# Pattern to Process: Research and Applications for Understanding Multiple Interactions and Feedbacks on Land Cover Change
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## Subproject: Land Cover Patterns and Avian Biodiversity in Southern Costa Rica: General Model or Unique Case?
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**OBJECTIVES OF SUBPROJECT:**

1. To develop statistical models to predict how land-cover composition and arrangement in southern Costa Rica (Coto Brus) affect total bird species richness and the richness of subgroups of birds of particular interest.

2. To test the general applicability of the models by generating bird species richness predictions for central Costa Rica (Monteverde) and comparing these predictions with actual richness values determined from on-the-ground sampling.


Blue-Crowned Motmot
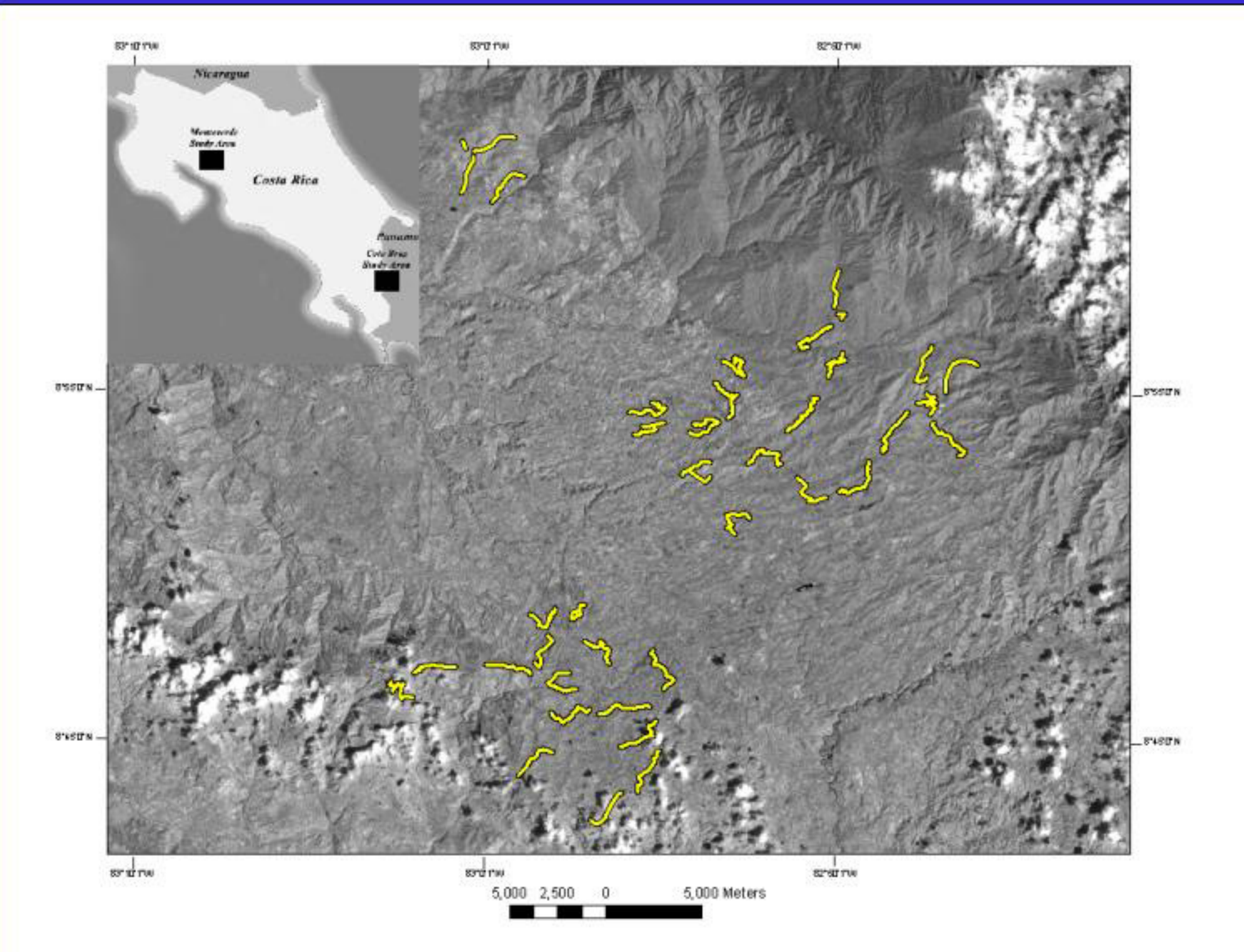



Coto Brus sampling routes

**STUDY SITES:**

Coto Brus and Monteverde are mountainous areas between 1,000 and 1,700 m in elevation. Primary land covers are forest, pasture, and coffee.

**WORK TO DATE:**

1. Sampling of bird species along 37 3-km routes in Coto Brus and 8 3-km routes in Monteverde.

2. Estimation of total bird species richness per route using software CAPTURE.

3. Enumeration of three groups of birds for each route:
   a. Species of the family Emberizidae, many of which inhabit agricultural and young second-growth land covers.
   b. Species of the families Thamnophilidae and Formicariidae, the antbirds, the majority of which are restricted to old second-growth or mature forest land covers.
   c. Neotropical migrant species. Many Neotropical migrant species are of conservation concern.
4. Development of land-cover classification using Landsat ETM+ imagery. The primary land-cover classes, verified by ground observations, are forest, 0-1 m non-woody (pasture), 1-2 m woody (coffee and early second growth), and 2-5 m woody (coffee and older second growth).

