ARTIFICIAL PERCHES AS A TECHNIQUE FOR ENHANCING TROPICAL FOREST RESTORATION:

A case study from the Dominican Republic

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Introduction

Forest Regeneration in Abandoned Farmlands

- Secondary tropical forests are key in conservation goals to maintain ecosystem services and biodiversity
- Deforestation can break ecological links between plants and seed dispersal
  - Local extirpations
  - Habitat modification affecting animal movement
- Depressed seed dispersal rates limit regeneration, in addition to other barriers to seedling establishment

Can Artificial Perches Help Restore Forest?

- Many birds readily use isolated perches while transiting open landscapes
- Artificial perches may direct the movement of potential seed dispersers to target restoration areas

Research Questions:

1. Do perches increase seed dispersal to abandoned pastures?
2. Does sound influence the rate of seed disperser visits?
3. Do perches increase seedling recruitment?

Methods

Study Area

Figure 1: Study area shown in geographic context of the Caribbean island of Hispaniola. Perch design diagram with an example photo from the field. Restoration sites were located in the Rio Yaque del Norte watershed of La Vega Province, Dominican Republic (elevation 500-800 m).

Sites and Perch Design

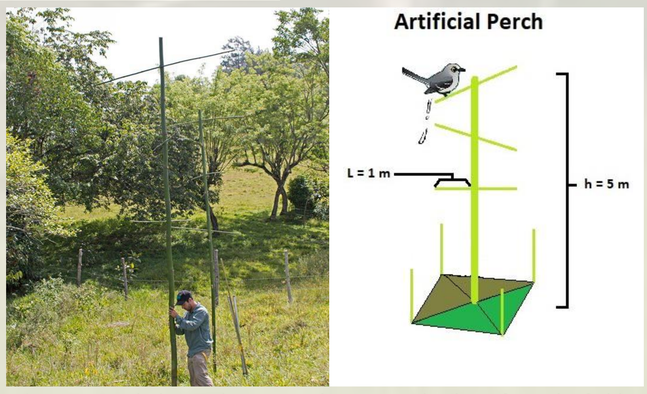

Figure 2: Perch design diagram with an example photo from the field.

- 5 sites on private farms surrounding town of Jarabacoa
- Restoration plots 0.15-0.25 ha constructed 2017-2018
- Installed arrays of perches (6-14 per plot) using bamboo
- Experimented with variations of ground layer treatment, i.e. full, partial, and zero grass/topsoil removal

General Monitoring

- **Observations:** Digital video cameras used to remotely monitor perch use by birds
- **Seedling Censuses:** Surveys conducted for all restoration plots in 1 m^2 quadrats, including both quadrats beneath perches and in open spaces (i.e. control). Surveys done at 0, 12, and 24 months (only a subset)
- **Seed Collection:** 0.5 m^2 screen seed traps

Sound Playback Experiment

- May-July 2019: playback experiment using bird call soundtracks to test the effect on bird activity/seed dispersal
- Multiple playlists were assembled to include calls from taxa with differing levels of frugivory

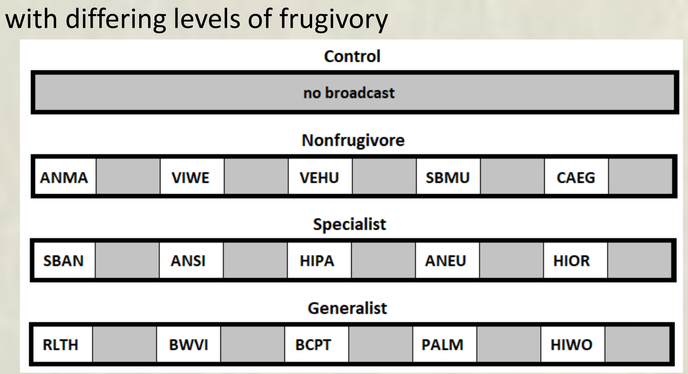

Figure 3: Tracks played 10 minutes of bird sounds, followed by 10 minutes of silence, with a total of five cycles (100 minutes). Species frugivory status was based on number of plant species they are known to disperse (NF = 0, SP ≤ 5, GE ≥ 20).

