Post-fire tree regeneration and managed reforestation following the 2020 Colorado wildfire season: 2021 workshop summary

Forest Health Advisory Council August 2021 Meeting

COLORADO FOREST RESTORATION INSTITUTE
COLORADO STATE UNIVERSITY

Marin Chambers & Chuck Rhoades

August 12, 2021

FOREST SERVICE US DEPARTMENT OF AGRICULTURE
ROCKY MOUNTAIN RESEARCH STATION

POST-FIRE TREE REGENERATION AND FOREST RECOVERY WORKSHOP

APRIL 20, 2021

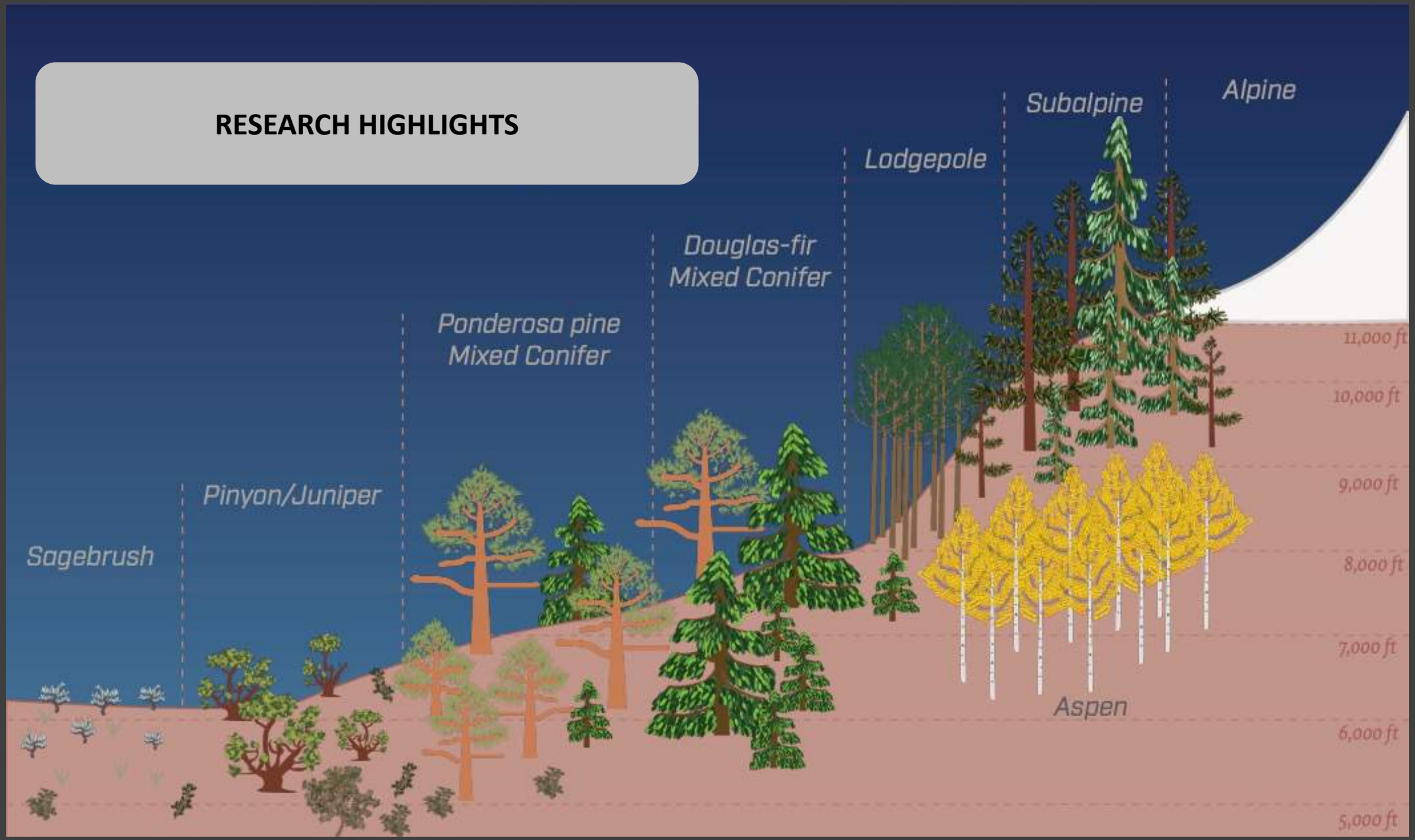
Goals:

a) local researchers to share highlights of post-fire forest research;

b) managers to discuss practical concerns and considerations about post-fire natural forest regeneration and planting;

c) managers, researchers, and stakeholders to discuss knowledge gaps and solutions.

