

Modelling Rural Land Use in New Zealand

A Discrete Choice Perspective

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Introduction

What? Why? How?

- Model land use decisions on private rural parcels in New Zealand
- Land use decisions are critical for environmental and social outcomes
- Random utility maximization discrete choice model (multinomial logit)

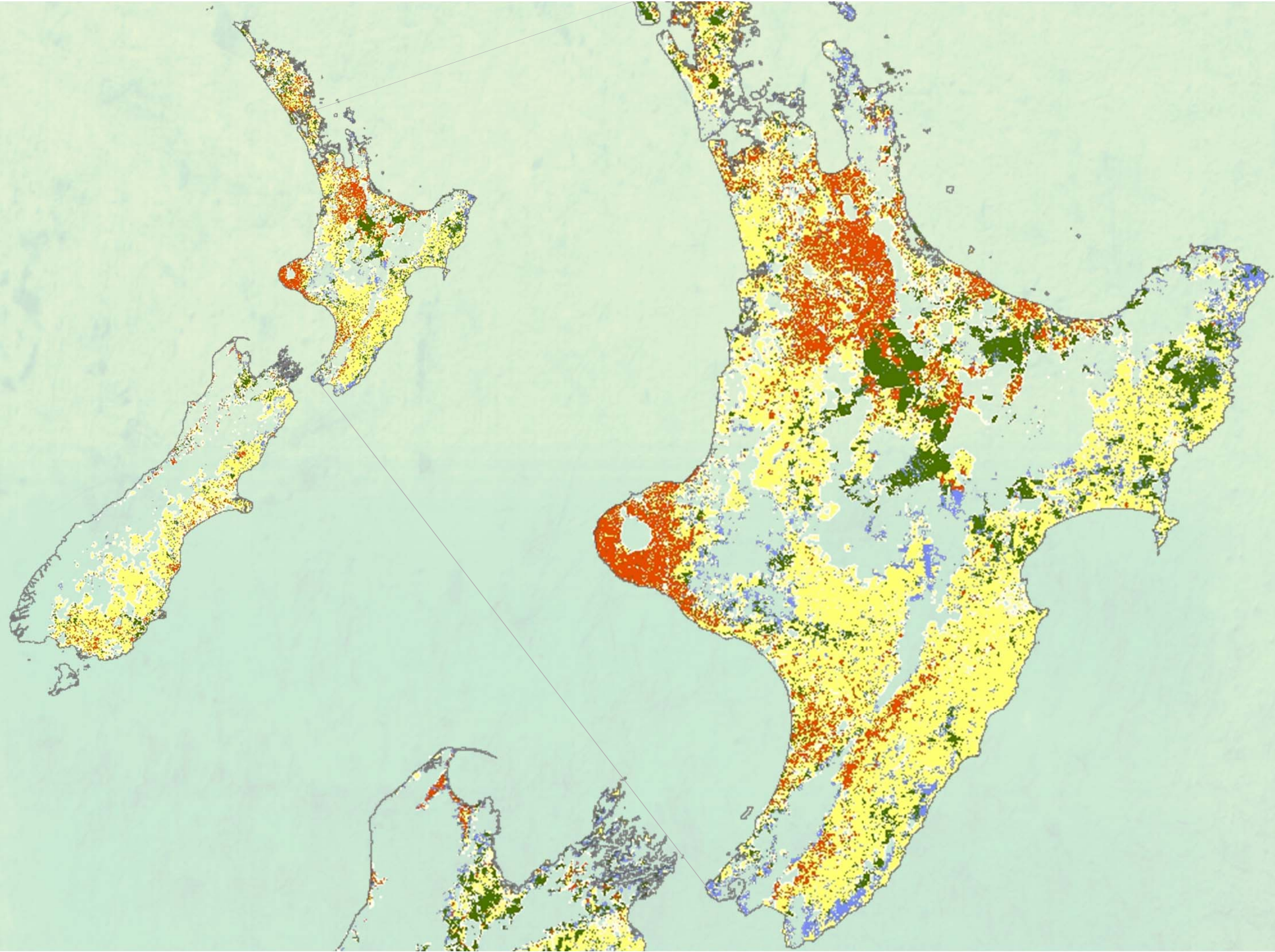


Data

Dependent Variable

- Land Use in 2002
 - Based on maps of land cover, land use, DOC land, ownership
 - Revealed preferences of landowners on private rural farms
 - 25-hectare cells
 - Choice set: dairy farming, sheep or beef farming, plantation forestry, scrub





Data

Explanatory Variables

- Geophysical land attributes
 - Slope
 - LUC class (rock type, soil type, slope, erosion severity)
 - Pasture productivity index (growing degree days, soil moisture deficit, soil particle size)



Data

Explanatory Variables

- Land governance (Maori status)
- Locational attributes
 - Distance to processing facilities
 - Distance to nearest supermarket
- Profitability
 - Mean regional profits
 - Mean regional revenue



Behavioural Model

- Profit (utility) maximizing farmers

$$R_{ij} > R_{ik} \quad \forall j \neq k$$

$$R_{ij} = V_{ij} + \varepsilon_{ij}$$

$$V_{ij} = \alpha_j + \beta_j' X_i + \gamma_j \Pi_{jr} + \delta_j \Pi_{jr} X_i + \varepsilon_{ij}$$

- Strategies to address potential spatial autocorrelation in error term



Estimation Results (t-statistics)

