

Framework for Post-fire Restoration in California's National Forests

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Wildfire trends in California

- ▶ Wildfires are becoming larger, more frequent, and severe in CA forests
- ▶ Substantial loss of forests & woodlands
- ▶ Can we effectively restore post-fire landscapes?



Current Approach on National Forests

1. Narrow range of management objectives
2. Largely tactical and conventional and often actions not aligned with current science
3. Management actions poorly linked to landscape-scale restoration objectives



New Approach Needed

- Landscape-scale strategic approach
 - Links management actions to restoration goals
- Long-term recovery
- Positive & negative fire effects
- Integrative and creative approaches
- Climate change & adaptation



Framework Development

- ▶ Workshops in 2015 & 2016
 - ▶ USFS multi-disciplinary group
- ▶ Develop a science-based framework for post-fire restoration on CA national forests
 - ▶ Forest and shrubland ecosystems
 - ▶ GTR-270 published in Jan. 2021



GTR Elements

- ▶ Background – purpose, need, & scope
- ▶ Guiding principles
- ▶ Five-step process – “Restoration framework”
- ▶ 3 case studies – conifer forests, chaparral, sagebrush
- ▶ Appendices – tools, datasets, etc.



Purpose of GTR

- ▶ Provide a science-based and comprehensive framework for post-fire ecological restoration on the national forests in Region 5
- ▶ Landscape-scale framing of ecological restoration and vegetation & fuels management



Important Topics Not Addressed in GTR

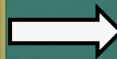
- ▶ Postfire management on non-FS lands
- ▶ Immediate postfire concerns (i.e., BAER)
- ▶ Safety (e.g., hazard trees)
- ▶ Socioeconomics and Recreation
- ▶ Tribal & stakeholder engagement/collaboration
- ▶ Tactical approaches (e.g., salvage, reforestation)
 - ▶ Some tactics discussed as examples



Guiding Principles:

1. Restore Key Ecological Processes
2. Consider Landscape Context
3. Promote Regional Native Biodiversity
4. Sustain Diverse Ecosystem Services
5. Establish a Prioritization Approach for Management Interventions
6. Incorporate Adaptation to Agents of Change

Restoration Framework
(five step process)