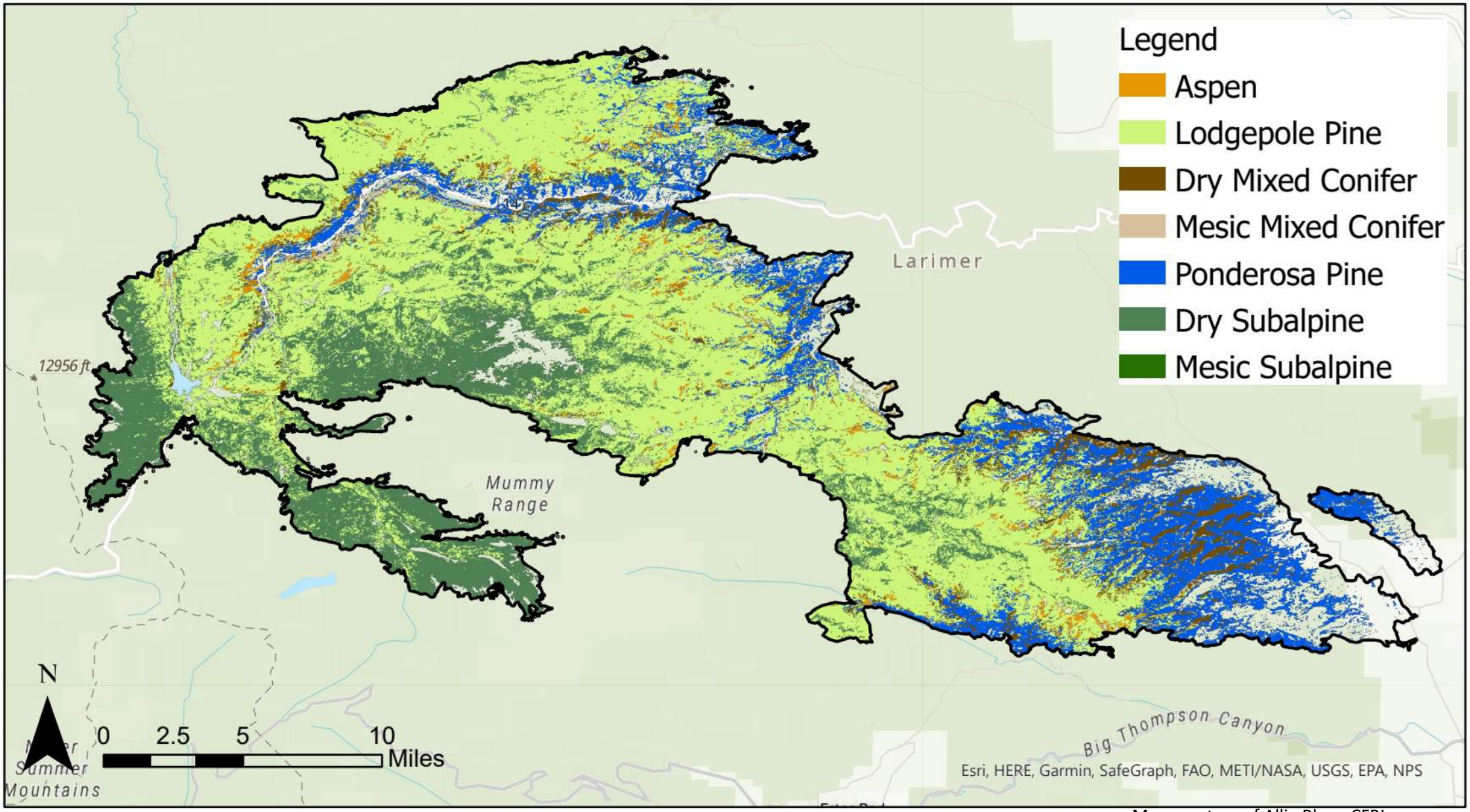
RESEARCH HIGHLIGHTS



Brown, Chambers, Stevens-Rumann, Edwards (2020) CFRI - 2007

Cameron Peak Fire - Vegetation Type

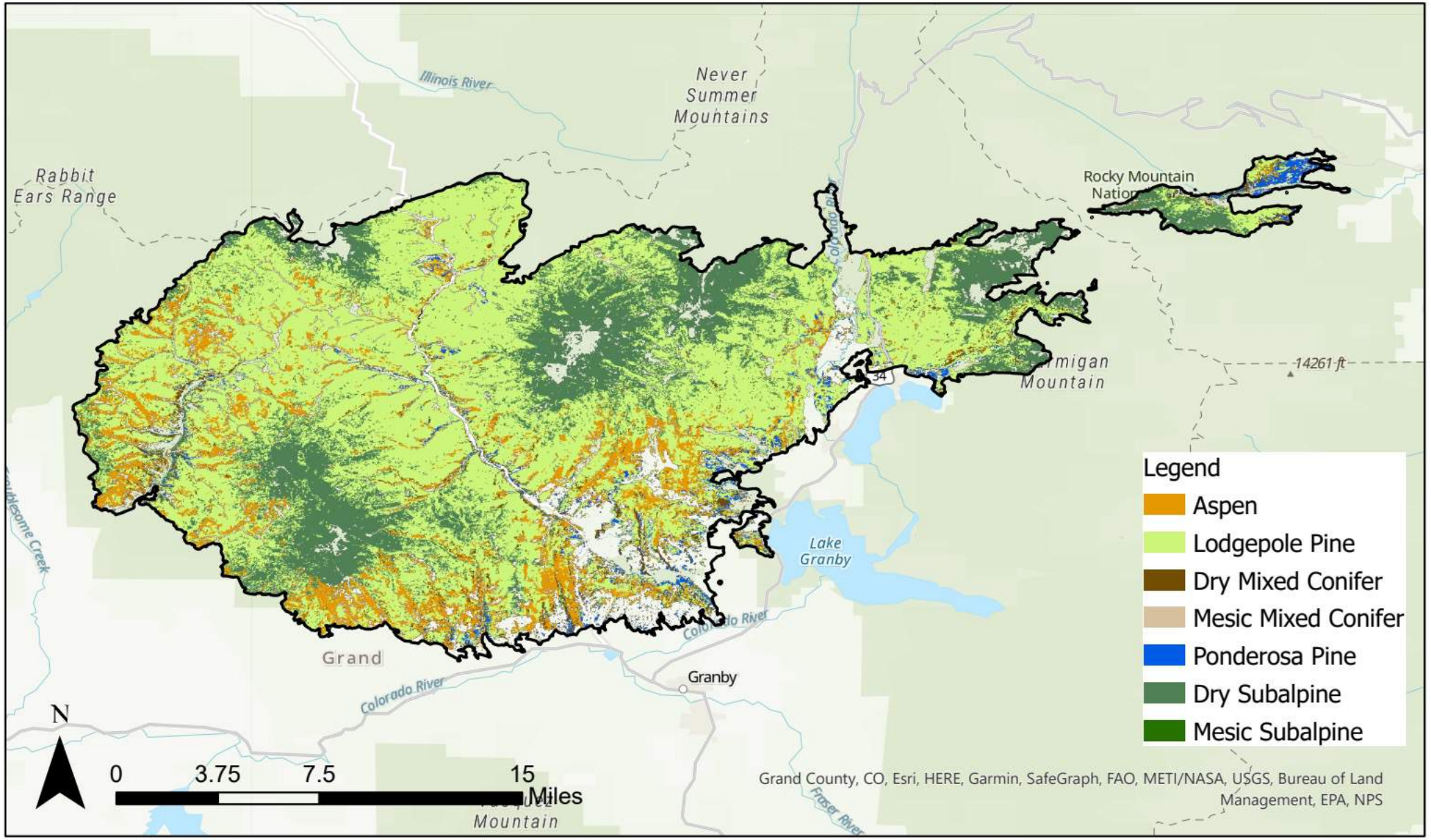
Data source: LANDFIRE 2016, Existing Vegetation Type



