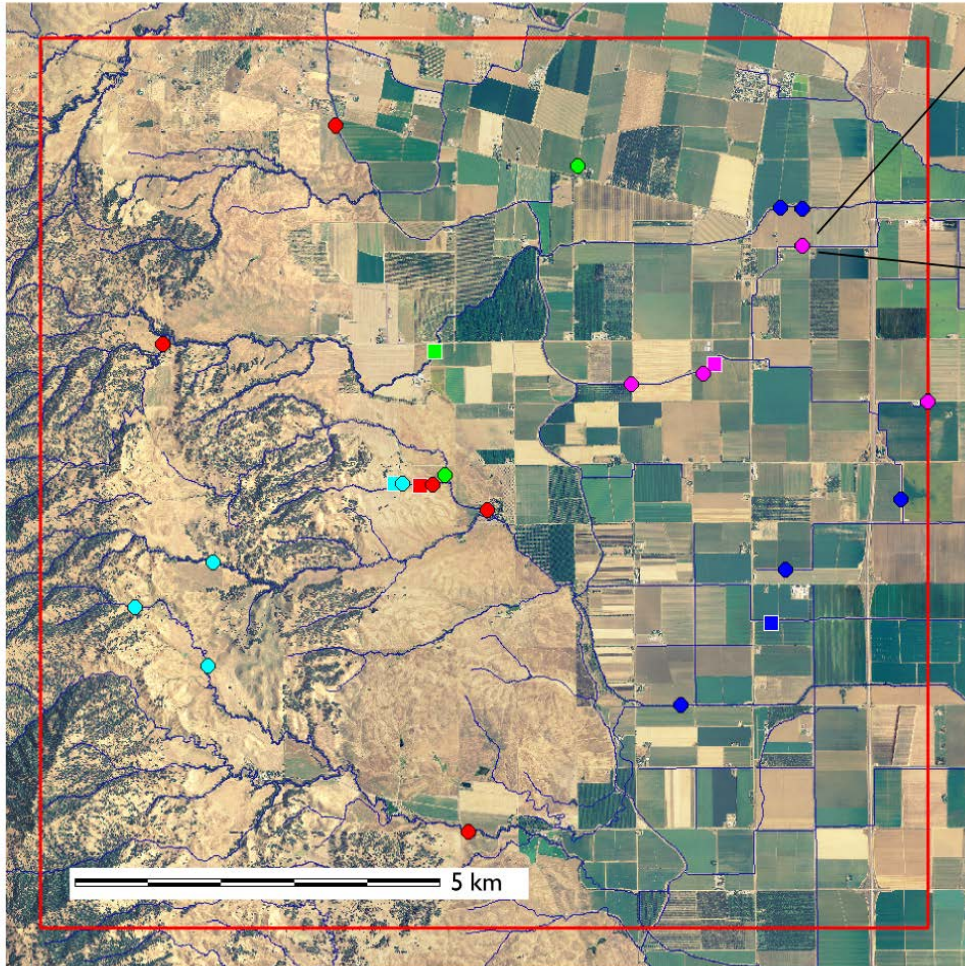# Landscape inventory: biodiversity & ecological function indicators

L. Jackson, S. Culman, A. Young-Mathews, H. Ferris, A. O'Geen and S. Sánchez Moreno
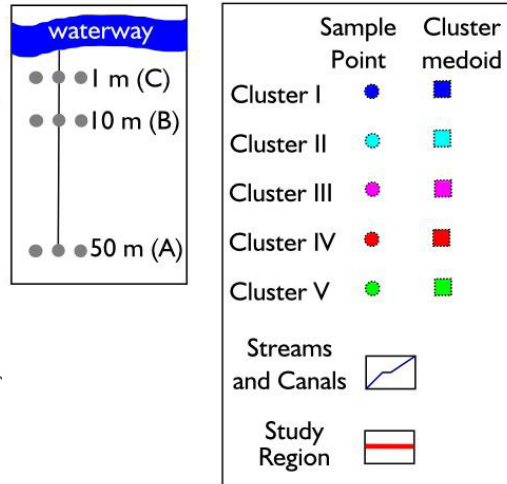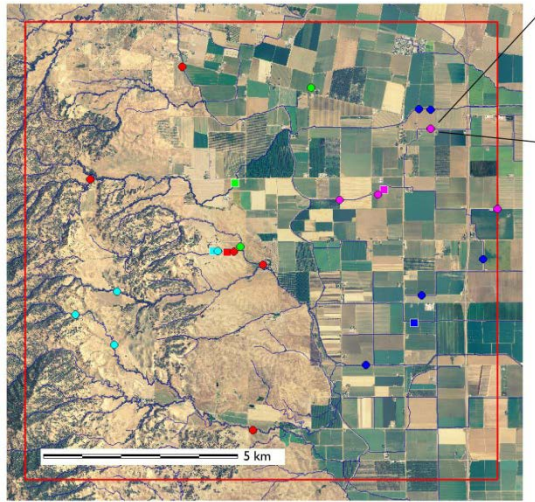UC Davis