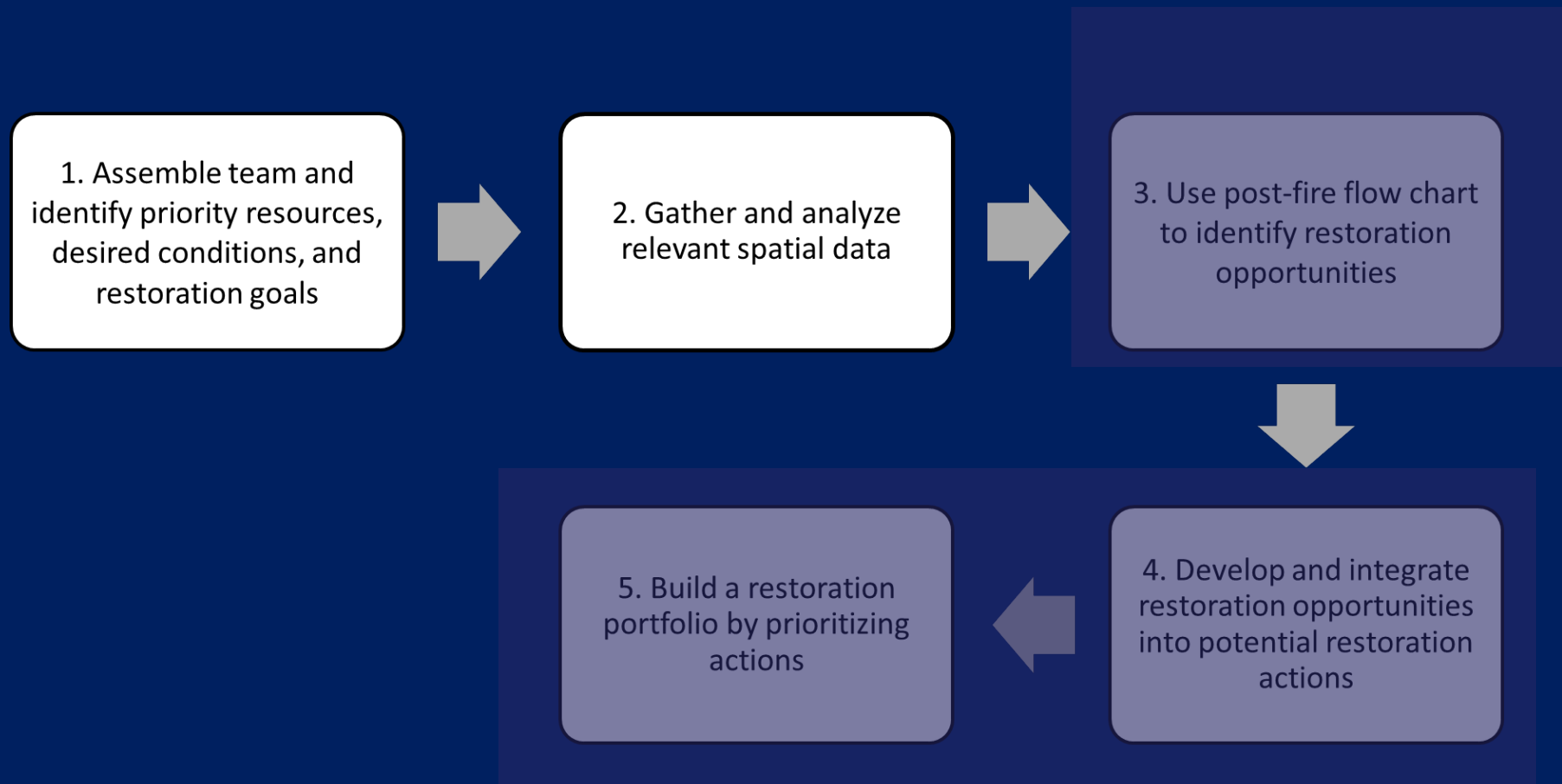
Project Planning and
Implementation



Monitoring informs
reassessment



Steps in Restoration Framework





Applying the
postfire
framework

Step 1. Assemble team, identify priority resources, desired conditions, and goals

Assessment Team – PSW Research Scientists, Province Ecologists, Forest Managers (Foresters, Fire Managers, and Wildlife Biologists)



Mixed conifer forest
(low severity, frequent fire
regimes)



California spotted owl
(forest-dependent species)

Data Gathering & Analysis

- ▶ Assess post-fire ecological condition
 - ▶ Vegetation, fire effects, priority resources
 - ▶ Basic spatial analysis units (e.g., LMUs, PODs*)
- ▶ Consider other factors that may influence post-fire recovery
 - ▶ Climate change, invasive species
- ▶ Incorporate additional analysis tools
 - ▶ Post-fire conifer regeneration tool (POSCRPT)



*LMU = Landscape Management Units; PODs = Potential Operational Delineations

Steps in Restoration Framework

1. Assemble team and identify priority resources, desired conditions, and restoration goals



2. Gather and analyze relevant spatial data



3. Use post-fire flow chart to identify restoration opportunities



4. Develop and integrate restoration opportunities into potential restoration actions



5. Build a restoration portfolio by prioritizing actions

Post-fire Flowchart

Where did fire improve or maintain ecological conditions and fire effects are within the Natural Range of Variability (NRV)?

*Conditions were improved
or maintained (within NRV)*



*Conditions were degraded
(departed from NRV)*



Post-fire Flowchart

Where did fire improve or maintain ecological conditions and fire effects are within the Natural Range of Variability (NRV)?

Improved or maintained areas

A. Where do other factors threaten ecological resilience and sustainability?

*Other factors absent
(Areas at low risk)*

I. Maintain/promote desired conditions



Applying the postfire flow chart to identify restoration opportunities

Where were fire effects **within** the Natural Range of Variability?

Stands that burned at low severity or with small patches of high severity



Tree mortality



(~60%) of conifer forest burned at low-moderate severity

In these areas, forest conditions may have been **improved or maintained**

Post-fire Flowchart

Where did fire improve or maintain ecological conditions and fire effects are within the Natural Range of Variability (NRV)?

Improved or maintained areas

A. Where do other factors threaten ecological resilience and sustainability?

Other factors present (high risk)



Areas where fire effects are within NRV but don't meet desired conditions

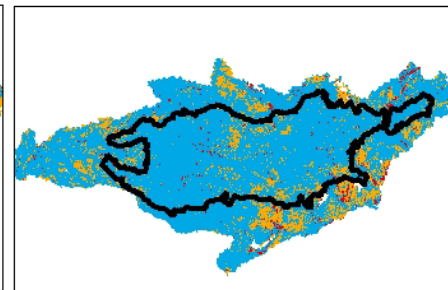
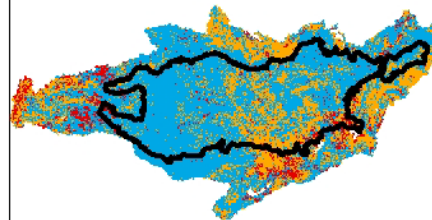


