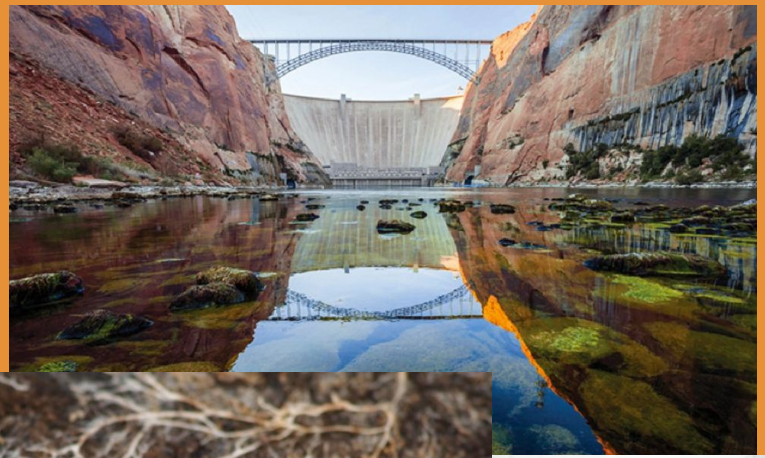
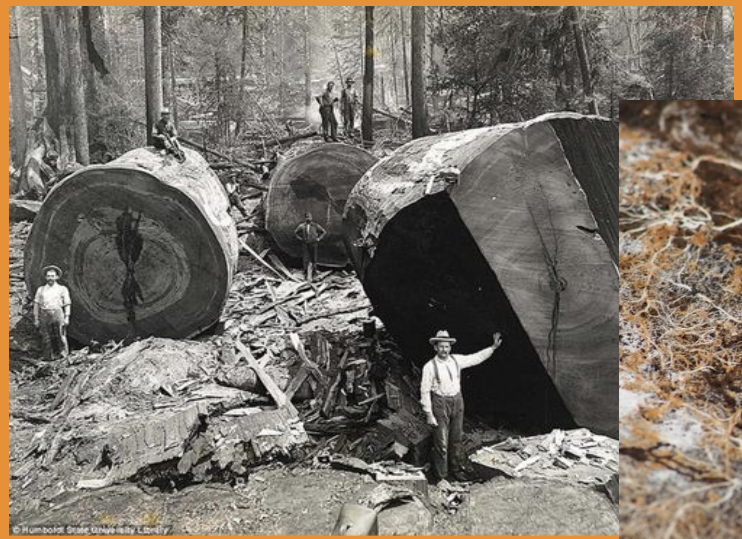
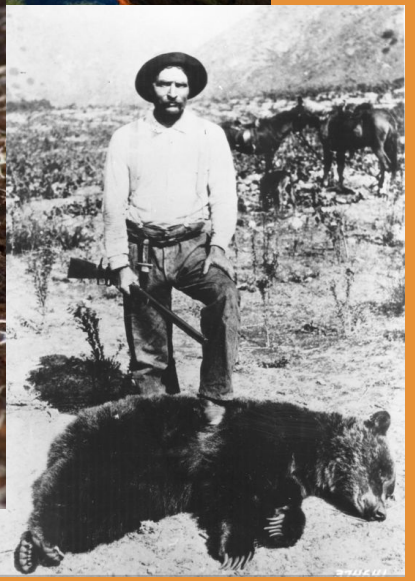
# Fungal Treatments for Post Fire Restoration

Maya Elson and Jeff Ravage | After The Flames 2024

# *Fungi Before the Flames*







# *Post-fire Terrestrial Threats*

- Release of toxins into environment
- Nutrient flow downwards
- Threat of mudslides and erosion
- Hydrophobic soil
- Increased risk of future high intensity fires
- Habitat loss for certain species

# What roles do Fungi play in Fire Recovery?

- Biodegradation of carbon (similar to fire)
- Remediation of Polycyclic Aromatic Hydrocarbons (PAHs), heavy metals and nitrites
- Emergence of pyrophilous fungi
- Food for animals/seed dispersal

