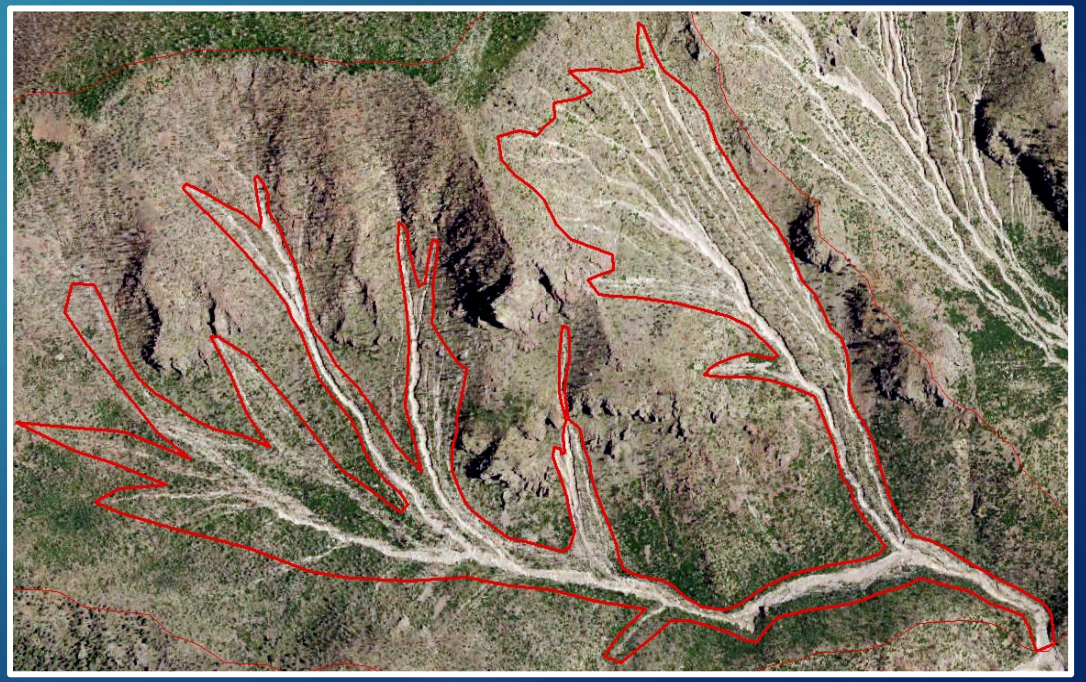
Las Conchas Fire - 2011

Pre-burn (2010)

Post-burn (2013)



Stand replacing crown fire consumed over half of watershed



Debris flows impacts on ponds

All four dams inundated and breached

Recovery Strategies

I. **Collaboration**

- Identify partners, roles, and responsibilities
- Leverage expertise from federal, state, local, non-government resources

II. **Restoration at the Watershed-Scale**

- Prioritize protecting water resources
- Top-down approach

III. **A Naturalistic Approach relying upon:**

- Indigenous Traditional Ecological Knowledge (ITEK) or Indigenous Knowledge
- Nature-based solutions (NBS)
- Process-based restoration (PBR)

Naturalistic Approach…

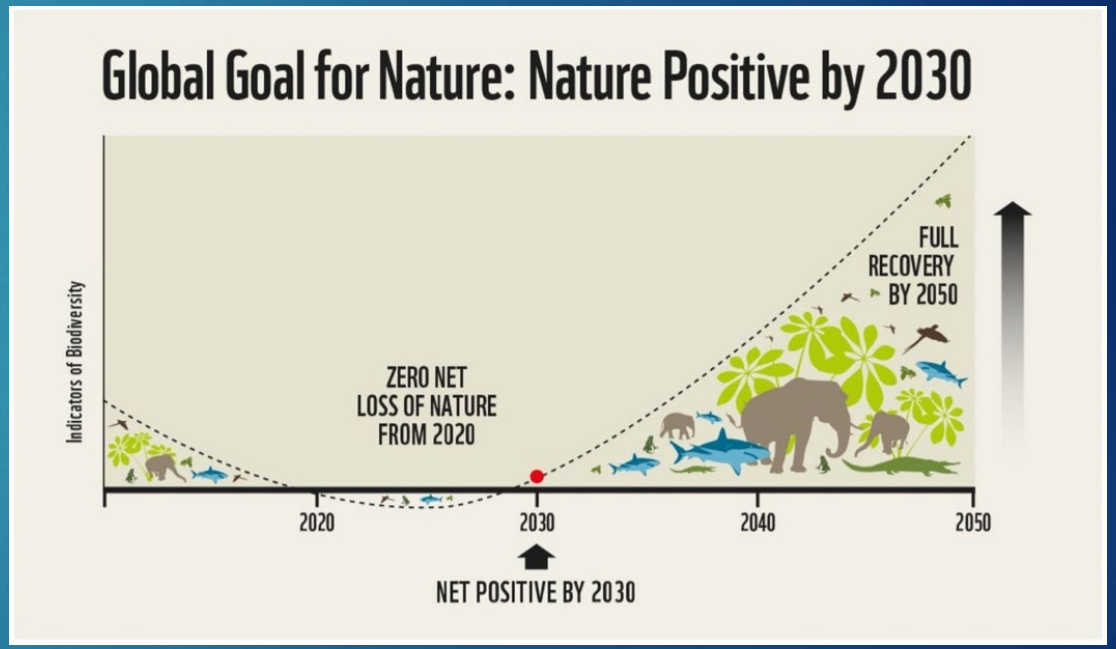
- Embedded in principles of Indigenous Knowledge, NbS, and PBR
- Develop climate resilience to extreme events… floods, fires, and drought
- Prioritize creek in flood mitigation, restoration, and infrastructure development
- Co-benefits for ecosystem productivity and cultural value ties to landscape