- Waterways in a I50 km² landscape in California's Central Valley
- Irrigated row crops to grazed dryland savanna
- GIS analysis to obtain representative data across catchment
- Ecological assessments & farmer interviews (sites shown)
- Agricultural intensification index: non-renewable inputs + landscape complexity at each site

Culman et al. *Landscape Ecol* 2010
Young-Mathews et al. *Agroforestry Systems* 2010

Representative sampling of landscape

waterway
- 1 m (C)
- 10 m (B)
- 50 m (A)

	Sample Point	Cluster medoid
Cluster I	●	■
Cluster II	●	■
Cluster III	●	■
Cluster IV	●	■
Cluster V	●	■
Streams and Canals	⟋	
Study Region		▭

- GIS layers
  - Soil properties
  - Drainage
  - Vegetation
  - Wetlands
  - Land use

- 2050 random points along waterways

- PAM multivariate analysis to cluster points

- Sampling points chosen from each of 5 clusters

Yolo County — CALIFORNIA

Agricultural intensification index for each sampling point:

- Field level
  - Land use type
  - Tilled in last 30 days
  - Tilled in last 2 years
  - Irrigated in last 30 days
  - Planted in last 30 days
  - Organic vs. Conventional
  - Riparian restoration
  - Channel disturbance
  - Riparian health rating