# *What roles do Fungi play in Fire Recovery?*

- *Mycorrhizal Fungi support native plant community establishment*
- *Soil aggregation, increases water, mineral and carbon storage and availability*
- *Addressing hydrophobicity*
- *Fire keeps pathogenic fungi in check*

# Post Fire Toxin Mitigation

# *Post Fire Biofiltration Initiative (PFBI) and Post Fire Watershed Defense Coalition*

- Installed and studying “Mycowattles” as biofilters after fire for heavy metal sequestration, soil stabilization and Polycyclic Aromatic Hydrocarbon biodegradation
- Comparing no wattle, uninoculated straw wattles and straw wattles inoculated with a local *Pleurotus* species
- Grassroots research projects in the CZU in collaboration with the Post Fire Watershed Defense Coalition and in 4 other burn scars from the 2020 Central California fires.

# Maui Bioremediation Group

- Fungal-inoculated Filter Socks and Logs
- Liquid Biological Soil Amendments
- Solid Microbial Amendments
- Phytoremediation

- How does fire affect soil, plant, bacterial and fungal communities?
- How can reintroducing native Mycorrhizal Fungal spores kickstart ecological succession?
- What methodologies can we develop to support human and ecological communities to regenerate after megafires?

# *Effects of Microbial Inoculation on Post-Fire Microbial Community Resilience and Ecosystem Recovery*

## *Optimizing Post-Fire Microbial Inoculation*

FENIXS
POST-FIRE BIOREMEDIATION

Goals:

- Stabilizing and detoxifying soils
- Restoring soil microbial richness and diversity
- Sequestering Carbon

Point Blue Conservation Science

GLASSMAN LAB #THEFUTUREISFUNGI

CoRenewal

UNIVERSITY OF CALIFORNIA RIVERSIDE

IRVINE RANCH CONSERVANCY

# *Microbial Inoculation for Carbon Sequestration, Fuels Reduction and Erosion Mitigation in Post-Fire Mixed Conifer Forests (aka Biome Logs Project)*

**A Project of Mycelial Solutions at UCSC (MySo)**

# *What Are Biome Logs?*

# *Why Biome Logs?*

- Logs retain ~25X more moisture than bare soil, when partially buried there is even more water retention
- Return valuable nutrients to the forest  ecosystem, while sequestering carbon
- Establish robust communities of beneficial microbes, associated with increased in plant health and water retention, with less vulnerability to pathogens and invasive species
- Can be integrated with other fuels treatments, such as mastication, lop and scatter, and biochar production
- Provide alternatives to controversial fuels treatments such as logging and biomass incineration

# Inocula and Treatments

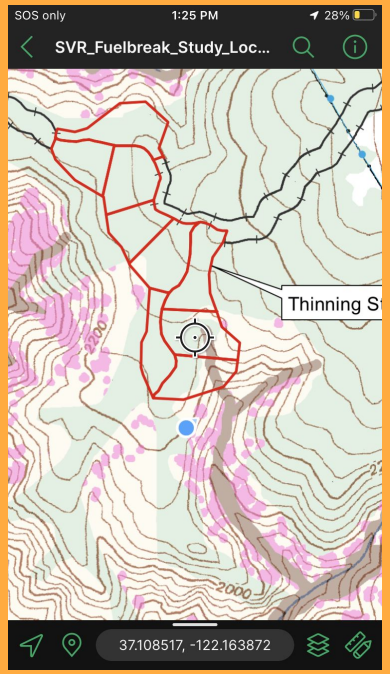
*Local Saprotrophic Fungus:*

- Locally sourced *Pleurotus ostreatus* (Oyster Mushroom) or other species
- Inoculant will be inserted in partially buried, downed Tanoak logs
- Local native species
- Low dispersal potential

# Inocula and Treatments

*Reference Soil and Soil Tea:*

- Soil collected from less severely burned area at SVR
- Whole, fresh soil and aerated “soil tea” made from soil
- Uses local microbes to speed up regeneration process