Variable	Dairy	Sheep-beef	Forestry
Slope	-0.2072 (-122.74)	-0.0633 (-71.35)	-0.0497 (-43.86)
LUC class	-0.6386 (-95.84)	-0.4354 (-76.96)	-0.0717 (-10.30)
Pastoral productivity	1.9360 (71.90)	-1.2985 (-73.32)	0.0590 (2.54)
Maori status	-1.8203 (-38.02)	-1.1395 (-47.11)	-0.0793 (-2.99)
Distance - facility (own)	-0.0231 (-99.16)	-0.0027 (-15.95)	-0.0307 (-53.82)
Distance - market	-0.0150 (-17.87)	0.0008 (1.55)	0.0121 (15.91)
Mean profit (own)	0.3596 (17.47)	0.5271 (28.29)	-0.0082 (-17.11)
Constant	2.9889 (33.99)	6.4691 (169.55)	2.0889 (42.95)

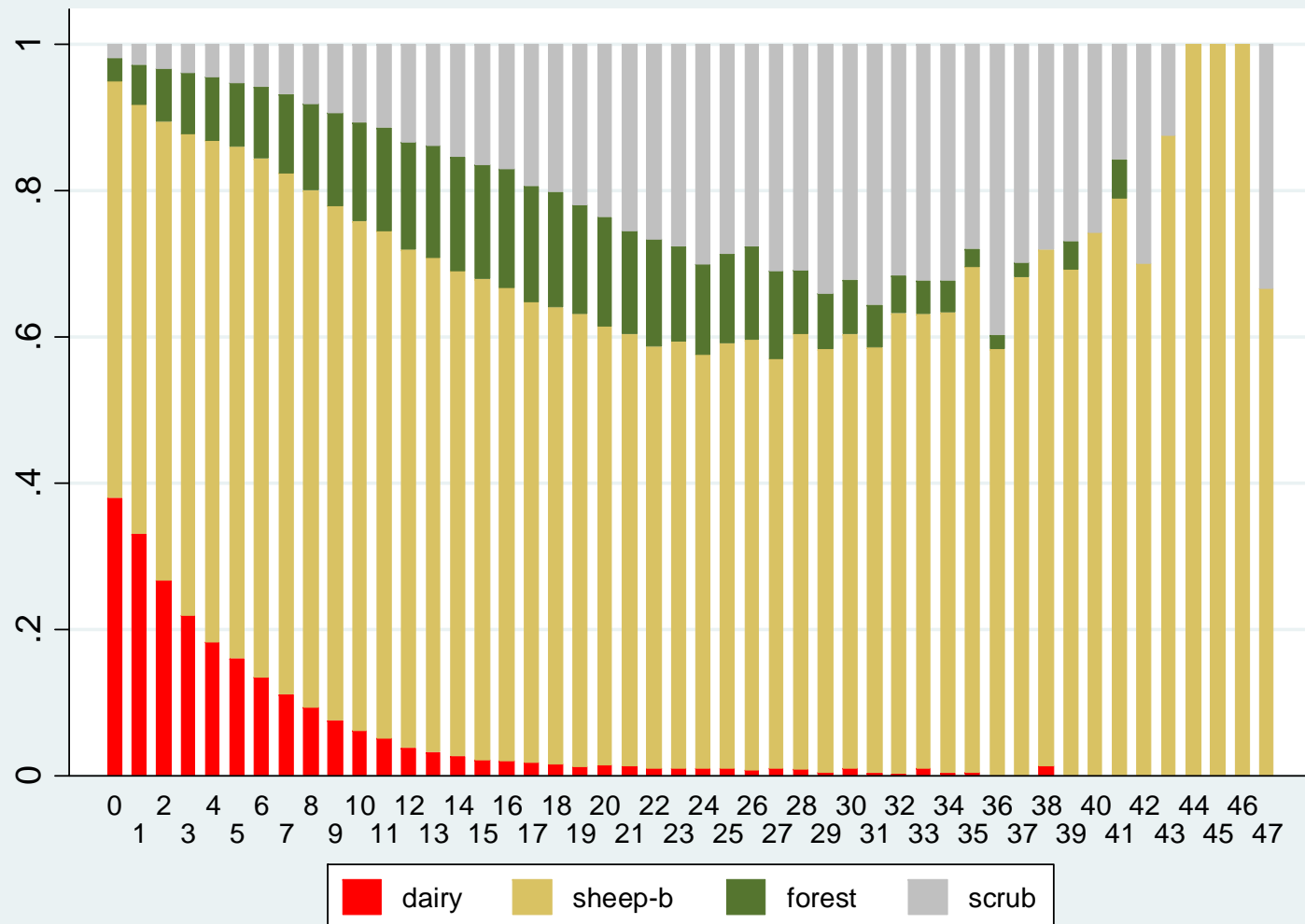


Evaluation

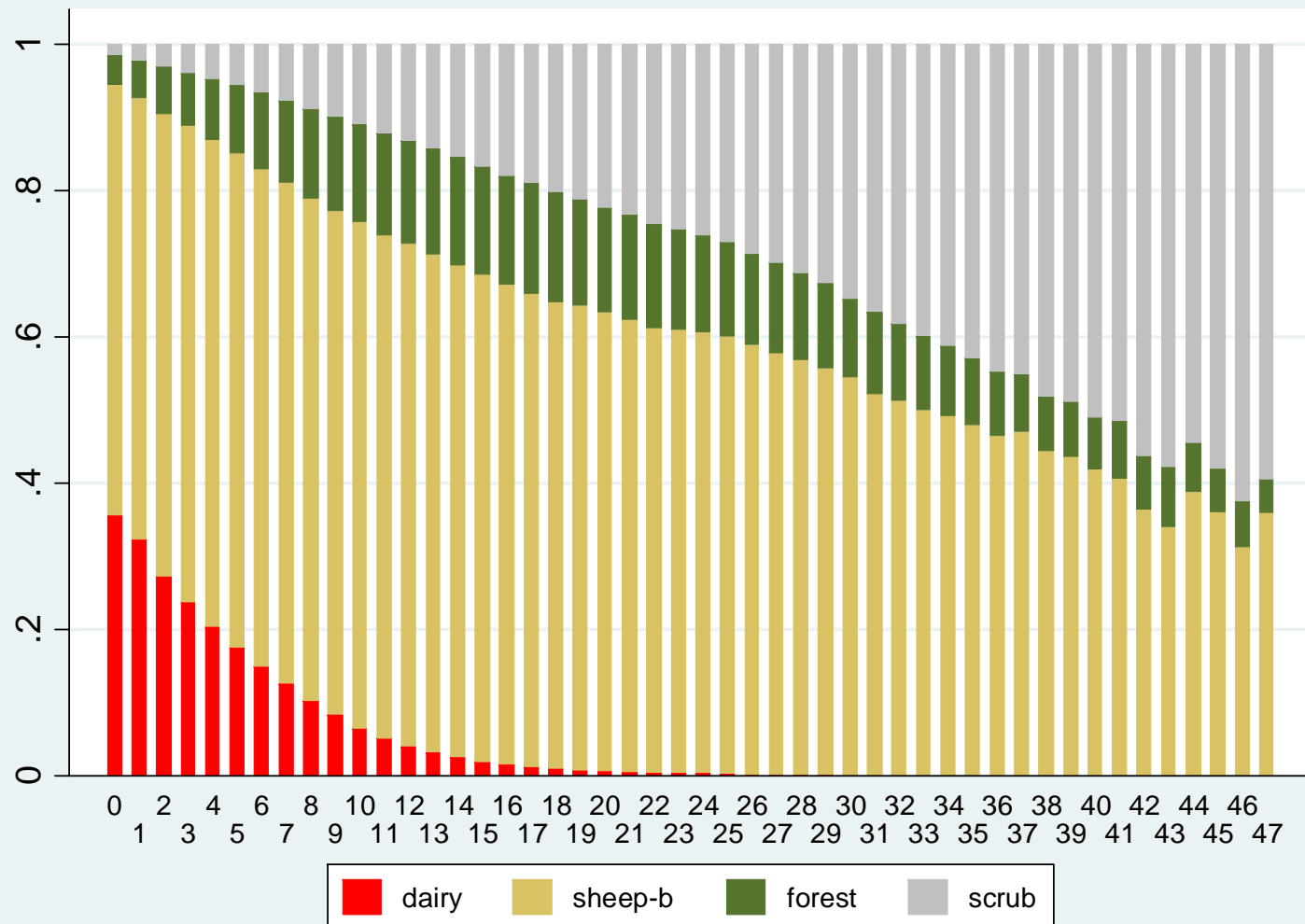
- Estimates robust to model specification and systematic spatial subsampling, but...
- How well does the model fit the data?
- Assess predictions (subjectively) by comparing observed and predicted distribution of land uses
 - across explanatory variables
 - across geographic regions
 - across probability categories