Climate Vulnerability

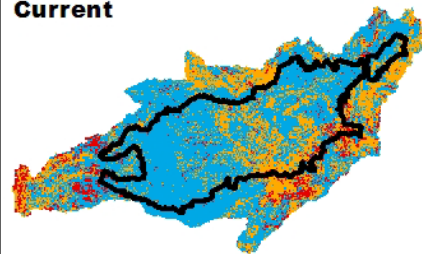
CNRM RCP 8.5

MIROC RCP 8.5

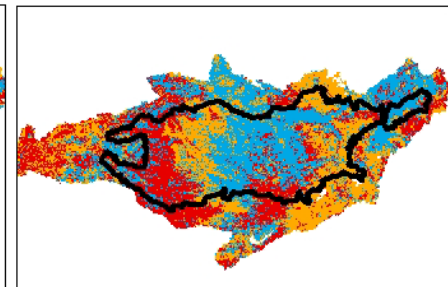
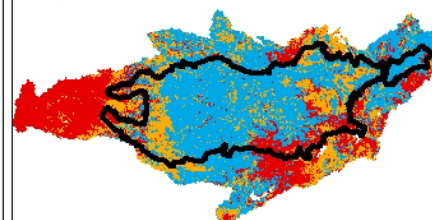
2010 - 2039



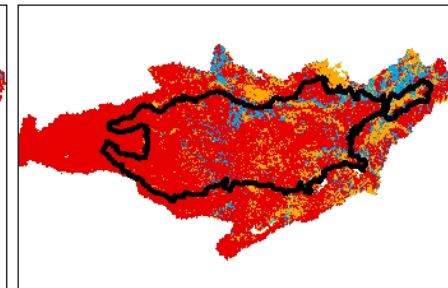
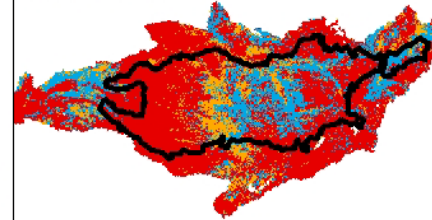
Current



2040 - 2069



2070 - 2099



Mapped climate exposure under the "Warm and Wet" CNRM CM5 climate projection under Higher Emissions RCP8.5. This image shows the climate exposure of Eldorado National Forest vegetation types at current time and three future periods: 2011-2039, 2040-2069, and 2070-2099. Areas considered to be highly climatically exposed are in the 95-99% and 99-100%. Areas with values <80% are considered to be in climatically suitable conditions for the vegetation that it currently occupies.



Post-fire Flowchart

Where did fire improve or maintain ecological conditions and fire effects are within the Natural Range of Variability (NRV)?

Improved or maintained areas

Degraded areas

A. Where do other factors threaten ecological resilience and sustainability?

Other factors present (high risk)

B. Where are management approaches feasible for the restoration of desired conditions given current and anticipated future conditions?

Other factors absent (Areas at low risk)

