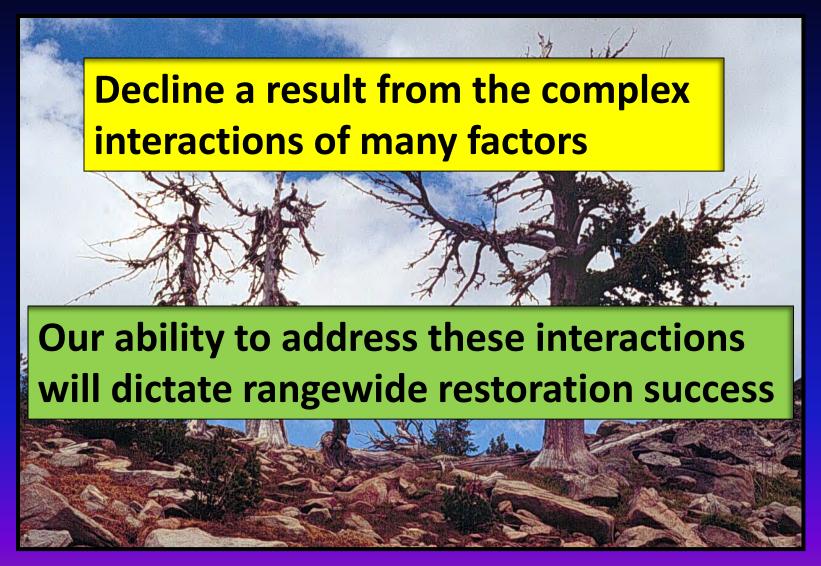
No Tree Left Behind: Interesting findings from two case studies in whitebark pine: climate change and release

Sarah Flanary and Bob Keane
USDA Forest Service
Rocky Mountain Research Station
Fire Sciences Laboratory

### **Whitebark Pine Decline**



Great Burn Roadless Area, Idaho



Increase beetle outbreaks

Create longer rust infection spans

Increase wildland fire

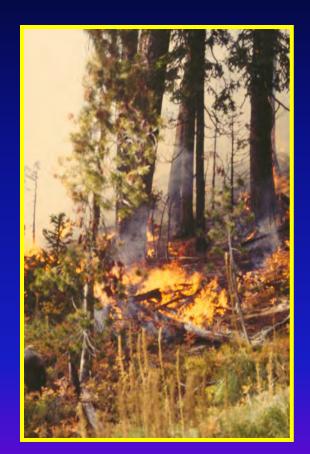
Modify habitat



# Whitebark Pine Climate change impacts to habitat

#### Conventional Wisdom:

- Pinched off tops of mountains
- Pushed northward
- Relegated to cove sites
- Experience local extinctions

