Tree seedling germination and establishment in masticated forest stands, Colorado

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Joint Fire Science Program
Research Supporting Sound Decisions
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Interface Areas of High Wildfire Risk in Colorado

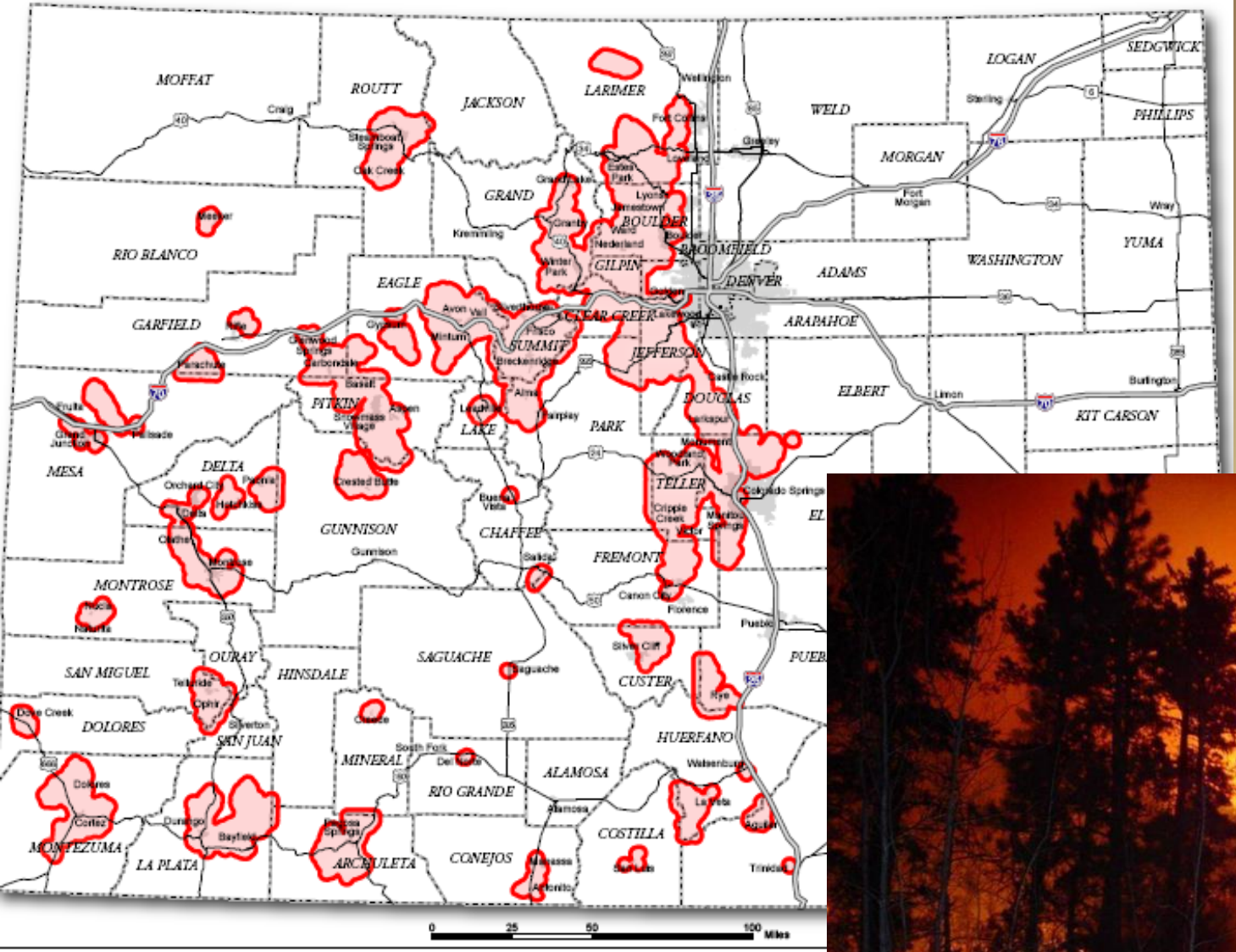


Photo by Terry Tompkins, BHNF

Reduce stand density and ladder fuels

Mastication or mulching

- Grinding or chipping trees (usually smaller diameter) in place and scattering the wood

Mulching treatments redistribute the standing biomass from the vertical to the horizontal