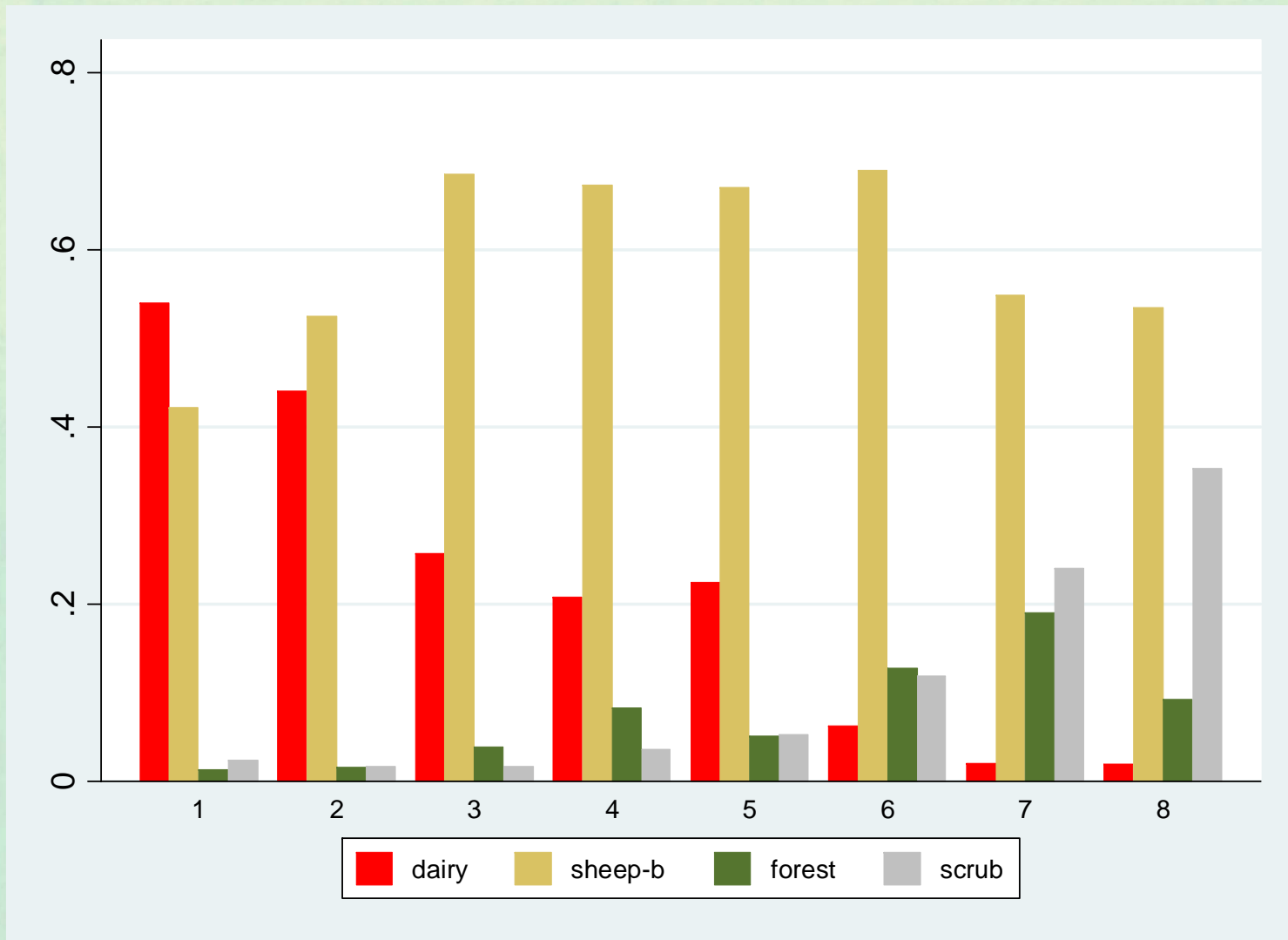
Observed distribution by slope class



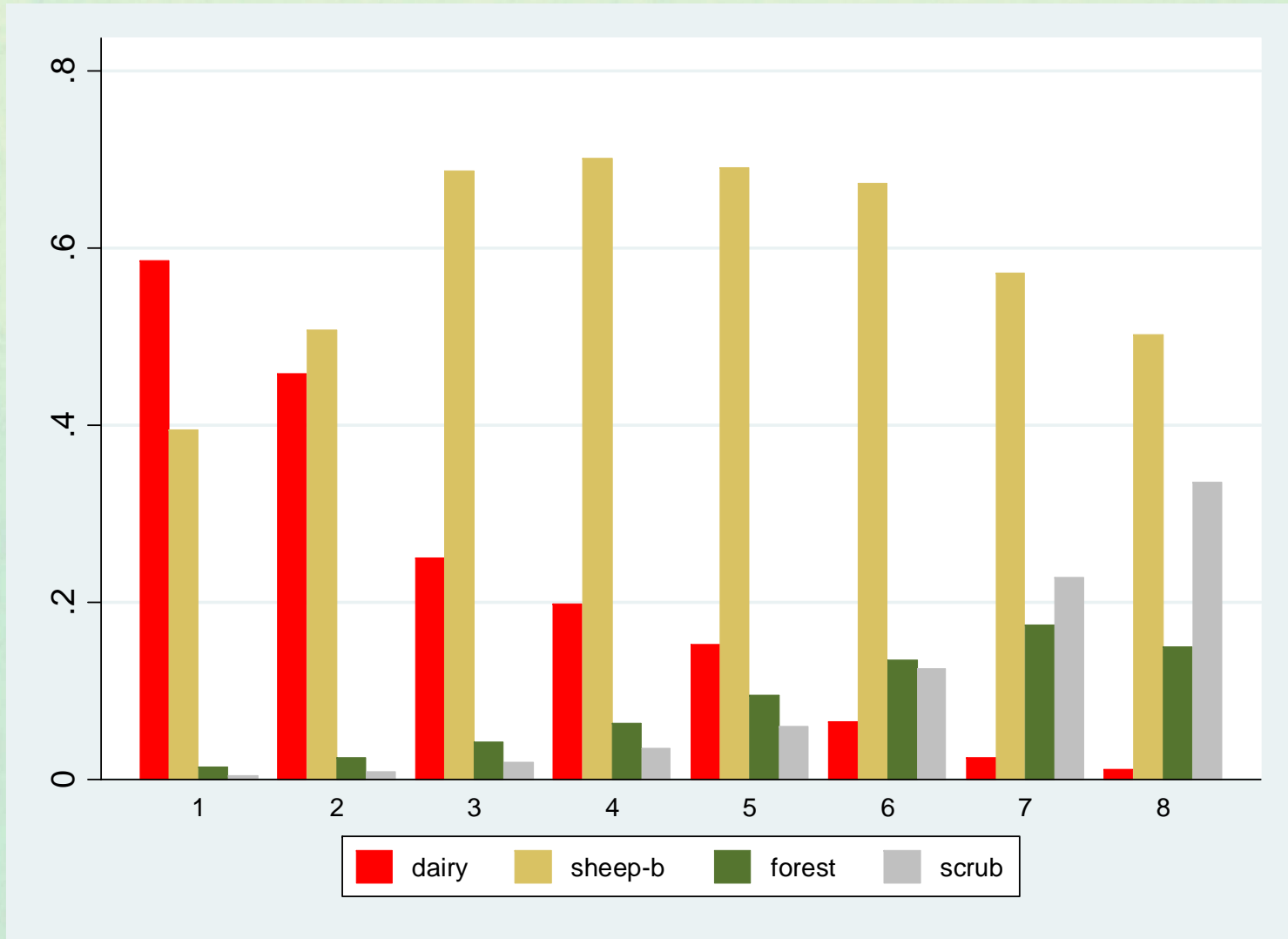
Predicted distribution by slope class



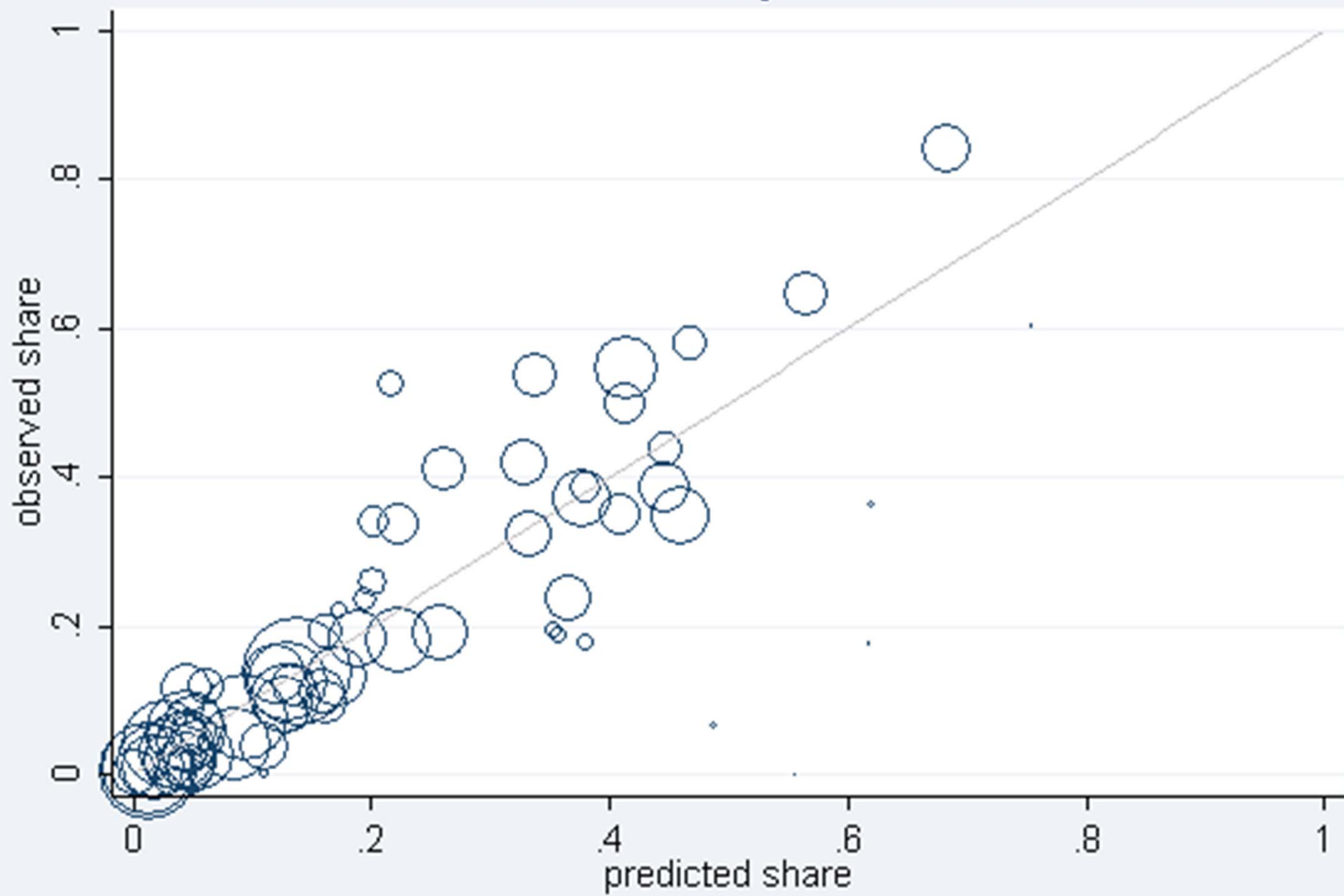