5. Quantification of proportions of different land-cover classes within 60, 120, and 240 m buffers around each of the routes and generation of a land-cover diversity index for each buffer. We have also generated a measure of the degree of landscape fragmentation by determining the length of edge between land covers per unit area for each buffer.

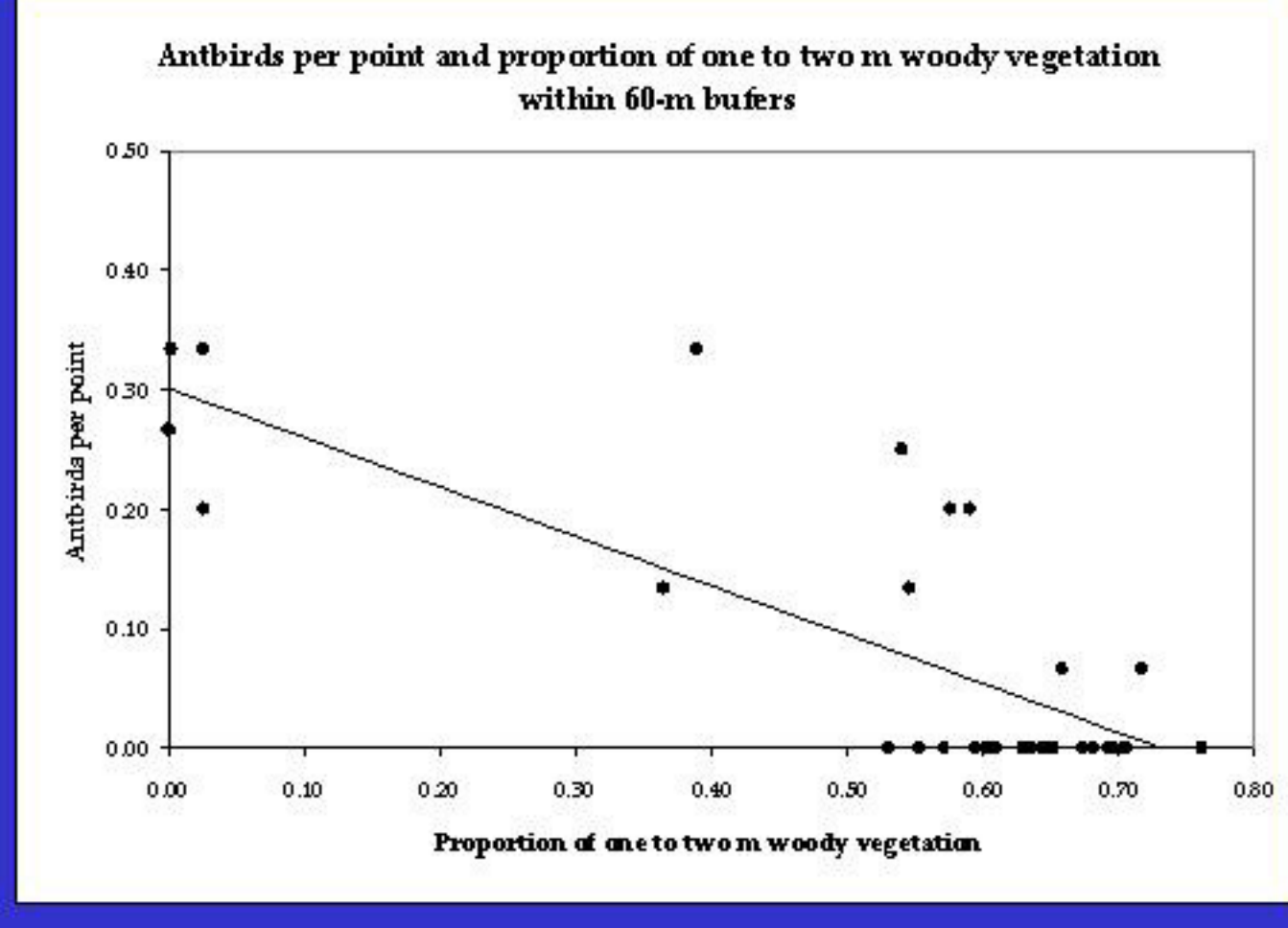**Preliminary regression models using the above variables within the 60 m buffers as predictors show:**

a. Total species richness is negatively related to proportion of pasture (28% of the variation) and positively related to land-cover diversity (27% of the variation).

b. Emberizid richness is negatively related to proportion of forest (59% of the variation).

c. Antbird richness is negatively related to proportion of 1-2 m woody growth (64% of the variation).