Changes to forest floor

- Physical barrier
- Moderates soil temperature and soil moisture

Seedling Regeneration

- Lodgepole pine
- Ponderosa pine

- Bare mineral soil favorable

- Avoid moisture stress and high temperature stress

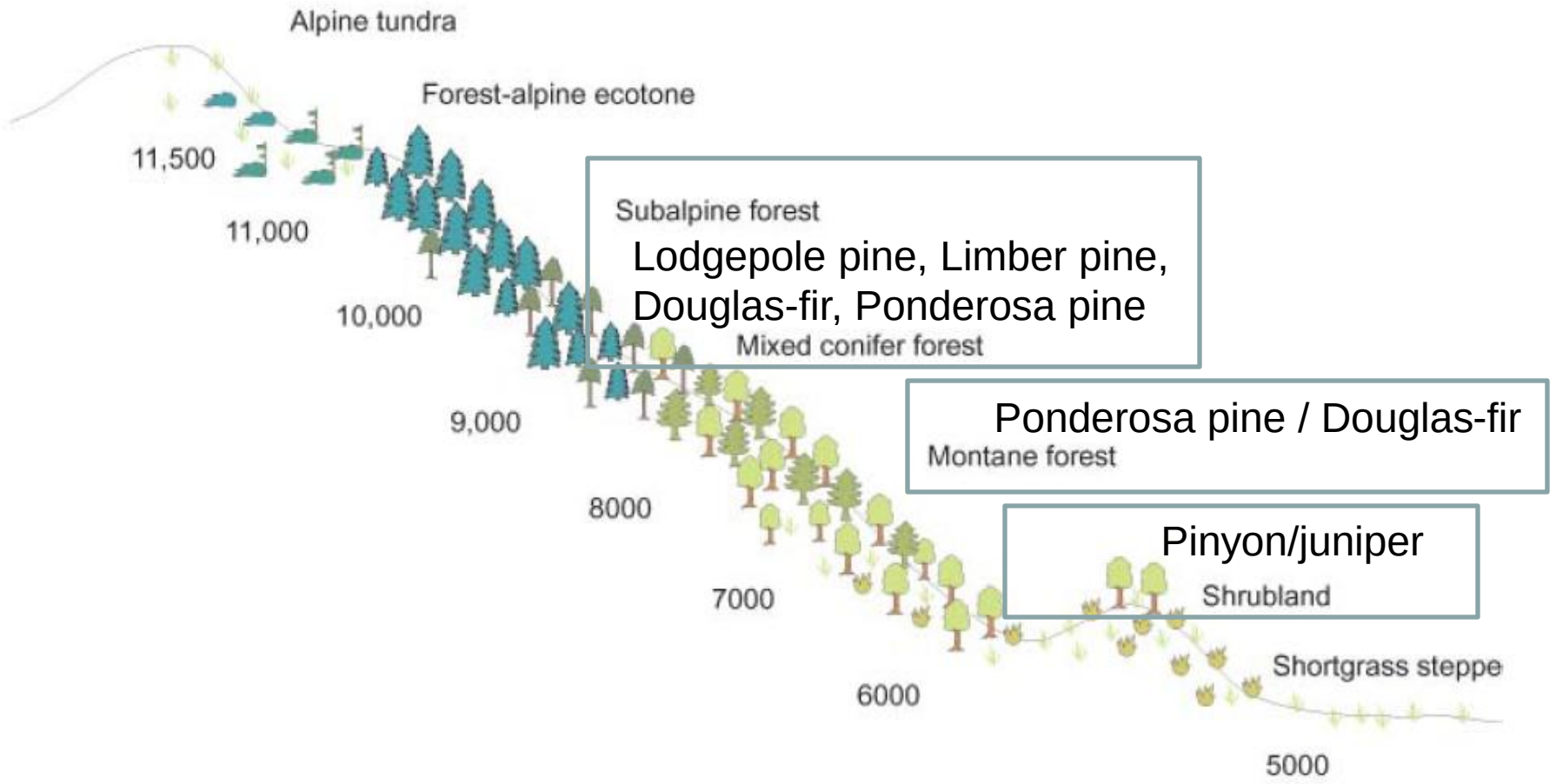
Seedling Regeneration

- Douglas-fir
- Pinyon pine

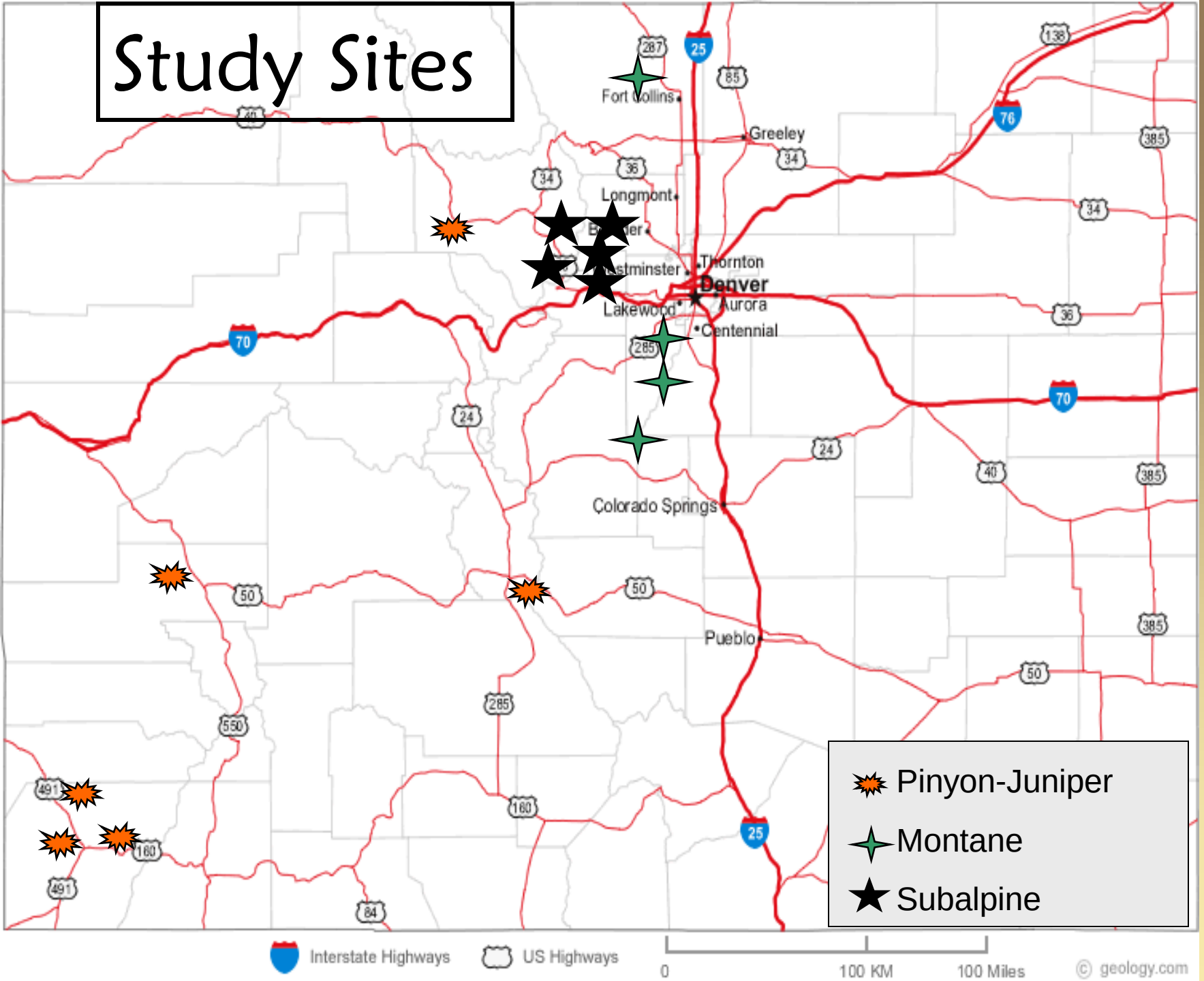
- Some needle litter and duff favorable

