

Notes from conversation with Julian:

1. Low-hanging fruit: Effect of connectivity on (a) species and functional group diversity and abundance
2. Next level: Movement & Dispersal. There are large areas of forest where it is possible to capture beetles for Mark-Release-Recapture (MRR) experiments.
3. Higher-risk, Higher reward (even if they don't go in MS, can be set-up for potential PHD projects): Experiments on Ecosystem Services
 - dung burial, decomposition, soil properties based on results of 1 & 2 (buckets with dung and beetle assemblages)
 - gas (e.g., methane) emissions
 - seed dispersal/burial/germination

Example studies

1. Diversity and Abundance
 - Estrada and Coates-Estrada (2002): "56% of individuals were captured in the continuous forest, 29% in the mosaic habitat and 15% in the forest fragments"
2. Movement & Dispersal
3. Ecosystem Services

Other stuff to work on:

1. Species List & Keys for Dung Beetles of the Southeastern US
2. Any previous work done on dung beetles in Southeastern US
3. List of Equipment and Tools needed
 - Dung beetle traps
 - alcohol
 - bait

Species

INTRODUCTION

1. Paragraph 1: Habitat Fragmentation is a common feature of most human dominated landscapes, and Corridors are thought to be an important means of connecting these isolated patches.
2. Paragraph 2: It is predicted that Corridors will increase diversity of connected patches. Summary of findings. However, because of this gap in research, it remains unclear how_____.
3. Paragraph 3: Part of the reason we have this gap is that few studies have assessed dispersal of animals through corridors from one patch to another. I know...crazy. Lots of studies have assessed movement, but few of these have actually done so in cases where one patch is connected to another.
4. Paragraph 4: Dung Beetles are a critical and diverse functional group that is often used as an indicator species. I am proposing to use a large-scale experiment of connected and unconnected patches to assess how corridors shape dung beetle diversity and movement. Specifically, I will address the following questions:

What is predicted about how corridors influence the diversity of insects communities (with an emphasis on Dung Beetles) in patches?

Are corridors predicted to enhance diversity in connected patches? What is the mechanism? A certain species groups are predicted to drive this change in diversity - rare species, larger species, specialists, particular function groups, better fliers, etc.? (Note: "Corridors" = Riparian strips, living fences, linear fragments, etc.)

- **Prediction 1:** Diversity higher in connected patches (citations in Damschen et al PNAS, others)
- **Prediction 2:**

Empirical Results

1. Studies that have compared diversity of Dung Beetles in Corridors and Other Habitats (e.g., primary forest, pastures) have found that:

- **Diversity increases:**
- **Diversity decreases:**
- **Similar diversity in both:**

2. Studies that have actually compared the diversity of patches that are connected by a corridor vs. patches that are unconnected

- **Diversity increases:**
- **Diversity decreases:**
- **Similar diversity in both:**

What is predicted or known about insect movement through corridors (with an emphasis on Dung Beetles)?

Do Corridors facilitate movement between patches? Are particular species or groups more able to move through corridors than others - larger species, specialists on particular resources, particular functional groups, better fliers, etc.?

1. Studies that have assessed movement of Dung Beetles have found the following can play an important role:

- **Habitat Preference:** Arellano, Leon-Cortes, and Halffter (2008).
- **Wing Loading:** (Cultid-Medina et al. 2015)
- **Sex:**
- **Foraging Mode:**

- **Size:**
- **Invasive vs. Native:**
- **No inter-specific or inter-group differences in movement:**

2. Studies that have estimated dispersal distance:

THE QUESTIONS

Question 1: Is dung beetle abundance greater in connected patches than isolated ones?

Question 2: Is dung beetle diversity greater in connected patches than isolated ones?

Prediction: Species diversity is greater in connected patches than isolated ones (due to the greater representation of rare species) OR Prediction: Diversity of _____ (e.g., specialists, foraging strategy X, etc.) is greater in connected patches, but the Diversity of _____ (e.g., generalists, foraging strategy Y) will be the similar in both. OR The diversity is similar, but the community composition changes to one dominated by specialists instead of generalists

2. Do Dunge beetles move through corridors?

References

- Arellano, Lucrecia, Jorge L. Leon-Cortes, and Gonzalo Halffter. 2008. "Response of Dung Beetle Assemblages to Landscape Structure in Remnant Natural and Modified Habitats in Southern Mexico." *INSECT CONSERVATION AND DIVERSITY* 1 (4): 253–62. <https://doi.org/10.1111/j.1752-4598.2008.00033.x>.
- Cultid-Medina, Carlos A., Bedir G. Martinez-Quintero, Federico Escobar, and Patricia Chacon de Ulloa. 2015. "Movement and Population Size of Two Dung Beetle Species in an Andean Agricultural Landscape Dominated by Sun-Grown Coffee." *JOURNAL OF INSECT CONSERVATION* 19 (4): 617–26. <https://doi.org/10.1007/s10841-015-9784-3>.
- Estrada, A, and R Coates-Estrada. 2002. "Dung Beetles in Continuous Forest, Forest Fragments and in an Agricultural Mosaic Habitat Island at Los Tuxtlas, Mexico." *BIODIVERSITY AND CONSERVATION* 11 (11): 1903–18. <https://doi.org/10.1023/A:1020896928578>.