

Using Fire and Grazing for Weed Control

Fadzayi E. Mashiri Ph. D.

Livestock and Natural Resources Advisor (Mariposa and Merced
Counties)

County Director (Mariposa)



Considerations when using fire and grazing

- Goal
 - Weed management
 - Wildlife habitat
 - Forage production/quality
 - Cultural resources
 - Biodiversity
- Fire/grazing regime
 - Fire frequency
 - Timing
 - Fire intensity
- Target species phenology
- Growth form of target species
- Non-target species





Fire/grazing adapted ecosystems

- Tolerance to periodic fires
 - Underground/low growth points
 - Apical dominance
- Avoidance
 - matures early to avoid fire
 - Physical: barks, thorns, awns
 - Secondary compounds
- Need for scarification –
 - Fire
 - Digestion
- Smoke → acorn production



Historic Average Fire Return Interval (FRI)



Lynn Huntsinger

"There is no doubt that forest fires encourage a spirit of lawlessness and a disregard for property rights."
Gifford Pinchot

Vegetation Type	Pre-1860 FRI	20 th Century FRI
Grasslands and oak woodlands	10	78
Ponderosa Pine	4	192
Foothill Chaparral	30	-

Changes in fire and grazing regime

- Decrease
 - Fire suppression → increase fuel
 - Grazing → reduced fuel load
- Increase
 - Introduction of non-native species
 - Eg cheatgrass → decline in native shrubs
 - Eg. Buffelgrass and lehman lovegrass → affects desert succulents



Grazing and plant diversity

2002



2007



Impact of fire

- Reduce seed production and seed bank
- Consumes thatch/biomass
- Reduced competition for desirable and perennial plants



Photo by Brian Mattos



Plant phenology and timing of Rx fire

Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Natives & forage

Growth

Senescence



Medusahead, goatgrass, starthistle



- Late spring to early summer
- Selectively affect invasives
- Enough fuel from desirable species
- Kills 90% of seeds

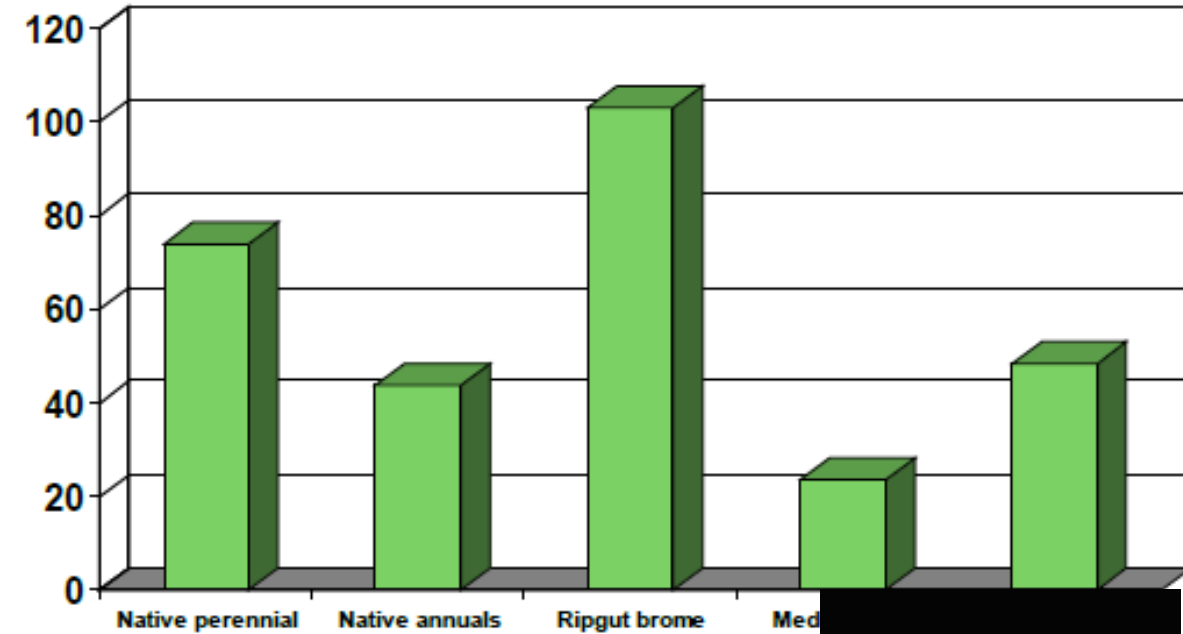


Photo by Brian
Mattos

Medusahead (and Barb goatgrass)