- Avoid moisture stress and high temperature stress

Colorado Vegetation



Study Sites


Fort Collins
Greeley
Longmont
Boulder
Westminster
Thornton
Denver
Aurora
Lakewood
Centennial
Colorado Springs
Pueblo
Pinyon-Juniper
Montane
Subalpine
Interstate Highways
US Highways
0
100 KM
100 Miles
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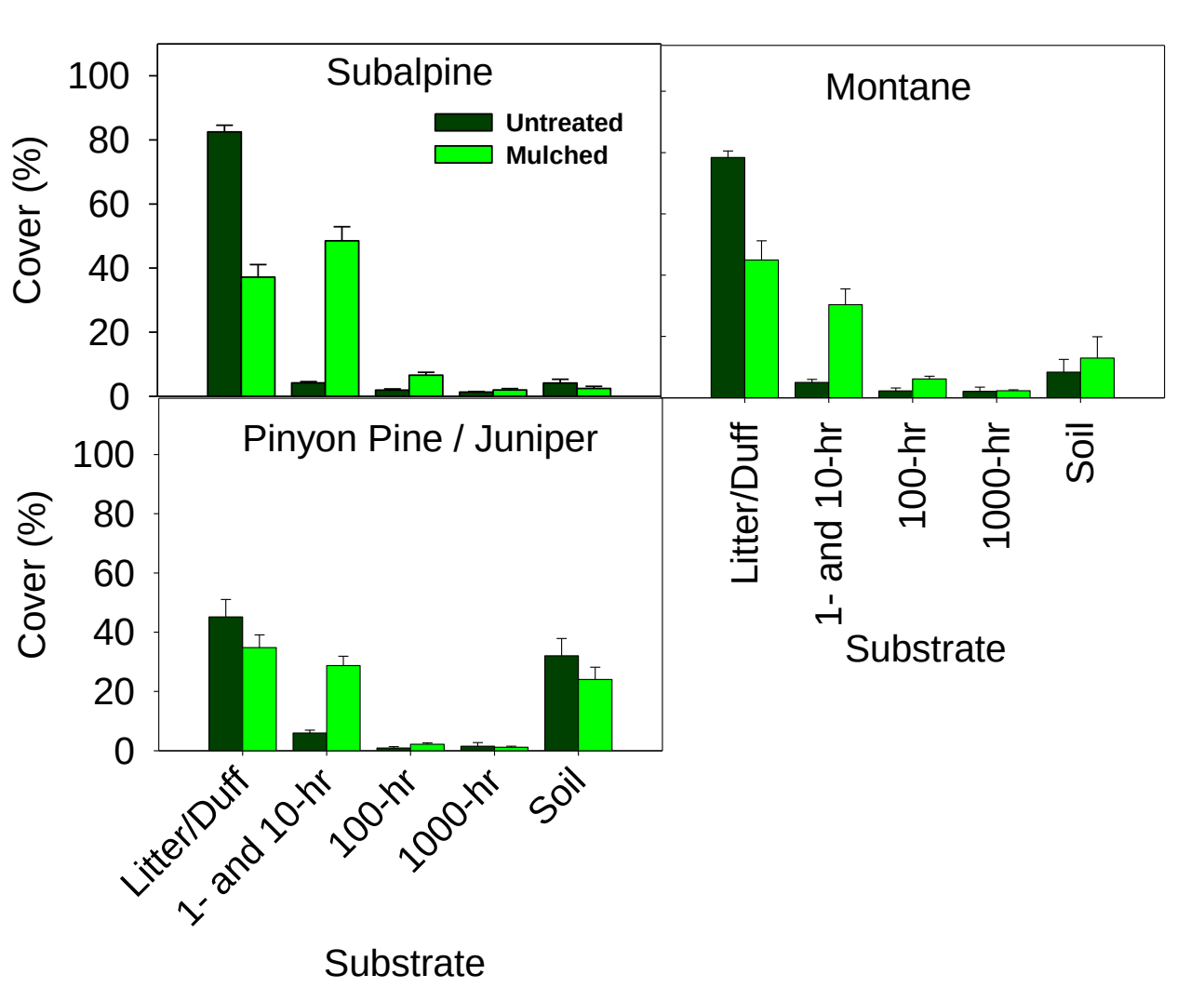
Overall study design