I. Maintain/promote desired conditions

Areas where restoration is feasible

II. Take management actions to restore desired conditions

Areas where restoration is not feasible

III. Reevaluate desired conditions considering climate change and other stressors

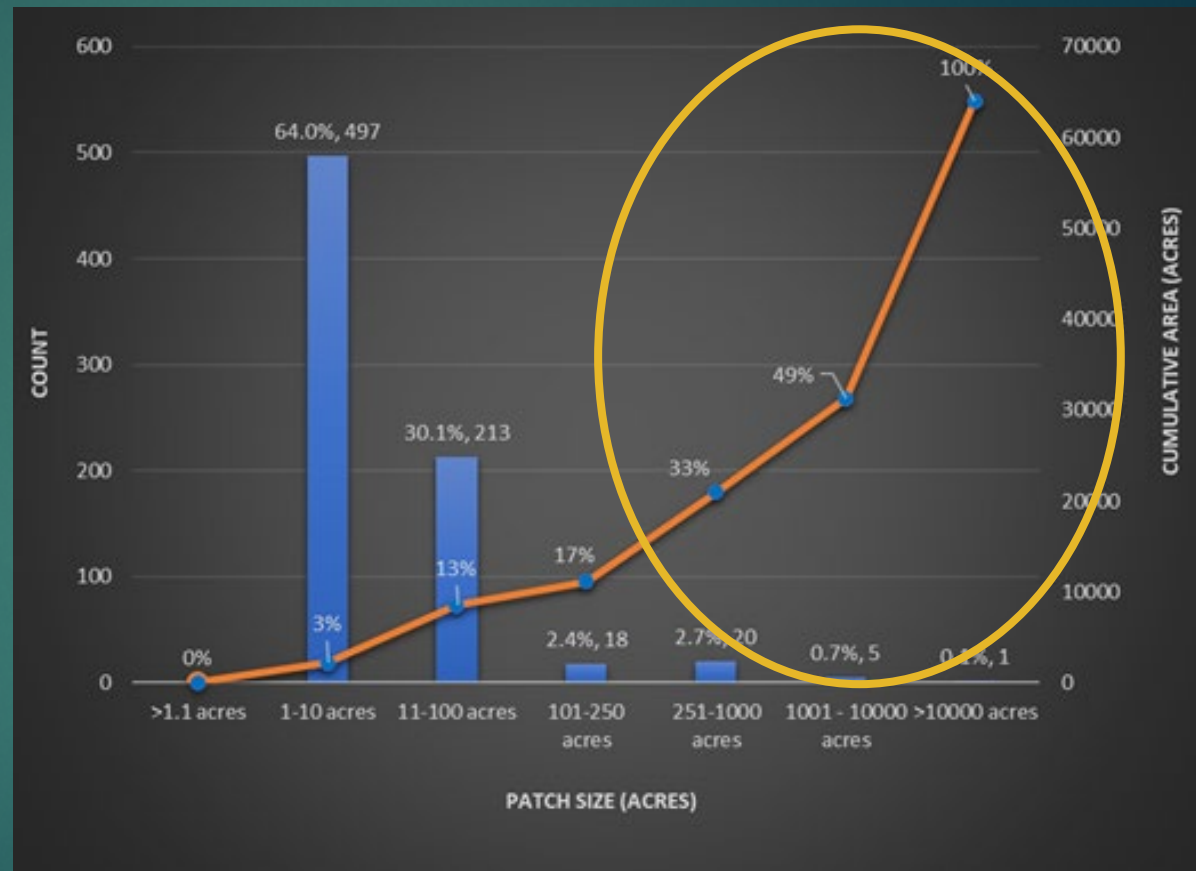


Applying the postfire flow chart to identify restoration opportunities

Where were fire effects outside the Natural Range of Variability?



Criteria #1: Large patches of high severity fire



~80% of total area burned at high severity = in large patches (>250 acres)

Largest patch = 32,748 acres (~50 square miles)

Applying the postfire flow chart to identify restoration opportunities

Where were fire effects outside the Natural Range of Variability?