Indigenous Knowledge (IK)

- Humans belong to the Earth and should live in harmony with the environment
- Recognizes value of nature and natural processes
- Prioritizes ecosystem services
  - Floodplain connectivity; alluvial fans; beaver ponds
- Limits introduction of foreign materials (ex. concrete)
  - Prioritizes integrating locally sourced materials (rocks, logs, seedlings, etc.

Nature-based Solutions (NBS)

- Maximize ecosystem services (floodplains, vegetation, alluvial fans, beaver ponds, wildlife connectivity, etc.)
- Create habitat diversity & complexity
- Develop resilience to climate variability
- Attain Nature Positive results



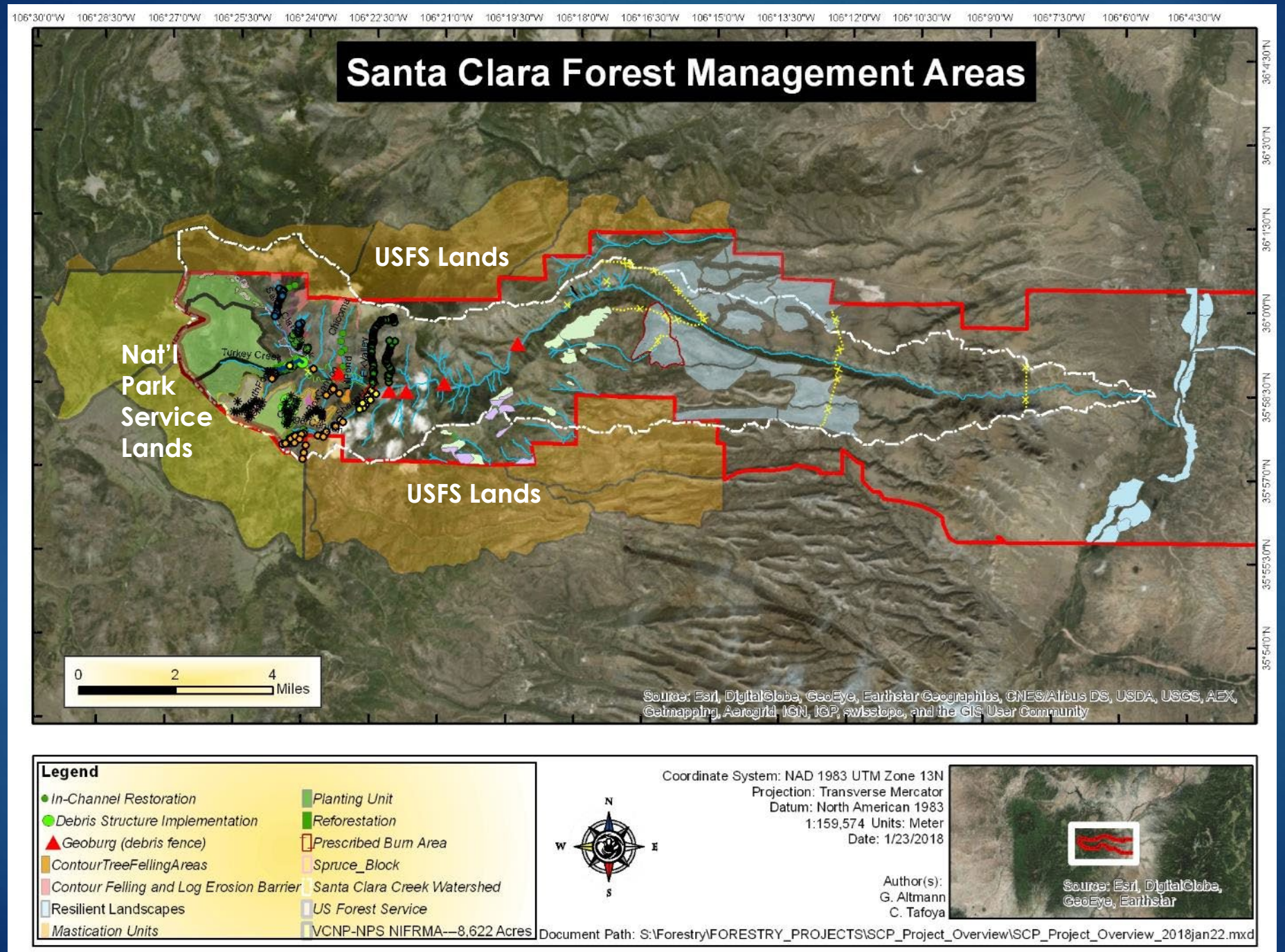
- Executive Order 14072 in April, 2022 directed the federal government to accelerate our use of solutions that are grounded in nature