Results

Avian Activity

Table 1: Summary of visits by avian seed dispersers.

Bird Species	Visits	Time (min)	Sites
Northern Mockingbird (*Mimus polyglottos*)	78	76.0	3
Gray Kingbird (Tyrannus dominicensis)	46	155.7	4
Hispaniolan Pewee (*Contopus hispaniolensis*)	20	24.6	4
Yellow-faced Grassquit (Tiarus olivaceus)	15	11.1	2
Black-crowned Palm Tanager (Phaenicophilus palmarum)	11	13.5	2
Palmchat (*Dulus dominicus*)	9	10.8	3
Loggerhead Kingbird (*Tyrranus caudifasciatus*)	5	8.5	1
Broad-billed Tody (*Todus subulatus*)	3	1.5	3
Red-legged Thrush (*Turdus plumbeus*)	2	1.2	1
Hispaniolan Woodpecker (*Melanerpes striatus*)	1	0.75	1
Black-faced Grassquit (Tiarus bicolor)	1	0.5	1

- A total of 191 visits from 10 potential seed dispersers were recorded in the restoration plots over more than 33 hours of video recordings.

Effect of Sound Playback

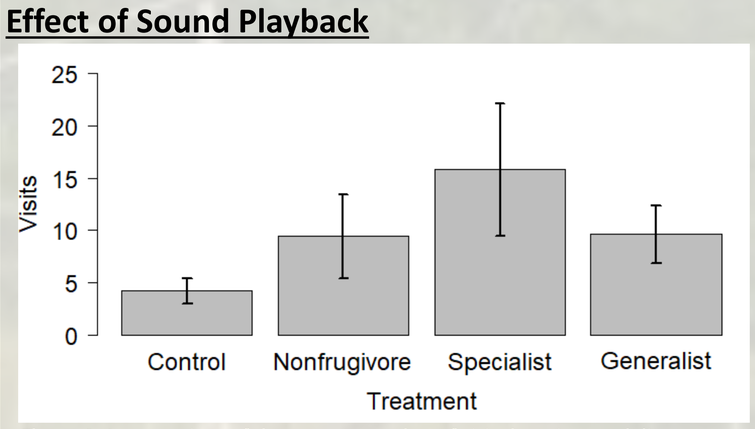

Figure 4: A comparison of the average number of visits by avian seed dispersers in each experimental group: control (no sounds), sounds of nonfrugivorous taxa, sounds of "specialist" taxa, and sounds of "generalist" taxa. N = 5. Bars show SE.

- All playback treatment groups resulted in significantly more visits by avian seed dispersers to the plot

Seed Dispersal & Seedling Recruitment

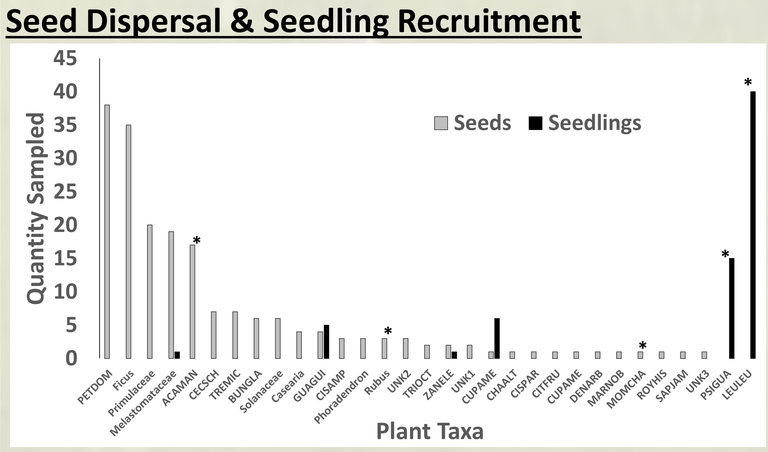

Figure 5: Seed trap from May-Jul 2019 and seedling data from perches installed both in 2017 and 2018. Note: Seed data is displayed by each independent "sample" rather than the quantity of individual seeds. * indicates exotic species.