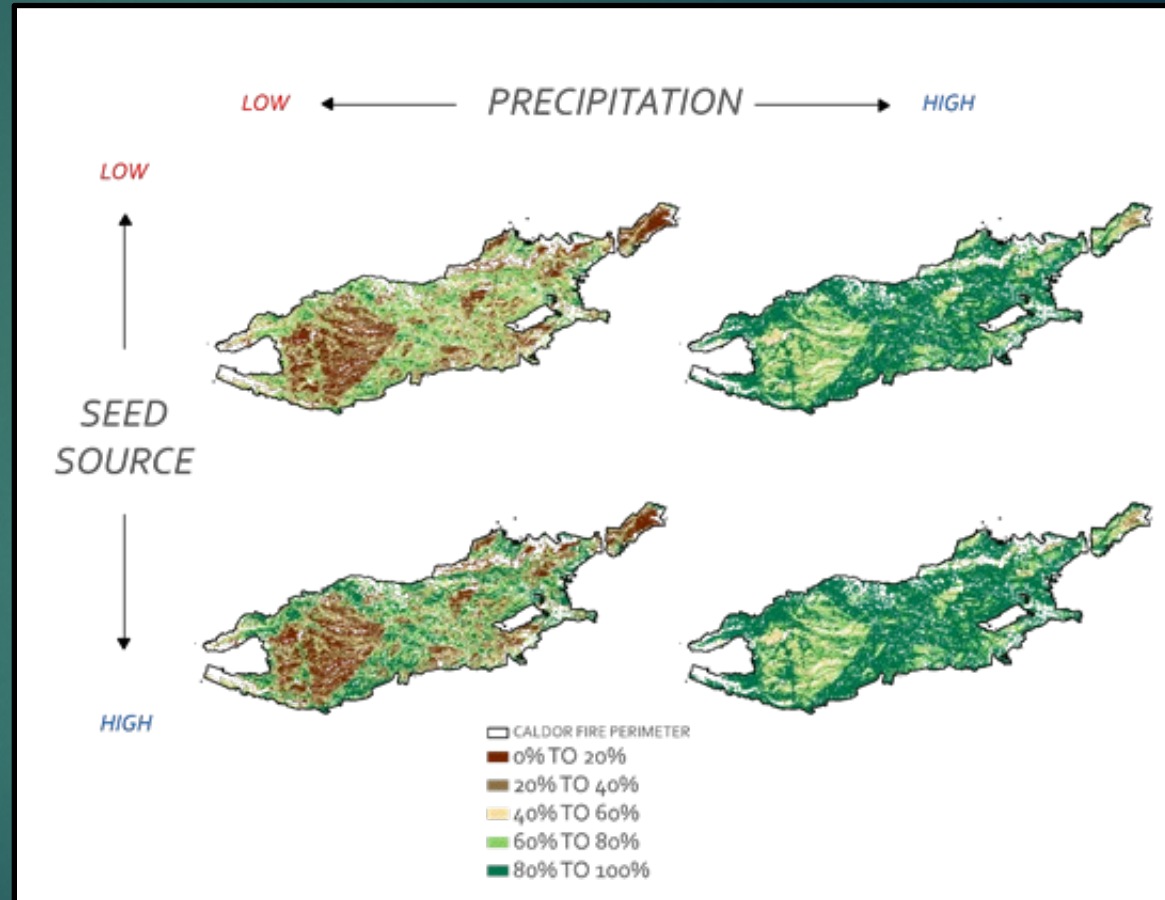


Criteria #2: Areas unlikely to naturally regenerate in the near-term



18% of the fire

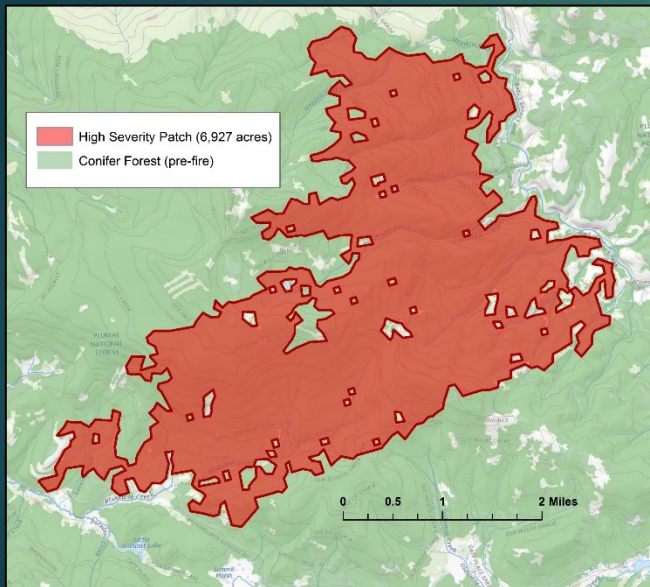
low-moderate probability of natural regeneration



Postfire Spatial Conifer Restoration Planning Tool (POSCRPT)

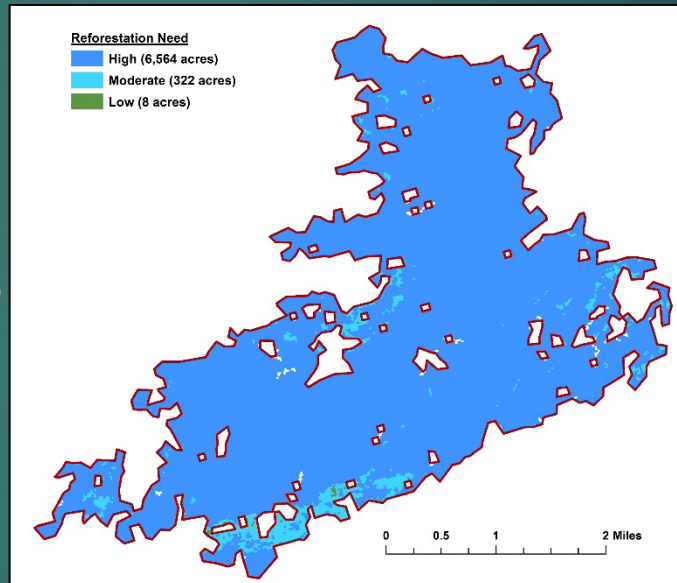
Restoration opportunities in areas that were degraded by the fire

Where were fire effects outside the Natural Range of Variability?



Large patches (>250 acres) of high severity fire

+



Areas with low-moderate potential (0-60%) for natural regeneration

priority acres



Facilitate forest recovery through reforestation

Using the postfire flow chart to identify restoration opportunities

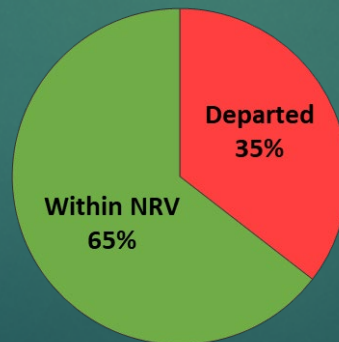
Where did the fire improve or maintain forest conditions? Where were fire effects within the NRV?

