The role of hedgerows in supporting multiple agroecosystem functions in smallholder farms of the Andean highlands

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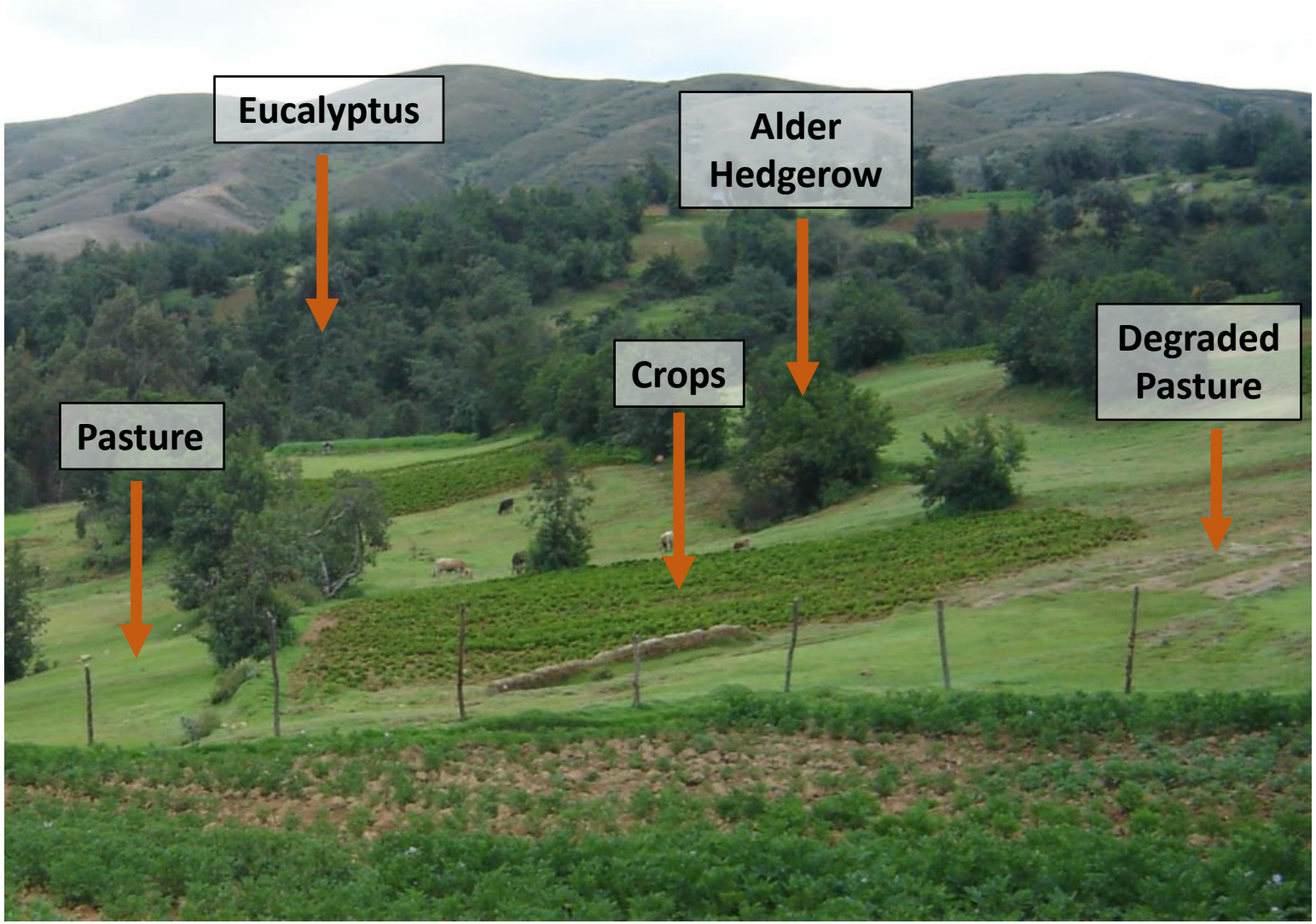
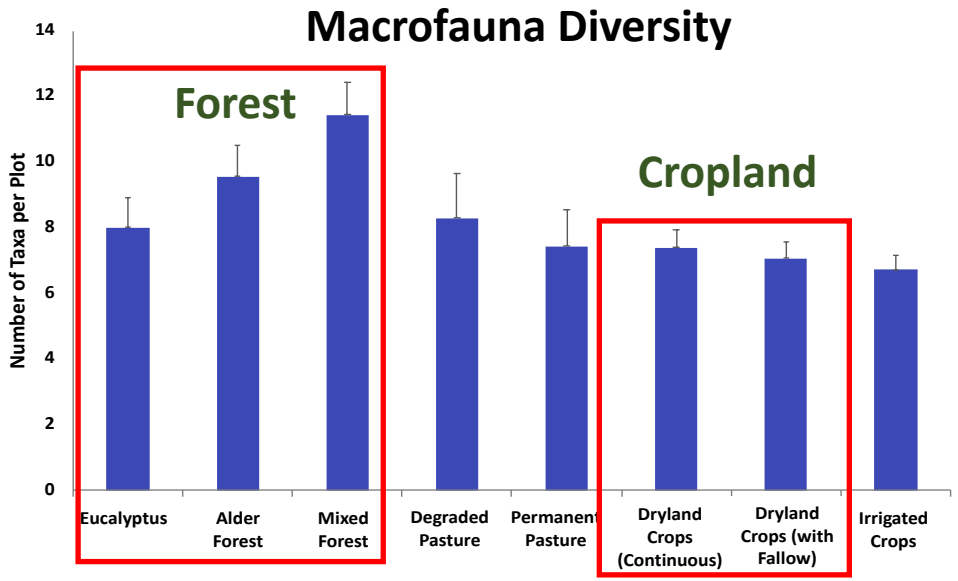
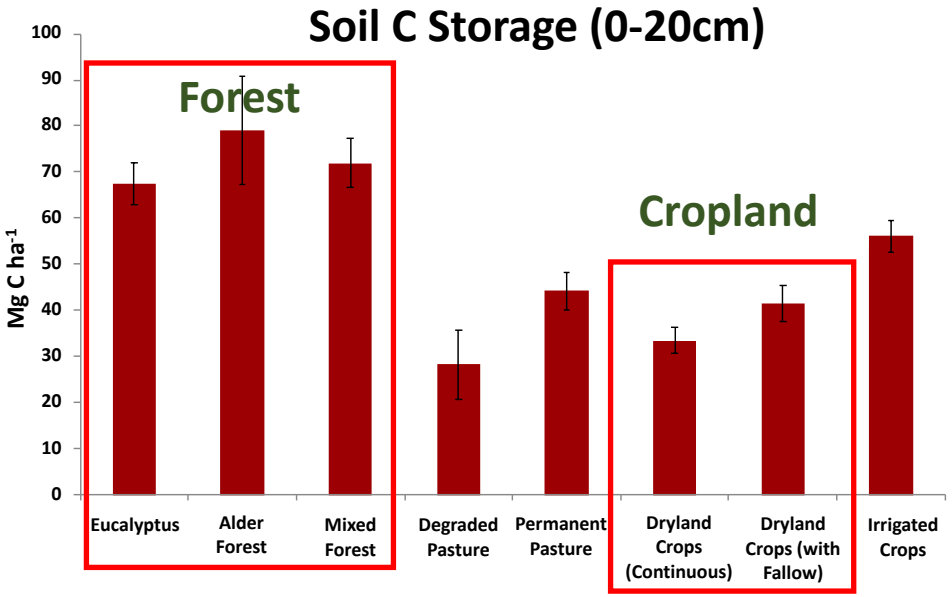
Past Research in the Andes - Land Use Impacts on Soil Biodiversity and Ecosystem Services