Map courtesy of Allie Rhea, CFRI

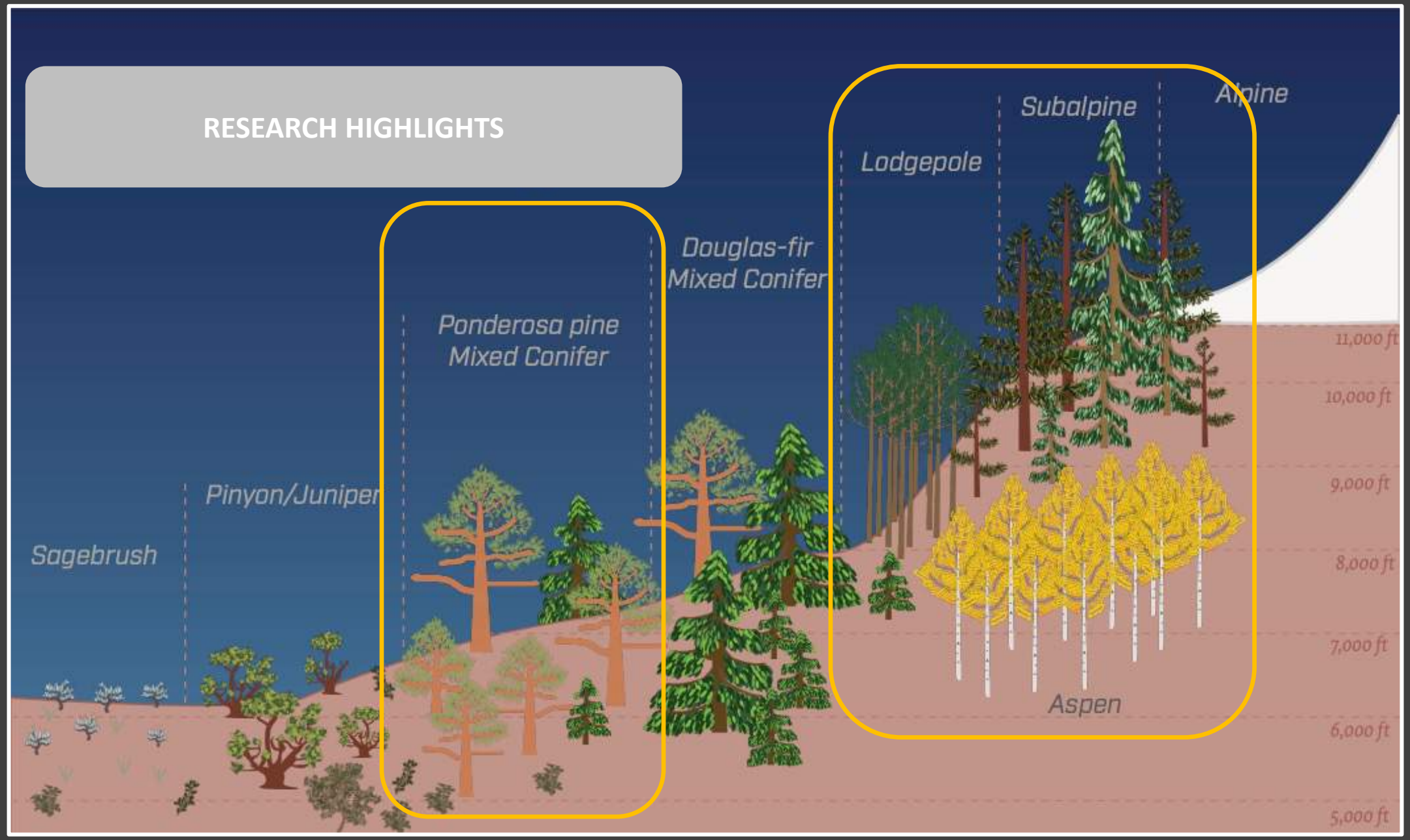
East Troublesome Fire - Vegetation Type

Data source: LANDFIRE 2016, Existing Vegetation Type



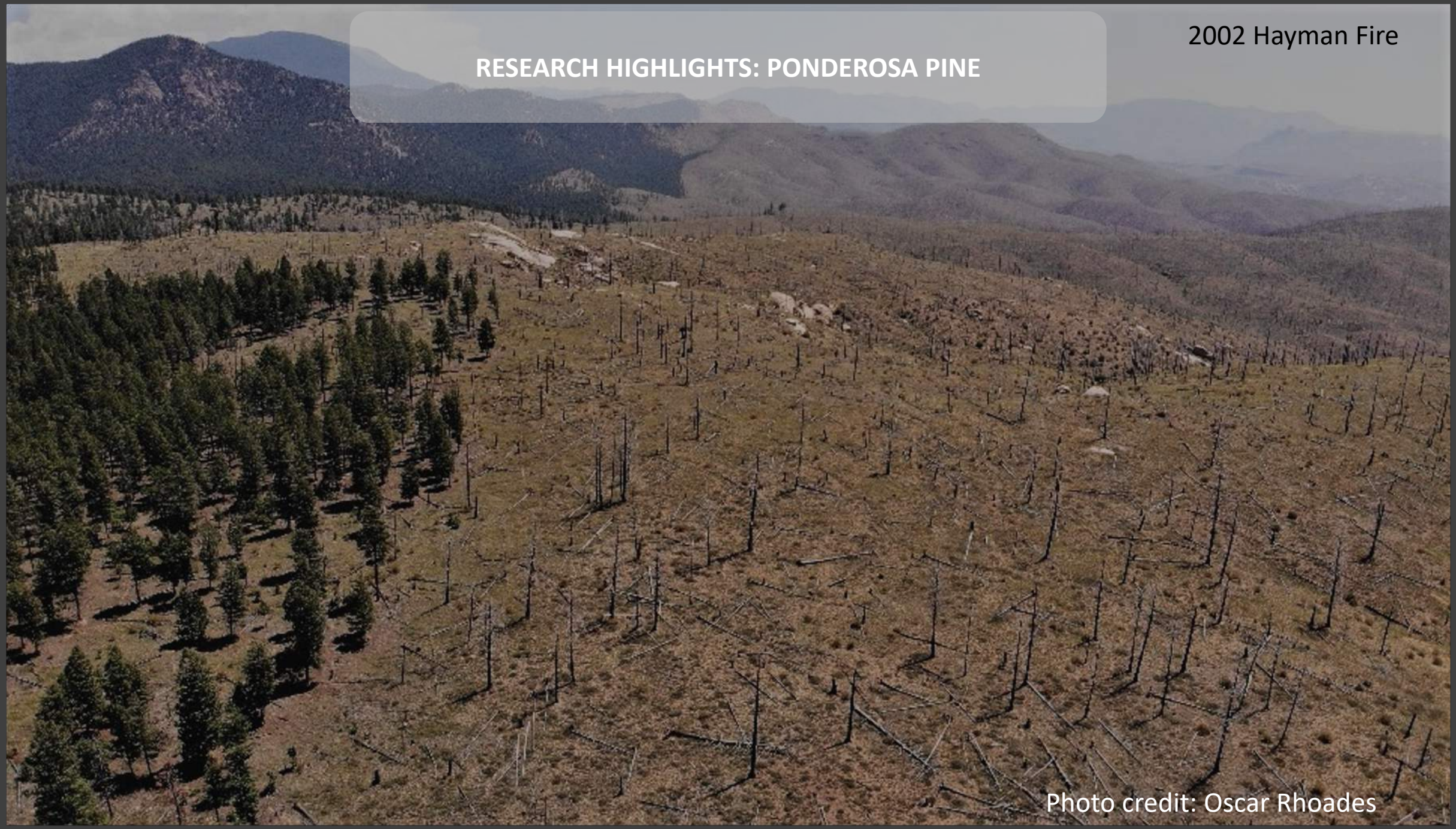
Map courtesy of Allie Rhea, CFRI

RESEARCH HIGHLIGHTS



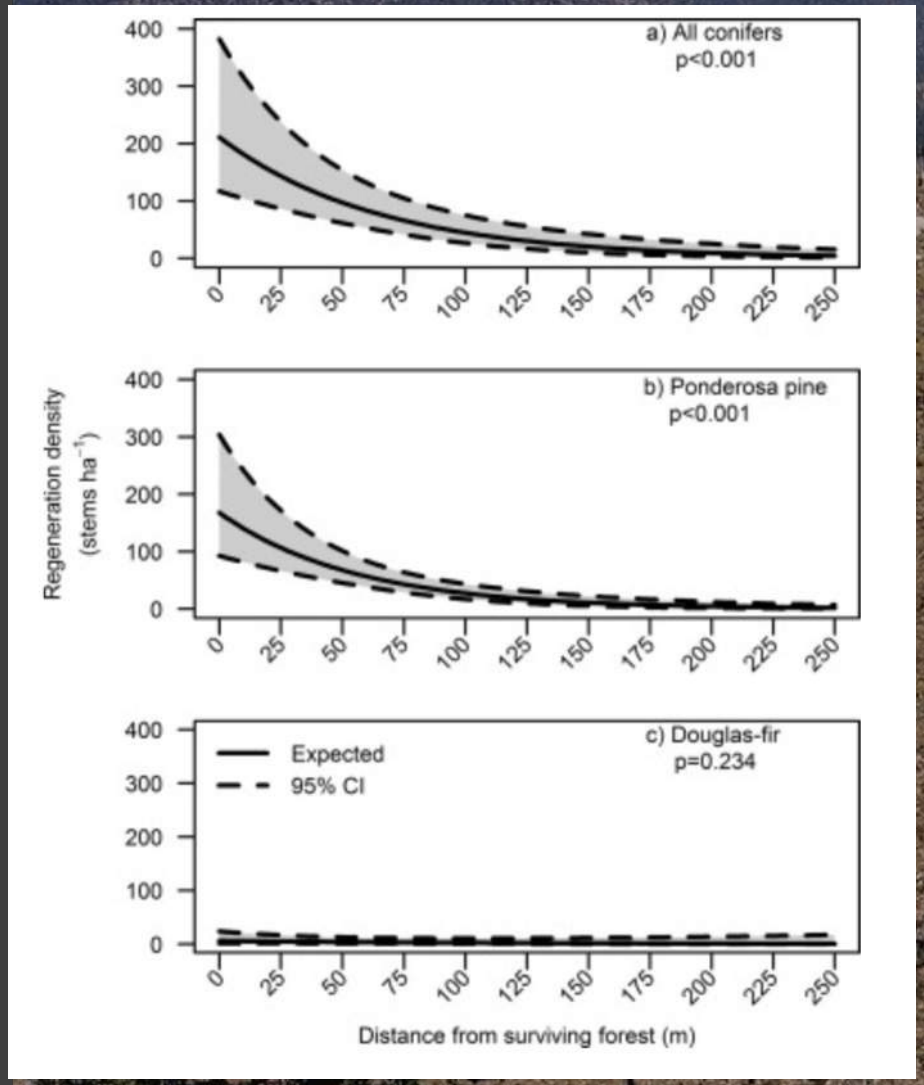
Brown, Chambers, Stevens-Rumann, Edwards (2020) CFRI - 2007