Conditions **improved**
or **maintained**



Stands that burned at low severity or with small patches of high severity

Departure from the Natural Range of Variability (NRV)



Conditions **degraded**



Large patches of high severity fire that are unlikely to naturally regenerate in the near-future

Other Considerations

Restoration opportunities in areas that were degraded by the fire

Where were conditions degraded?



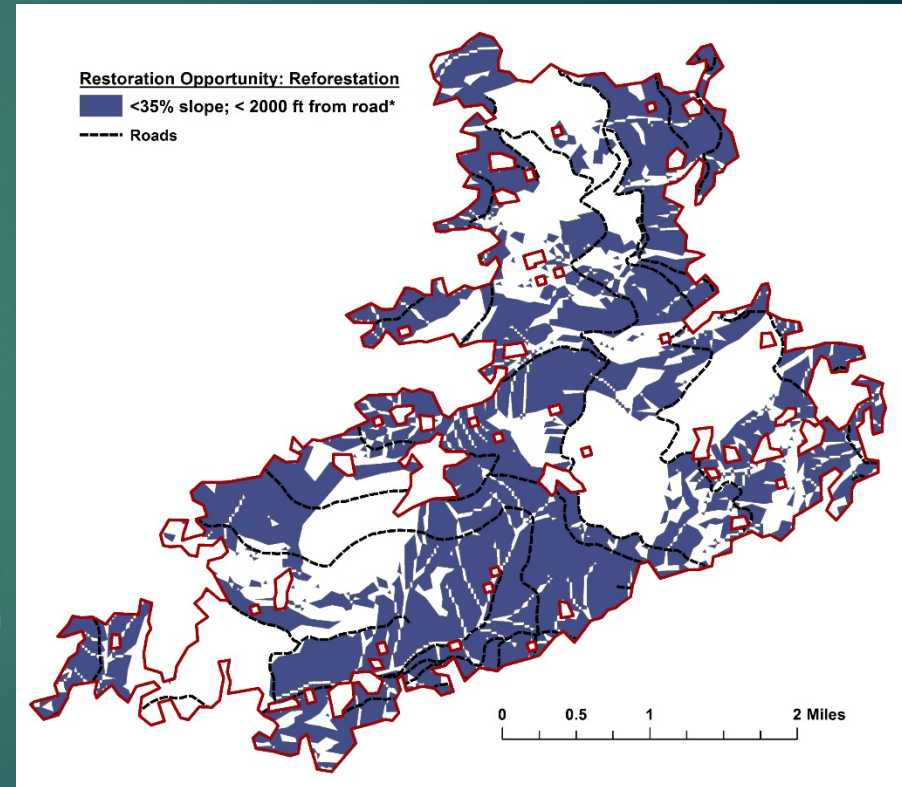
Where are management approaches feasible for restoration of desired conditions?



Take management actions to restore desired conditions

Factors that may influence where, what, and how we design our treatments

- Feasibility
- Future climate (refugia)
- Soils and site productivity
- Topographic position
- Other sensitive resources
- Reburn risk



Post-fire Flowchart

Where did fire improve or maintain ecological conditions and fire effects are within the Natural Range of Variability (NRV)?

Improved or maintained areas

Degraded areas

A. Where do other factors threaten ecological resilience and sustainability?

Other factors present (high risk)

