Effects of Rangeland Conversion to Regenerative and Conventional Almonds Orchards on Ecosystems Function

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INTRODUCTION

- General consensus is that widespread rangeland conversion without sound conservation management negatively affect ecosystem services, but limited research has explored the full range of ecosystem changes (negative or positive)
- This multidisciplinary research attempts to do that by quantifying effects of rangeland conversion to almond orchards on multiple ecosystem function indicators in the Central Valley
- Goal: Investigate the tradeoffs and/or synergies between post conversion management (regenerative vs conventional almond production) and ecological function, and economic returns.
- We also investigate the socio-economic drivers of rangeland conversion.
- We will explore the potential for integrated crop-livestock systems(regenerative) to enhancing enhance sustainability and profitability.

METHODS

Sampled 3 sites with rangelands adjacent to almond orchards

- Rangelands
- Almond orchards Young <7yrs vs Old >10yrs
- Conventional vs Regenerative (integrated crop-livestock)

Data Collected:

- Plant diversity (using seedbank study up to 12”)
- Insect Diversity
- Soil characteristics (12”)
- Socio-economic drivers of conversion

Data collected not presented here:

- *Hydrological processes and Economic analysis*

RESULTS

Drivers of Rangeland Conversion (+/-)

Lower Economic Returns, Inheritance issues, Fragmentation

Williamson Act

Negative public perceptions about grazing

Working rangeland recognized to conserve plant and animal communities

Conservation Easement

Payment for Ecosystem Services

Environmental Quality Incentives Program (EQIP)

Reduced grazing recognized to ↑ non-native invasives and ↓ wildlife communities

Establishment of the California Rangeland Conservation Coalition (CRCC)

Technology to use more marginal rangeland for Ag

Negative perceptions about grazing and GHG

Plant Diversity

- $D = \Sigma(n_i * (n_i - 1)) / (N * (N - 1))$
- Highest on rangelands except on sites dominated by *J. bufonius* (rush)
- Regenerative young> old
- Regen old similar to conventional

Insect Diversity

Asynchronous between rangelands and orchards

Thrips highest identified category

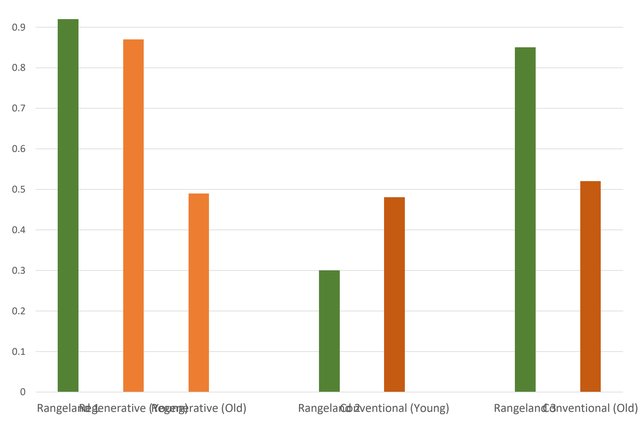
% thrips: conventional > regenerative

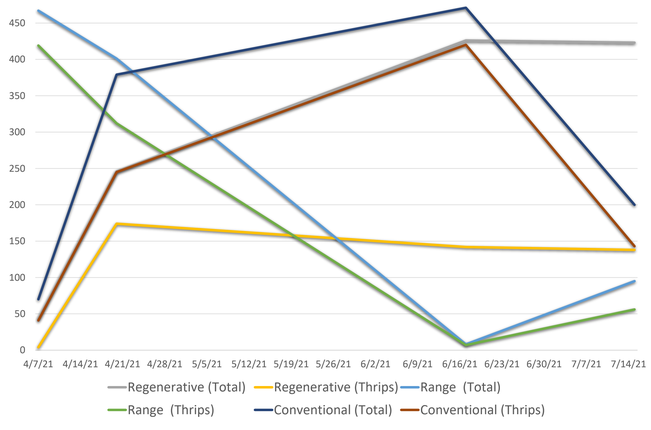
Soil Organic Matter

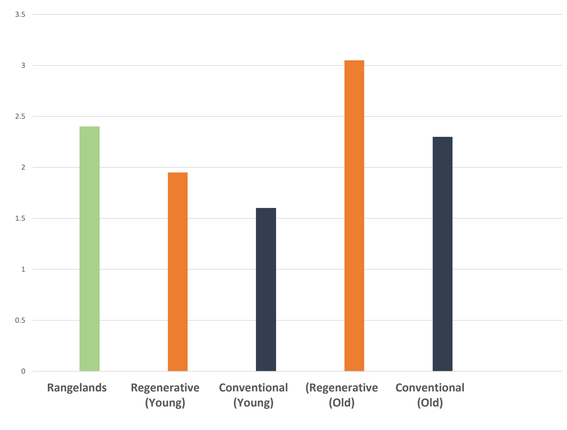
- Soil Carbon lost at conversion
- SOM build-up as trees mature
- Regen > Conventional
- Old Regenerative > rangelands

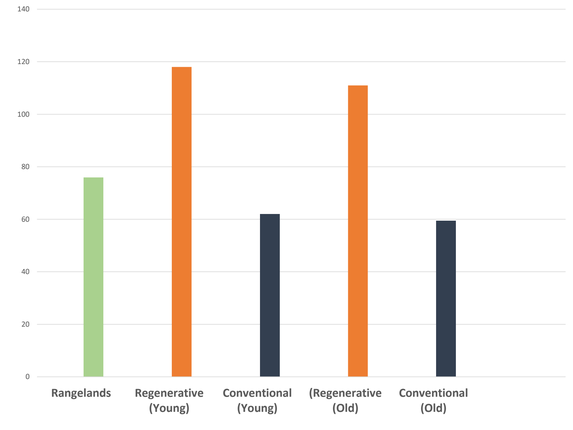
Soil Respiration

- Measures biological activity and decomposition
- Regenerative > Rangelands > Conventional









CONCLUSION

- Some loss in plant diversity in the long-term if diverse cover crops are not consistently planted.
- Post rangeland conversion management matters:- Overall regenerative almond production reduced the negative ecological impacts (plant and insect diversity, soil health) compared to conventional production systems.
- Since conversion is likely to continue, using integrated systems that optimize landscape level ecological health across rangelands and orchards, improve efficient use of by-products, and create multiple income sources should continue to be explored to increase synergies.
- This approach will likely promote cooperation across production systems, sustainability and climate resilient landscapes.

UC CE University of California Agriculture and Natural Resources Cooperative Extension

Berkeley UNIVERSITY OF CALIFORNIA

SARE Sustainable Agriculture Research & Education

UCDAVIS UNIVERSITY OF CALIFORNIA

UCMERCED

SIU Southern Illinois University CARBONDALE