Process-based Restoration (PBR)

- Focuses on restoring physical processes that sustain healthy river and floodplain ecosystems
- The scope of degradation of these ecosystems is massive. Tens of thousands of miles of riverscapes are in poor, or fair condition
- Structural starvation is both a cause of degradation, and a consequence from land use changes and stream modification
- Low-tech, hand built structures can improve geomorphic and fluvial processes.
- Engineered structures can be supplemented to further facilitate the goal of self-sustaining systems.

Co-benefits of a Naturalistic Approach

- Develop resilience to climate variability
- Promote habitat creation, diversity, and connectivity
- Increase surface and groundwater storage
- Supports resilient infrastructure
- Reconnects people to the land
- Works to a develop self-sustaining ecosystems


Santa Clara Forest Management Areas
USFS Lands
Nat'l Park Service Lands
USFS Lands
Turkey Creek
Chicoma
0 2 4 Miles
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community
Legend
In-Channel Restoration
Debris Structure Implementation
Geoburg (debris fence)
ContourTreeFellingAreas
Contour Felling and Log Erosion Barrier
Resilient Landscapes
Mastication Units
Planting Unit
Reforestation
Prescribed Burn Area
Spruce_Block
Santa Clara Creek Watershed
US Forest Service
VCNP-NPS NIFRMA---8,622 Acres
N
W
E
S
Coordinate System: NAD 1983 UTM Zone 13N
Projection: Transverse Mercator
Datum: North American 1983
1:159,574 Units: Meter
Date: 1/23/2018
Author(s):
G. Altmann
C. Tafoya
Source: Esri, DigitalGlobe, GeoEye, Earthstar
Document Path: S:\Forestry\FORESTRY_PROJECTS\SCP_Project_Overview\SCP_Project_Overview_2018jan22.mxd

Watershed-scale Strategies

- *'Top-down Approach'*
  - Stabilize erosion sources before restoring creek
  - Fuel breaks, mulching/mastication, tributary stabilization, creek restoration.
  - Maximize extent of riparian resources

- Develop long-term sustainability
  - Prescribed fire, flash grazing, invasive species management
  - Resilient infrastructure (i.e. roads & crossings, recreation sites)
  - Beaver reintroduction

Reforestation & Fire Management

- Fuel Breaks and Hazardous Fuel Reduction (HFR)
- Prescribed Fire
- Invasive Species Management
- Reforestation – seedlings, shrubs, grass planting

Forest Development

- Strategic conifer and shrub nucleation planting
- Co-stewardship on adjacent non-tribal lands
- Community engagement

Grazing Management

- Traditional fencing (wire & post pole), integrate wildlife passage, 'grazing blocks'
- Bio fencing (barrier or jack straw effect), short-term

Sediment management

- Woody residue integration (branches, logs, mulch) for best practices
  - Intercepts precipitation energy, reduces sediment transport, promotes aggradation

Erosion Control

- Low-tech structures to mitigate sediment transport
- Principles of NbS, Engineering with Nature (EWN) and bioengineering
- Cost-effective, hand built, utilizing on-site materials
- Innovation and adaptive management to suit site conditions