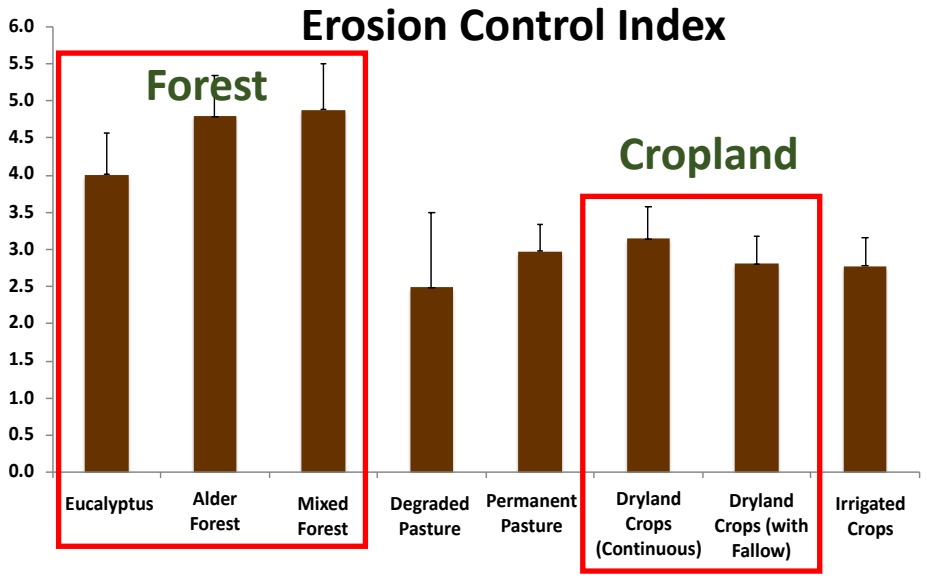
- Elevation: 3200-3600 m
- Precip: 800-1000 mm yr^{-1}



Evaluation of Soil Biodiversity and Ecosystem Services







de Valenca et al. (2017)

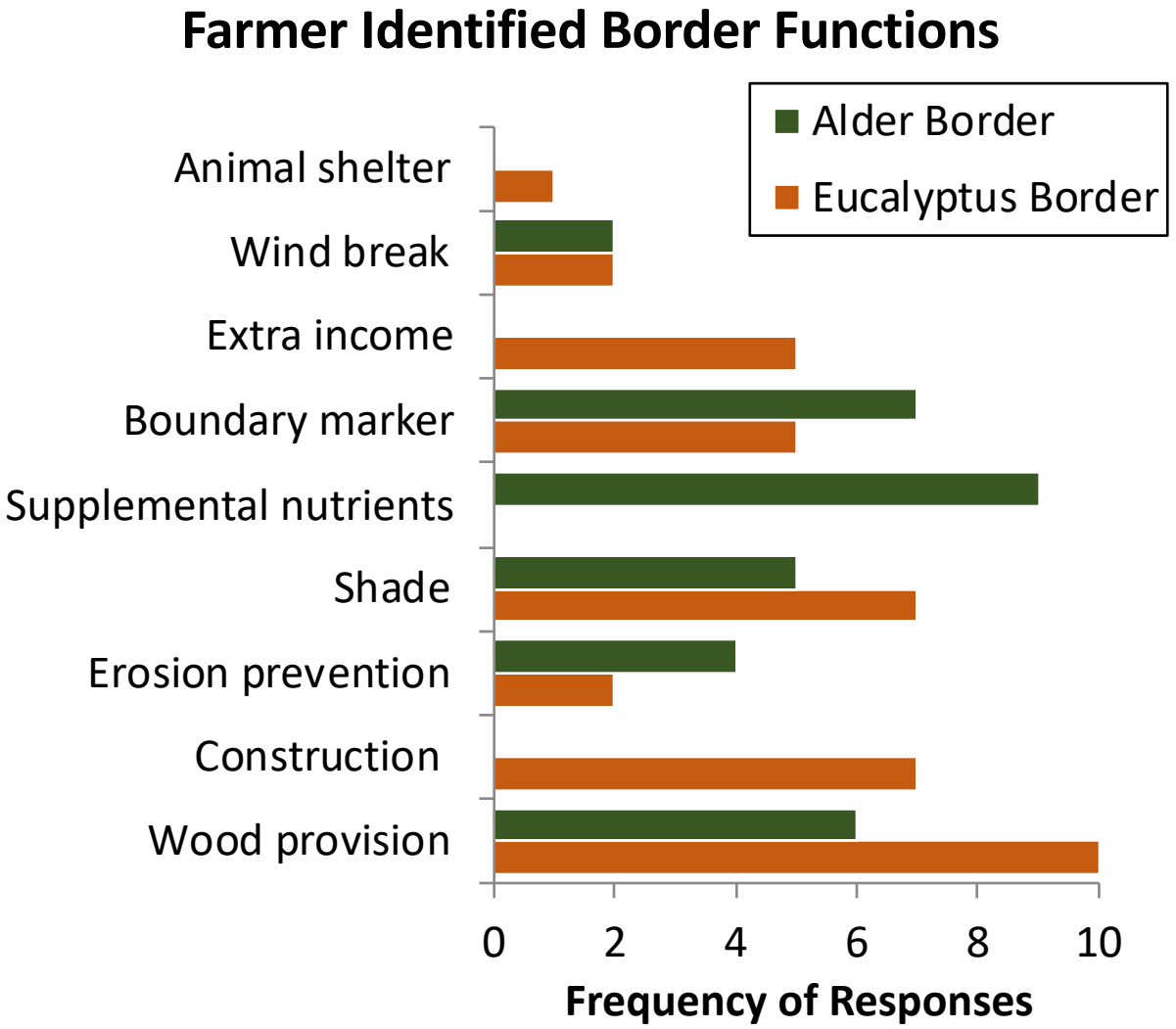
Interactions Between Land-uses

- Many production fields are bordered by trees …and there is considerable potential for interaction between cropland and tree rows

Smallholder fields in Quilcas, Peru
(Google Earth)

Farmer Observations

What uses do tree borders have?