d. Migrant richness is not related to any of the variables above.
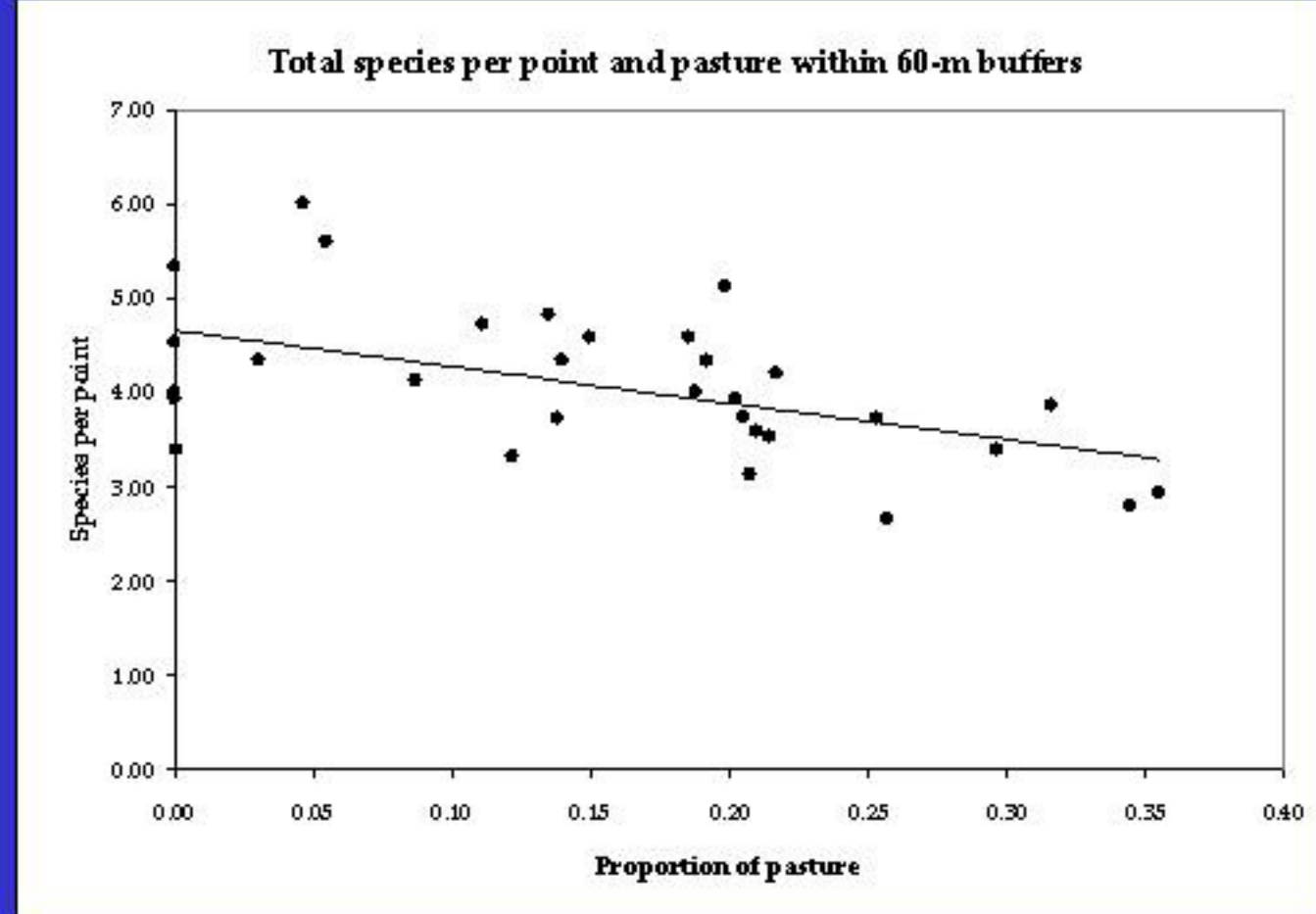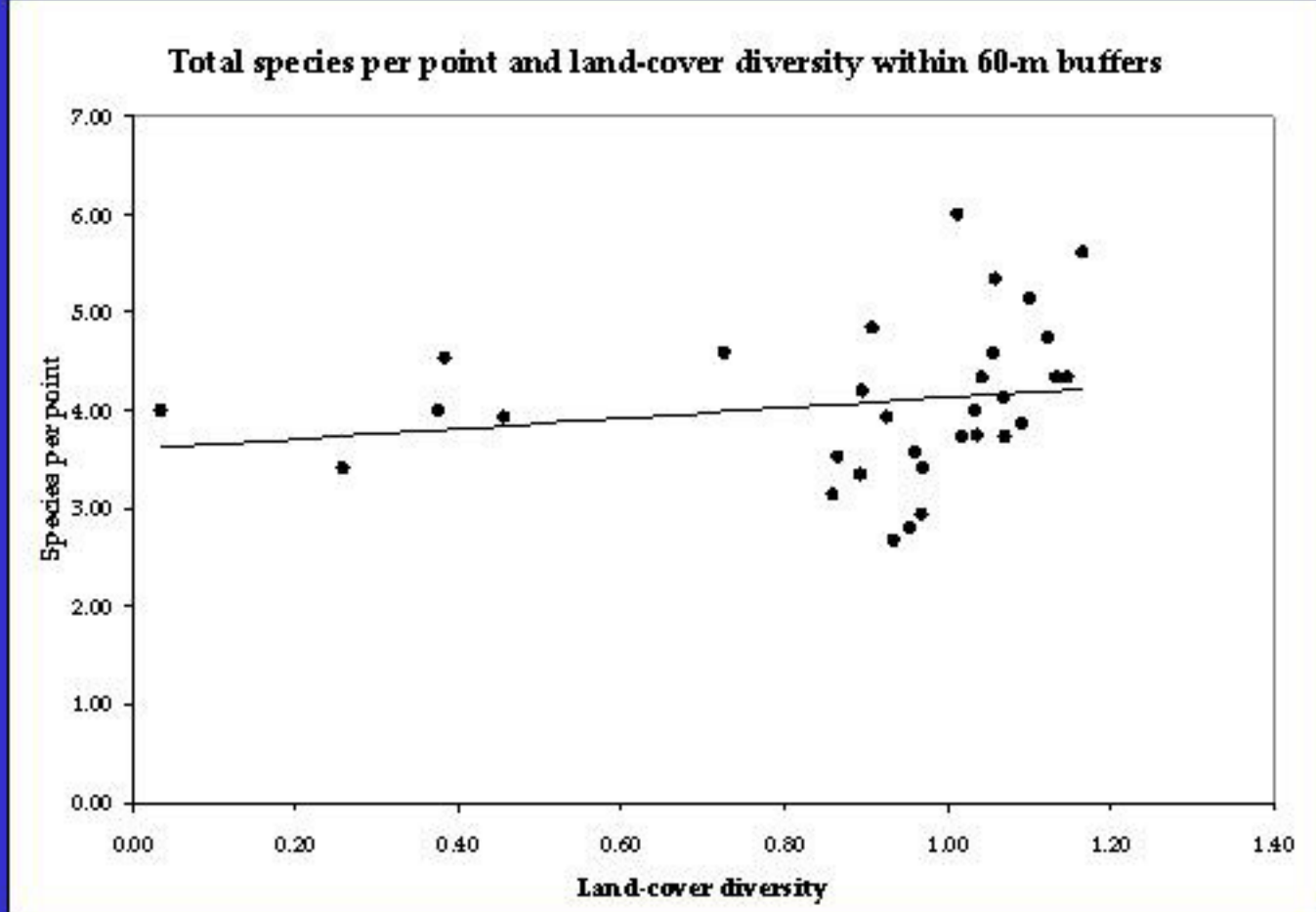