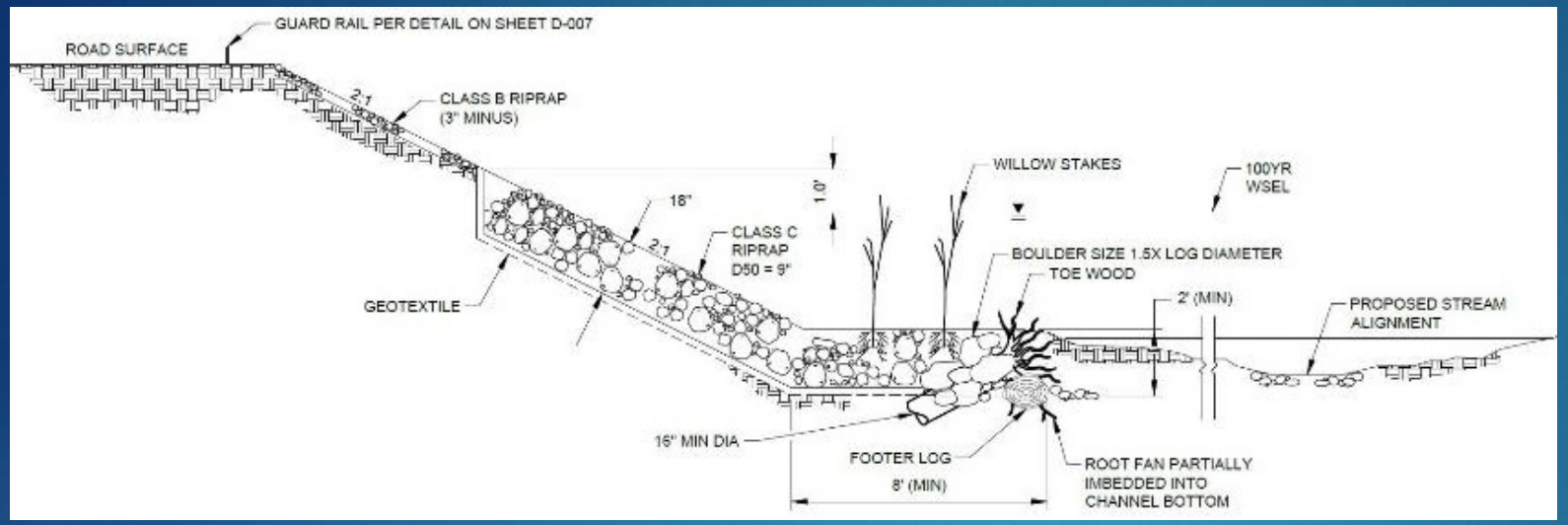
Log Erosion Barriers (LEB's)

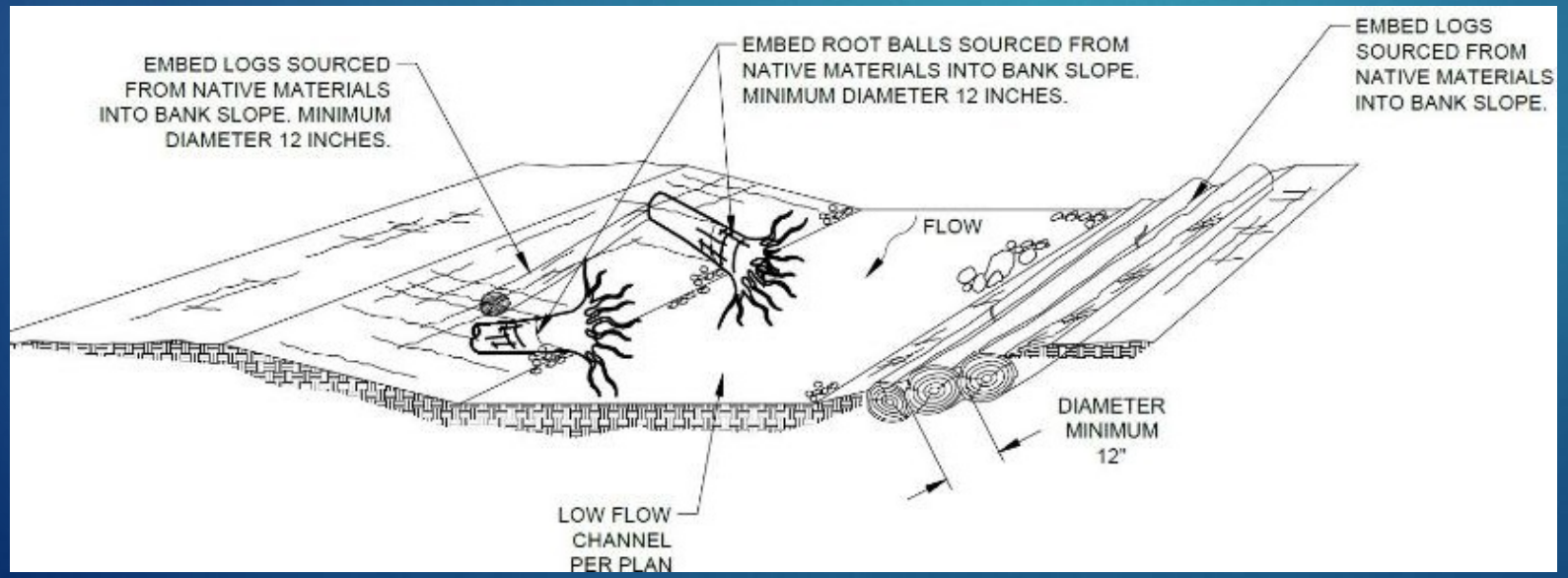
- Contour felling perpendicular to slope