- 3 Paired mulched and untreated sites
- 1st Sampled 2 to 4 years after treatment
- 2nd round of sampling taking place now (6 to 8 yrs after treatment)

Overall study design

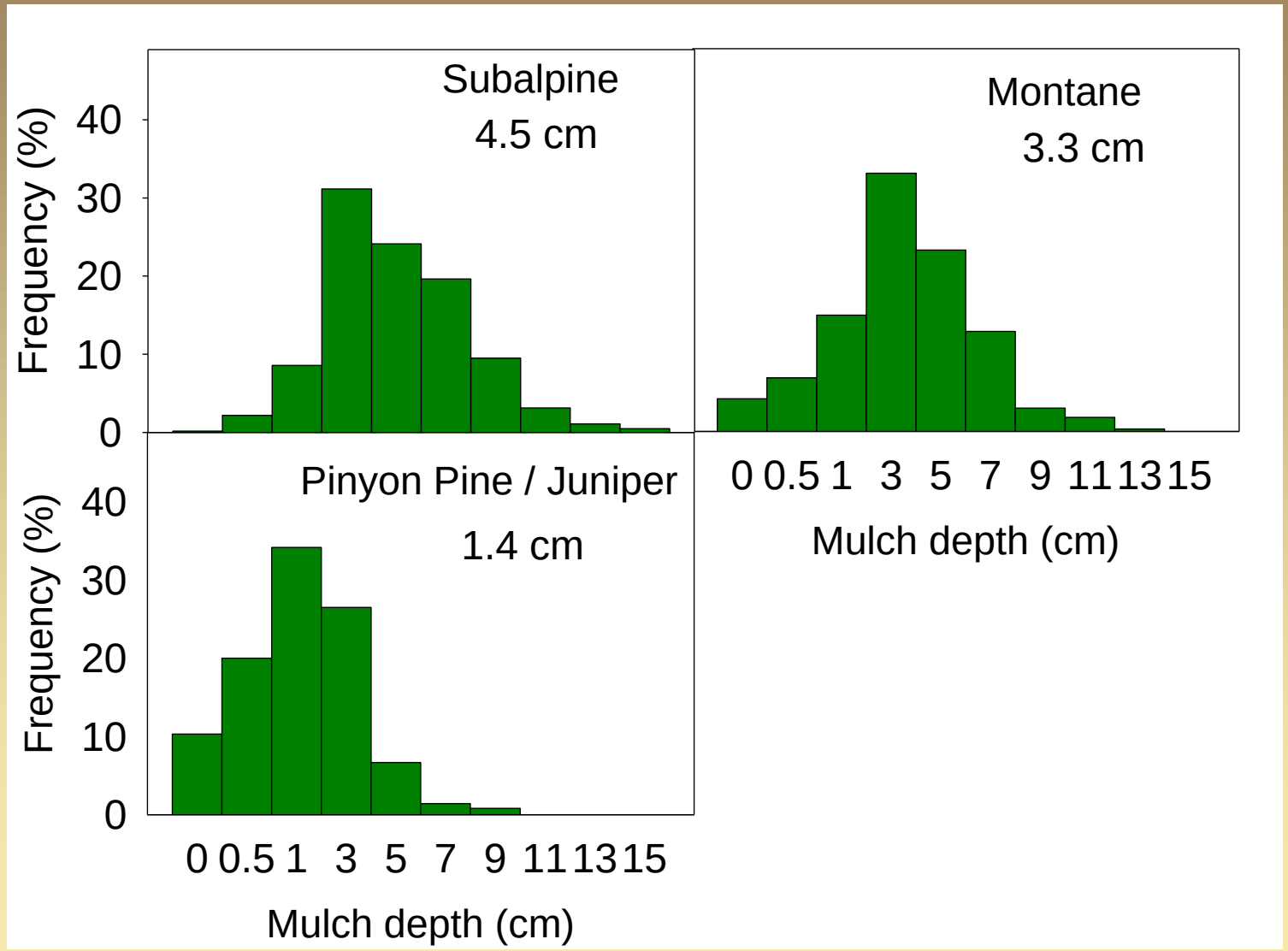
- Substrate cover and mulch depth measured on 25 1-m^2 quadrats per transect
- Substrate cover and mulch depth for each seedling measured