Bay-headed Tanager
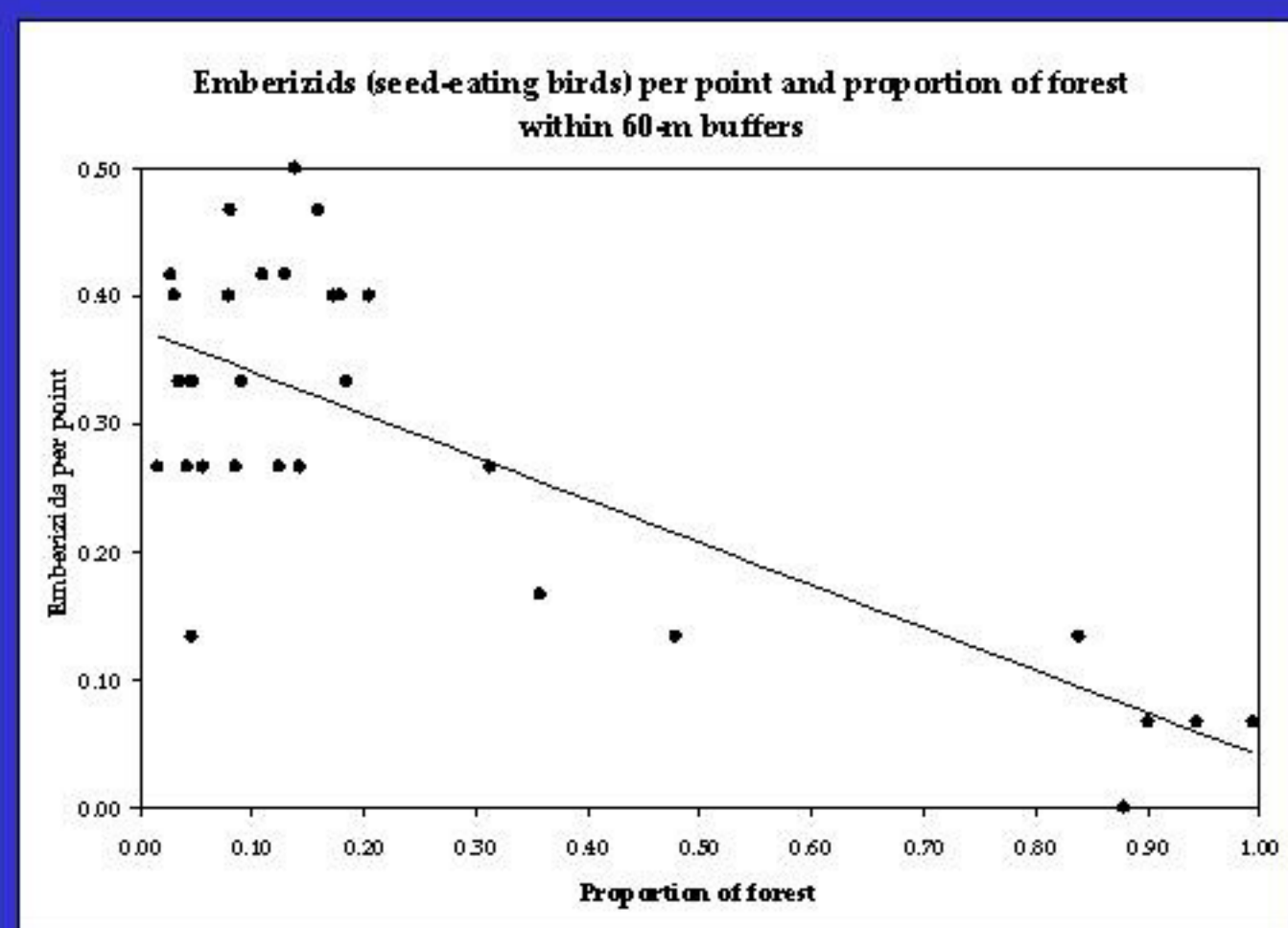



Bicolored Antbird

**Preliminary regression models using the above variables within the 240 m buffer as predictors show:**

a. Total species richness is negatively related to proportion of pasture (28% of the variation) and positively related to land-cover diversity (29% of the variation).

b. Emberizid richness is negatively related to proportion of forest (61% of the variation).

c. Antbird richness is negatively related to proportion of pasture (73% of the variation).