Mitigate erosion sources & headcuts

- Check structures, trash racks, log mattresses

Bank Stabilization - bioengineering





Bank stabilization

Before

After

Lat: 35.973715° Long: -106.372861°

Embankment stabilization

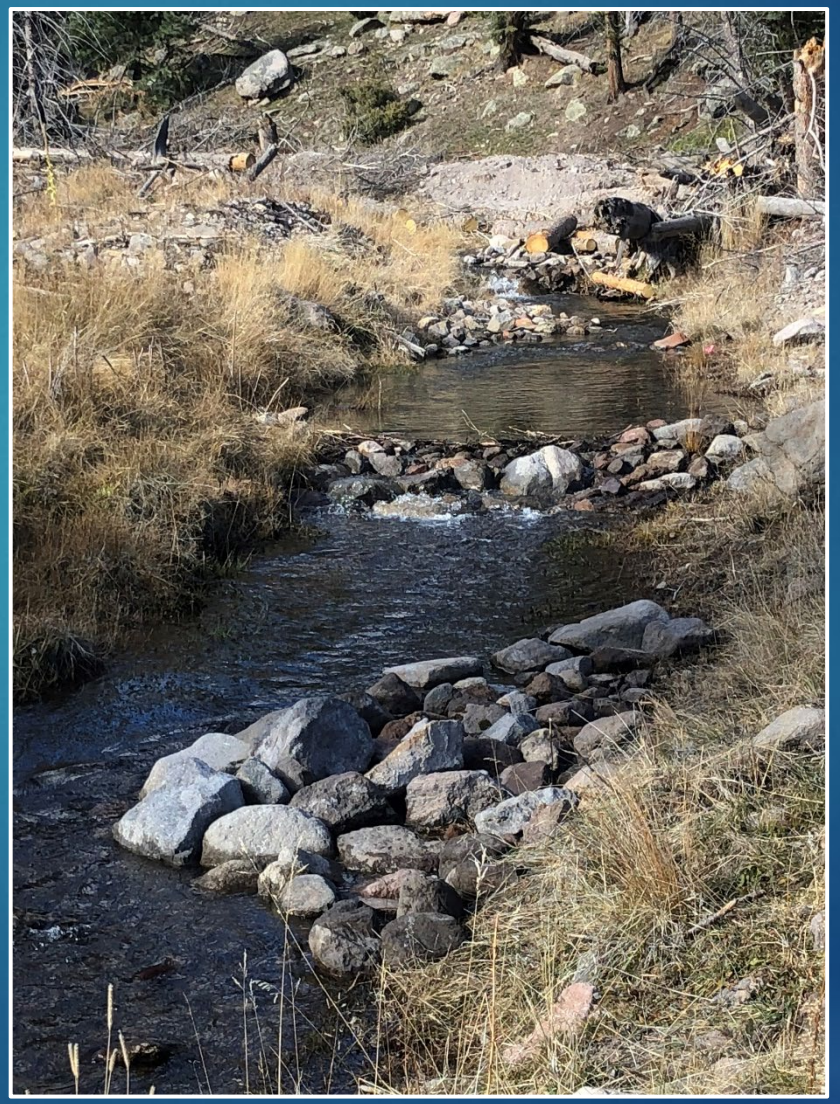
Before

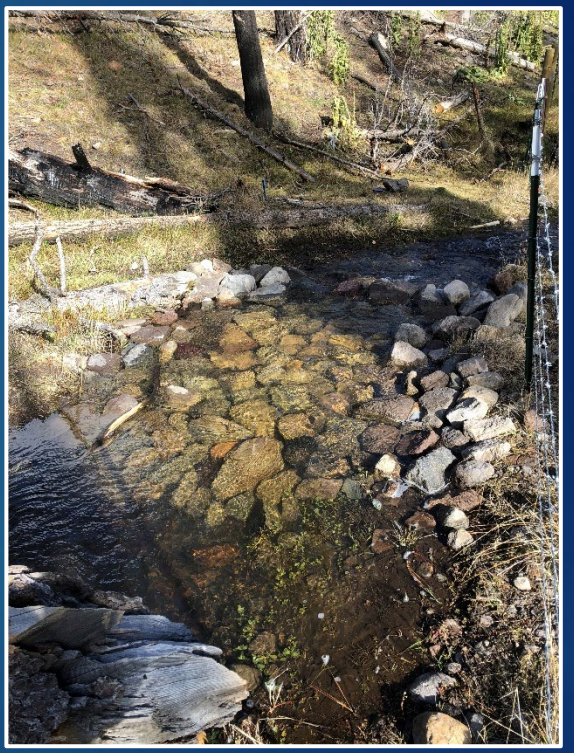
After

Lat: 35.973864° Long: -106.372406°

Stream Restoration - rock structures

- Rock dams, baffles, run-downs





Headwaters Restoration – log drops

- Logs must be set > 50% below grade

Road Crossings – natural bottom