Invasive potential

- Early germination
 - Stays green longer
 - Produces lots of seeds
 - Higher water efficiency
 - Low nutritional quality–
 - Protein content
 - Silica content – low digestibility and decomposition
- Thatch → monoculture → low forage value
- Mechanical injuries to livestock



Fire temperature

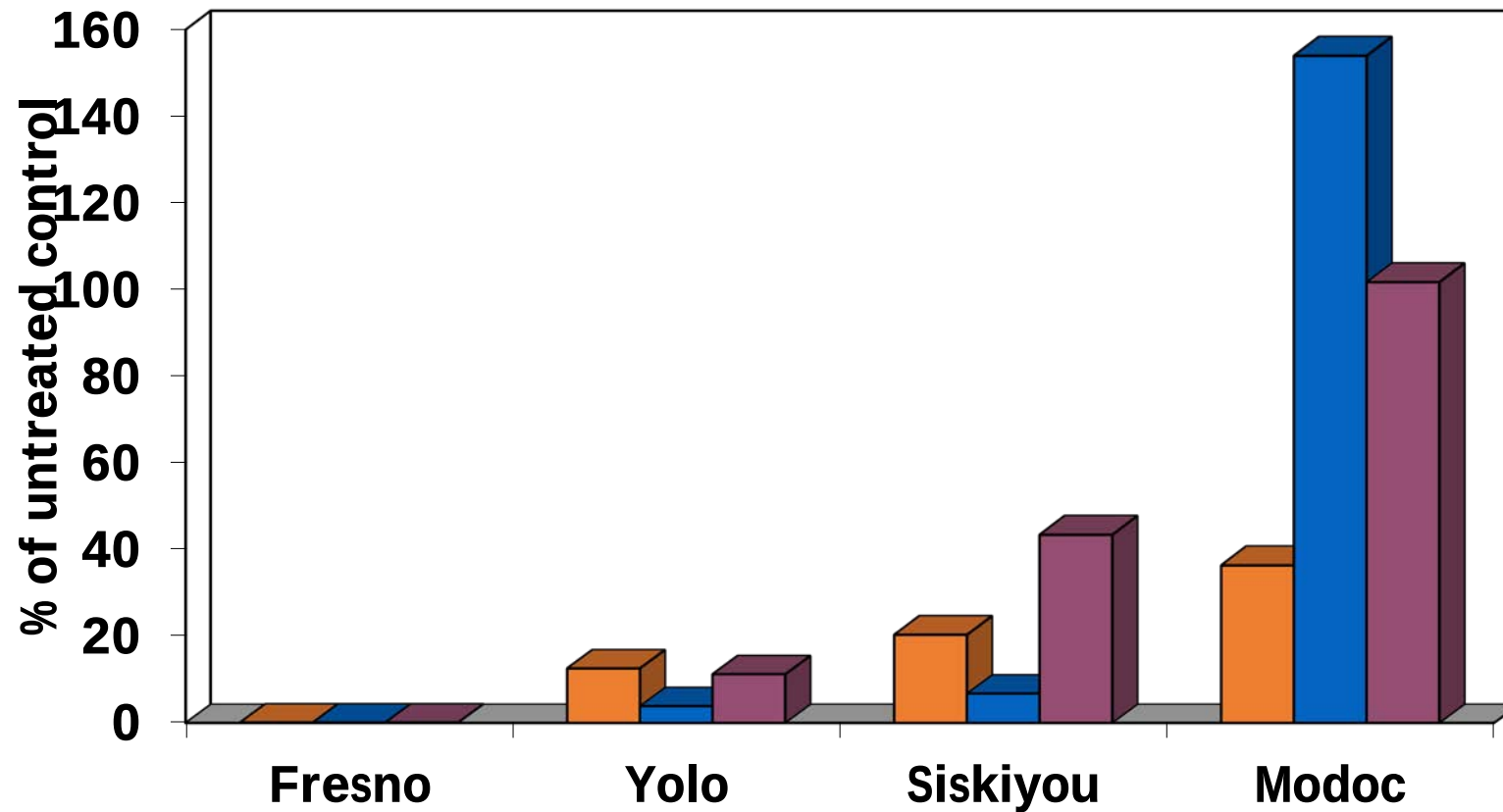
- Soil surface temperatures ~480 F
 - not hot enough to kill seeds
- Desirable species seeds escape fire.
- Canopy temperatures ~1200 F
 - enough to kill seeds
 - Burn awns (Bartolome et al, 2019)