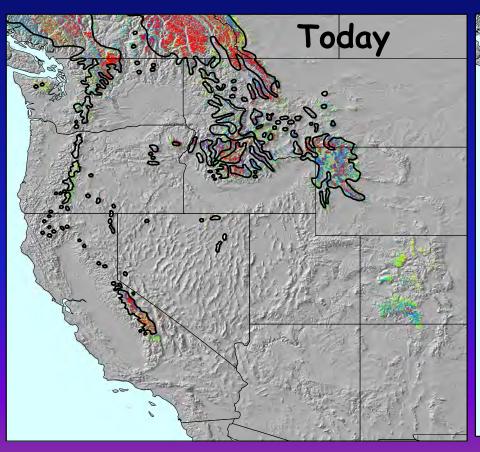


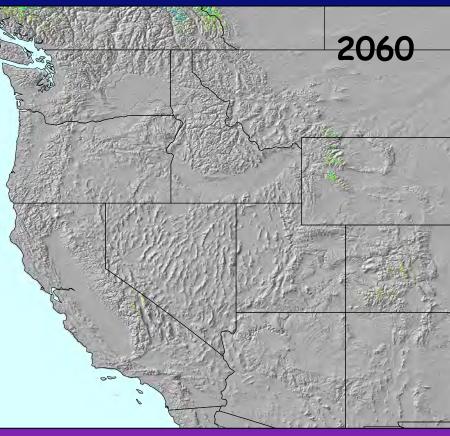
See Keane et al. (2017) for review

## Whitebark Pine into the future

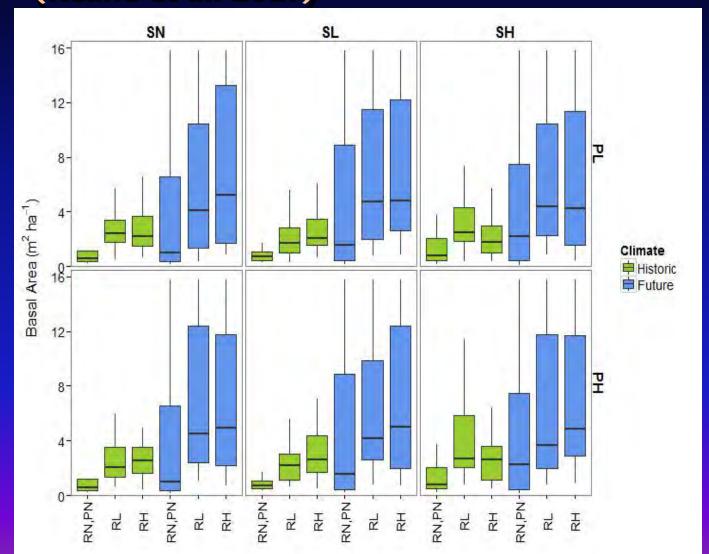
### **SDM models**

Warwell et al. 2007





### FireBGCv2 Simulation results Whitebark pine basal area in Bitterroot upper subalpine (Keane et al. 2017)



#### Climate

- Historical
- **Future: hot, dry**

#### Fire management

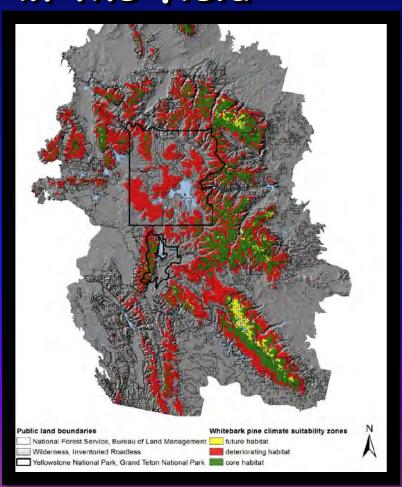
- N-No suppression L-Low supp (50%)
- **H-High supp (92%)**
- **Restoration treat**
- **N-None**
- L-Low (10 ha/yr)
- H-High (100 ha/yr)
- **Planting**
- **N-None**
- L-Low (10 ha/yr)
- H-High (100 ha/yr)

# How do you evaluate Climate Change Impacts

### Look at recent changes in the field:

- Encroachment into high environments
- Status and health in current environments
- Encroachment into lower environments

**GYE** habitat analysis



### Validation of predictions

Whitebark pine encroachment into a sagebrush grassland

Near Dillon Montana





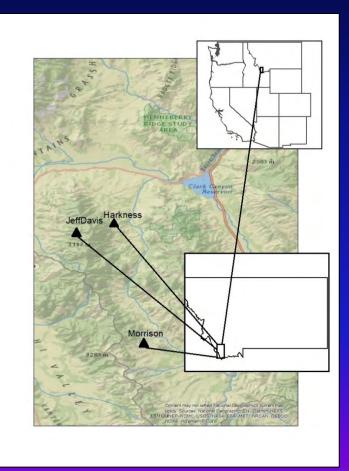
Photos by Emily Guiberson, BLM

Whitebark Encroachment into Sagebrush Transitions Funded by BLM - Guiberson

## **Three Study Sites**

- Harkness
- Morrison
- Jeff Davis

Flanary, S. and R.E. Keane. 2019[in press]. Whitebark pine encroachment into lower elevation sagebrush grasslands in southwest Montana, USA. Fire Ecology.