- Incorporate stream restoration above and below

Before (2018)

After (2021)

Road Crossings – stacked stone

Before

36"x 40' CMP Culvert

After

6'x 3'x 58' Bottomless Culvert

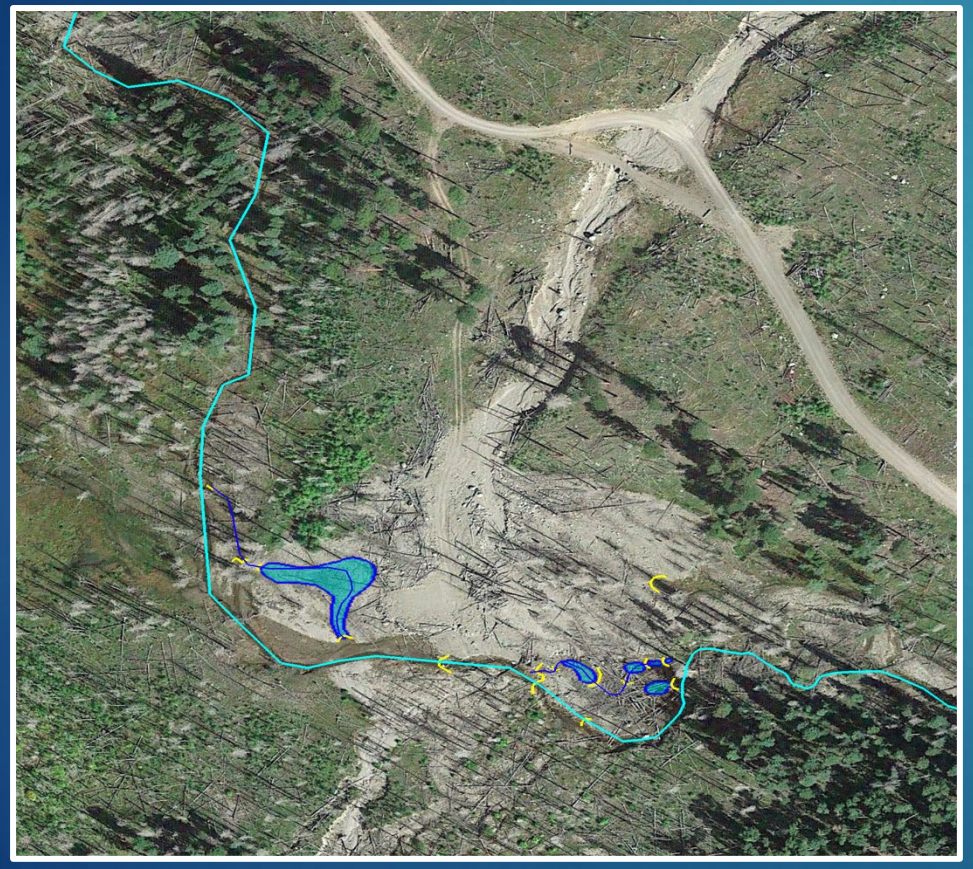
- Cylindrical culverts provide a cost-effective alternative when set below grade.

Water resources development

Maximize riparian habitat extent

Sediment retention basins

- Sediment retention basins mitigate flood and debris flows.
- Can be constructed as off-channel ponds to increase habitat availability