- Landscape level
  - % managed land within 100 m, 500 m or 1000 m radius
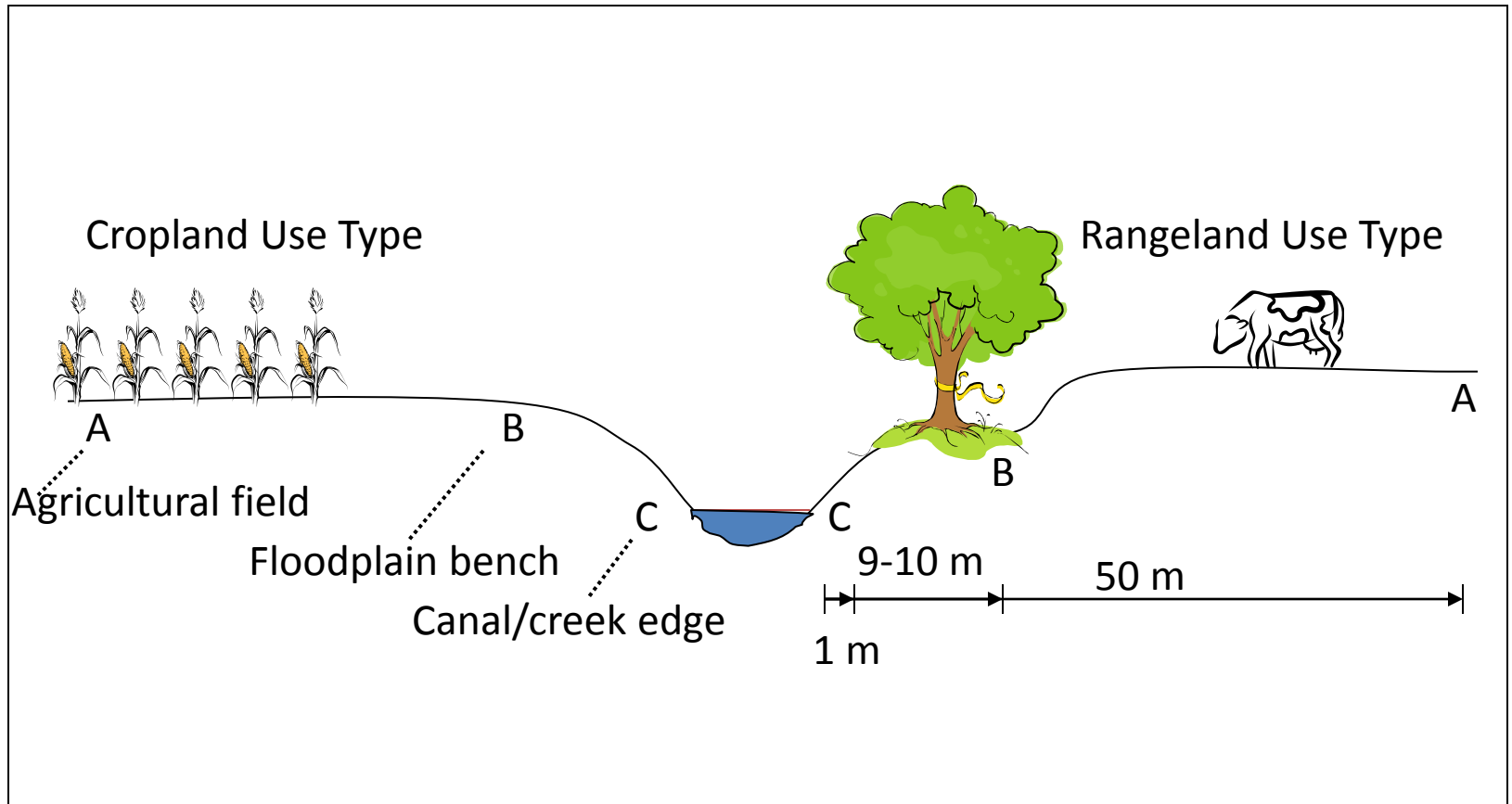 - Number of land use types within 100 m, 500 m or 1000 m