# Inocula and Treatments

*Commercial Inoculum:*


- BioComplete “Craft Compost” made by Catalyst Biomendments using Dr. Elaine Ingham’s Soil Food Web School methodology
- Solid compost and compost extract
- Quality and safety of compost verified using microscopic assessments and genetic testing

# *Inoculated Wood as an Alternative to Post-fire Logging*


**Post-fire "Salvage" Logging is t**he practice of logging trees in forest areas that have been damaged by wildfire in order to recover economic value that would otherwise be lost

*"Post-fire salvage logging causes extreme environmental damage including irrecoverable loss of forest soils, polluted streams, destroyed fish and wildlife habitat. It sets back natural recovery while immediately increasing hazardous fuel loads and wildfire risks."*

*—Firefighters United for Safety, Ethics and Ecology*

*Photo credit: Tripp Jennings*

# *Inoculated Wood as an Alternative to Biomass Incineration*

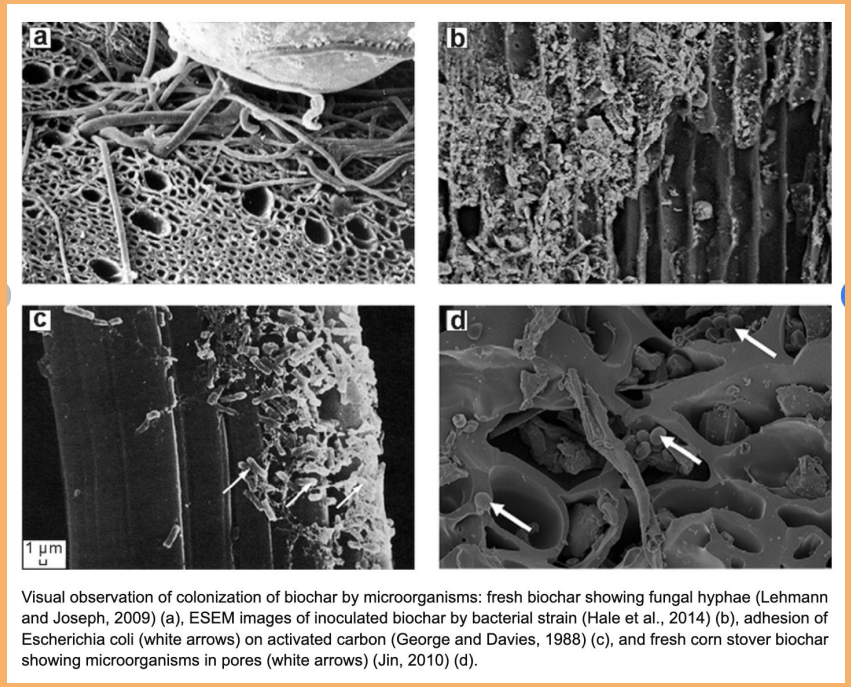
Biomass Incineration in a forestry context is the combustion of “waste” plant material for generating electricity

There is a need to look more closely at all of the impacts of biomass incineration, and revisit policy decisions using best available science and financial analysis.


# *Inoculated Wood in combination with Inoculated Biochar*

Biochar is made through a low oxygen combustion method of pyrolysis
The “charcoal” that is made can be hospitable to beneficial microbes

Biochar can use potential forest fuel and improve soil health… if done correctly.




Visual observation of colonization of biochar by microorganisms: fresh biochar showing fungal hyphae (Lehmann and Joseph, 2009) (a), ESEM images of inoculated biochar by bacterial strain (Hale et al., 2014) (b), adhesion of Escherichia coli (white arrows) on activated carbon (George and Davies, 1988) (c), and fresh corn stover biochar showing microorganisms in pores (white arrows) (Jin, 2010) (d).

# *Next Steps:*

- FENiXS Paper to be published soon!
- Testing and monitoring of Biome Logs
- Expansion of Biome Log Project
- Maui Bioremediation Projects
- Lots of potential collaborations!


Let's make mycelial connections!
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SCAN ME