Off-channel ponds for debris basins

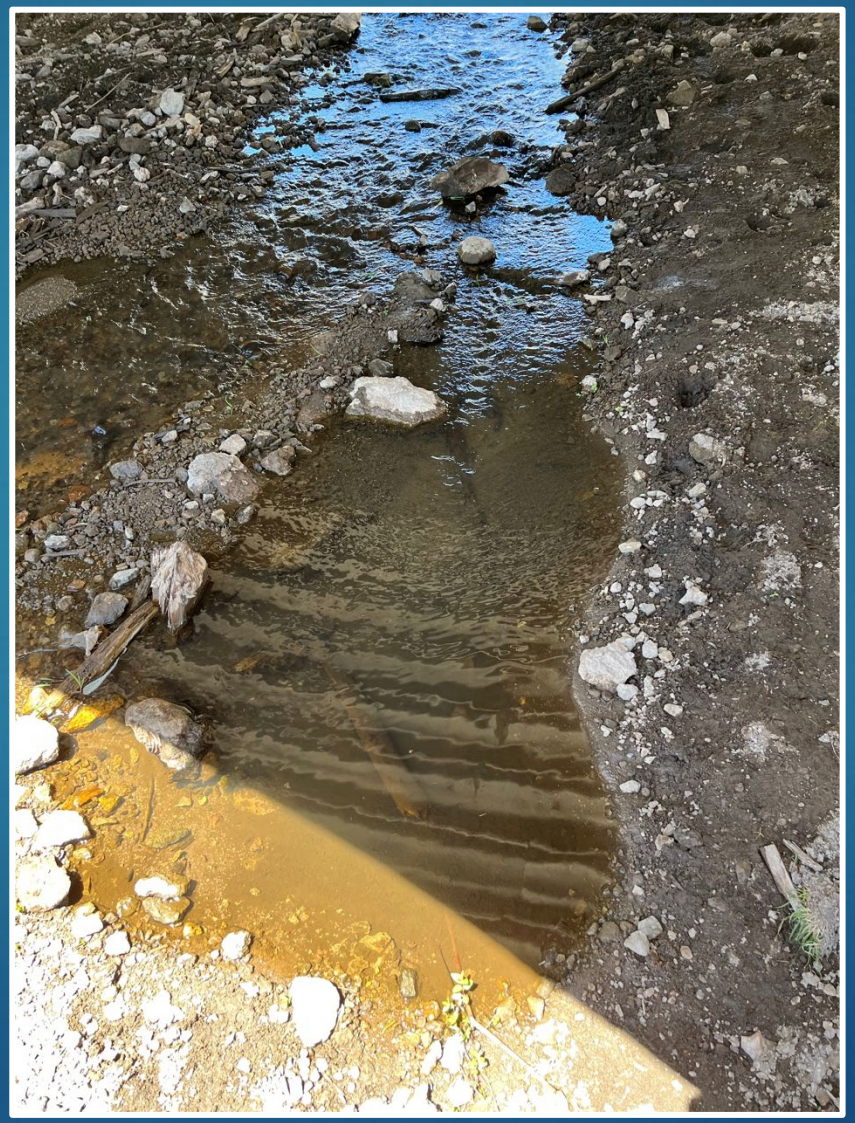
- Ponds increase surface & subsurface water storage, habitat, and sediment retention

- Co-benefits: sediment catchment , water storage, habitat, etc.
- Ecologically connected

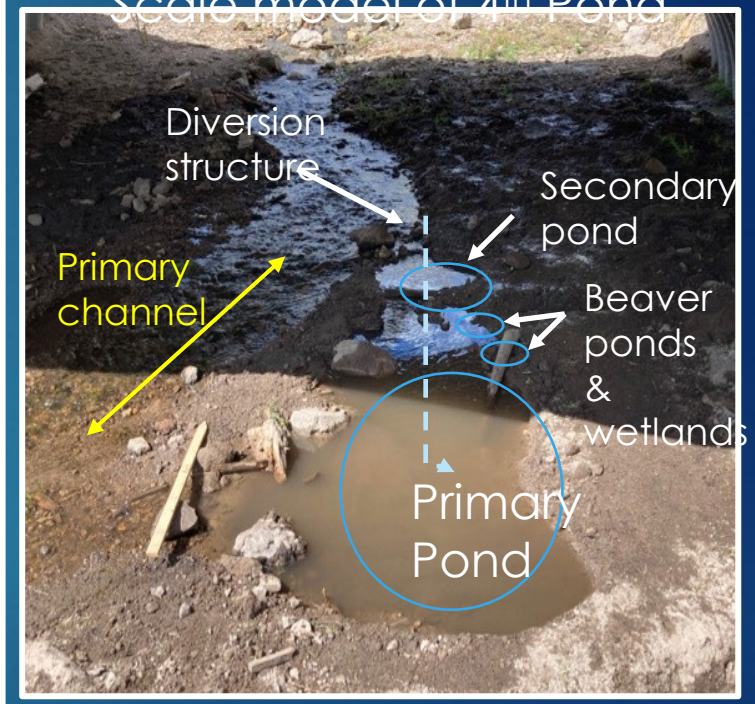
- Woody debris integrated to minimize erosion, intercept precip energy, and promote seed catchment

Off-channel Pond Concept

- Scale model
- Goal is to bypass sediment transport to minimize maintenance and infilling
- Evaluate sediment deposition
- Minimal sediment influx over 12 months



Scale model of 4th Pond



Conservation Trials: off-channel ponds

Off-channel ponds

- Floodplain ponds, similar to an oxbow lake
- Attenuate flood energy
- Function as sediment retention basins.
- Increase water storage, create habitat, and provide recreation.