- Total of 1,171 seeds collected from 31 distinguishable species during the 2019 summer period... Of these, only four were encountered as established seedlings
- Two other exotic species encountered only as seedlings
- Avian seed dispersal confirmed under all by two perches

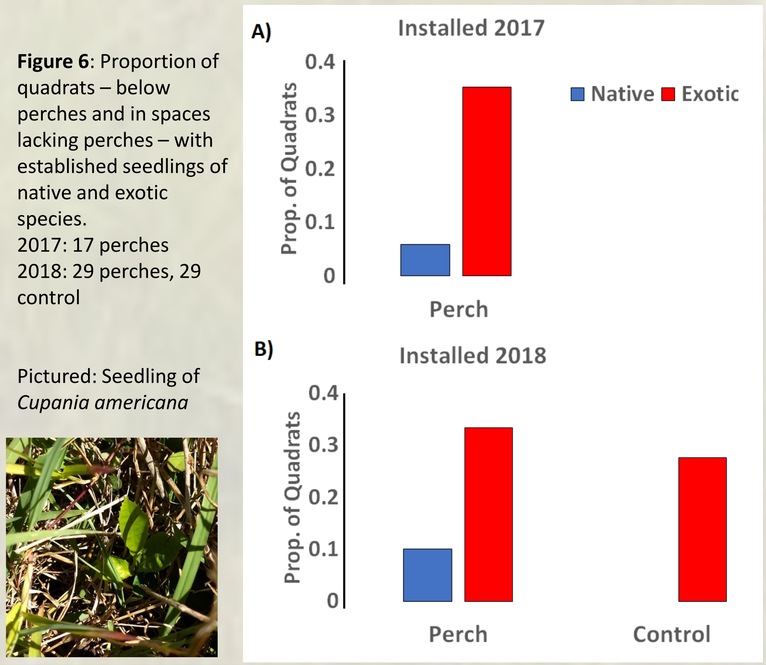

Figure 6: Proportion of quadrats – below perches and in spaces lacking perches – with established seedlings of native and exotic species.
2017: 17 perches
2018: 29 perches, 29 control

Pictured: Seedling of *Cupania americana*

Discussion

Seed Dispersers

- Northern Mockingbirds and Gray Kingbirds were the most consistent and frequent visitors to the restoration plots
- Most species seen are habitat generalists and feed to a great extent on insects (e.g. tyrant flycatchers)
- Several generalist frugivores – namely Black-crowned Palm Tanager, Palmchat, and Red-legged Thrush – were also observed to a lesser extent
- Majority of these generalist frugivore visits were in response to the species own call (i.e. during the Generalist experiment)

Figure 7: A Palmchat (*Dulus dominicus*) using one of the artificial perches. Photo credit to Holly M. Garrod

- Bird sound broadcasts, overall, had a positive effect on the activity of seed dispersers
- No clear difference seen among the treatment groups with bird sounds

Consequences for Seed Dispersal and Recruitment

- Use of perches by birds confirmed at all 5 restoration sites
- Bird-dispersed seeds were collected below all but 2 perches
- Only 4 perches out of 36 showed detectible seedlings of native bird-dispersed species, low counts may be due to relatively short-term monitoring (12-24 months)
- Recruitment of native plants was only detected in quadrats below perches
- Exotic species recruitment was comparable between perch quadrats and control quadrats

Figure 8: An example of one of the restoration plots with perches installed.

- Two of the most prevalent exotic seedling species, *Psidium guava* and *Leucaena leucocephala*, were not detected in the seed traps, despite having ripe fruits during this season… likely caused by a legacy of former land use or dispersed by other animals (e.g. livestock, rodents, bats)

Conclusion and Next Steps

- Perches are likely to be most effective in a context where they can be combined with more active restoration measures (i.e. transplanting seedlings, suppressing grasses, invasive species control)
- Perch installation adjacent to transplanted seedlings in clusters may facilitate natural regeneration nuclei
- Results from this study to inform future restoration management efforts by private and government stakeholders in the Dominican Republic and Haiti
- Developing a technical guide with local partners

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