Forest floor coverage altered by mulching treatment

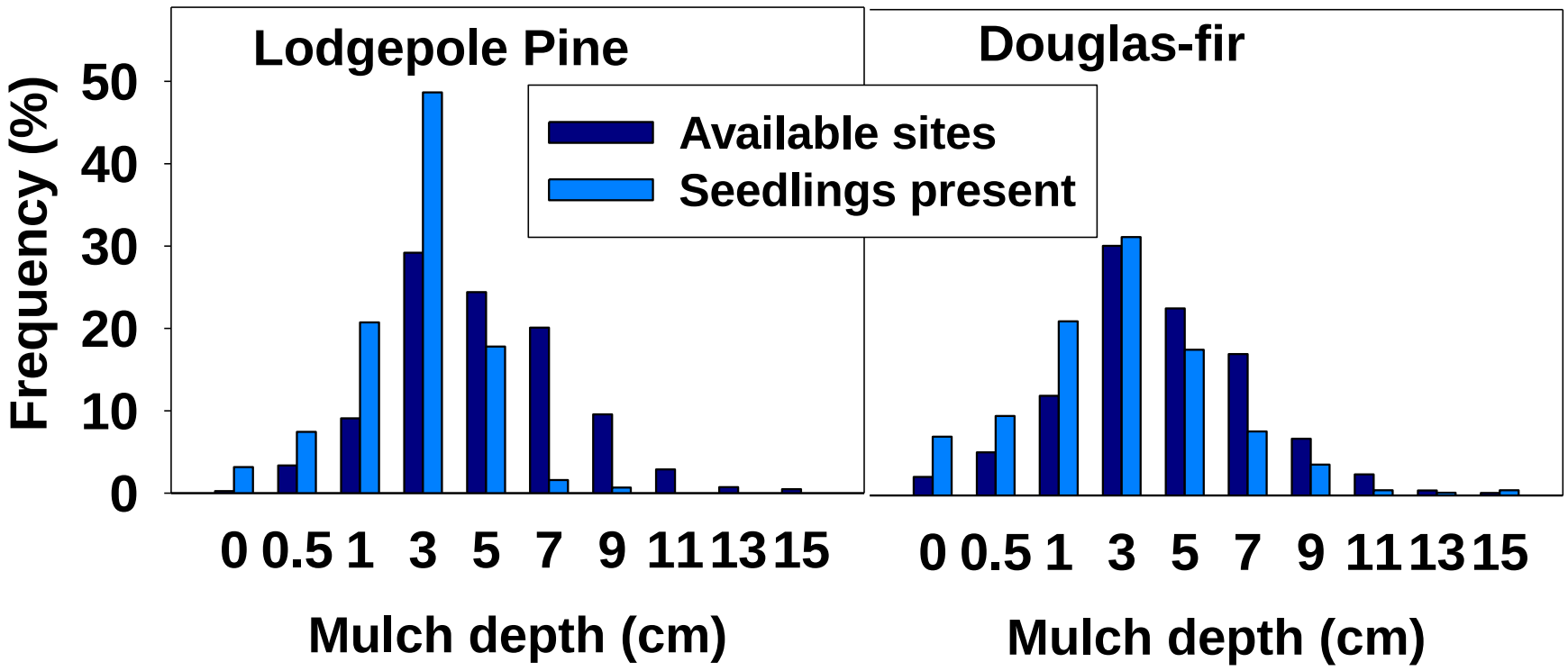


- Switch from a needle litter layer to a layer of small pieces of wood
- In Pinyon pine, a decrease in soil cover