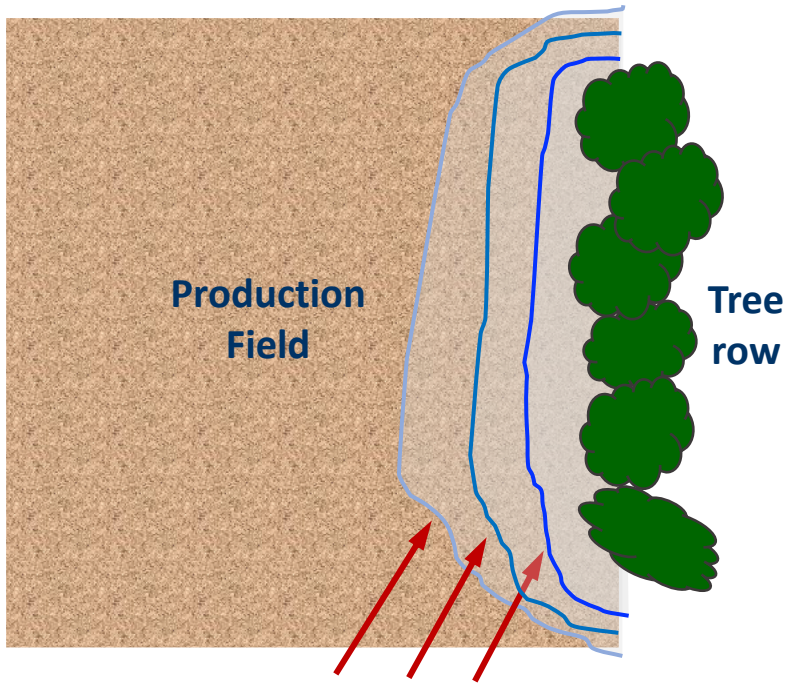


Hypotheses

H1: Perennial field margins will support higher levels of soil biodiversity and ecosystem services than production fields

H2: The influence of perennial field margins will extend into production fields

H3: The magnitude of the effect depends on the type of border (Alder vs. Eucalyptus)



Gradients of soil biodiversity and ecosystem services

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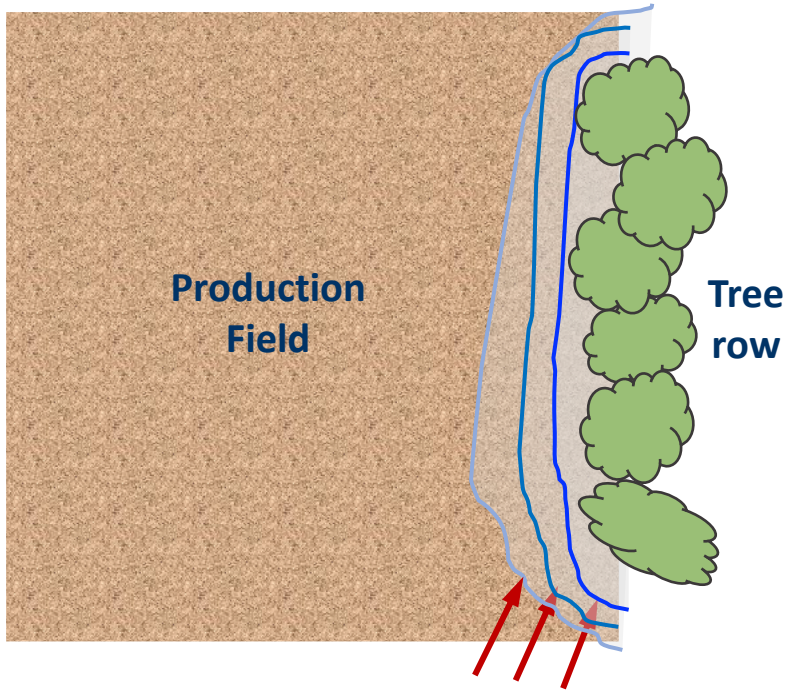
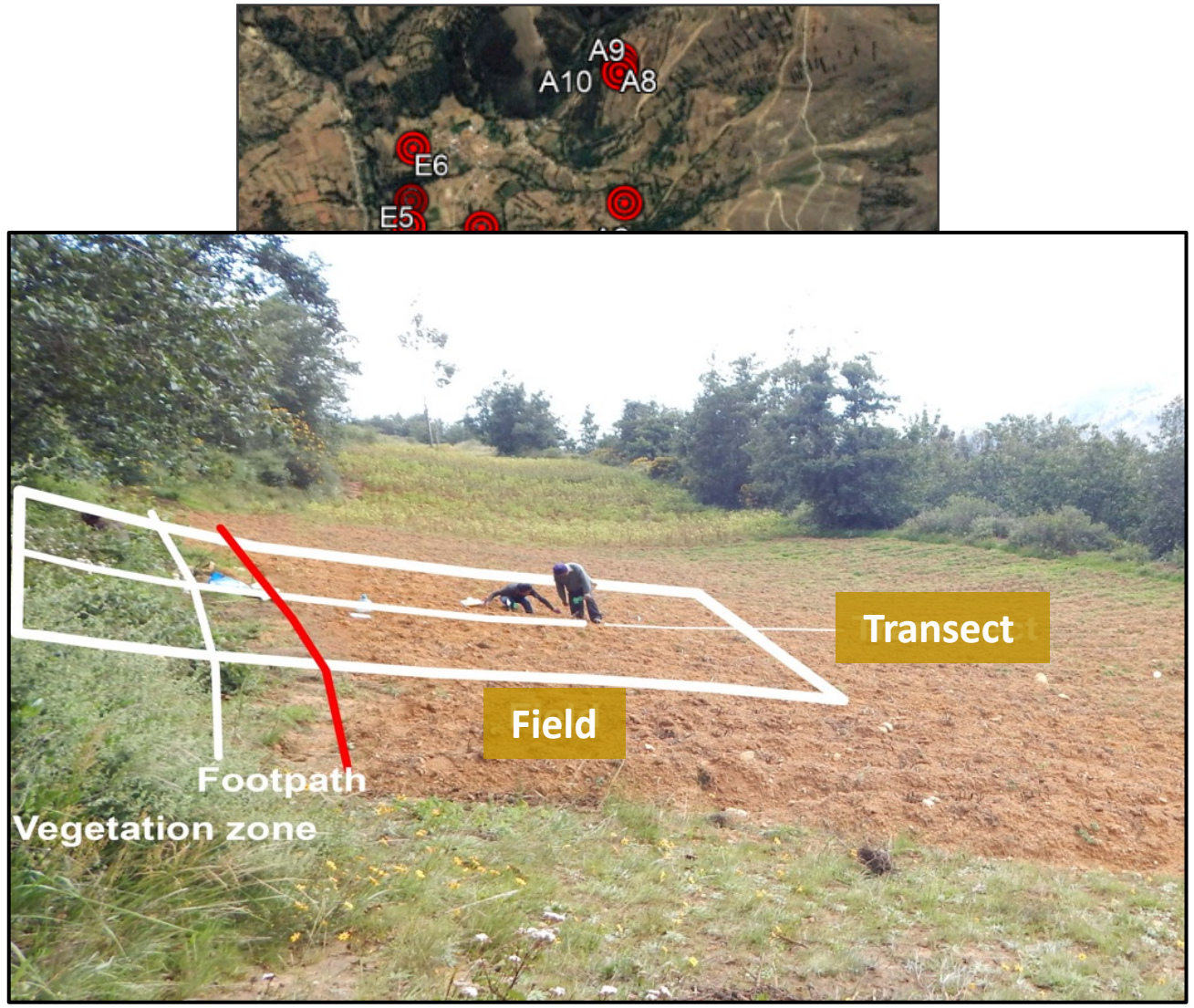