Observed distribution by LUC class



Predicted distribution by LUC class

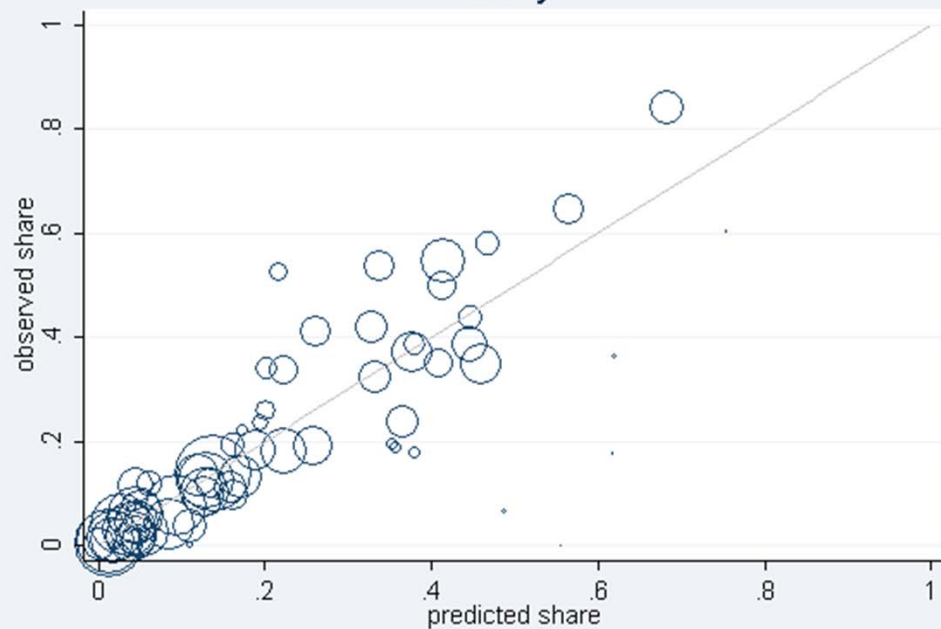


Dairy

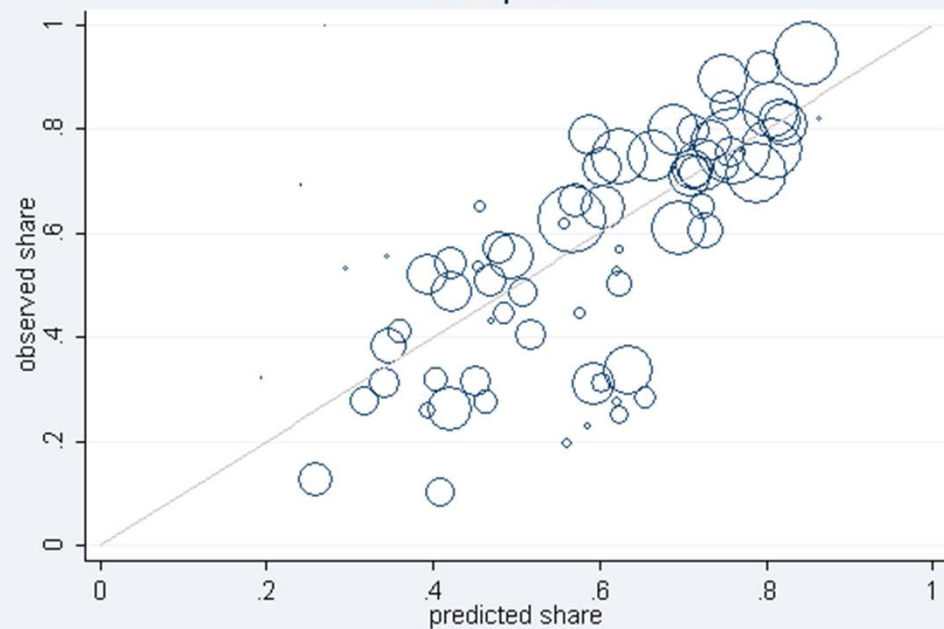




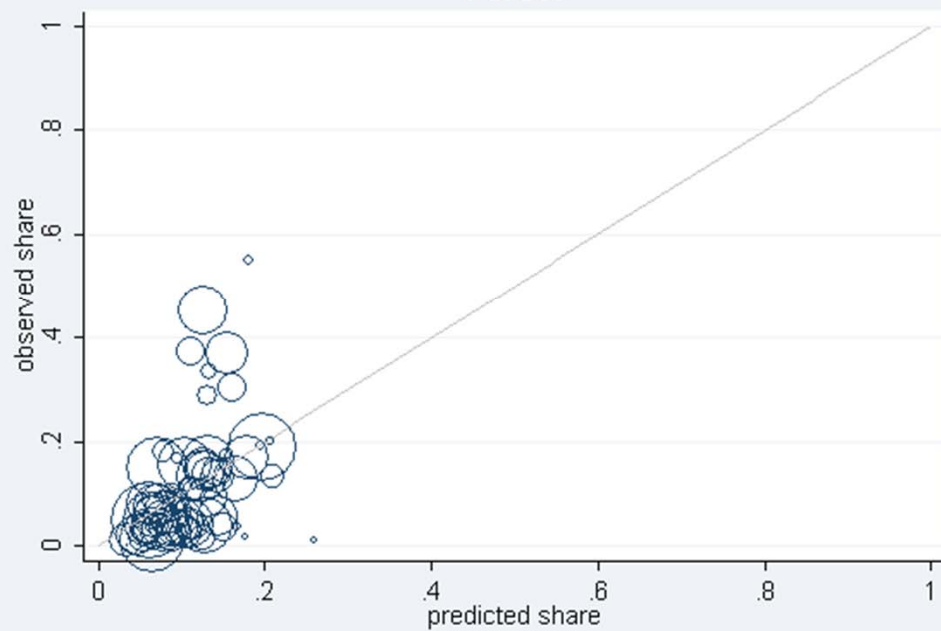
Dairy