Random points along waterways

Points were classified into 1 of 5 clusters
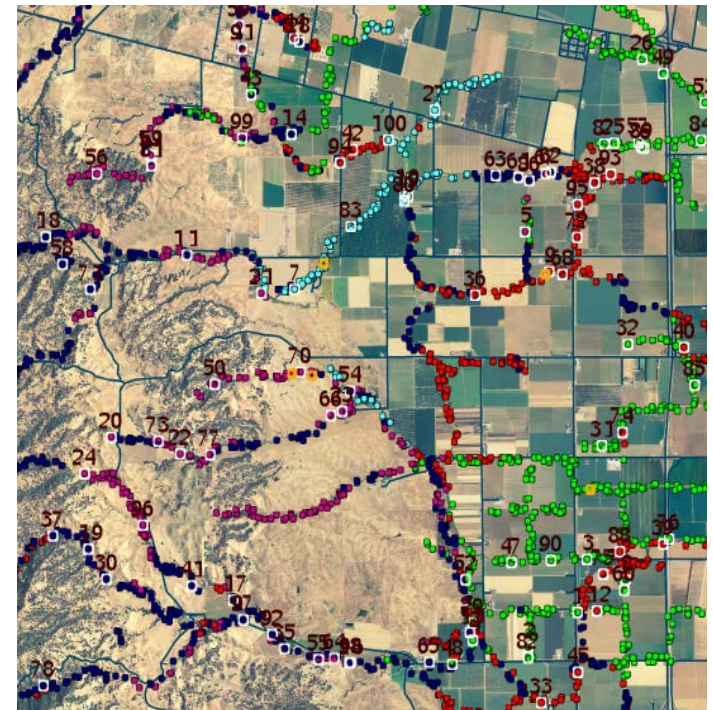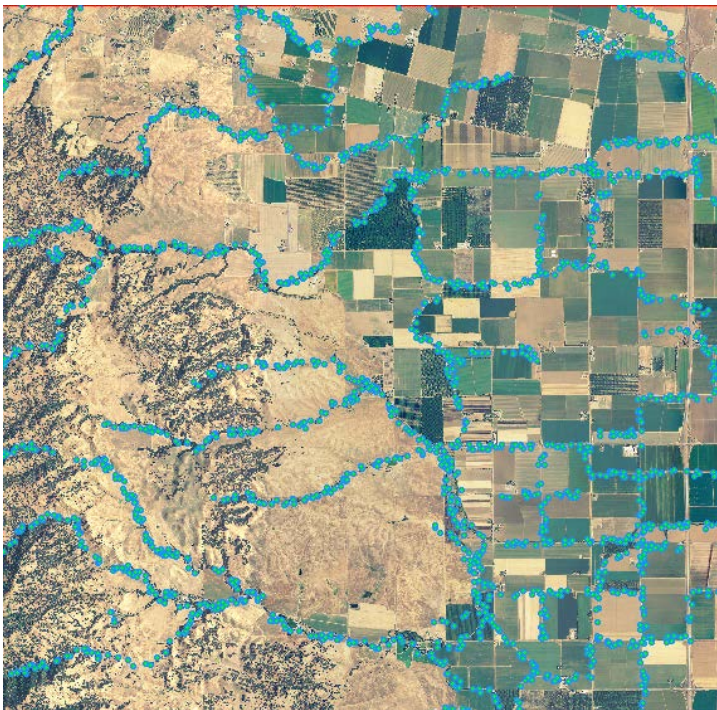
2049 points located 50 m from waterways