Gradients of soil biodiversity and ecosystem services

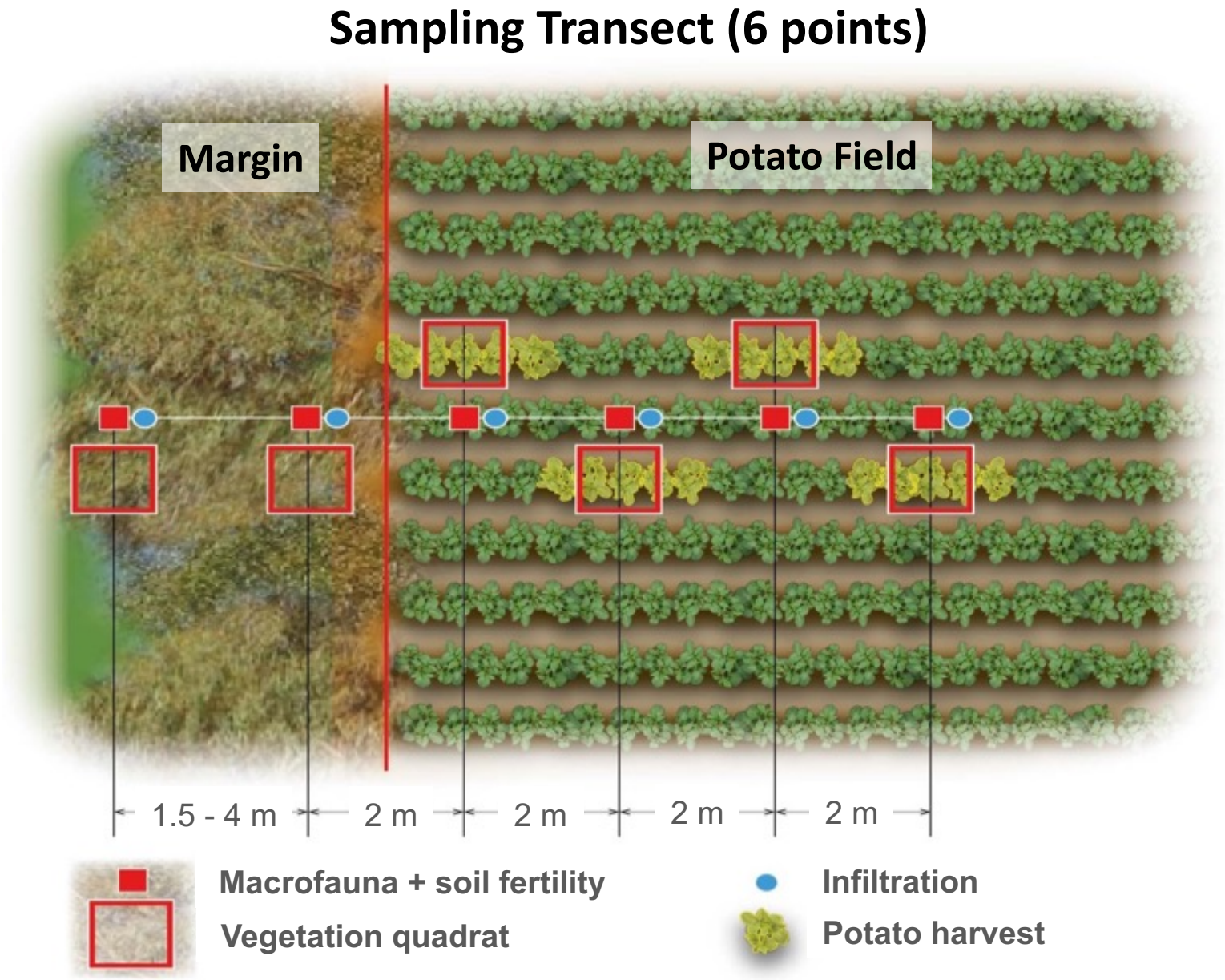
Study Design

- Selection of 20 potato fields in Quilcas, Peru
  - 10 with alder-based field margins
  - 10 with eucalyptus field margins
- Farmer interviews
- Establishment of transects (~10 m) from hedgerow towards center of potato field
- Evaluation of soil-based ecosystem services and soil biodiversity