Whitebark Encroachment into Sagebrush Transitions

**Three Study Sites** 



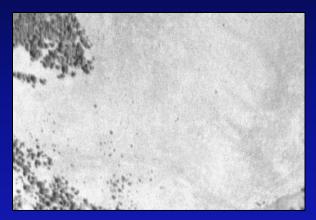




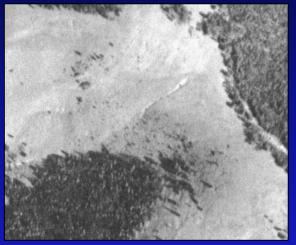


# **Three Study Sites**

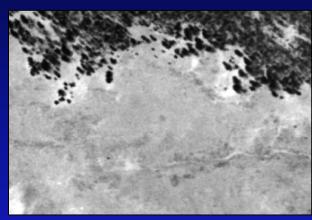
Harkness 1953



Jeff Davis 1954



Morrison 1954



Harkness 2018



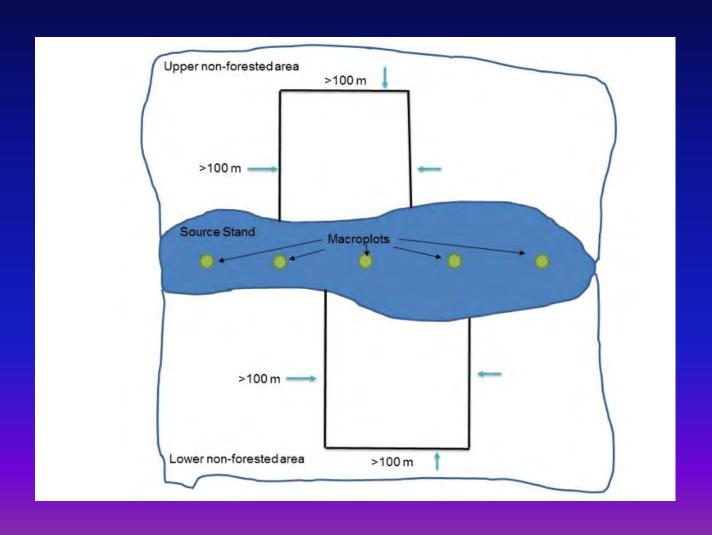
Jeff Davis 2018



Morrison 2018

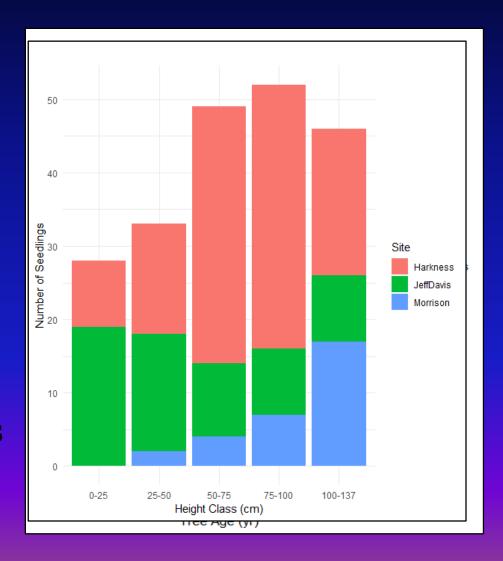


# WEST study Whitebark Encroachment into Sagebrush Transitions Methods



# WEST study Whitebark Encroachment into Sagebrush Transitions Results

- No encroachment into upper elevation sites
- Only encroachment to sagebrush grasslands
- Many trees producing cones
- All trees healthy with minor rust
- Scattering of seedlings
- Only 5 Douglas-fir trees at Harkness



Whitebark Encroachment into Sagebrush Transitions

Why did whitebark pine encroachment only go downhill?