Sampling scheme

Sampling methods

Soil Sampling
- 4 depths (0 – 15 cm, 15 – 45 cm, 45 – 75 cm, 75 – 100 cm)
- Soil chemical properties (C, N, NO_3^-, NH_4^+, P, K, cations, texture)
- Soil biota
  - Microbial communities (phospholipid fatty acids)
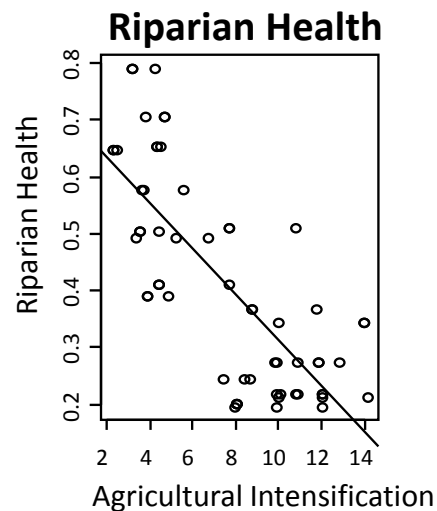 - Nematode communities (soil food web analysis)

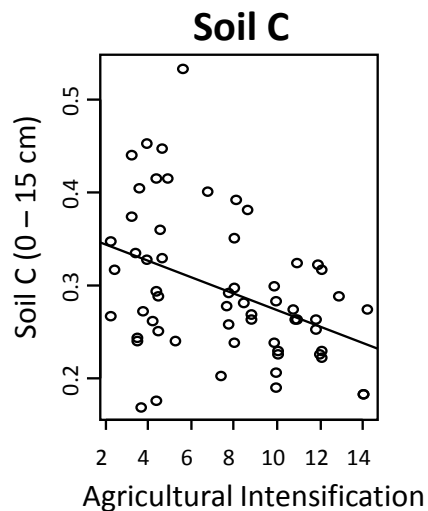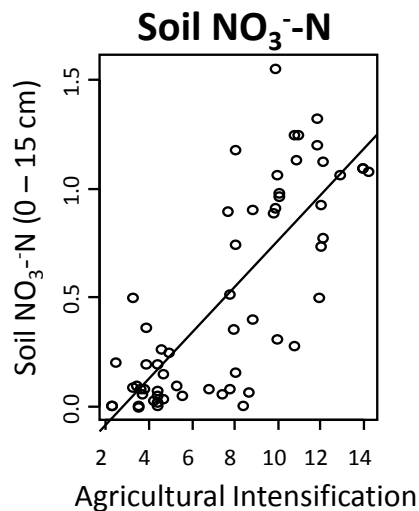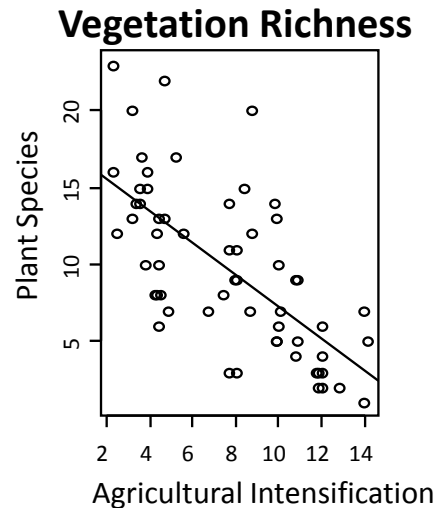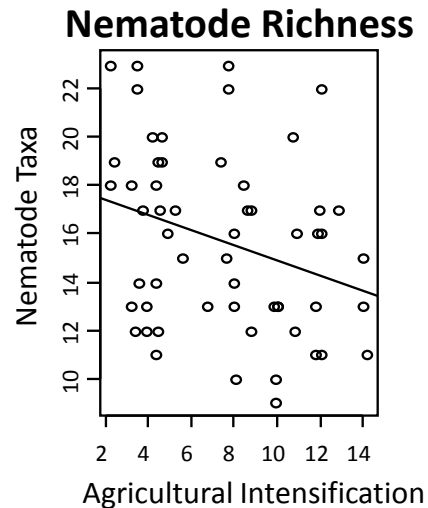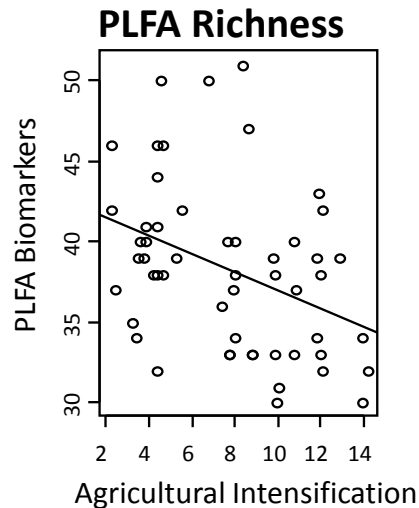**Vegetation Sampling**
- Species count, percent cover and functional group classification
- Woody carbon estimate

Riparian Health Assessment
- Streambank and waterway characterisitics
- Visual quantitative ratings

Biodiversity & indicators of ecosystem services decrease with agricultural intensification

PLFA Richness

Y-axis: PLFA Biomarkers (30, 35, 40, 45, 50)
X-axis: Agricultural Intensification (2, 4, 6, 8, 10, 12, 14)

Nematode Richness

Y-axis: Nematode Taxa (10, 12, 14, 16, 18, 20, 22)
X-axis: Agricultural Intensification (2, 4, 6, 8, 10, 12, 14)

Vegetation Richness

Y-axis: Plant Species (5, 10, 15, 20)
X-axis: Agricultural Intensification (2, 4, 6, 8, 10, 12, 14)

Soil NO_3^--N

Y-axis: Soil NO_3^--N (0 − 15 cm) (0.0, 0.5, 1.0, 1.5)
X-axis: Agricultural Intensification (2, 4, 6, 8, 10, 12, 14)

Soil C

Y-axis: Soil C (0 − 15 cm) (0.2, 0.3, 0.4, 0.5)
X-axis: Agricultural Intensification (2, 4, 6, 8, 10, 12, 14)

Riparian Health

Y-axis: Riparian Health (0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8)
X-axis: Agricultural Intensification (2, 4, 6, 8, 10, 12, 14)

A higher agricultural intensification index was significantly correlated with lower:

- No. of taxa of plants & nematodes
- No. of PLFA biomarkers
- Soil quality indicators
- Riparian health scores
- …but note low number of taxa overall

Note: log scale for NO_3−N and Soil C