Photo by Brian Mattos

Burning to control medusahead

After 1 yr burn After 2 yrs burn 1 yr after last treatment



- Fuel load
- Phenological stage/timing
- Environmental conditions
- Moisture content of target plants

Kyser et al, 2008

Yellow starthistle

- Decline with increasing diversity
- Increased once burning stopped

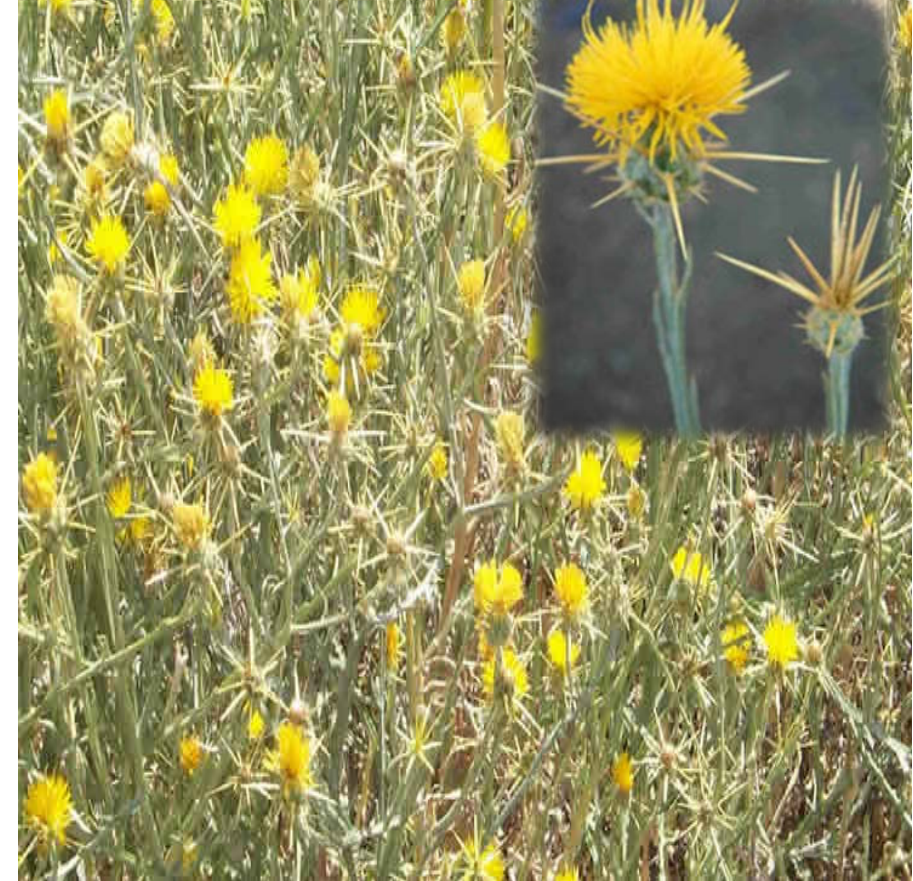


Table 1.

Yellow Starthistle Seedbank and Seedling Counts Following Burns

Burn Sequence	Seeds per square meter; 5 cm deep (percent of unburned)	Seedlings per square meter (percent of unburned)
Unburned	10,000	1,400
After 1 burn	2,600 (26)	265 (19)
After 3 burns	52 (0.5)	5 (0.4)

Yellow star thistle



Photos by Devil Rao

- **Timing:**
 - Early-mid summer
 - Bolted but not seeded & still green
 - Whole plant wilts after burn
- After seeding fire must be hot enough to kill seed
- **Follow up treatment very important**
 - Herbicide application
 - Grazing
 - Fire
- **Effectiveness**
 - dead YST
 - If NOT follow flush germination with herbicide treatment
 - E.g. Capstone , Milestone,

Perennial grasses benefit

- Summer burn
 - Stimulates perennial bunchgrasses
 - Increase perennial plant density, biomass and quality
- Fire not effective for perennial grasses or forbs

Except:

- Under high fuel load → High Fire intensity



Shrubs/chapparal spp

- Fire may reduce shrub encroachment
- Short-term effect because most sprout
- Follow-up treatment important





Desert ecosystems

- **Not fire-adapted**
 - Fuel to carry fire
 - Invasive grasses introduction
 - $\sim \leq 97\%$ mortality of native species
- Little use for Rx fire



Targeted grazing



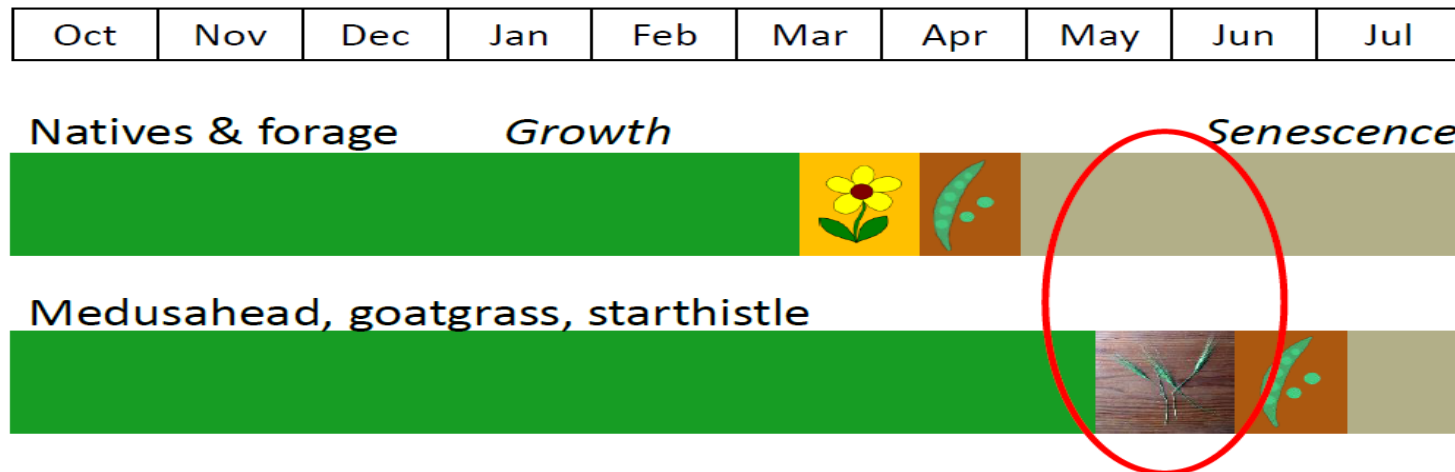
Viable and effective tool for vegetation management objectives

- controlling invasive weeds
 - Yellow star thistle
 - Medusahead
 - Shrub species
- reducing fire risk in wildland-urban interface

Control invasive weeds –targeted grazing



- Considerations:
 - Animal type
 - Animal numbers
 - Phenological stage
 - Plant characteristics-
 - chemical and physical
 - Cost
 - Infrastructure