RESEARCH HIGHLIGHTS: PONDEROSA PINE

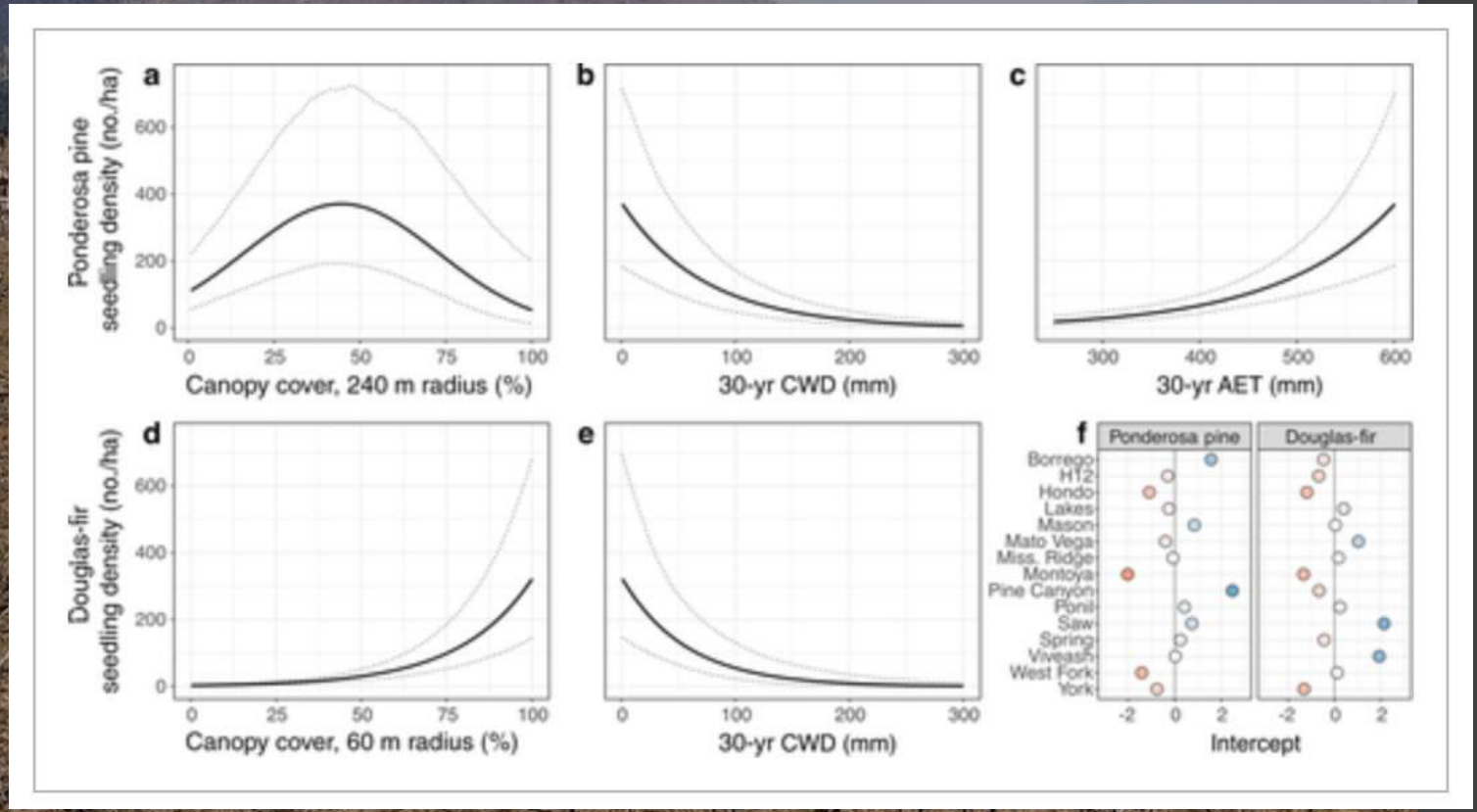


RESEARCH HIGHLIGHTS: PONDEROSA PINE

2002 Hayman Fire

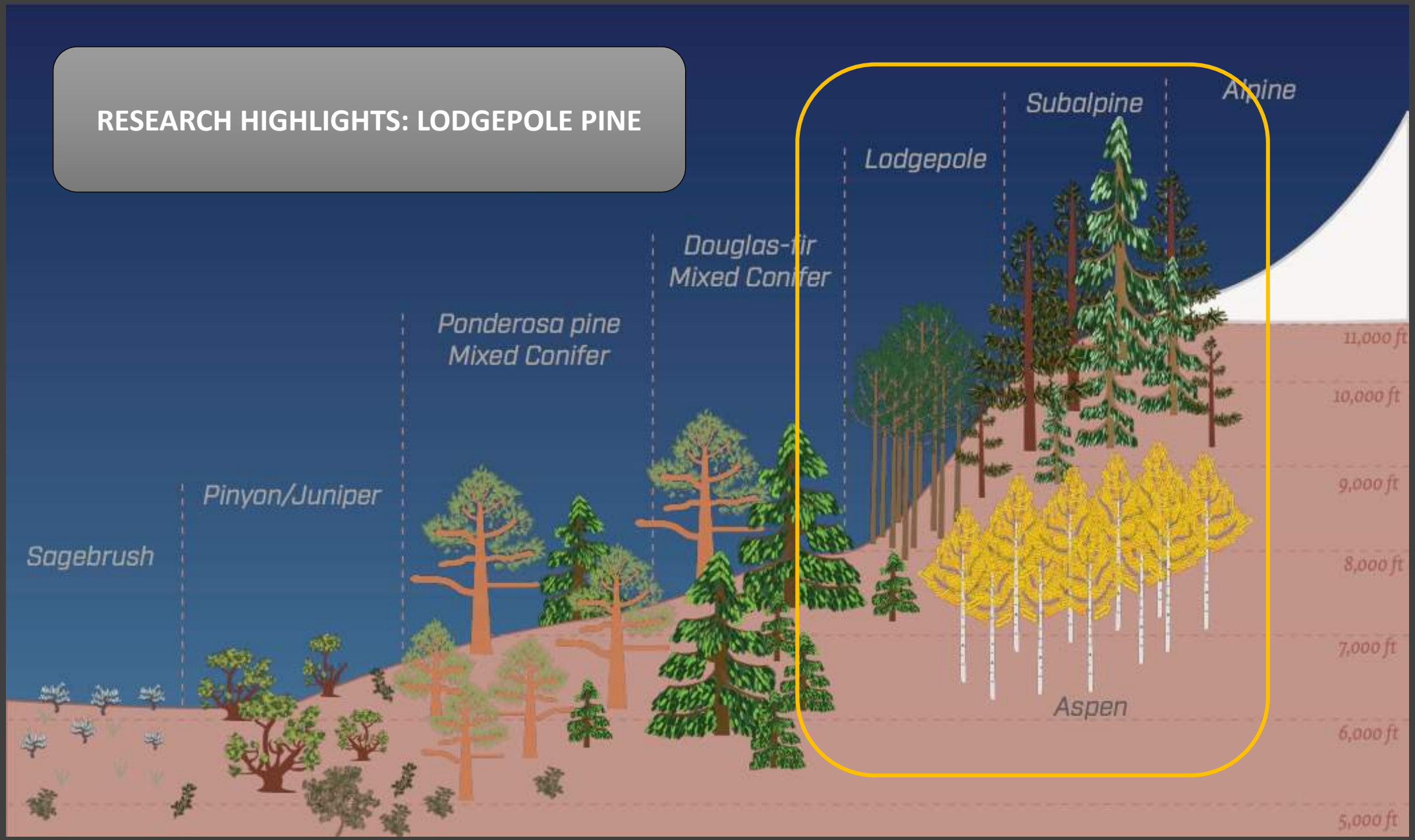


Chambers et al. 2016 FEM



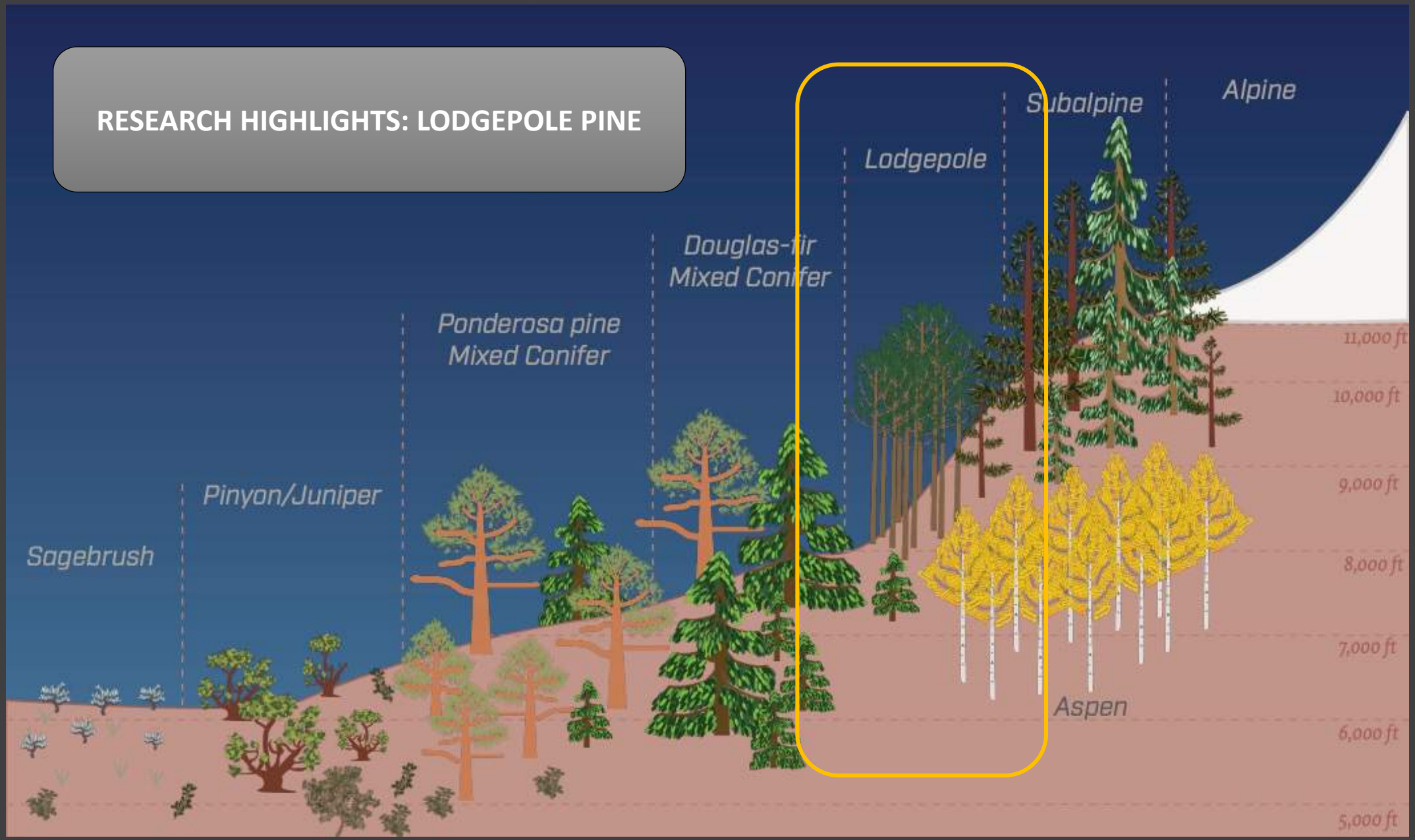
Rodman et al. 2019 Ecological Applications

RESEARCH HIGHLIGHTS: LODGEPOLE PINE



Brown, Chambers, Stevens-Rumann, Edwards (2020) CFRI - 2007

RESEARCH HIGHLIGHTS: LODGEPOLE PINE



Brown, Chambers, Stevens-Rumann, Edwards (2020) CFRI - 2007

SEROTINY