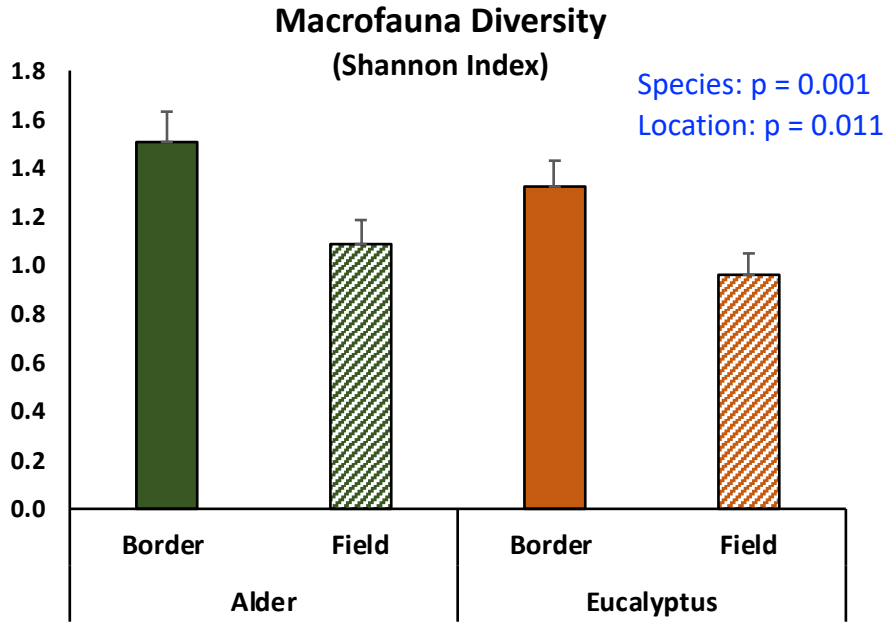
Variables Measured:

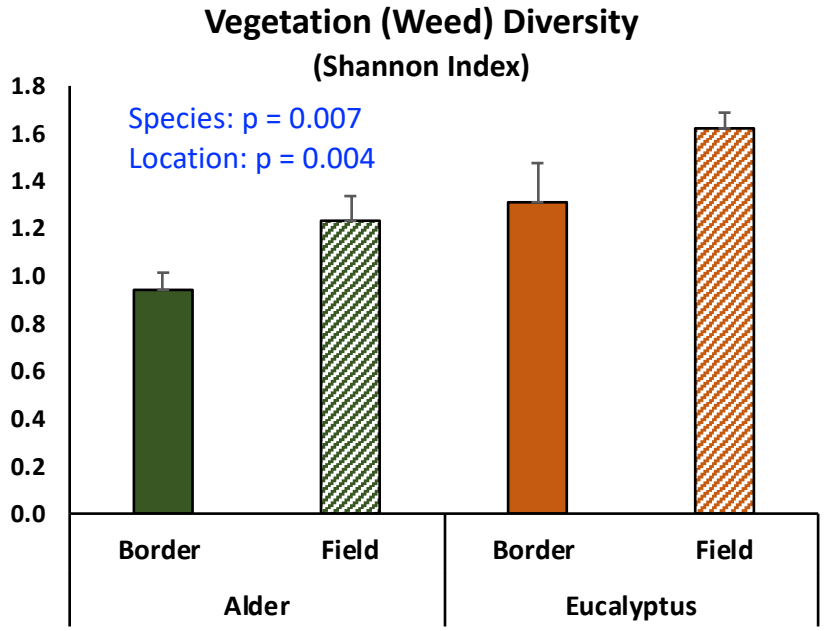
- Soil macrofauna communities
- Ground vegetation cover + diversity
- Soil chemical fertility (SOM, pH, available K, P, etc.)
- Water capture + erosion control (aggregate stability, infiltration, compaction)
- Production = potato yield
- Pest incidence/control



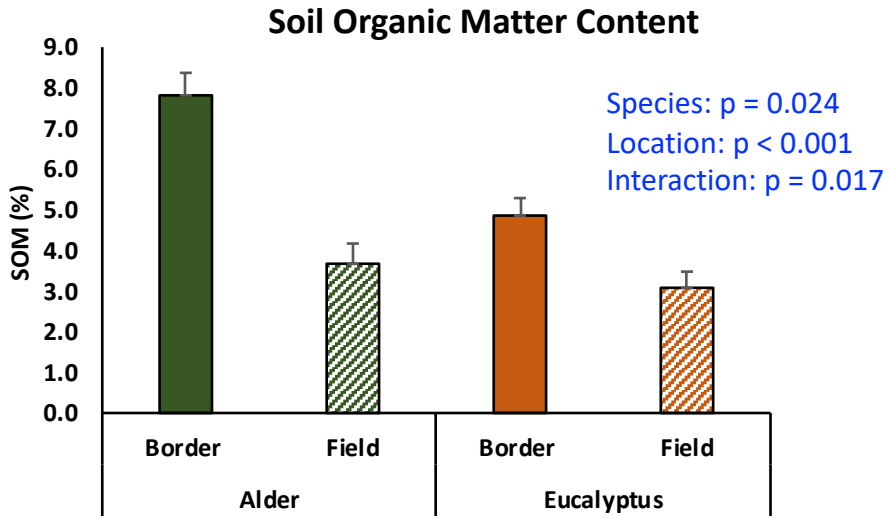
Results - Soil Biodiversity

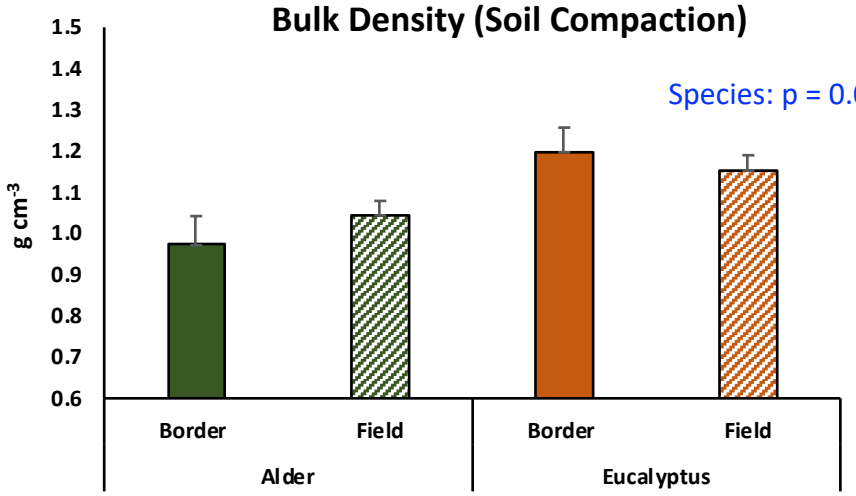
- Clear differences between field margins vs. potato fields (location); and eucalyptus vs. alder (species) = H1 supported