Grazing and fire in orchard systems



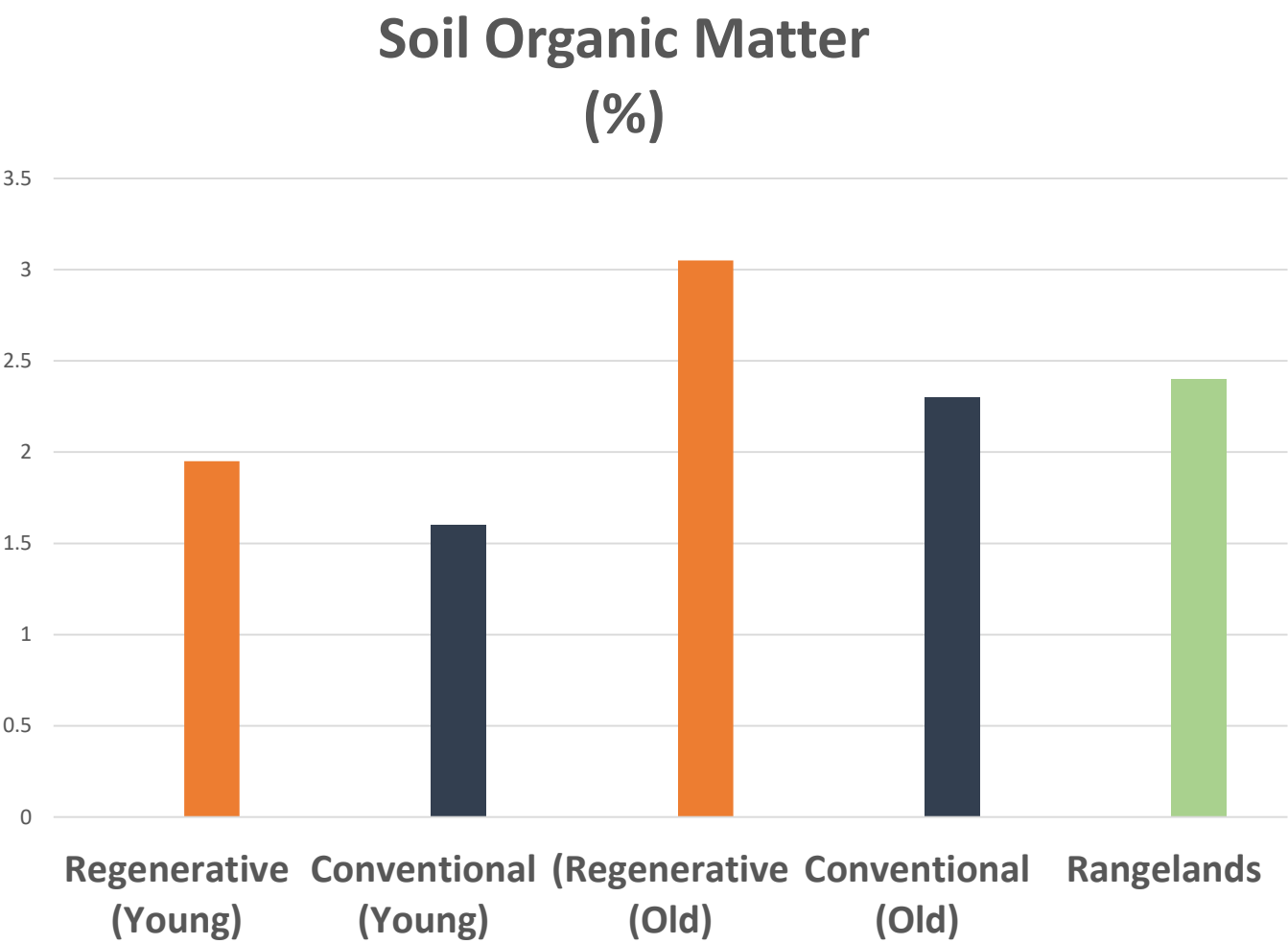
sacvalleyorchards.com

Regen > Conventional - both age groups

Conversion releases C

SOM build-up as trees mature