Conceptual design

Current development

Current Goals

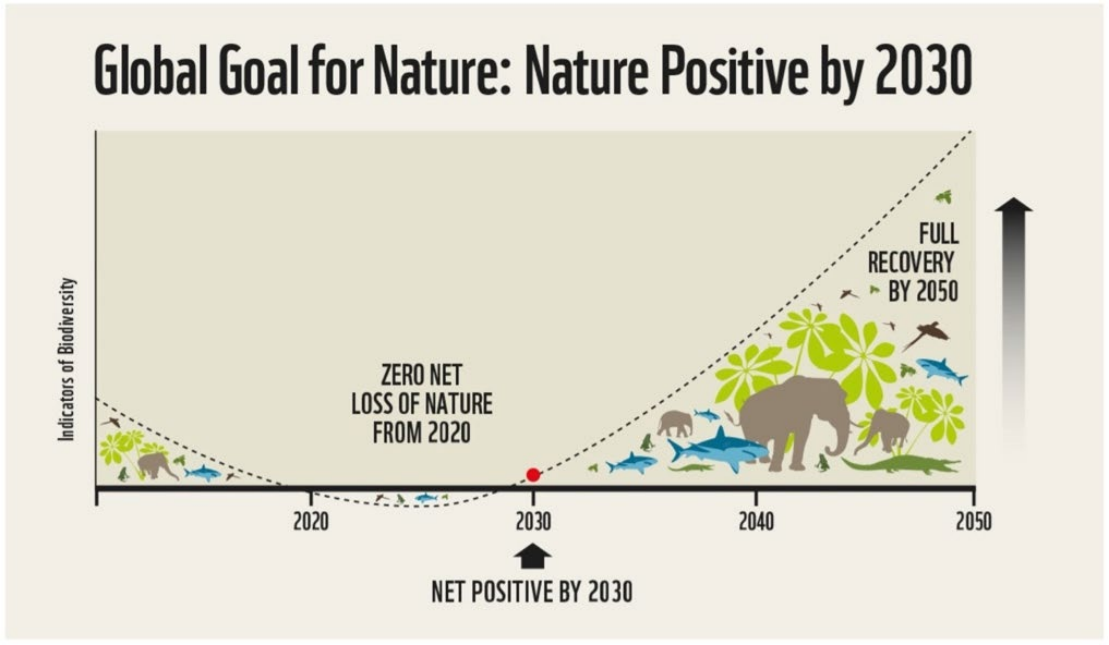
- Develop a resilient water storage model without the need for dams!
  - Provide a sustainable water supply that is resilient to climate variability
    - 100's of small ponds vs. a few large open water bodies
  - Develop water security for community
  - Provide habitat diversity, connectivity, and complexity
  - Increase cultural value and create recreation opportunity

Challenges

- Water quality & sediment transport
- Quantifying subsurface water volume and carbon sequestration
- Grazing management (cattle; deer/elk)
- ”Build it like it was”
- Contractor proficiency

Conclusion

- Leverage nature for cost effective, multi-benefit strategies.
- Build partnerships to braid funding, expertise, and extend treatment area.
- Maintain reasonable expectations, apply adaptive management.
- Integrate public participation.
- Think outside the box.
- Work to be nature positive!



"If it's good for the planet, it's ultimately good for us"

- Santiago Naranjo, Forestry Tech and Santa Clara Pueblo Tribal Member

Thank you!

Questions?

Pools & ponds

- Slow & spread the water out to increase water storage and infiltration

Habitat creation and complexity

Beaver Dam Analogs (BDA's)

NBS & PBR Citations & Resources

- US Forest Service: Process-based principles for restoring river ecosystems https://www.fs.usda.gov/treesearch/pubs/34786
- Utah State University, Restoration Consortium: Low-tech Process-based Restoration of Riverscapes https://lowtechpbr.restoration.usu.edu/
- FEMA: Job Aids for Bioengineering Stabilization Methods
  - Shoreline stabilization, Streambank Stabilization, Wildfire Mitigation (2018)
  - https://www.fema.gov/media-library/assets/documents/156338
- USACE
  - Manual: Engineering with Nature Using Native Plant Communities (2014)
  - Report: Incorporating Ecosystem Goods and Services in Environmental Planning – Definitions, Classification and Operational Approaches (2013)
- State of Colorado, Water Conservation Board
  - Living Streambanks- A Manual of Bioengineering Treatments for Colorado Streams (2016)