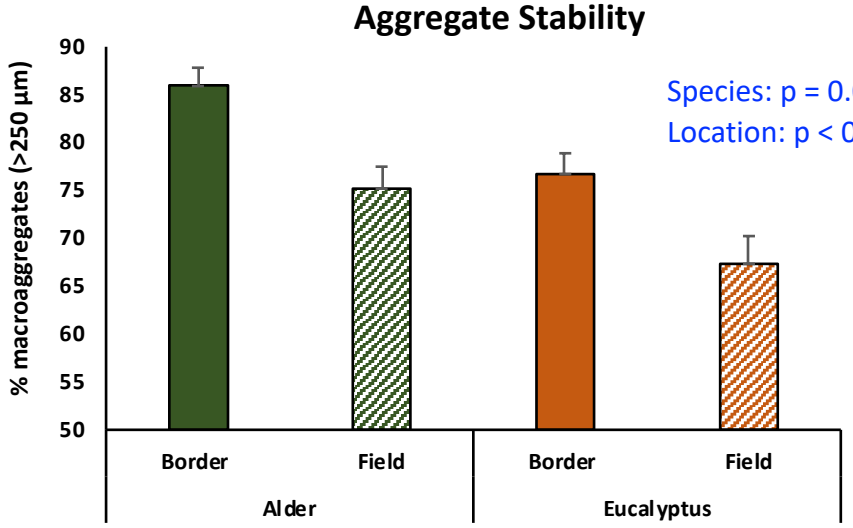




Soil Physical and Chemical Properties

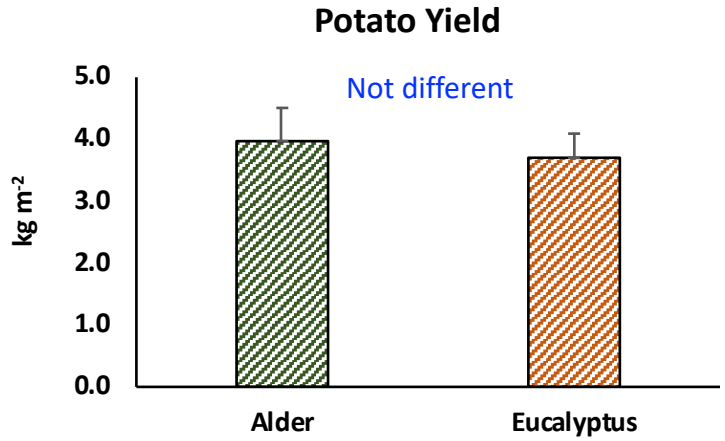


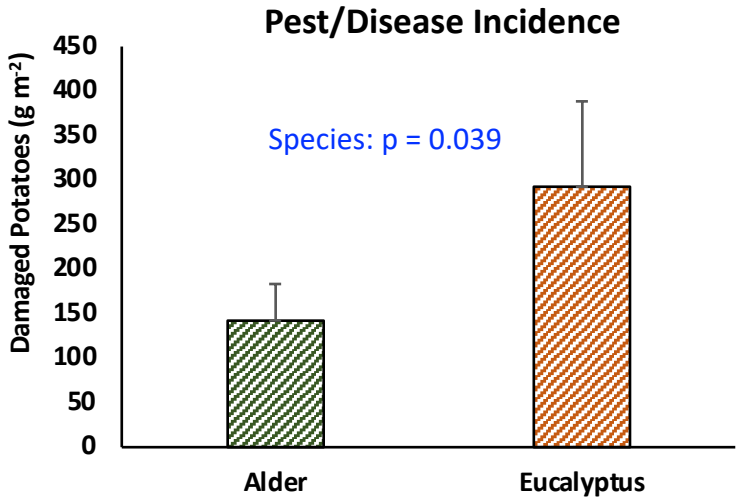




Agricultural Production and Pests

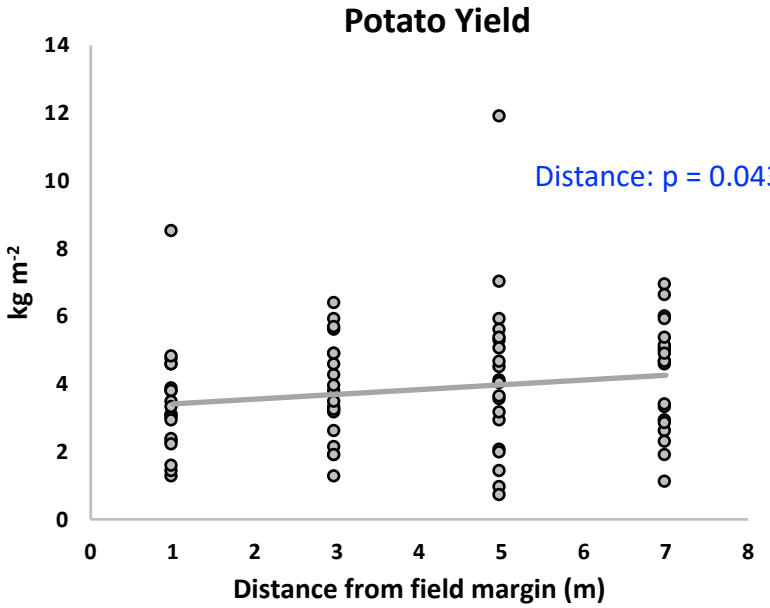
- Border type (eucalyptus vs. alder) does not affect yield, but does influence pest/disease pressure