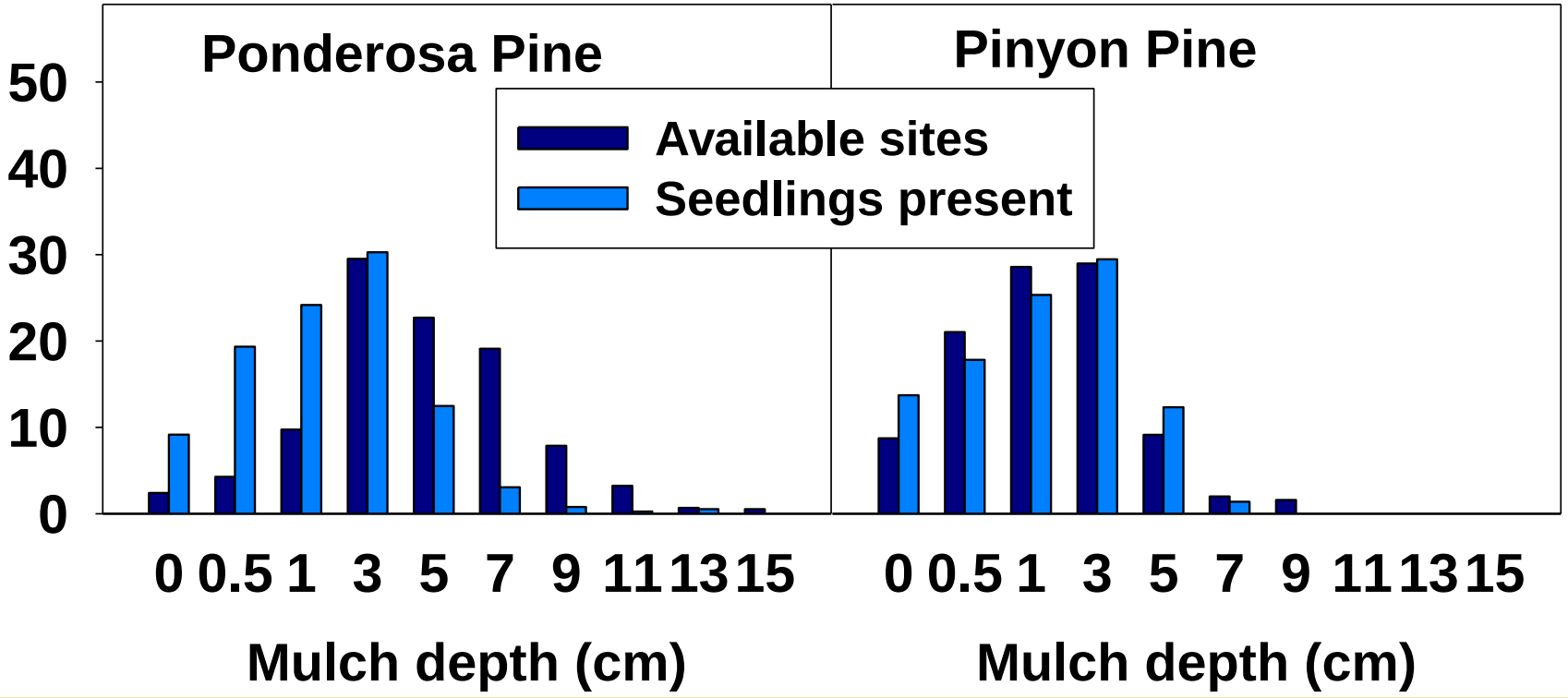
Distribution of mulch depth across treatments