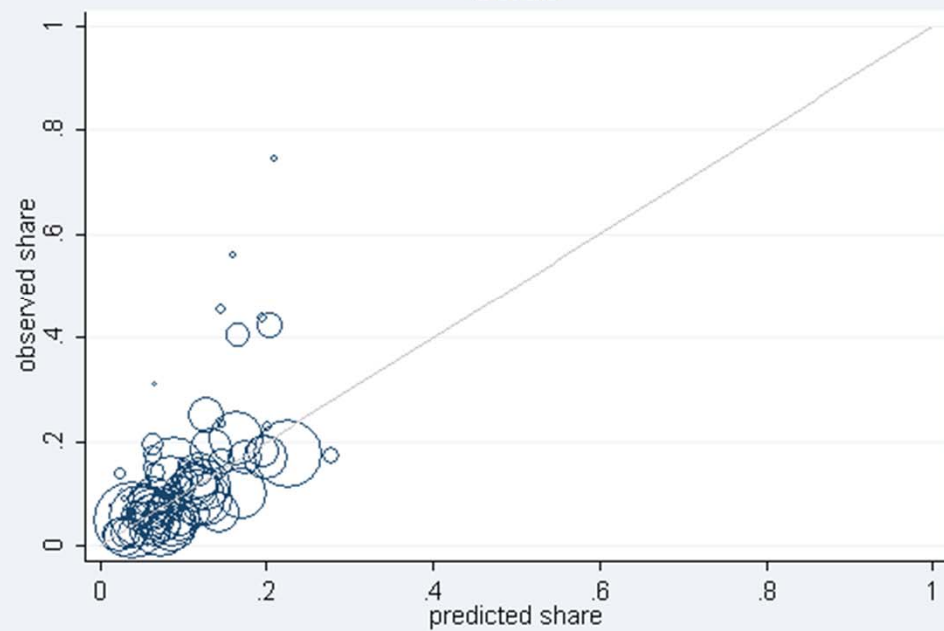
Sheep-Beef



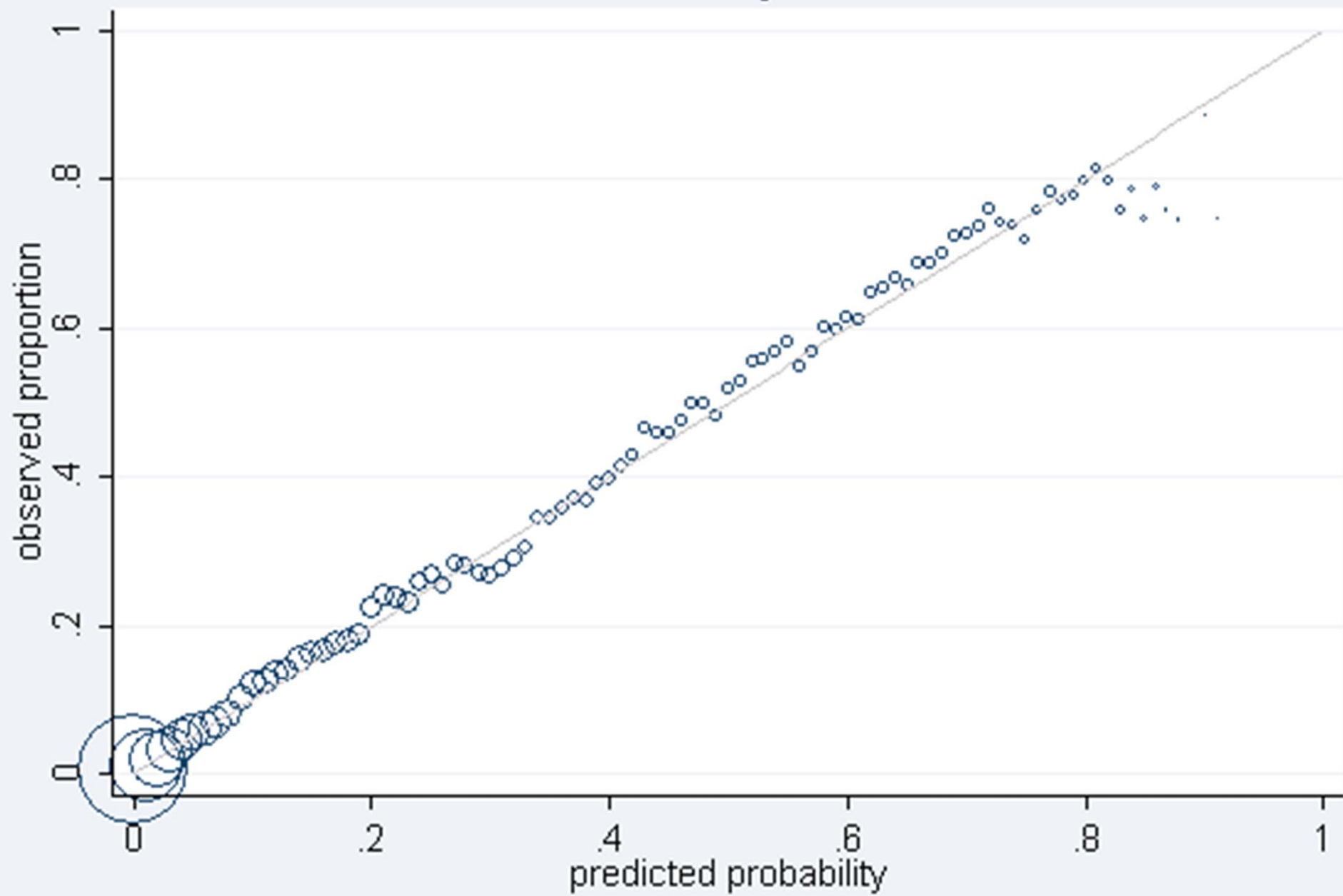
Forest



Scrub

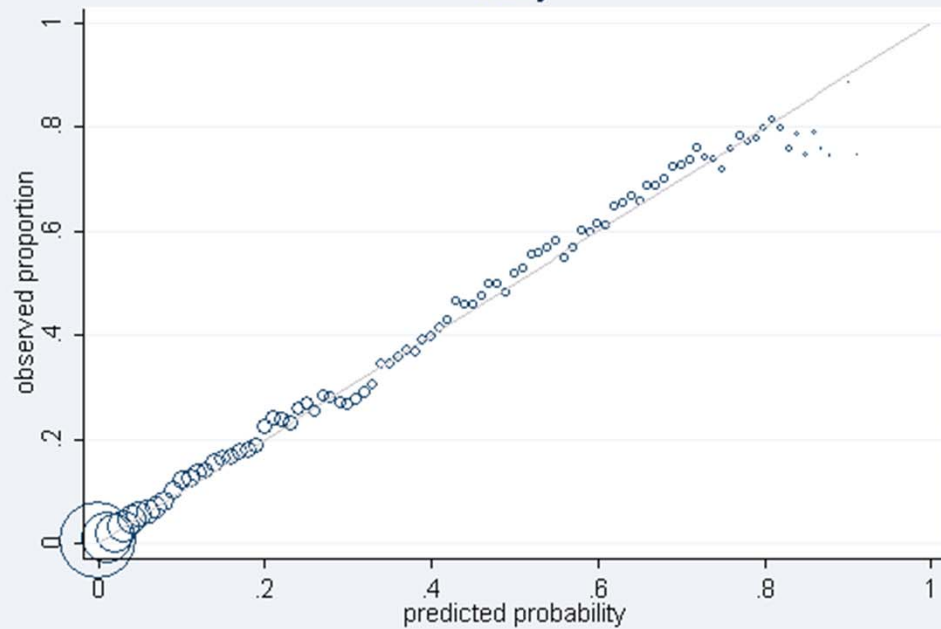


Dairy

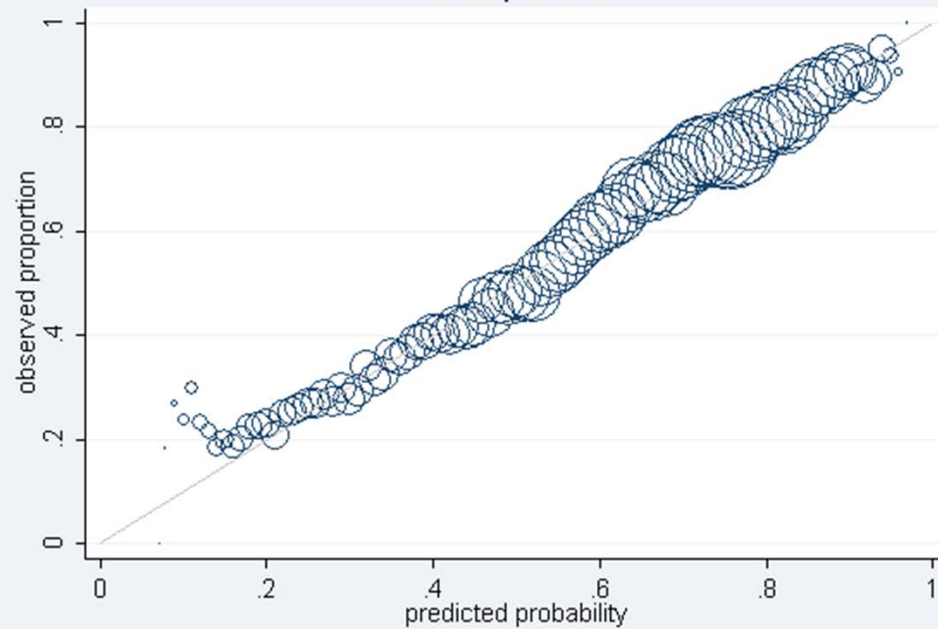