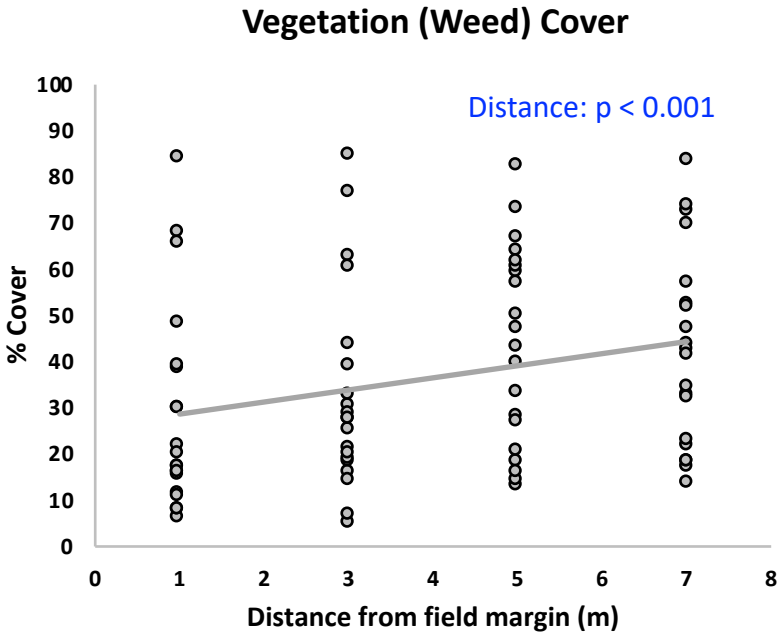


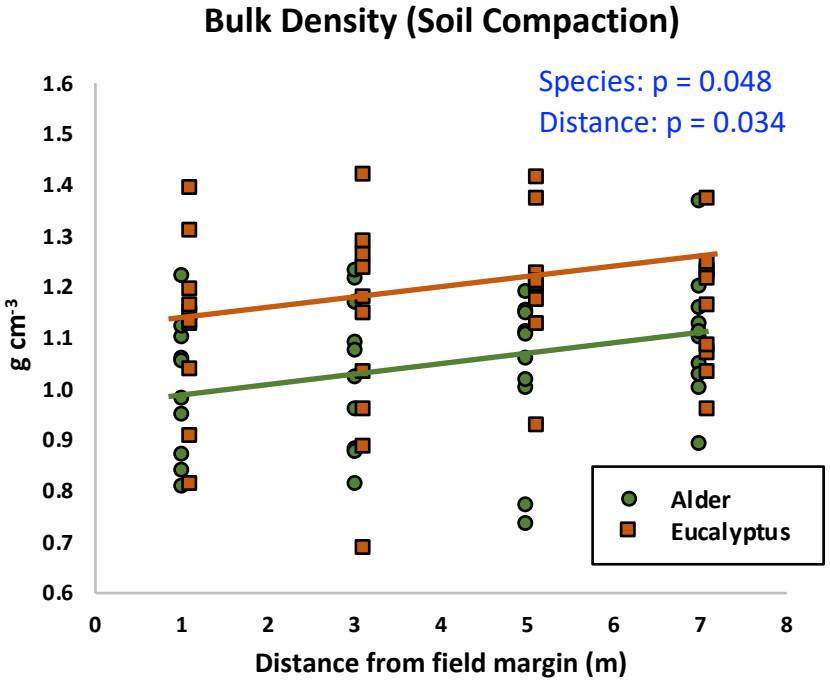


In-Field Border Effects

- Border effects extend into production fields = H2 supported







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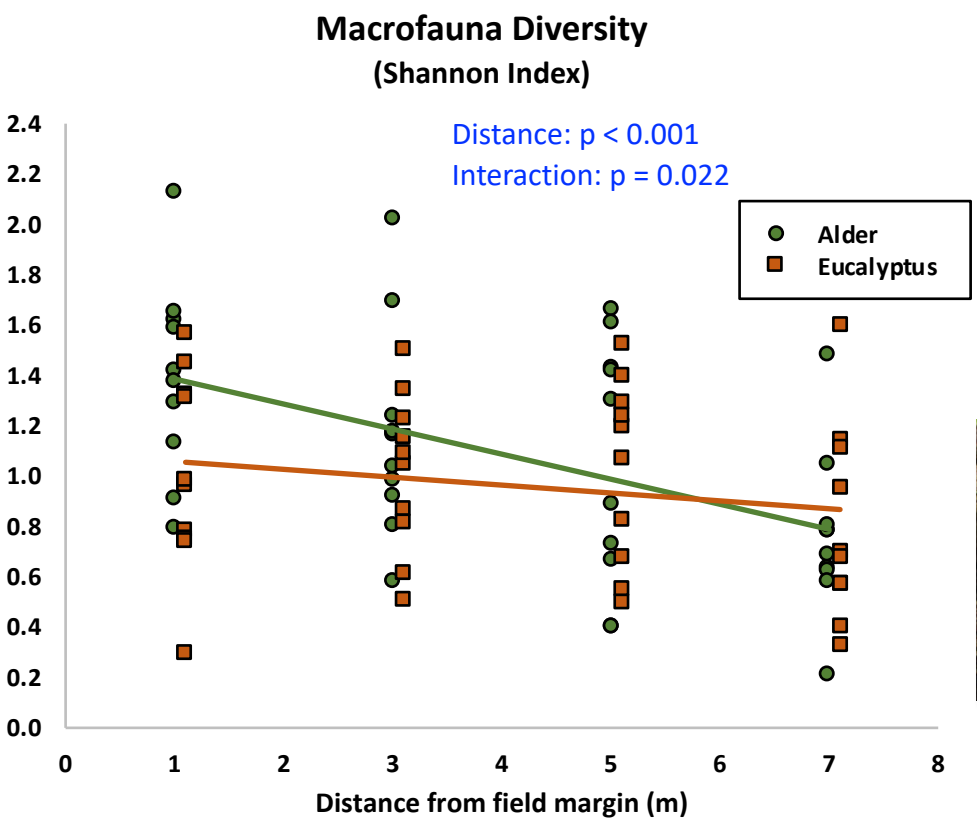
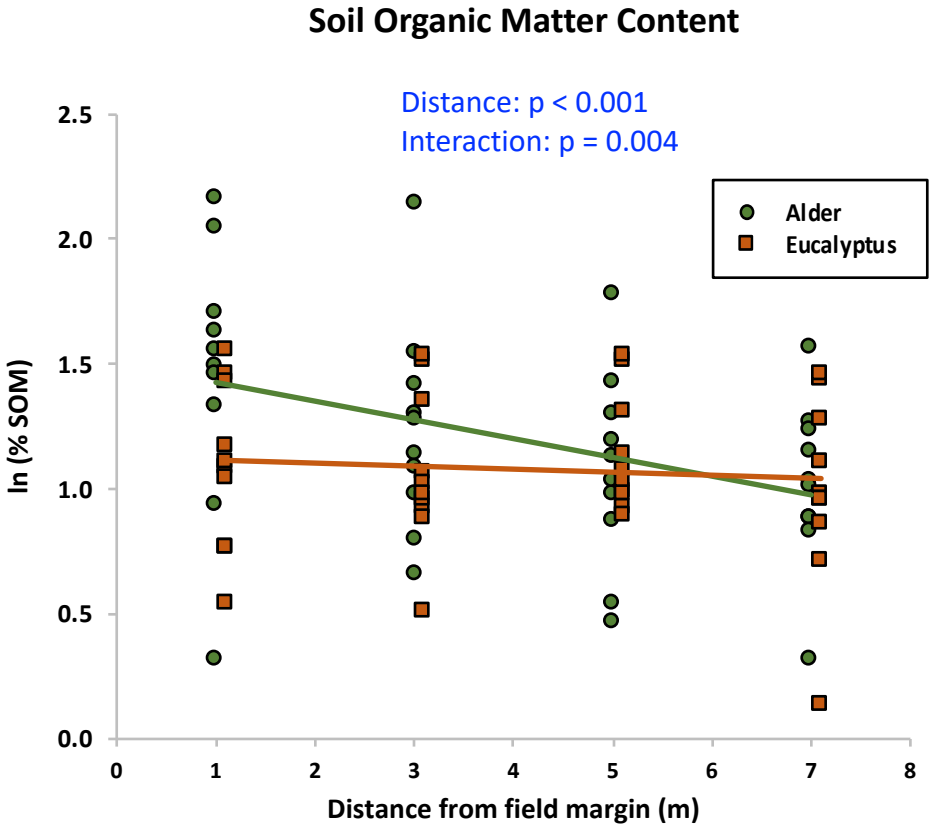
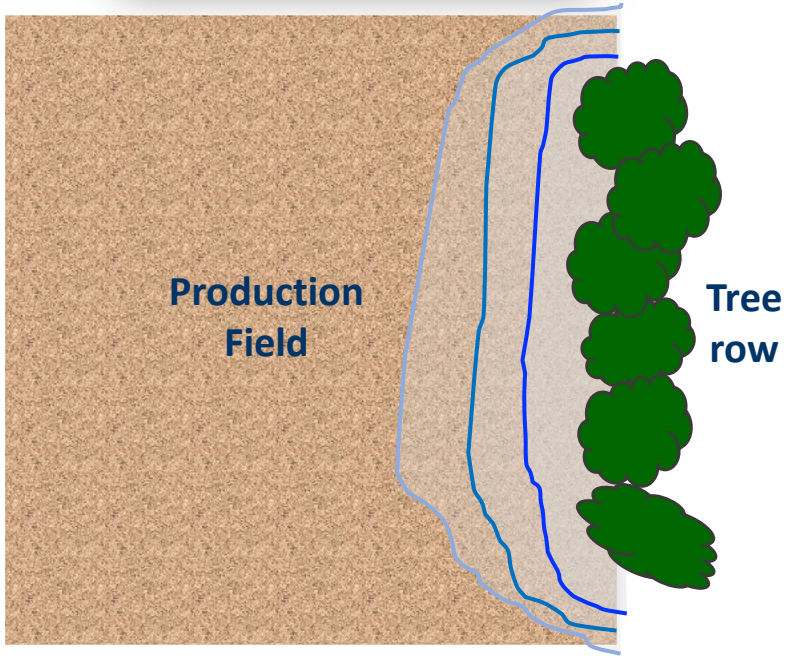