”Remaining on a tree after maturity and opening to release seeds only after exposure to certain conditions, especially heat from a fire”


https://www.alamy.com/stock-photo/serotinous-cones.html

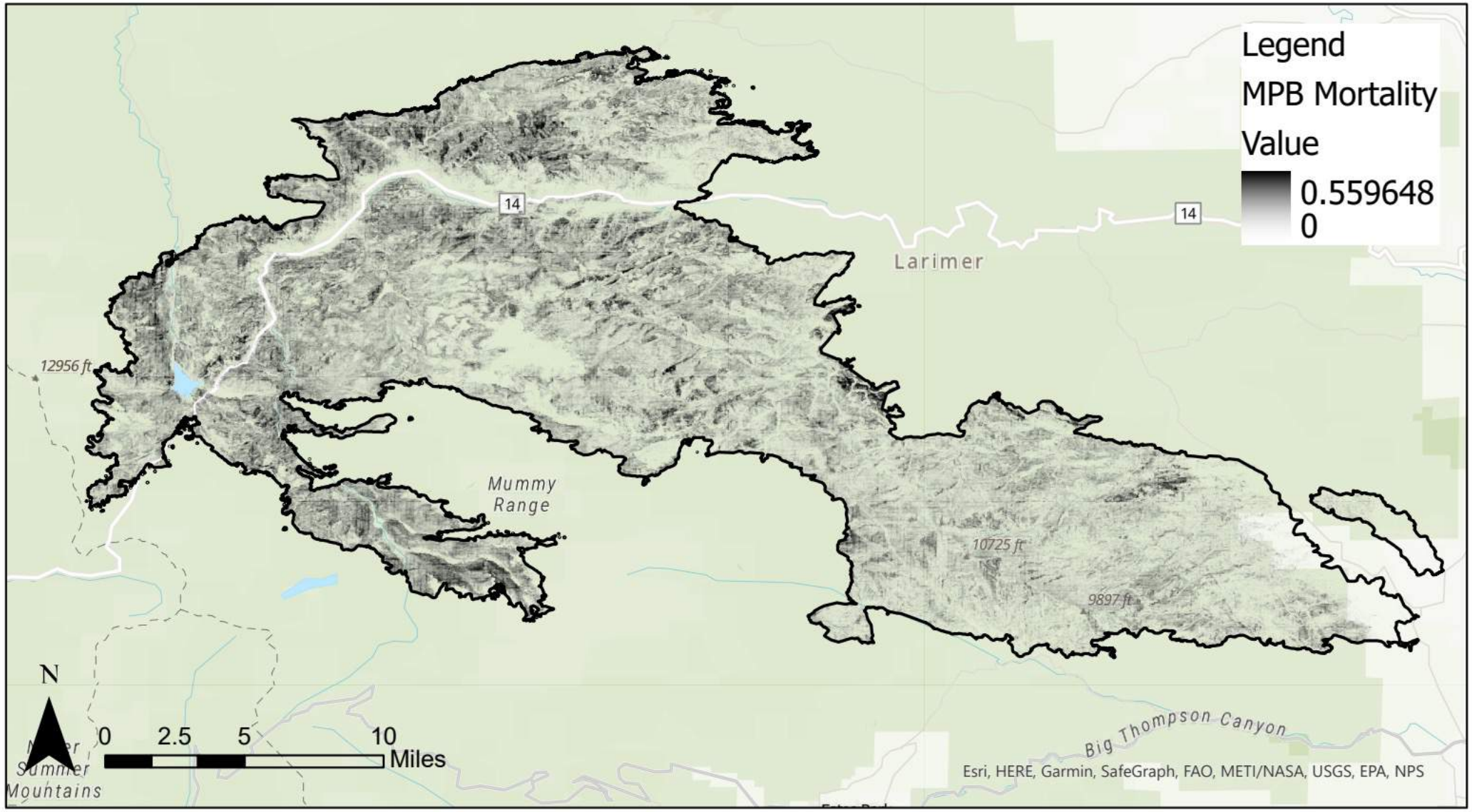

https://www.alamy.com/stock-photo/serotinous-cones.html


1988 Yellowstone Fire

Photo credit: Monica Turner

Cameron Peak Fire - Tree Mortality

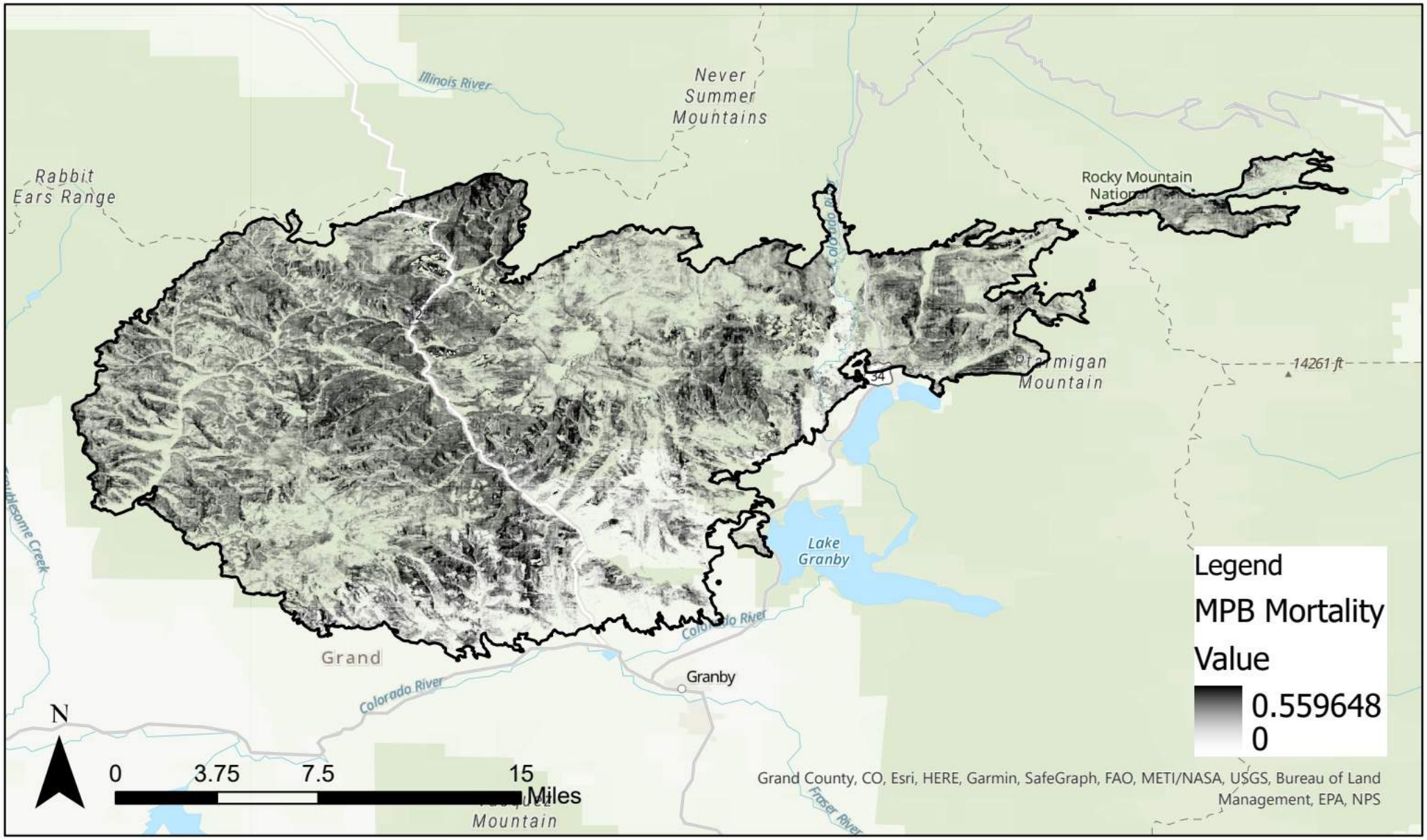
Data source: Bode et al. 2018 Journal of Applied Remote Sensing