B. Where are management approaches feasible for the restoration given current conditions?



Areas where restoration is feasible

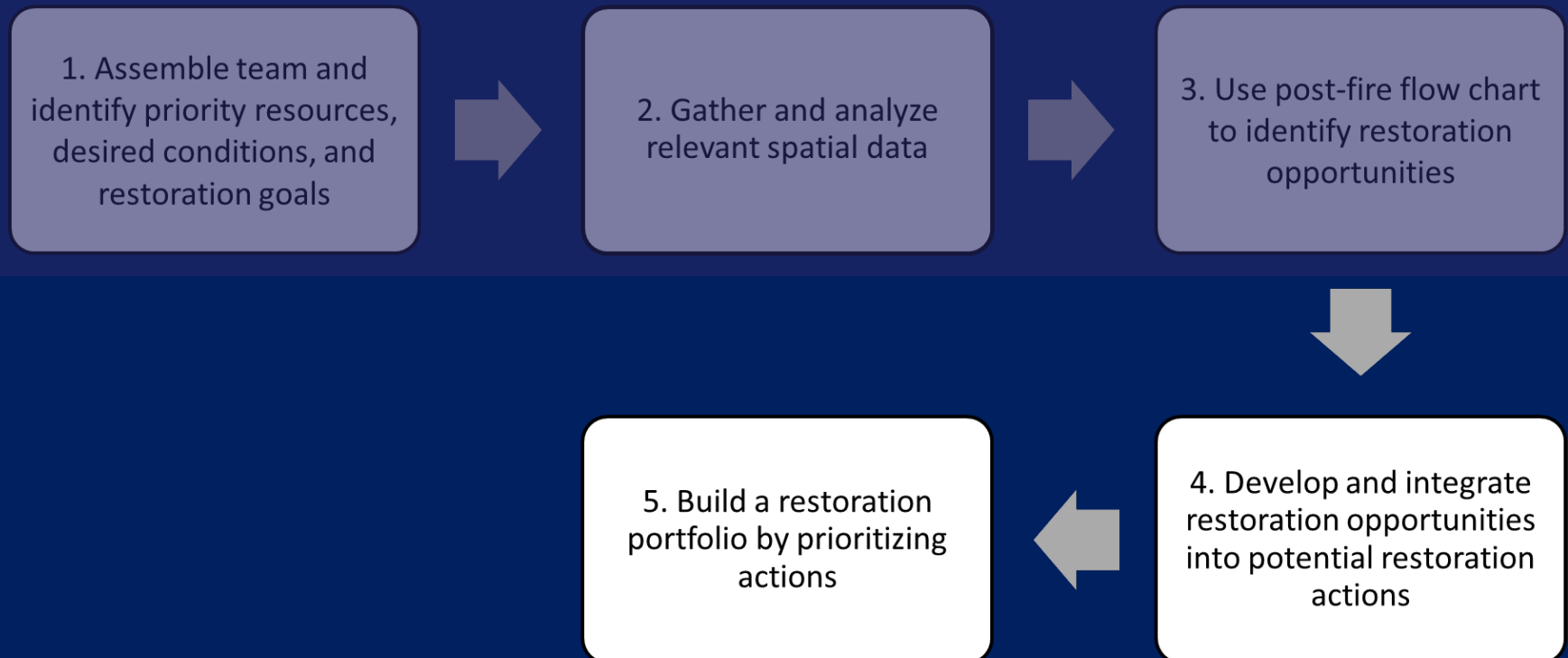
I. Maintain/promote desired conditions

II. Take management actions to restore desired conditions

III. Reevaluate desired conditions considering climate change and other stressors



Steps in Restoration Framework



Restoration Portfolio

- ▶ Suite of potential restoration actions
 - ▶ Maintain/promote desired conditions
 - ▶ Take management actions
 - ▶ Reevaluate conditions
- ▶ Prioritize
 - ▶ Feasibility
 - ▶ Timing
 - ▶ Cost of Inaction
 - ▶ Integration
- ▶ Spatially define (and field refine)



Restoration Portfolio Example

Restoration Opportunity	Target Areas	Management Actions	Timing	Feasibility	Cost of Inaction
<i>Maintain/promote desired conditions</i>	High quality fisher habitat that burned within NRV	Maintain high quality habitat using prescribed fire consistent with NRV	Long (10+ yrs)	Moderate	High
<i>Take management actions to restore desired conditions</i>	Mixed conifer forests and sequoia groves that burned outside NRV	Conduct reforestation in priority areas based on outputs of analysis tools	Short (1-3 yrs)	Moderate	Moderate
<i>Reevaluate desired conditions</i>	Low quality fisher habitat that burned outside of NRV	Promote hardwood cover in areas of high conifer mortality and monitor veg transitions	Moderate (3-5 yrs)	Low-moderate	Low-moderate



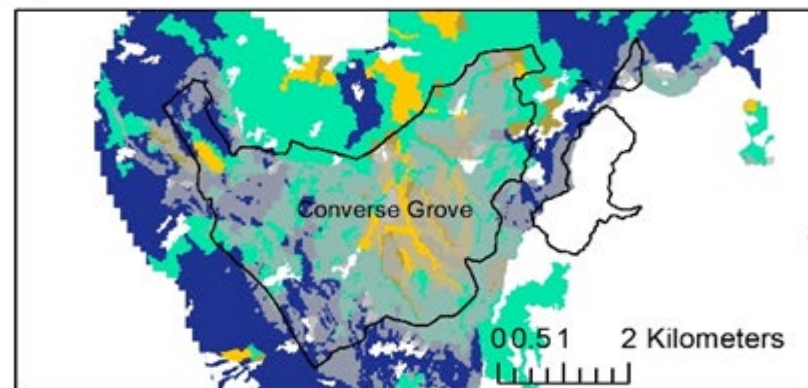
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Decision Framework