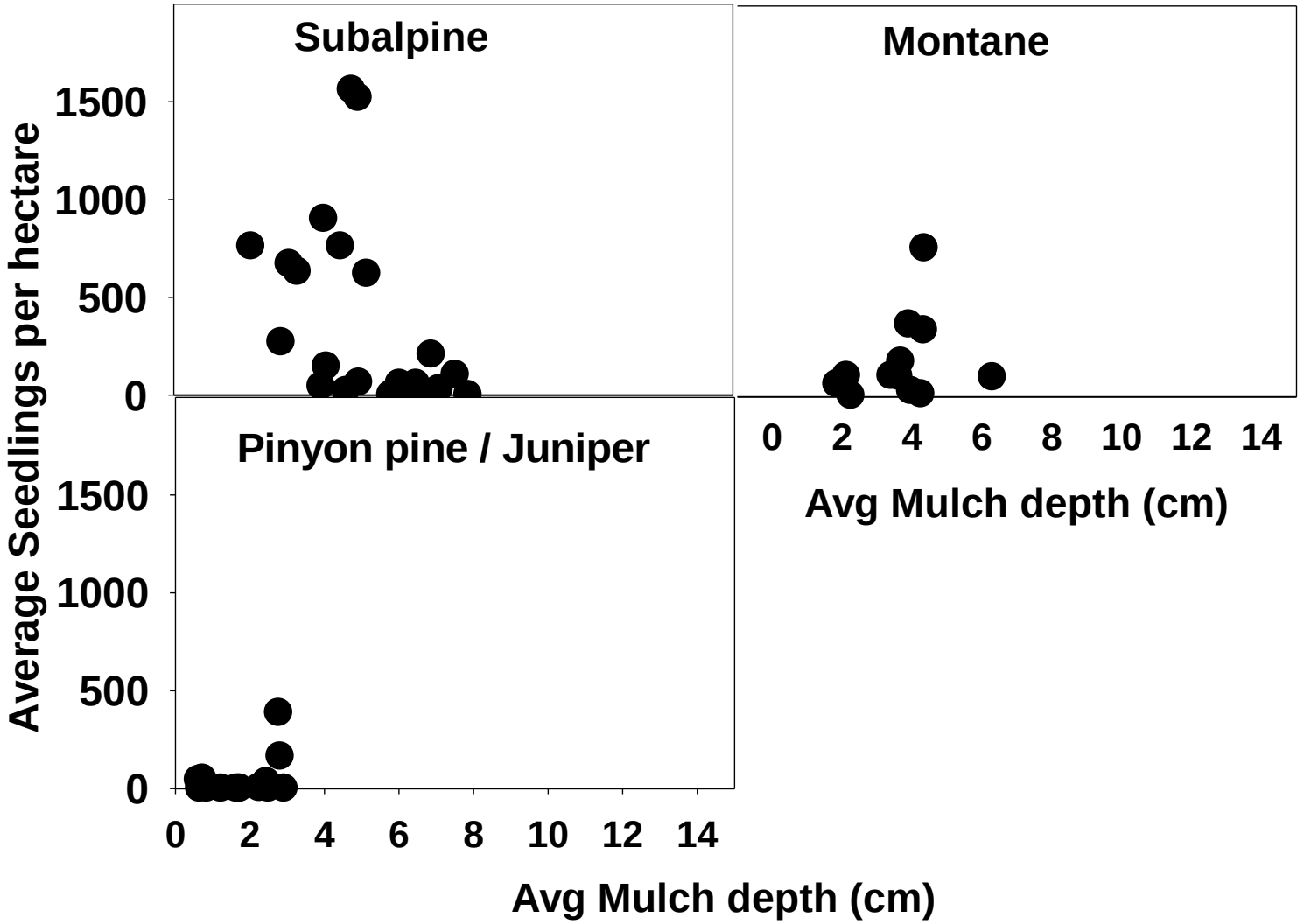
Species preferences for mulch depth



Species preferences for mulch depth



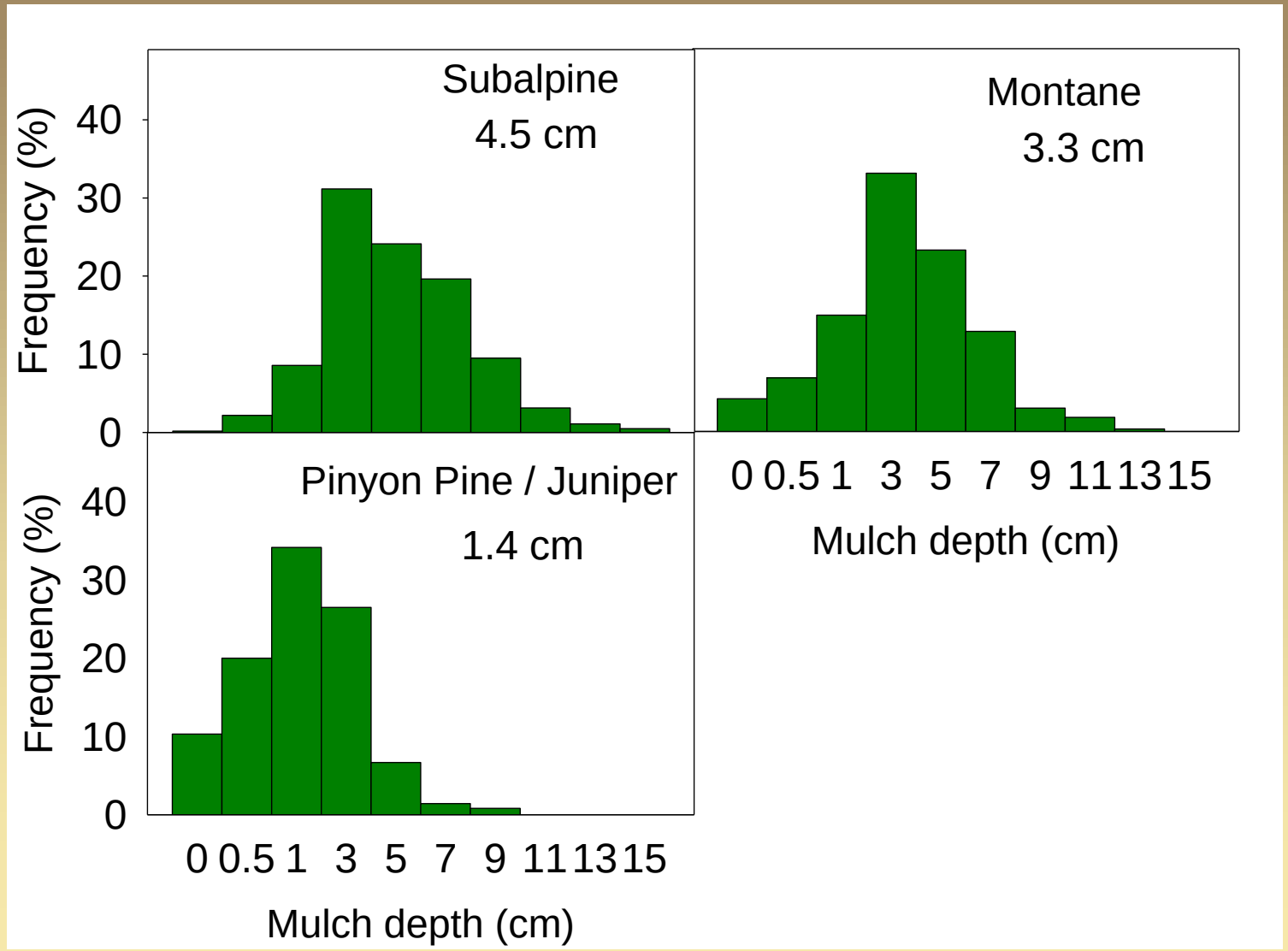
Seedling density relationship to mulch depth muddled