d. Migrant richness is not related to any of the variables above.
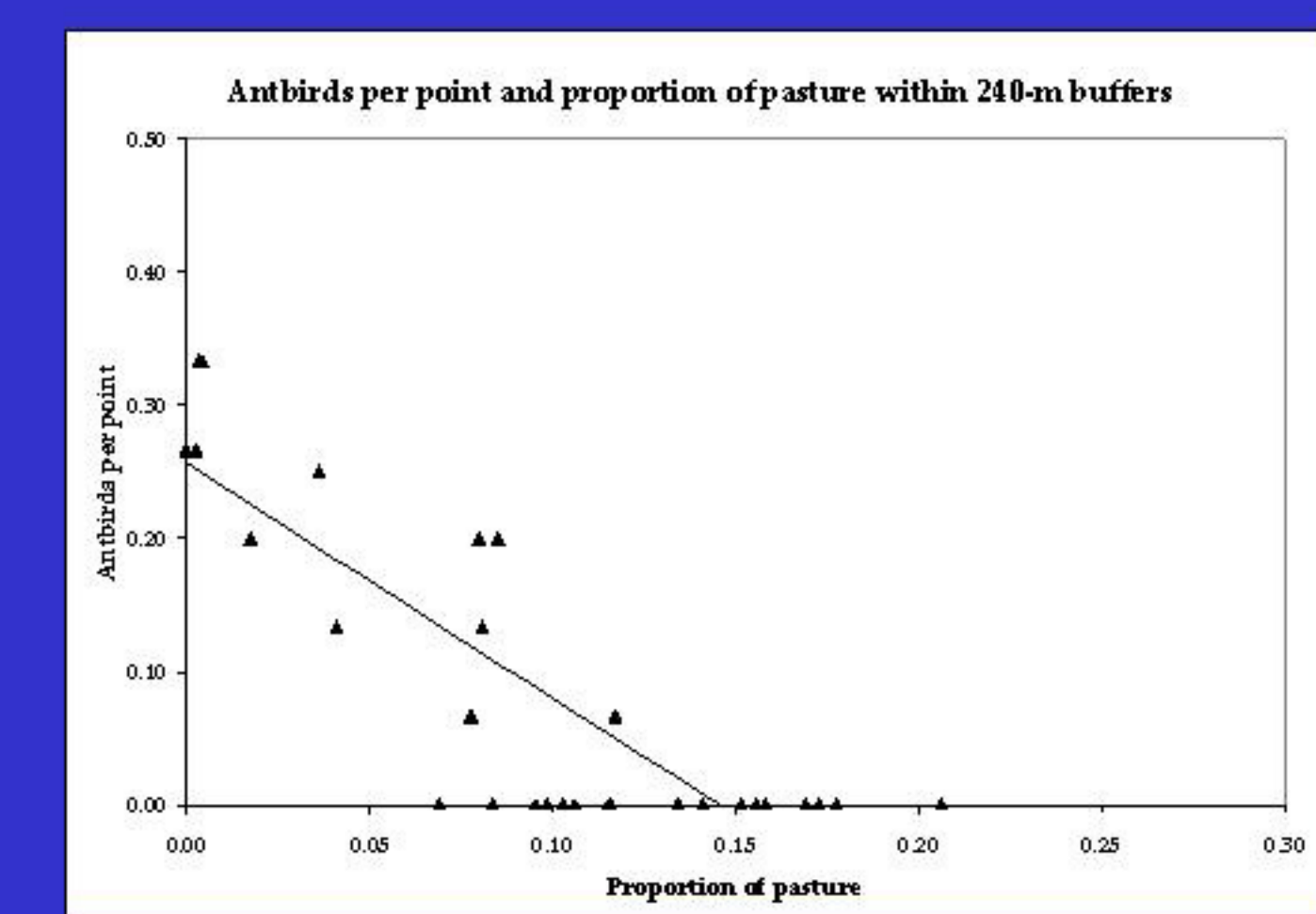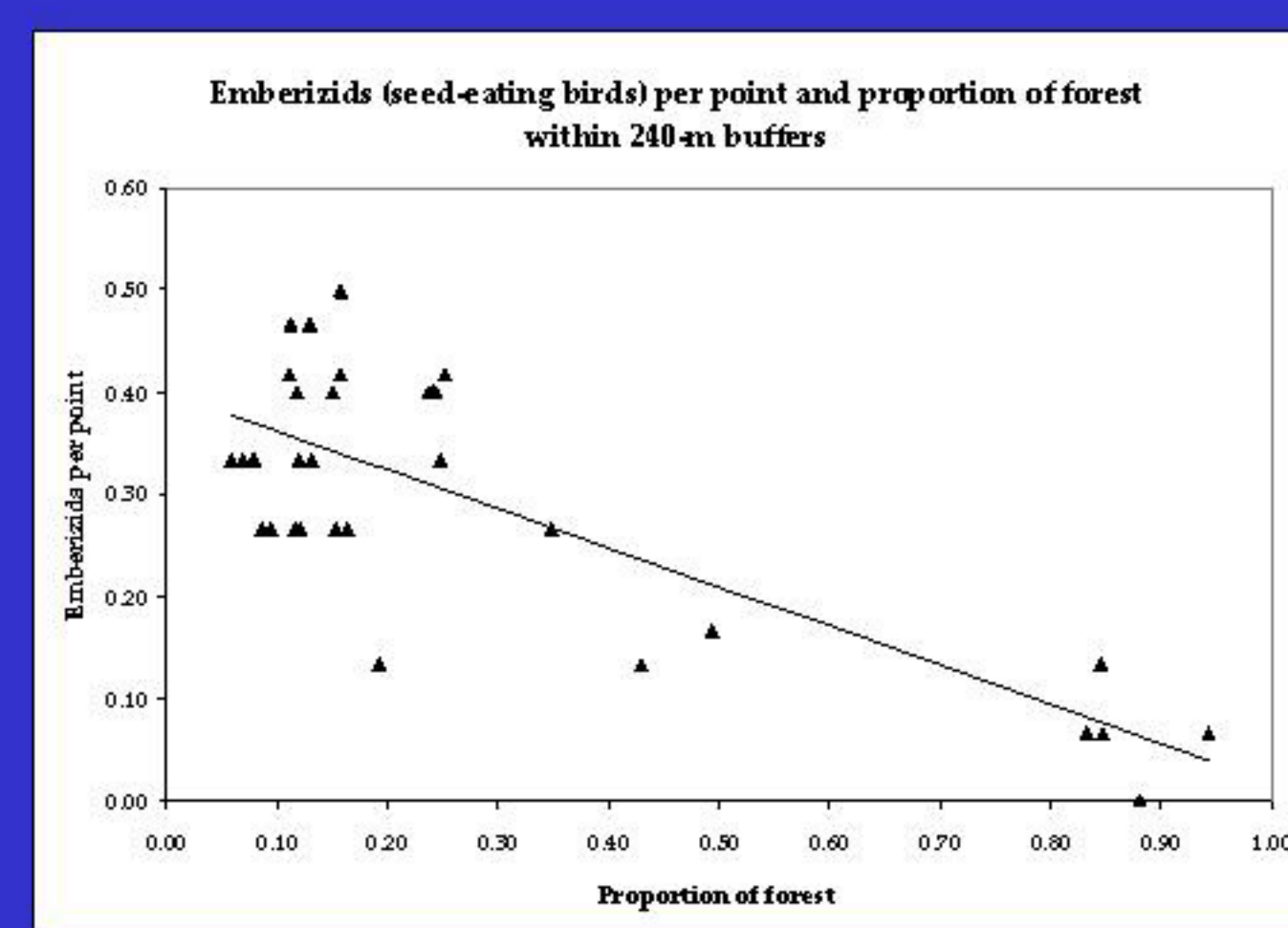