Map courtesy of Allie Rhea, CFRI

East Troublesome Fire - Tree Mortality

Data source: Bode et al. 2018 Journal of Applied Remote Sensing



Map courtesy of Allie Rhea, CFRI

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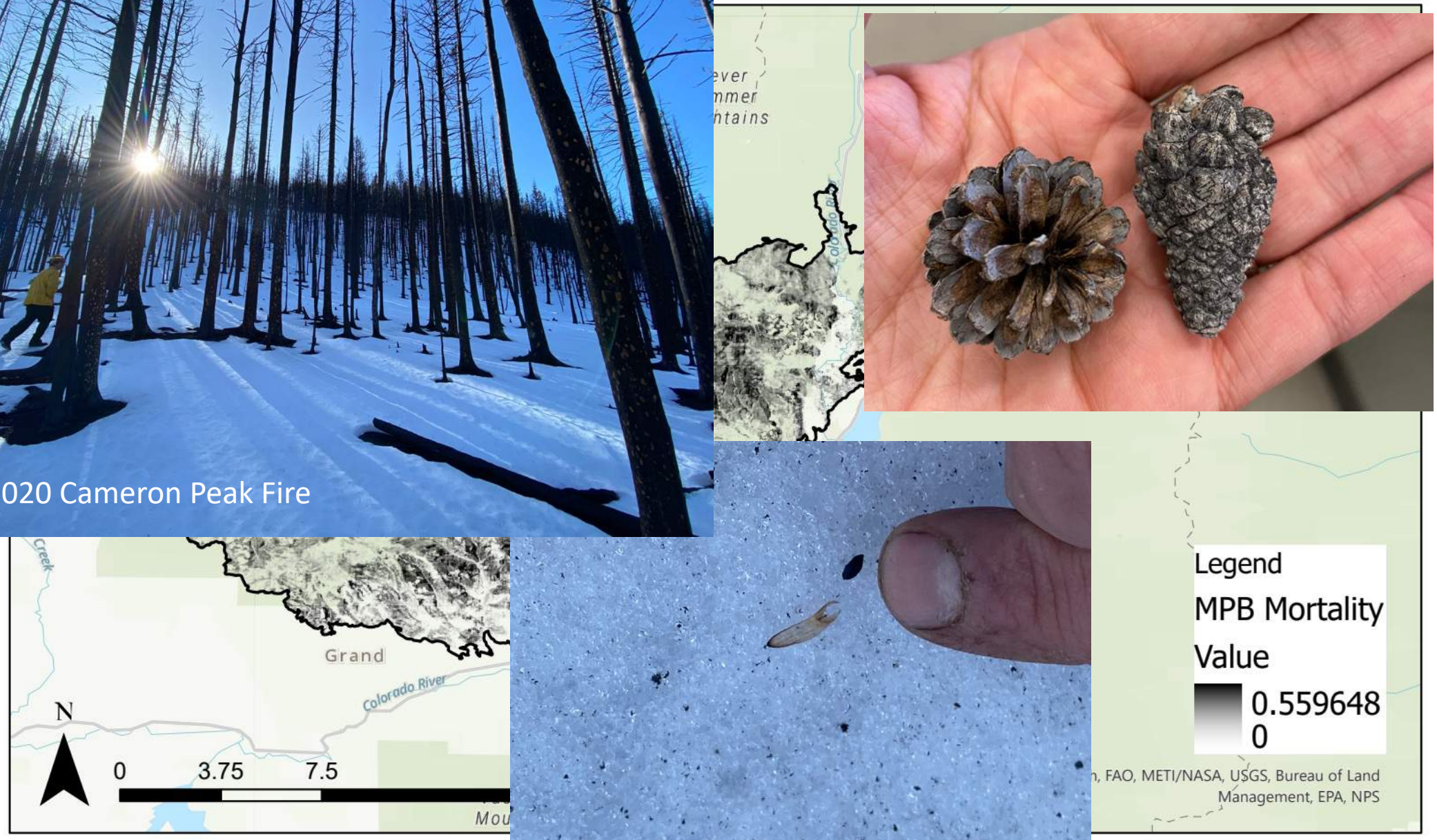
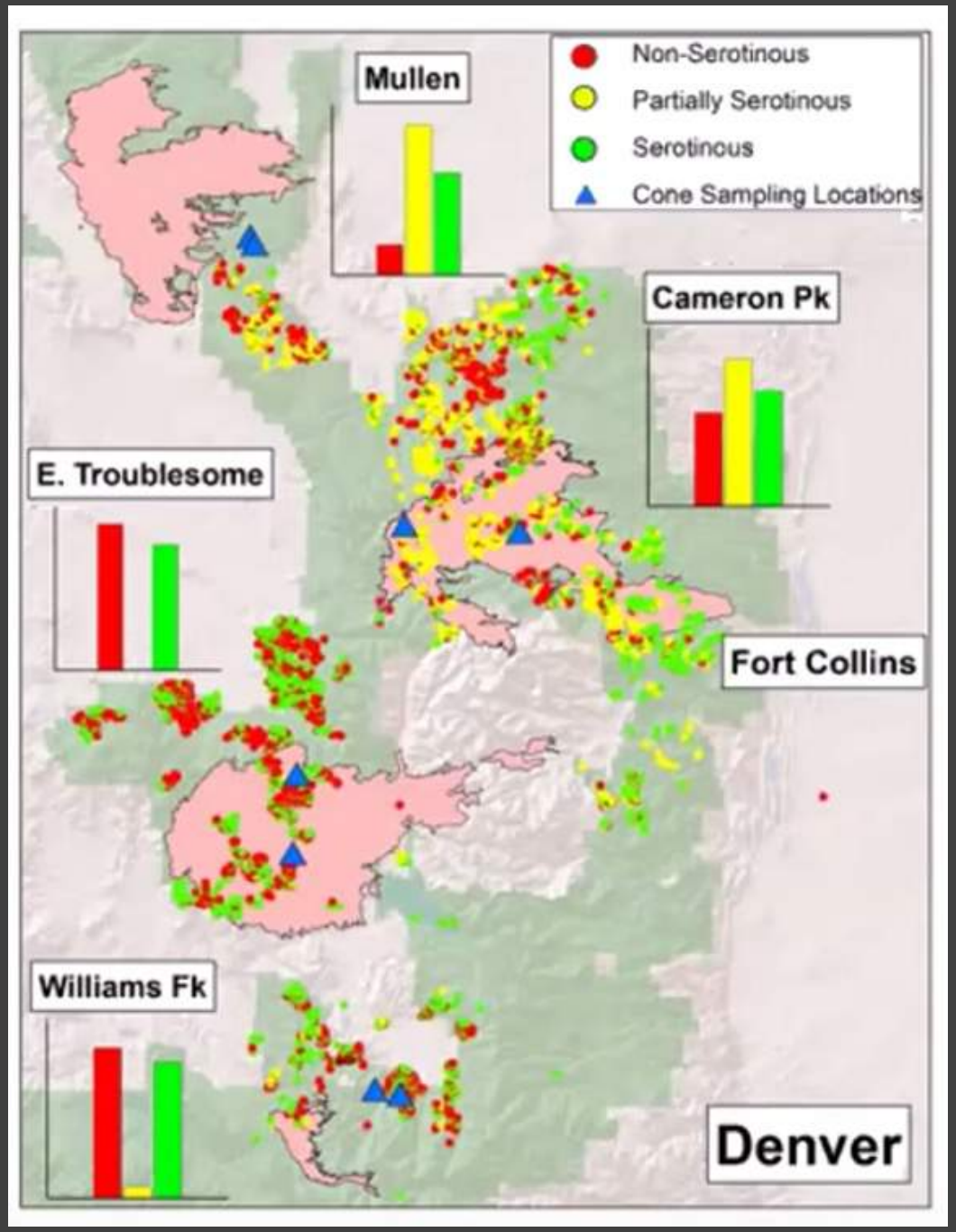
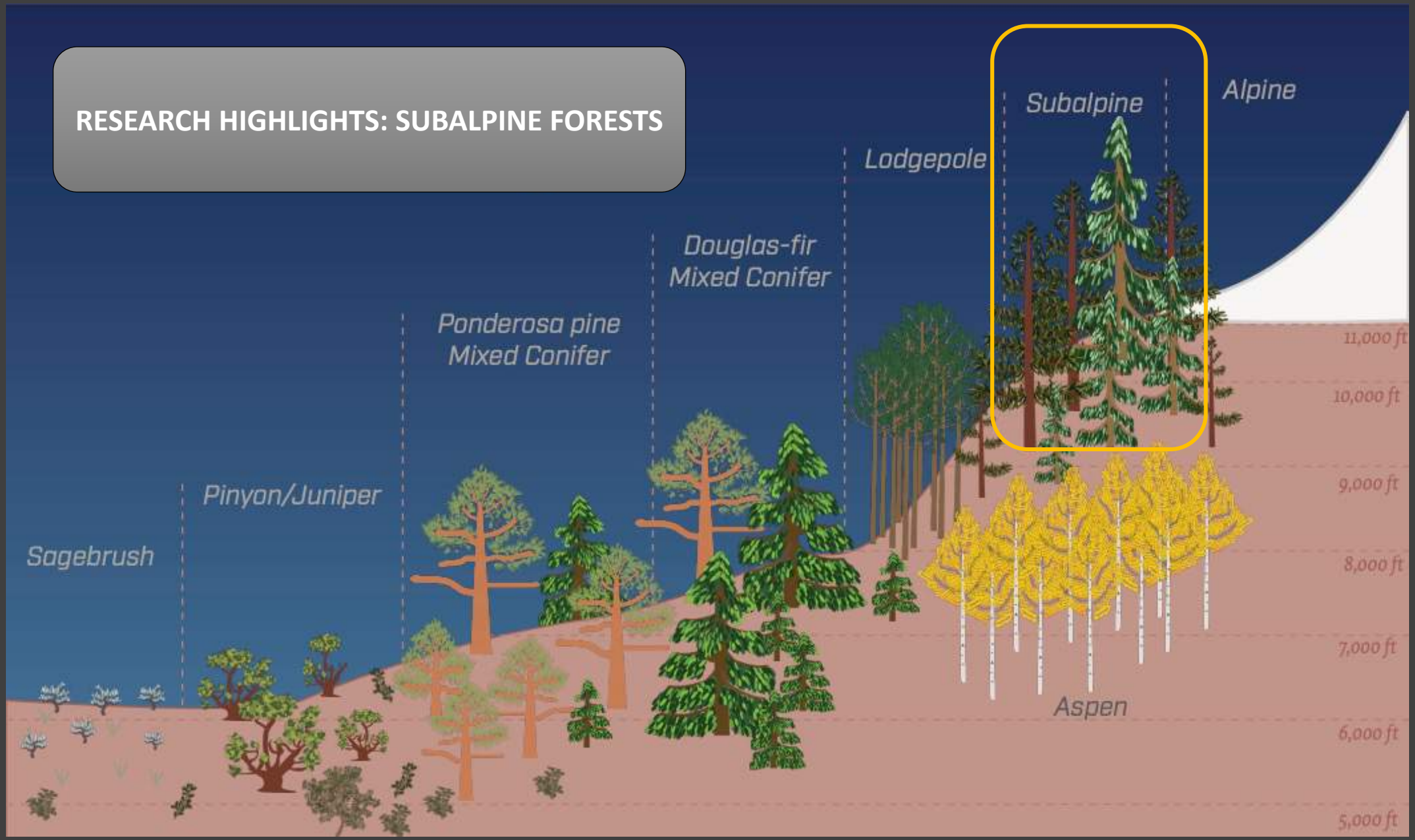