- Border effects (slope) depend on eucalyptus vs. alder = H3 supported

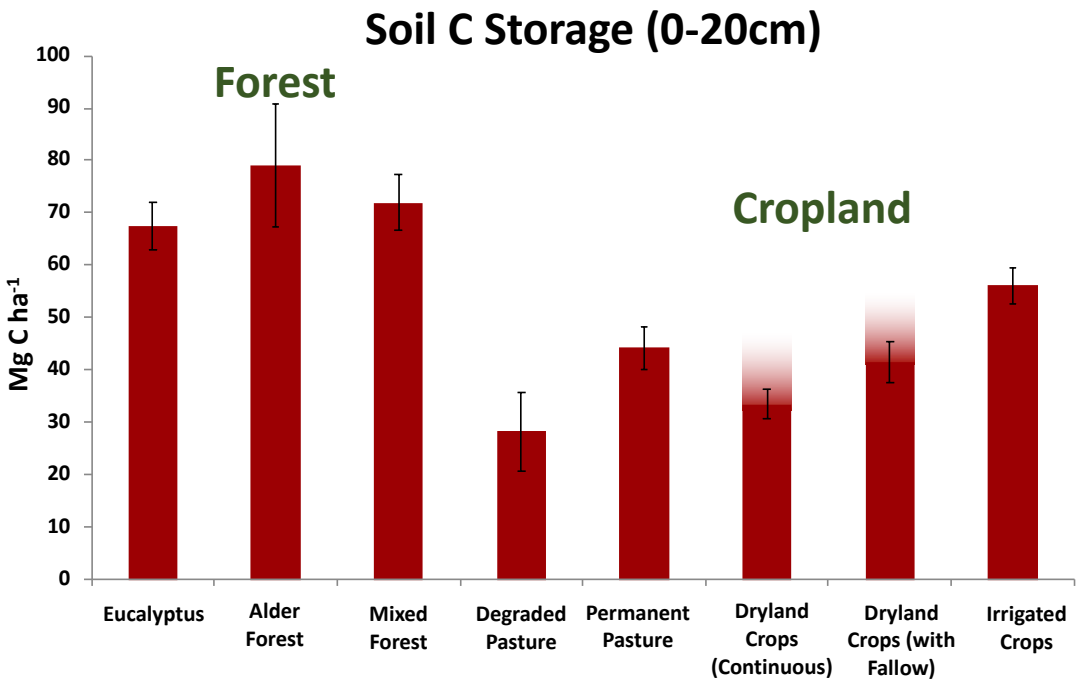
Conclusions

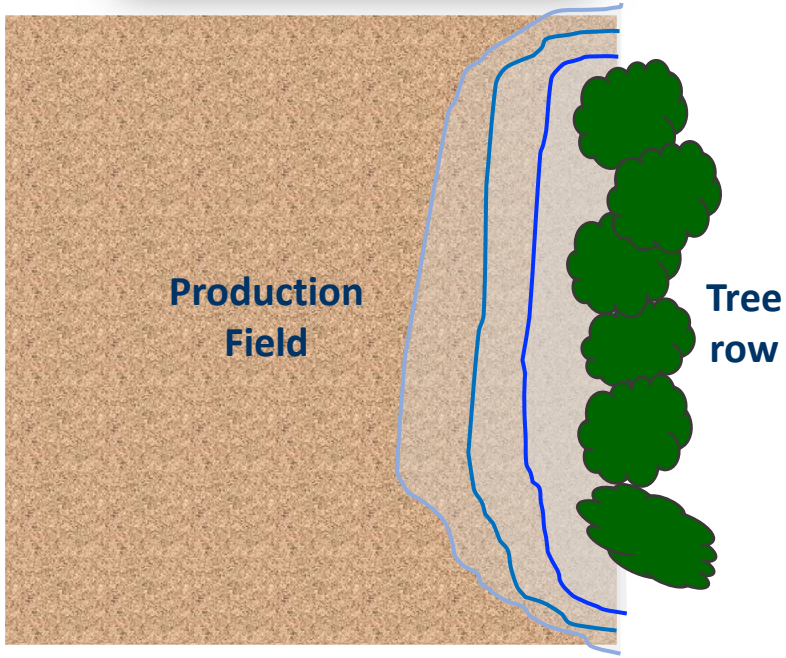
- There exist clear differences in biodiversity and the provision of ecosystem services between field margins and cultivated fields.
- The effect of perennial field margins clearly extends into the production fields, and depends on the tree species present (alder > eucalyptus).



Conclusions

- We need to consider tradeoffs associated with different hedgerow species.
- These findings have important implications for the organization of agricultural landscapes (optimal field size, arrangement).





Acknowledgements

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- **University of Huancayo**
- **And many more…**

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