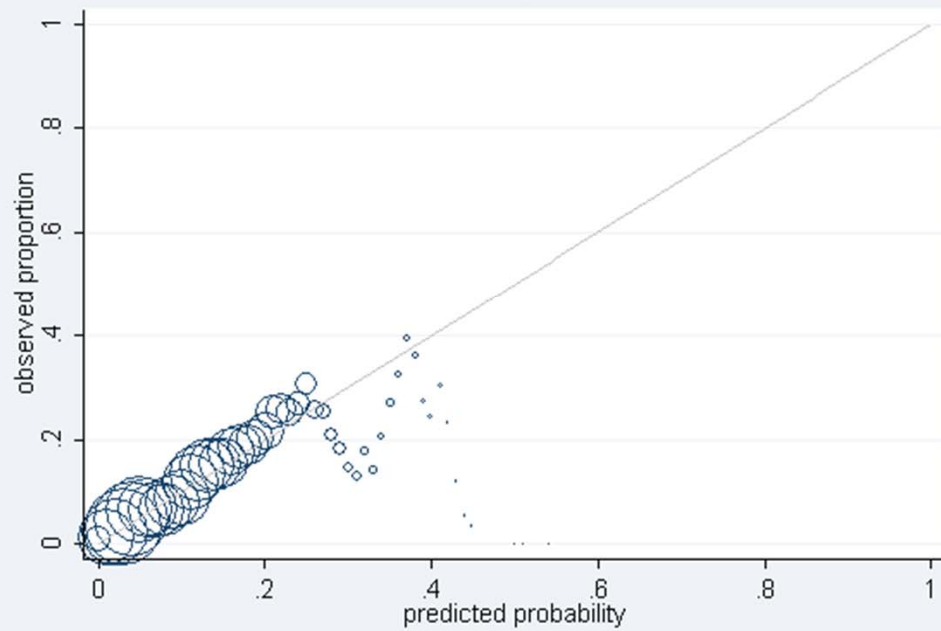
Dairy



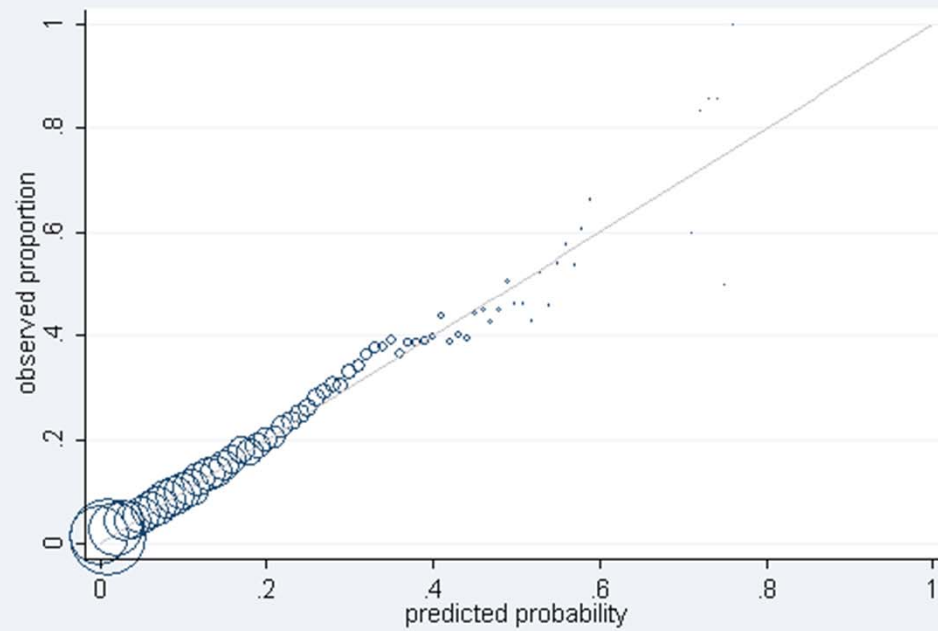
Sheep-Beef



Forest



Scrub



Concluding Remarks

- First DC rural land use model for NZ
- Results confirm expectations as to how underlying factors affect land use
- Poorest predictions across geographic regions – historical reasons, spatial effects?
- These are likely small-scale, as results are robust to systematic spatial subsampling