Map courtesy of Allie Rhea, CFRI

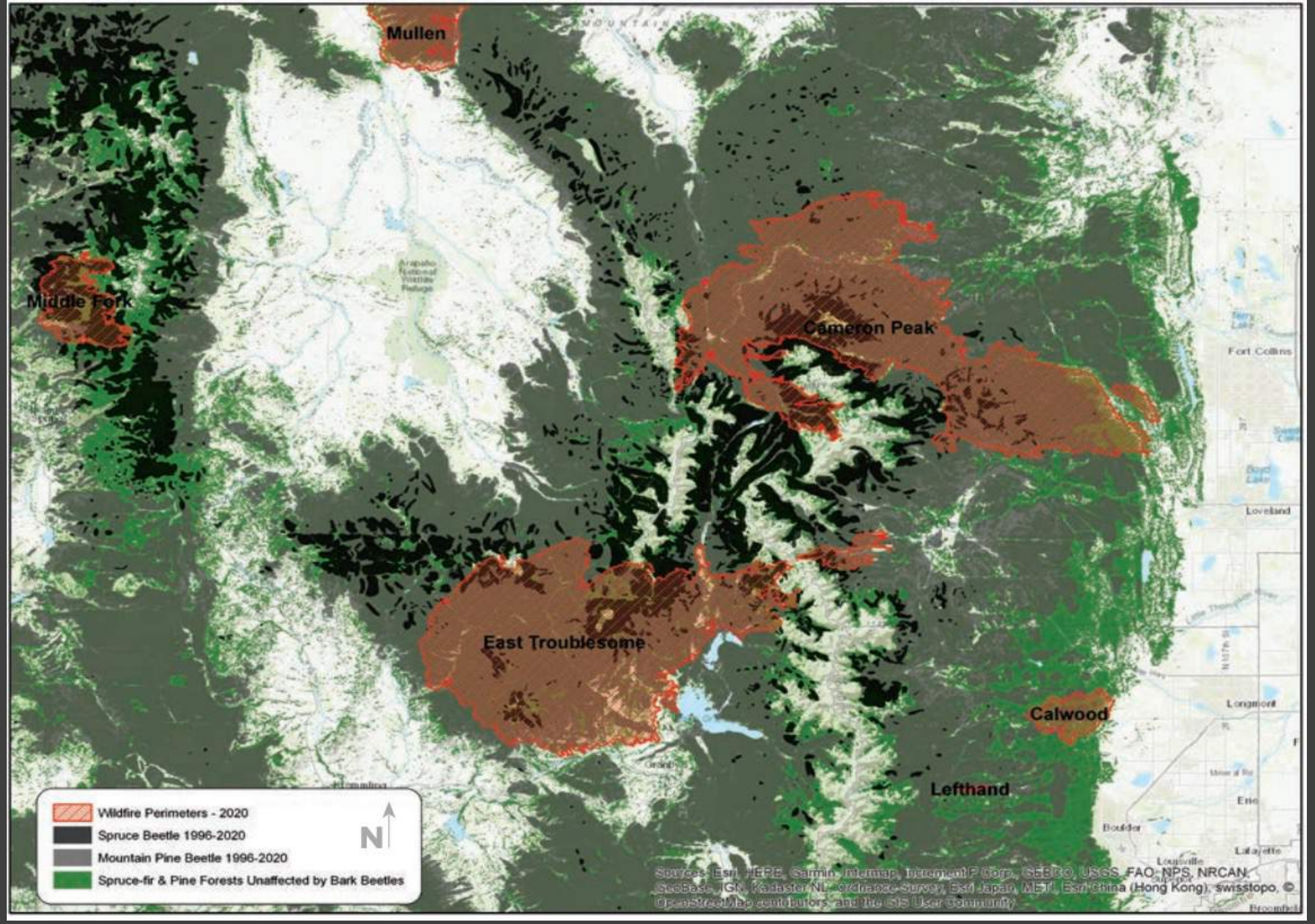


Map courtesy of Chuck Rhoades, USDA Rocky Mountain Research Station

RESEARCH HIGHLIGHTS: SUBALPINE FORESTS

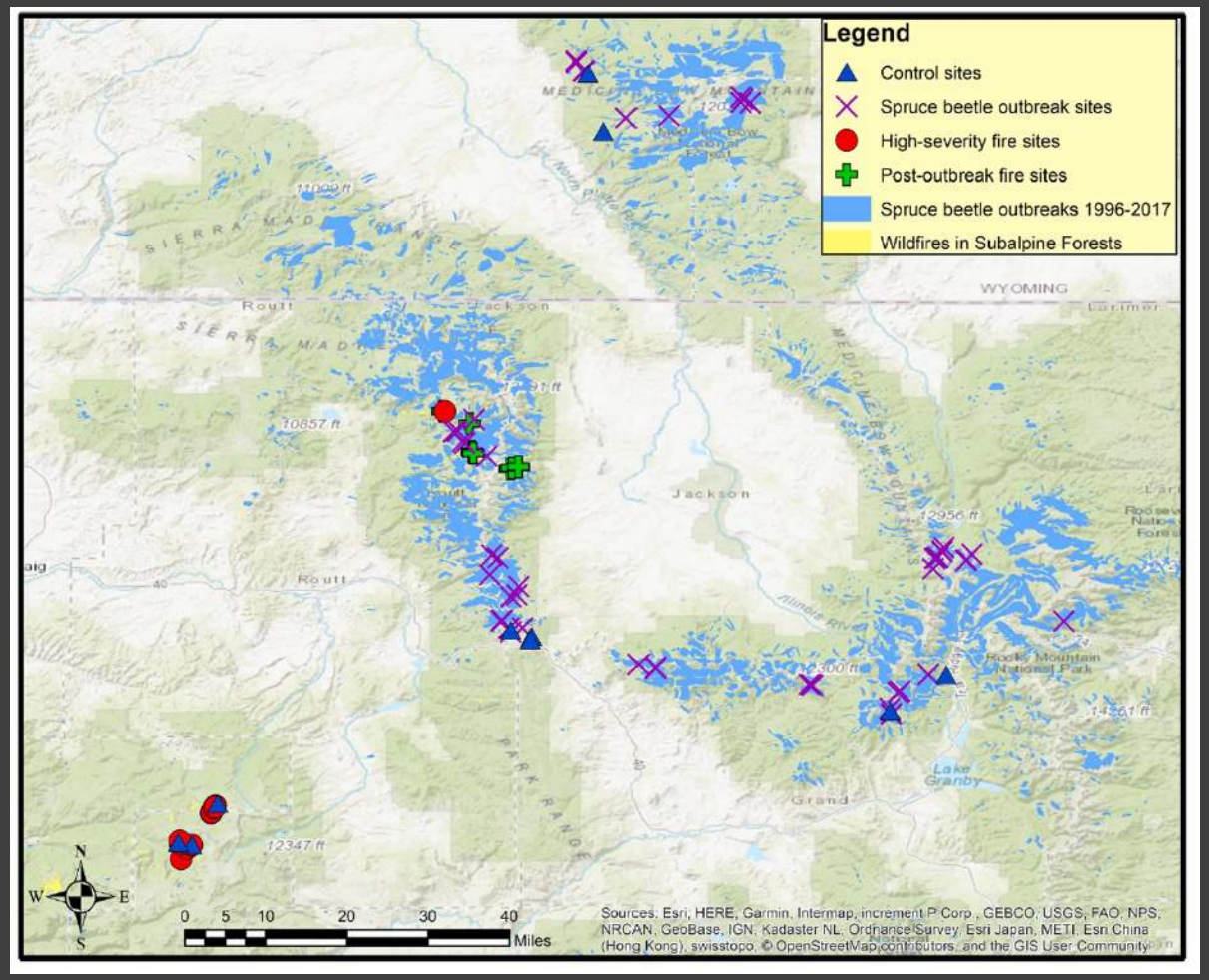


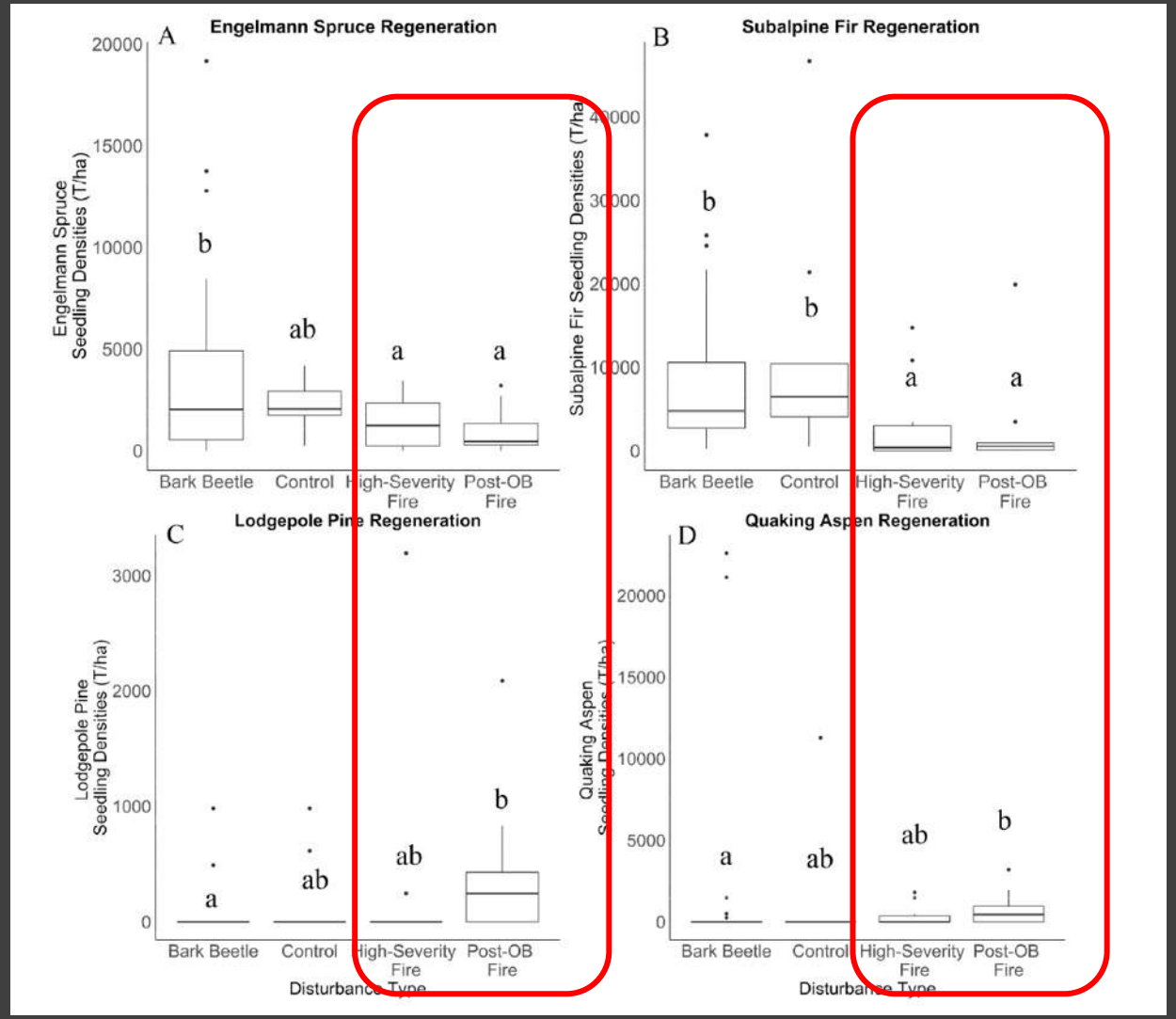
Brown, Chambers, Stevens-Rumann, Edwards (2020) CFRI - 2007