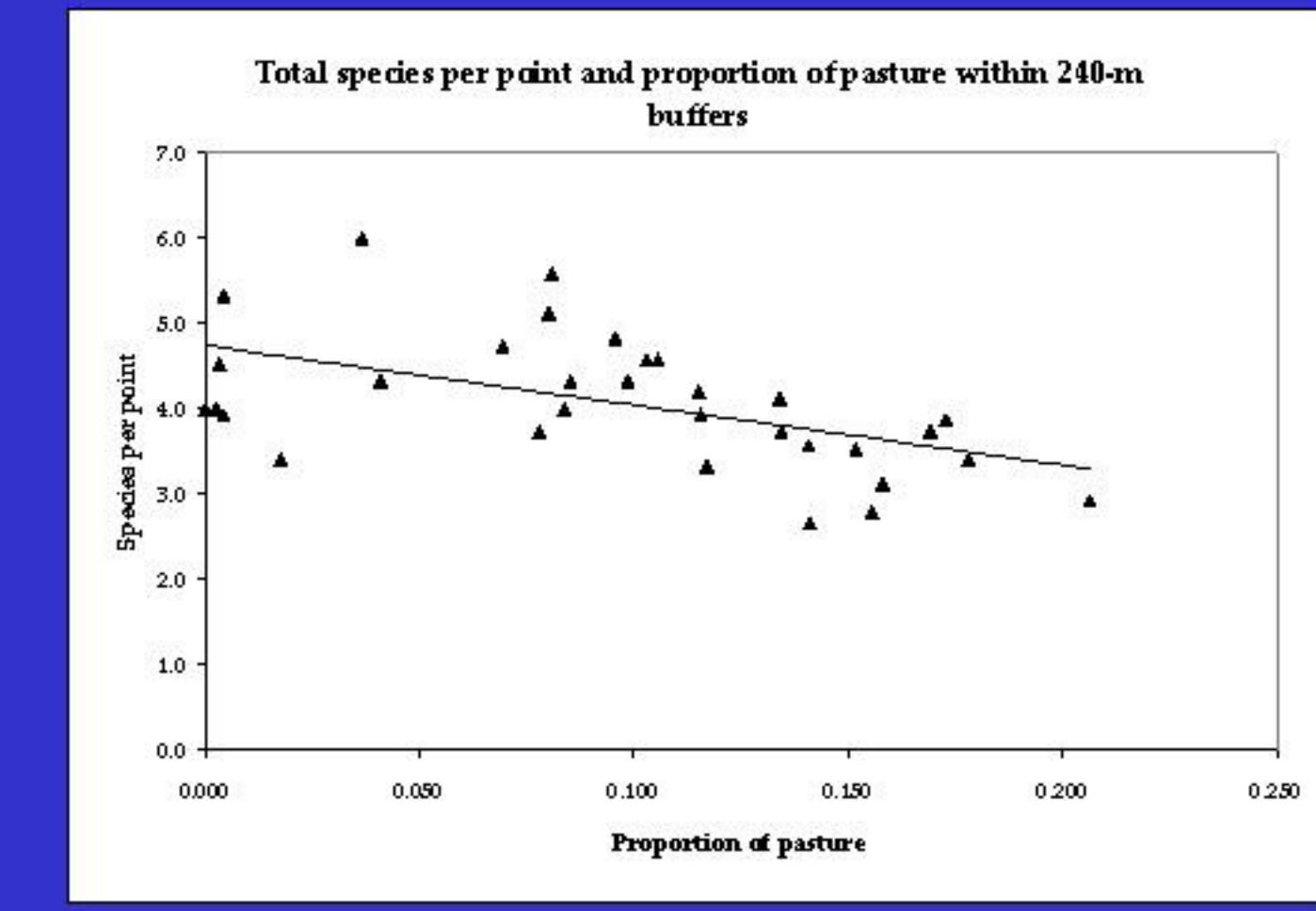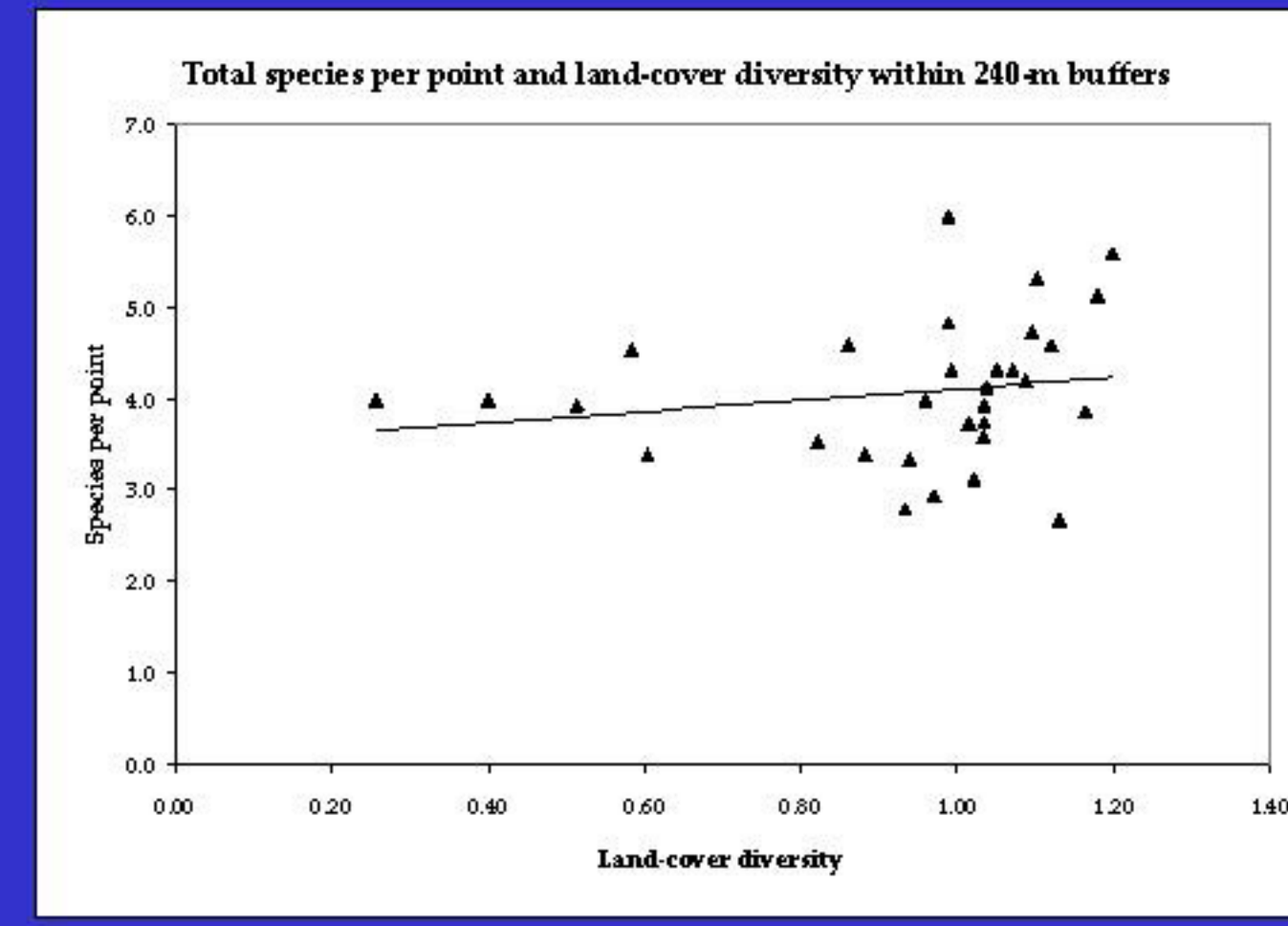