Seedling density relationship to mulch depth muddled

- Lack of exposed mineral soil?
- Favorable microclimate created by mulch?
- Variability in seed production?
- Climatic conditions since treatment?

Distribution of mulch depth across treatments



Seed sowing experiment

- **4 depths** (bare soil, litter layer, 7.5 cm, and 15 cm (in PJ 2.5 cm and 7.5 cm)

Species sown in each ecosystem type:

- Subalpine: Douglas-fir and Lodgepole pine
- Montane: Douglas-fir and Ponderosa pine
- Pinyon/Juniper: Pinyon pine

Seed sowing experiment

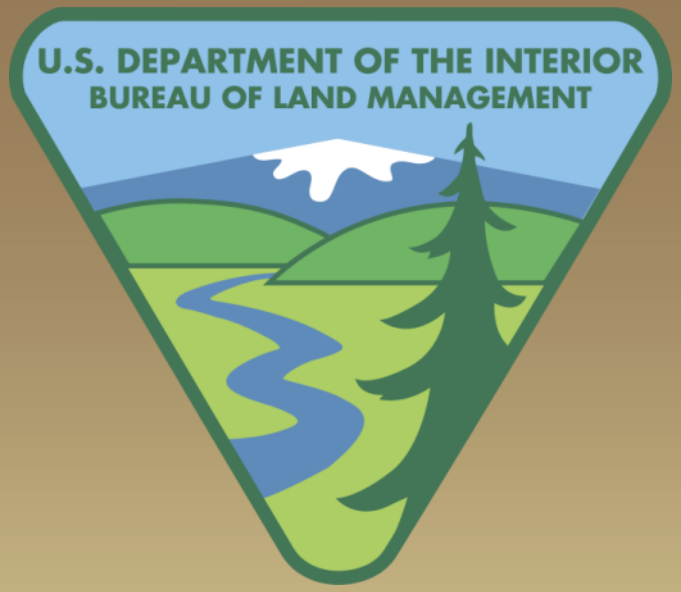
Take home messages

- Mulching treatments alter the forest floor substrate by increasing the coverage and depth of small woody biomass
- Seedlings were able to establish in depths up to 7 cm, but preferentially established in depths less than 3 to 4 cm

- Median mulch depths were < 4.5 cm in subalpine, montane, and pinyon ecosystems

Take home messages

- Seed sowing study should help provide some more answers to the impact of mulch depth on seedling regeneration and establishment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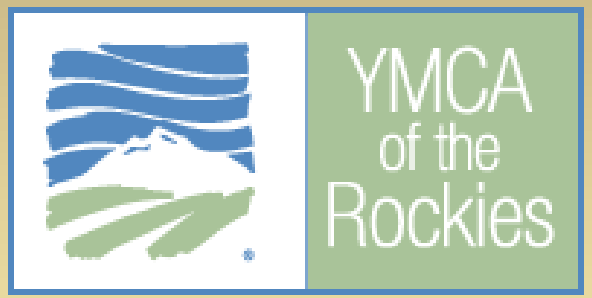
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Thank you!

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