Old Regenerative almonds > rangelands



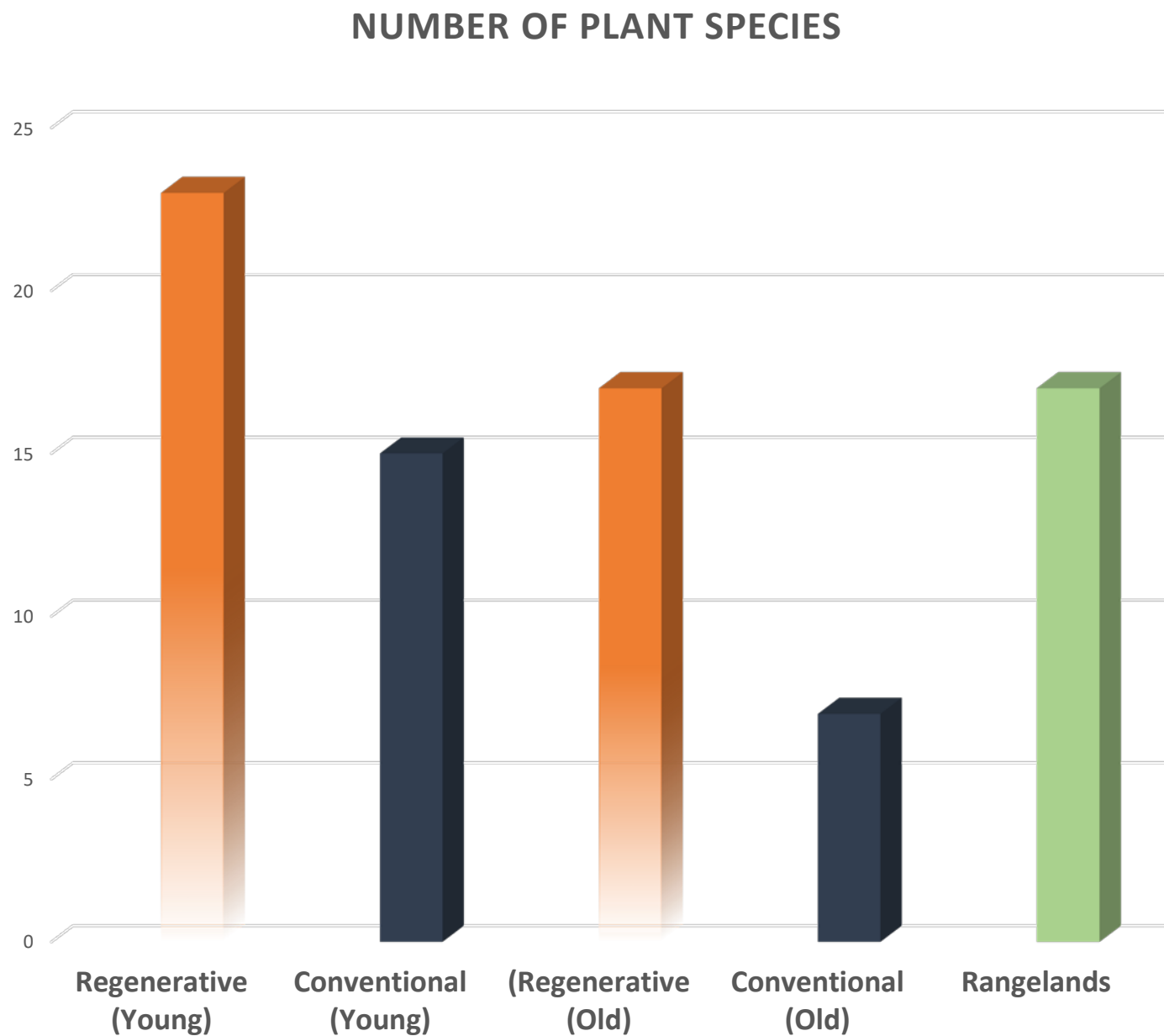
Resilience to change

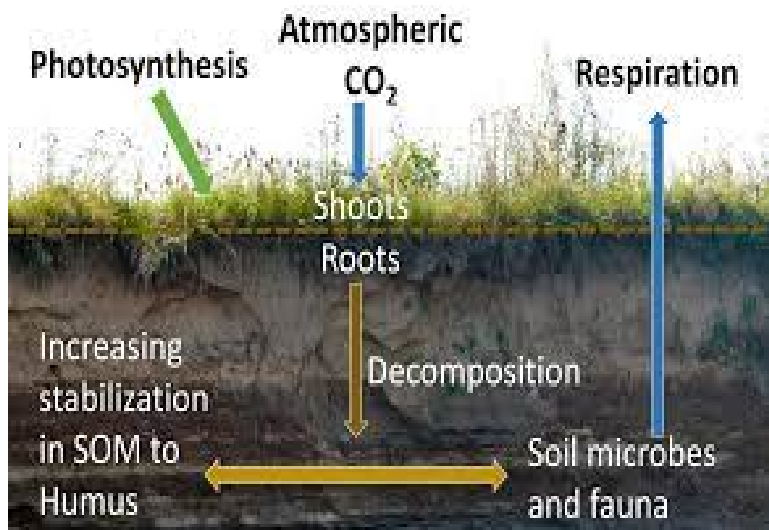
Regenerative young highest

Old Conventional lowest

Forage value:

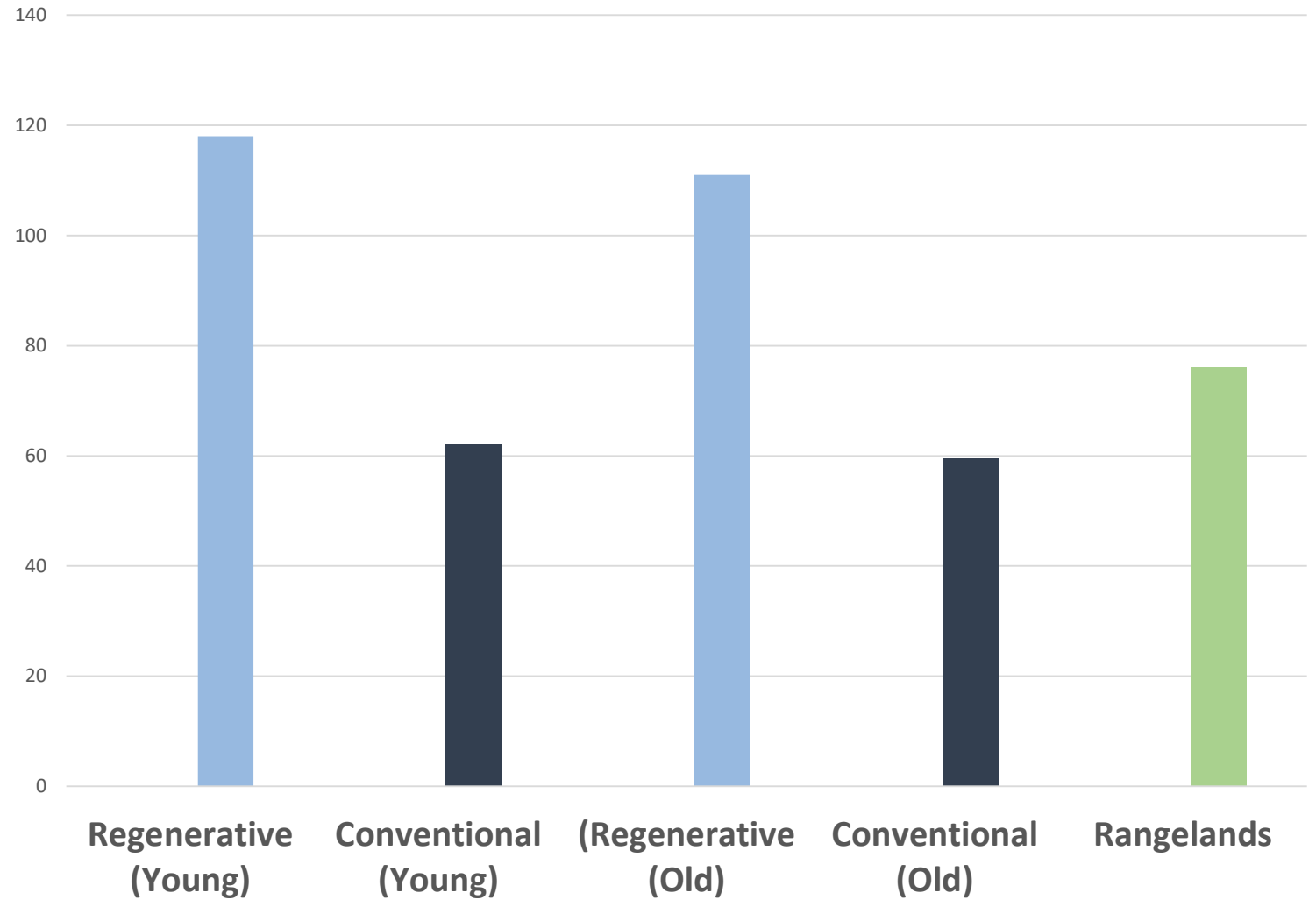
Regenerative > rangelands >
conventional





soilhealth.cals.cornell.edu

Soil Respiration Mineralizable C (mg/kg/day)



Insect diversity

- Pit fall traps and sticky traps
- Regenerative highest
- Seasonal differences



University of California
Agriculture and Natural Resources

Cooperative Extension



Benefits of grazing and fire as tools of ag/land management

- Soil Carbon (SOM)
- Increases water infiltration and retention
- Biodiversity
 - Species diversity
 - Diversified food systems
 - Helps with climate resilience
 - Improves resilience of production systems
 - More healthy ecosystems



Limitations of fire for weed control in orchards

- Repeated flaming may result in grasses becoming the dominant weeds because their growing points are at or below soil level and are not readily killed by flaming.
- Perennial weeds can be suppressed, but usually are not killed by flaming.



Questions?

Thank You!

More Resources

[The Use of Fire as a Tool for Controlling Invasive Plants](#)

<https://fireadaptednetwork.org/>

<https://ucanr.edu/sites/fire/>

<http://wric.ucdavis.edu/>