### **Speculations**

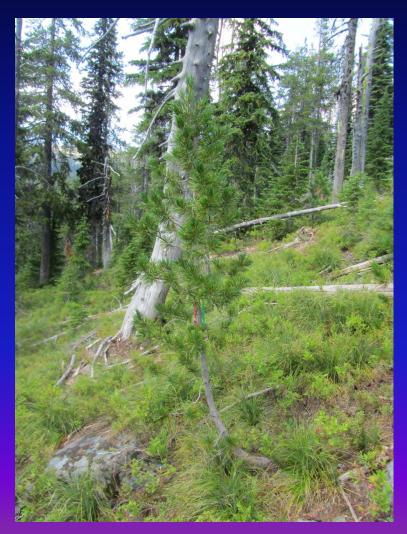
- Regeneration following a fire exclusion gradient
- Presence of mycorrhizae in sagebrush environments
- Whitebark pine is certainly more drought tolerant than expected

### **Caveats**

- Did not happen everywhere
- Haven't seen this encroachment in other areas
- Have observed encroachment in subalpine meadows

Whitebark pine DBH and height increase after daylighting

- Ten year results of DBH and height growth in whitebark pine seedlings and saplings that were treated using daylighting
- Original study implemented by John Schwandt FHP and given to RMRS to complete

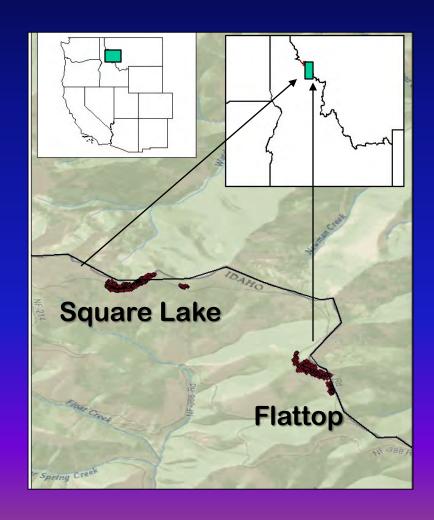


Whitebark pine DBH and height increase after daylighting

### **Two Study Sites**

- Square Lake
- Flattop Both TSME/LUHI

Flanary, S. and R.E. Keane. 2019[in review]. Diameter and height release over ten years in small whitebark pine trees after two daylighting treatments. Forest Ecology and Management.



# Whitebark pine DBH and height increase after daylighting

#### **Methods**

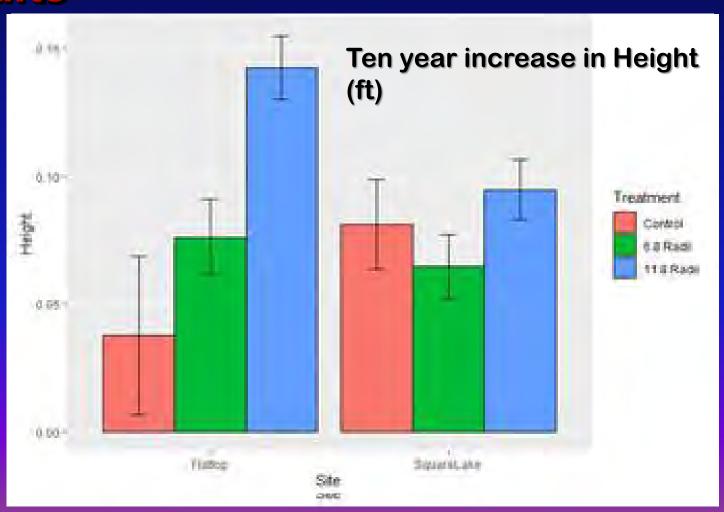
- Schwandt identified 790 seedlings/saplings
- Two daylighting radii
  - 2 m (6.8 ft)
  - 4 m (11.8 ft)
- Three height classes
  - 2-4.5 ft
  - 4.5-10 ft
  - > 10 ft

Treatment	Tree	Radius (m)	Desired	Treatment
#	Height		number	
	(feet)		of trees	
1	2-4.5	2	100	Thin
2	2-4.5	-	100	Control
3	4.5-10	2	100	Thin
4	4.5-10	4	100	Thin
5	4.5-10	-	100	Control
6	>10	4	100	Thin
7	>10	-	100	Control

Measured in 2008,
 2013, and 2018 (10 yr)

Whitebark pine DBH and height increase after daylighting

### **Results**



Whitebark pine DBH and height increase after daylighting

### **Conclusions**

- The 4 m (11.8 ft) radius worked sometimes
- Daylighting prescription made at wrong scale
- Too small a radius to have real increases in vigor & too large of residual trees
- Wrong site for daylighting