CSFS 2020 Health of Colorado's Forests

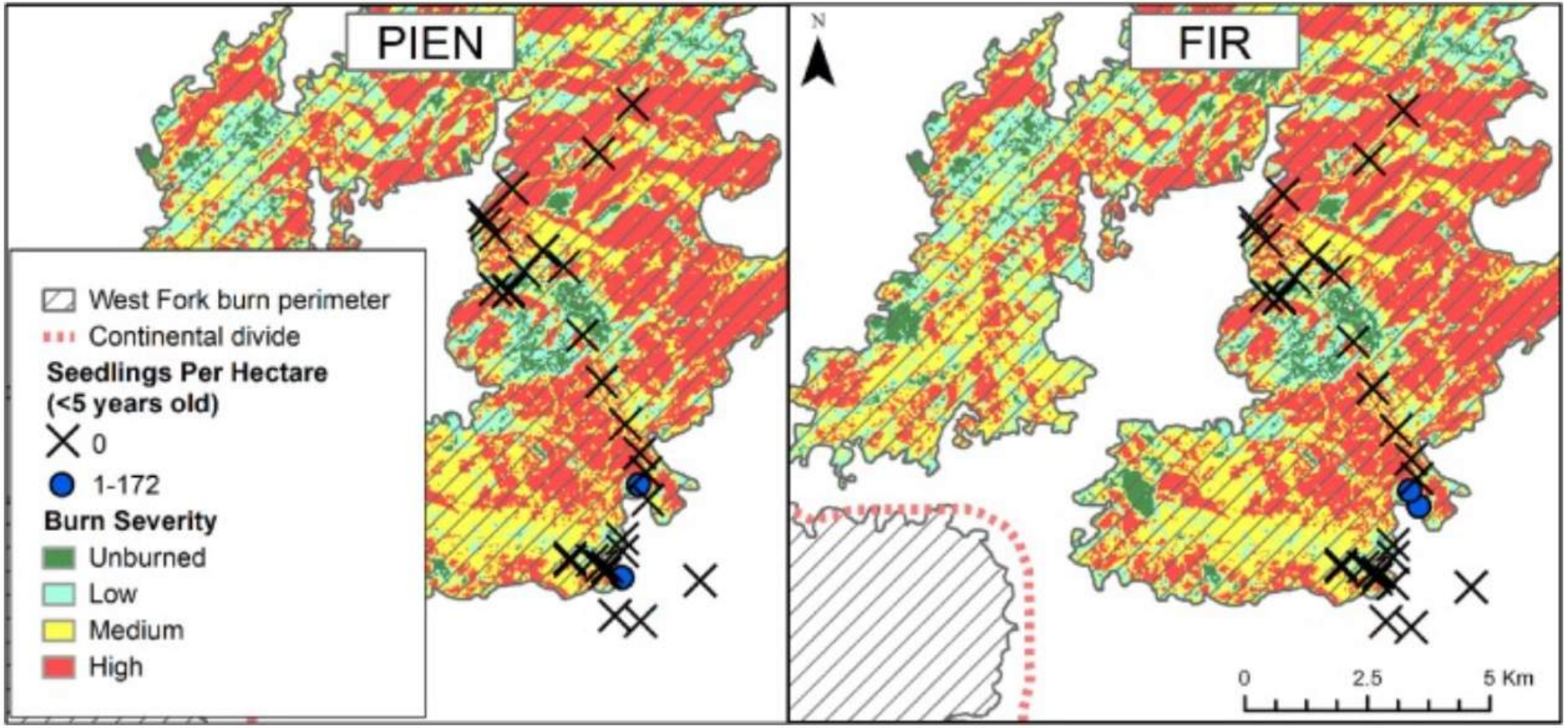
SUBALPINE FIR AND COMPOUND DISTURBANCES





Schapira et al. 2021 FEM

SUBALPINE FIR AND COMPOUND DISTURBANCES



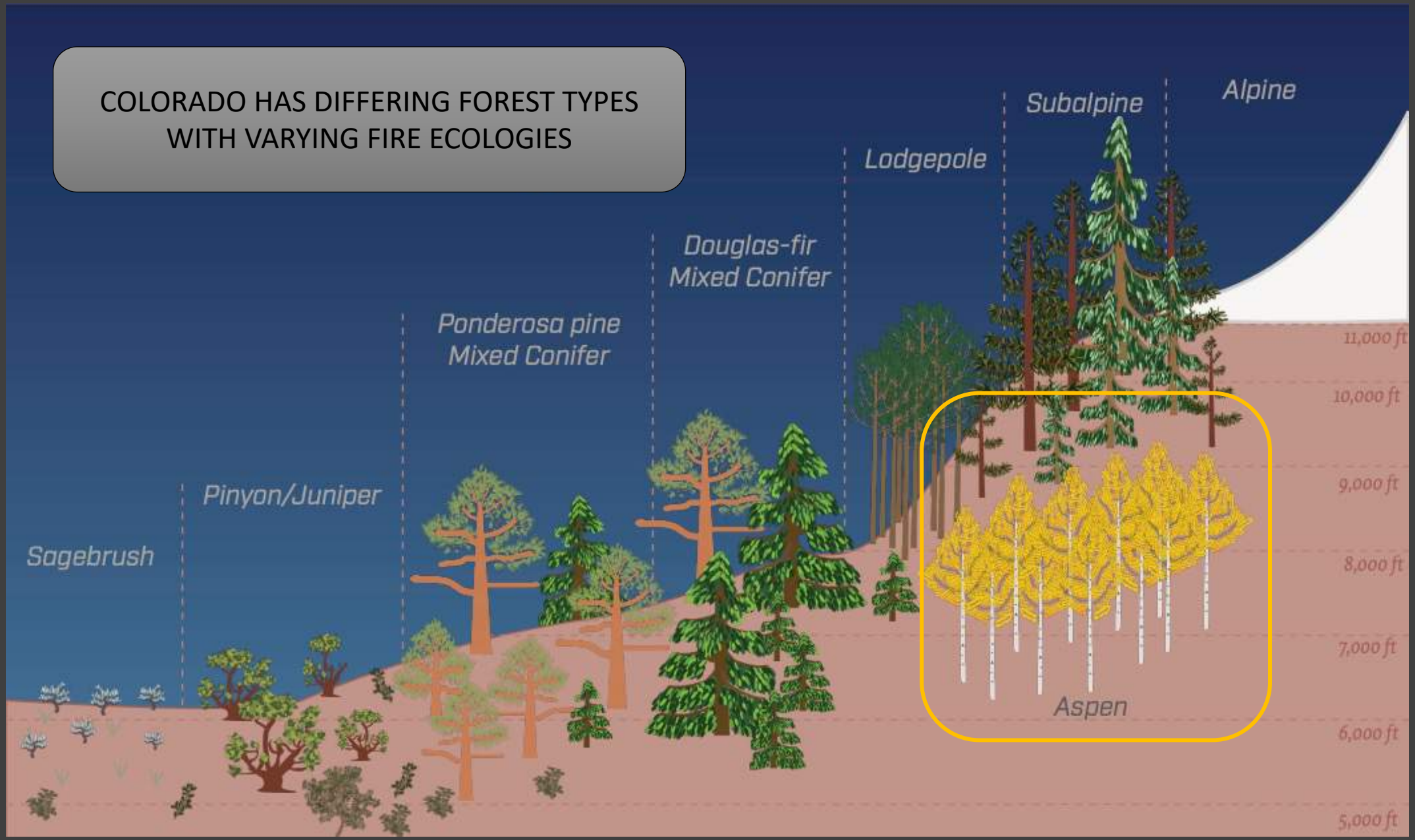
Carlson et al. 2020 FEM

SUBALPINE FIR AND COMPOUND DISTURBANCES

Fire	Area burned (ha)	Fire year	Elevation (m)	Severity (%)			No. plots	Postfire stem density(no./ha)		
				High	Mod./ Low	Unburned		Fir	Spruce	Aspen
Papoose	22,400	2013	3105 (3305–2884)	76	17	7	16	0 (0, 0)	0 (0, 0)	7100 (3325, 9690)
West Fork	25,700	2013	3090 (3490–2611)	73	19	7	13	0 (0, 0)	0 (0, 0)	0 (0, 2600)
Windy Pass	1,400	2013	3222 (3256–3150)	33	56	11	5	0 (0, 0)	0 (0, 0)	0 (0, 0)
East Fork	450	2013	3319 (3481–3099)	52	33	15	5	1778 (717, 2621)	2296 (1595, 2795)	1113 (102, 2683)
Little Sands	10,000	2012	2831 (2911–2792)	22	55	23	7	0 (0, 0)	0 (0, 200)	5200 (4200, 7175)

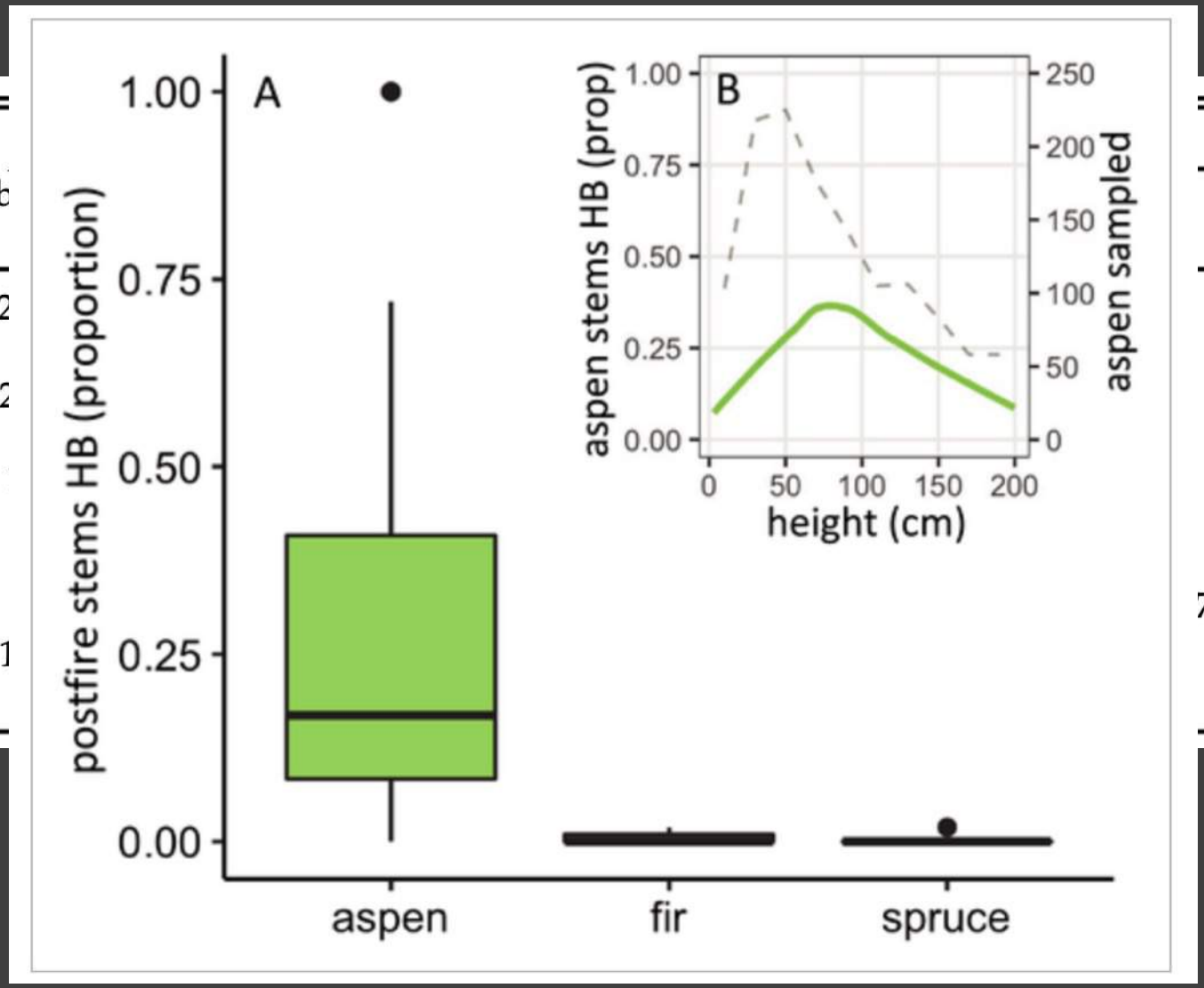
Andrus et al. 2021 Ecosphere

COLORADO HAS DIFFERING FOREST TYPES WITH VARYING FIRE ECOLOGIES



Brown, Chambers, Stevens-Rumann, Edwards (2020) CFRI - 2007

ASPEN REGENERATION: CLONING OR SEEDING FOLLOWING FIRE??



Fire	b	Postfire stem density(no./ha)		
		Fir	Spruce	Aspen
Papoose	2	0 (0, 0)	0 (0, 0)	7100 (3325, 9690)
West Fork	2	0 (0, 0)	0 (0, 0)	0 (0, 2600)
Windy Pass		0 (0, 0)	0 (0, 0)	0 (0, 0)
East Fork		1778	2296	1113
Little Sands	1	717, 2621) 0 (0, 0)	(1595, 2795) 0 (0, 200)	(102, 2683) 5200 (4200, 7175)

Andrus et al. 2021 Ecosphere

RESEARCH HIGHLIGHTS

- Decline in naturally occurring tree regeneration has been observed due to changing climatic conditions across Western US
- Regeneration trends in higher elevation forests uncertain
- Many areas of uncertainty- forest shifts, compounding disturbance, water and soil dynamics, future fires

2020 Mullen Fire

MANAGERS CONCERNS

- **Natural regeneration**
  - what can we expect, when will we know we have enough?
  - How will a changing climate impact long-term recovery?

- **Reforestation activities:**
  - Should we start now? How long should we wait?
  - What to plant that may be drought/fire resilient?
  - How should we plant for the best “bang for buck”

- **Invasive species or resprouting species**
  - how will this impact long-term forest recovery?

- **Lots of operational, logistical, inner-agency considerations** (i.e., lack of seed, nursery capacity, coolers, etc.)

2020 East Troublesome Fire
Photo Credit: Chuck Rhoades

RESOURCES NEED TO BETTER UNDERSTAND AND MANAGE FOR POST-FIRE RECOVERY

- **Integrated datasets** (e.g., site index, tree densities, severity of beetle mortality, cone serotiny)
- **New remotely sensed and on-the-ground monitoring** to assess natural regeneration
- **Collaborative partnerships and learning opportunities** (i.e., scientific publications, workshops, and field trips)
- **Additional funding and expertise.**
- **A cohesive, long-term strategy to address the multiple post-fire management activities and needs**
- **Compatible pre-fire fuel mitigation and post-fire reforestation approaches.**

CURRENT CFRI & RMRS EFFORTS

On the ground monitoring and research:

- Rhoades et al. in prep serotiny study

- CFRI post-fire monitoring:
  - **Ponderosa pine** – little to no germination
  - **Mixed conifer -** germination dominated by lodgepole pine
  - **Lodgepole pine** germination is occurring but is highly variable
  - **Subalpine** – little to no spruce/fir germination, but lodgepole pine is germinating in these areas

Seed collection cooperatives and future workshops

TAKE AWAYS

2020 Calwood Fire (foreground);
2005 Overland Fire (background)

- Evidence from Western US is illustrating a decline in post-fire natural regeneration across many forest types
- Local ecological evidence is sparse….
  - LOTS of uncertainties!
- Many logistical, operation, capacity and funding improvements needed for reforestation activities
- Increased need to collaborate around
  - Knowledge sharing
  - Strategic planning
  - Resources/infrastructure
- Ecosystem processes and services in short –> longer term

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THANK YOU!

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ROCKY MOUNTAIN RESEARCH STATION

Citations:

Andrus, R. A., Hart, S. J., Tutland, N., & Veblen, T. T. (2021). Future dominance by quaking aspen expected following short-interval, compounded disturbance interaction. *Ecosphere*, *12*(1), e03345.

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Colorado State Forest Service. (2020). 2020 Report on the Health of Colorado's Forests: Protecting Our Future After a Historic Wildfire Year. https://csfs.colostate.edu/media/sites/22/2021/02/CSFS_2020_Forest_Health_Report_WEB.pdf

Rodman, K. C., Veblen, T. T., Chapman, T. B., Rother, M. T., Wion, A. P., & Redmond, M. D. (2020). Limitations to recovery following wildfire in dry forests of southern Colorado and northern New Mexico, USA. *Ecological Applications*, *30*(1), e02001.

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