Little Hermit
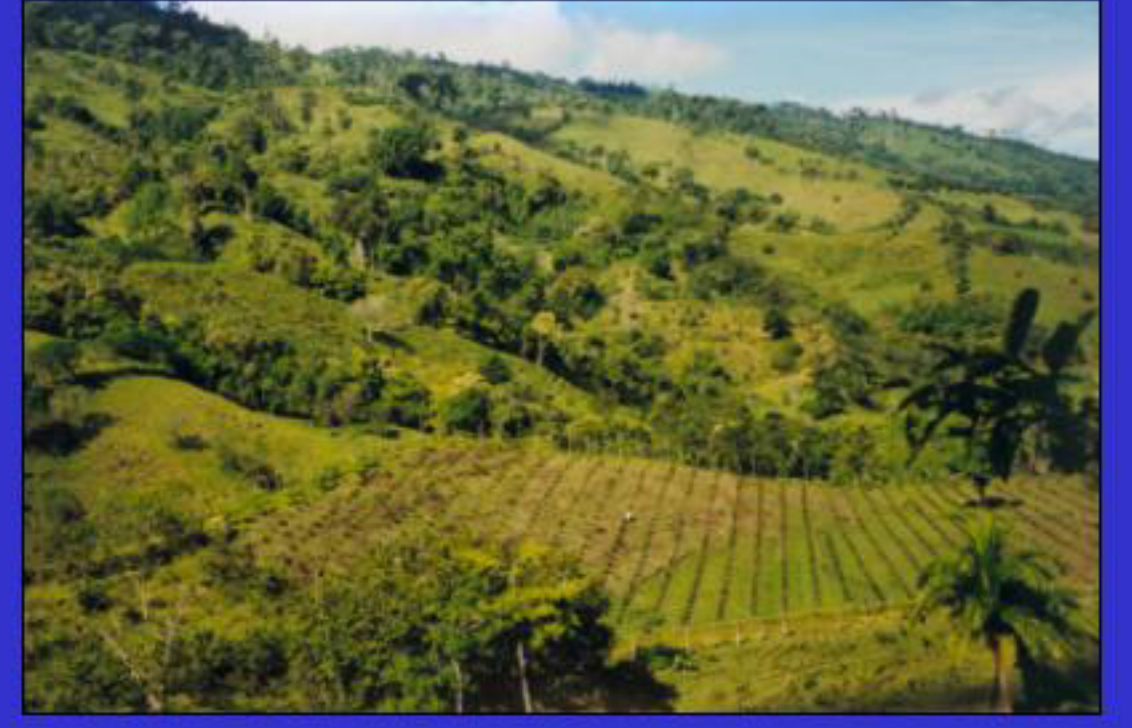



Wilson's Warbler

**TO BE COMPLETED:**

1. Refinement of regression models.

2. Testing for spatial autocorrelation among the routes within the two study sites.

3. Formal testing of Coto Brus models with Monteverde data.

**ISSUES TO DATE:**

1. Five of the routes from Coto Brus were more than 25% obscured by clouds and so were not included in the above analyses.

2. Only one antbird was detected on the Monteverde routes. Hence we will identify another forest-dependent group for model development and testing.