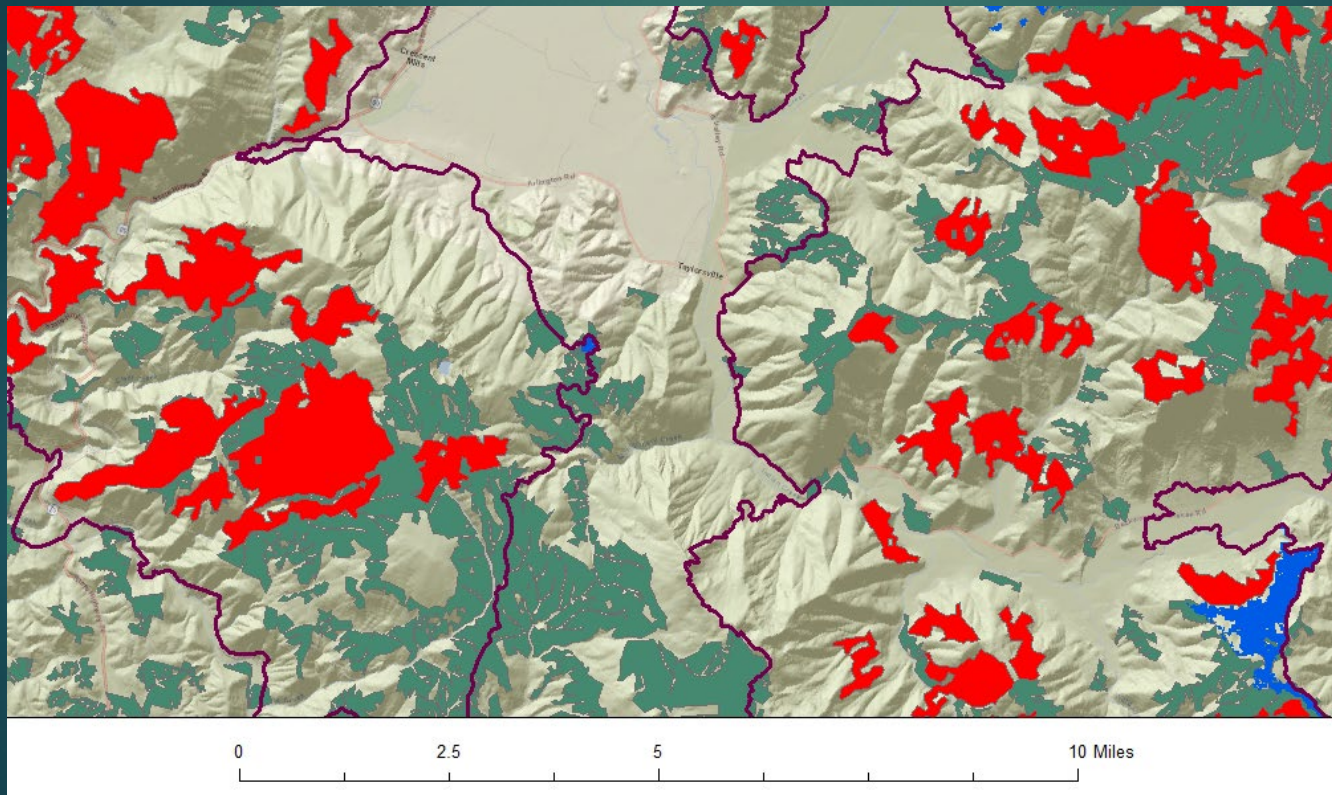
- Maintain/Promote Desired Conditions
- Reevaluate Desired Conditions
- Take Management Actions - Prescribed Fire Limited Fuel Reduction
- Take Management Actions - Reforestation




0 3.75 7.5 15 Kilometers

- Sequoia Groves
- MechConst
- Rough Perimeter



Development and integration of restoration opportunities



-  Maintain/ promote desired conditions
-  Take management actions to increase resilience to future disturbance
-  Take management actions to reestablish forest

Summary

- ▶ Post-fire restoration framework is a process
- ▶ It's not a tool, dataset, or research study of the effectiveness of postfire management



Summary

- ▶ Post-fire restoration framework is a process
 - ▶ Think more broadly, creatively, and strategically
 - ▶ Link individual actions to landscape-scale restoration goals
 - ▶ Identify areas to maintain, restore, and reevaluate desired conditions in a “restoration portfolio”
 - ▶ Integrate new tools and spatial data



Additional Thoughts

- ▶ Restoration portfolio can be broad
 - ▶ Besides fuels reduction & reforestation, additional postfire management actions:
 - ▶ Restoration of understory plant communities
 - ▶ Watershed improvements (e.g., meadow restoration)
 - ▶ Promoting hardwood forests (e.g., black oak groves)
 - ▶ Invasive species control & eradication
 - ▶ Many others



Acknowledgements

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Areas Association

Available online at:

https://www.fs.fed.us/psw/publications/documents/psw_gtr270/

