Influence of the dry forest – wet forest ecotone over the differentiation of lowland neotropical bird populations

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Introduction

Theory predicts that populations of species distributed along environmental gradients might evolve differences when subjected to divergent selective pressures. It has been demonstrated that when selection is strong enough, morphological divergence might be maintained even in the presence of gene flow. The Magdalena Valley in Colombia displays a strong precipitation gradient resulting in a turnover from dry to wet forest (700-5000 mm annual rainfall) (Figure 1). Several bird species and allospecies are distributed along the entire gradient and might be subject to divergent selection that drives morphological divergence and potentially results in speciation. In this study we evaluate the role of the Magdalena Valley's precipitation gradient in the diversification of five species (Figure 2).

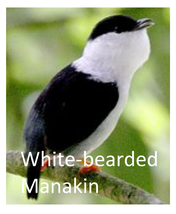

Figure 2. Sample of the birds collected in the field (far left). Focal species used for the study (right).

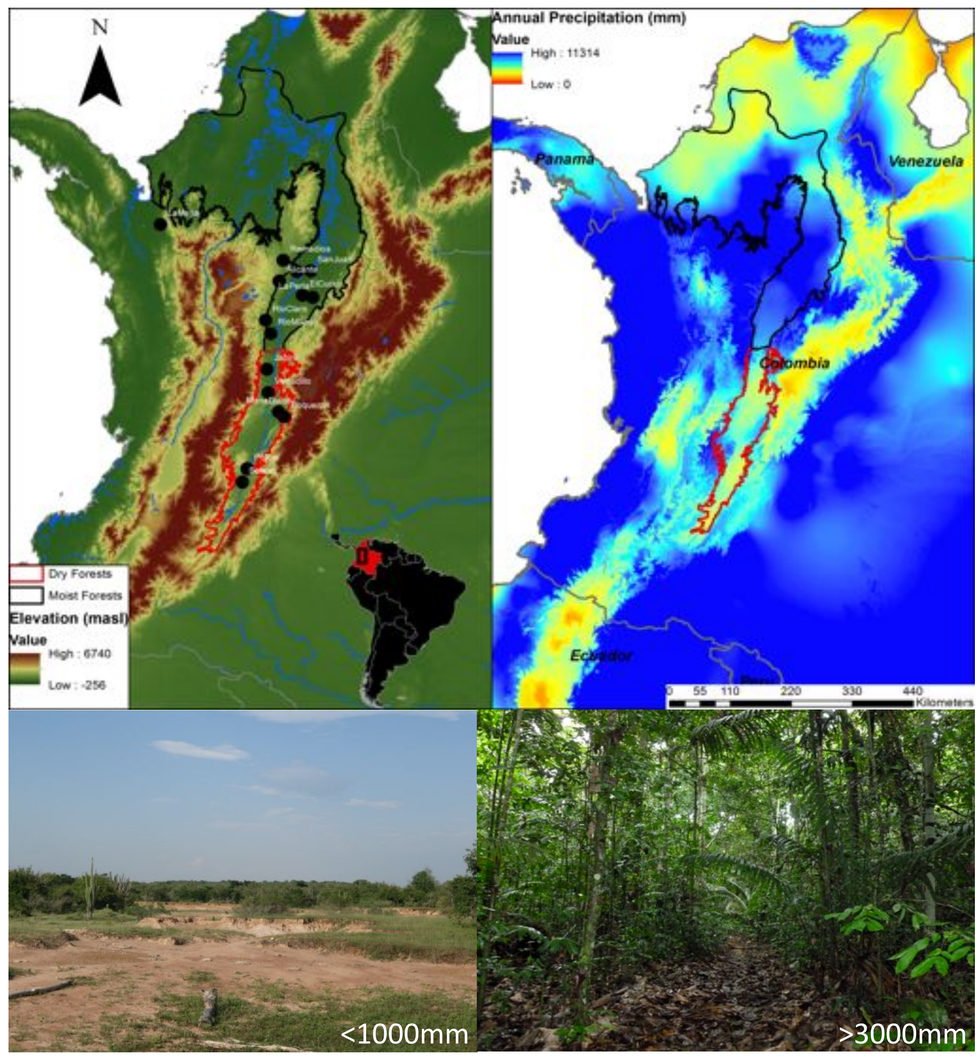

Figure 1. Maps of elevation (left) and precipitation (right) showing the delimitation of dry and wet forest and locations of sampling localities. In the bottom we show pictures of localities in the extreme dry (left) and wet (right) forests.

Methods

During May and August 2012 and January and July 2013 we visited 15 localities along the Magdalena valley where we used mist nets to collect 208 specimens of five species (Figure 2) in which we measured mass, wing chord, tail length, tarsus length and bill width, height and length. For each of the specimens we saved the skin and tissue samples for genetic analyses.

Because the response to songs of conspecifics can be used to determine species recognition and infer potential restrictions to gene flow, we used playback experiments to determine the level of response between dry forest and wet forest birds. The playback experiments consisted in playing at random a song of a wet forest or a dry forest bird to an individual and measure the response to the call and the type of forest the individual inhabited.

Preliminary results

We found significant morphological divergence at least in body weight of the Cocoa Woodcreeper. The variation shows a significant increase in body weight with increasing precipitation (Figure 3; n = 34, F F = 14.25, p<0.001) and significant sexual dimorphism (Figure 3; n= 34, F = 6.607, p=0.01). However, the significance in the sexual dimorphism is much more marked in the dry forest being the males significantly bigger in the dry forest but not in the wet forest (dry forest, n=18, F= 4.5, p=0.04; wet forest, n=16, F =3.28, p = 0.09).

Preliminary playback experiments suggest at least some level of reproductive isolation. We found an asymmetrical response to the call of conspecifics where dry forest birds only respond to calls from the dry forests while wet forest birds respond to both types of calls. Also, calls from the wet forest birds tend to be longer with fewer notes and at a higher frequency than calls from the birds of wet forests (Figure 4).

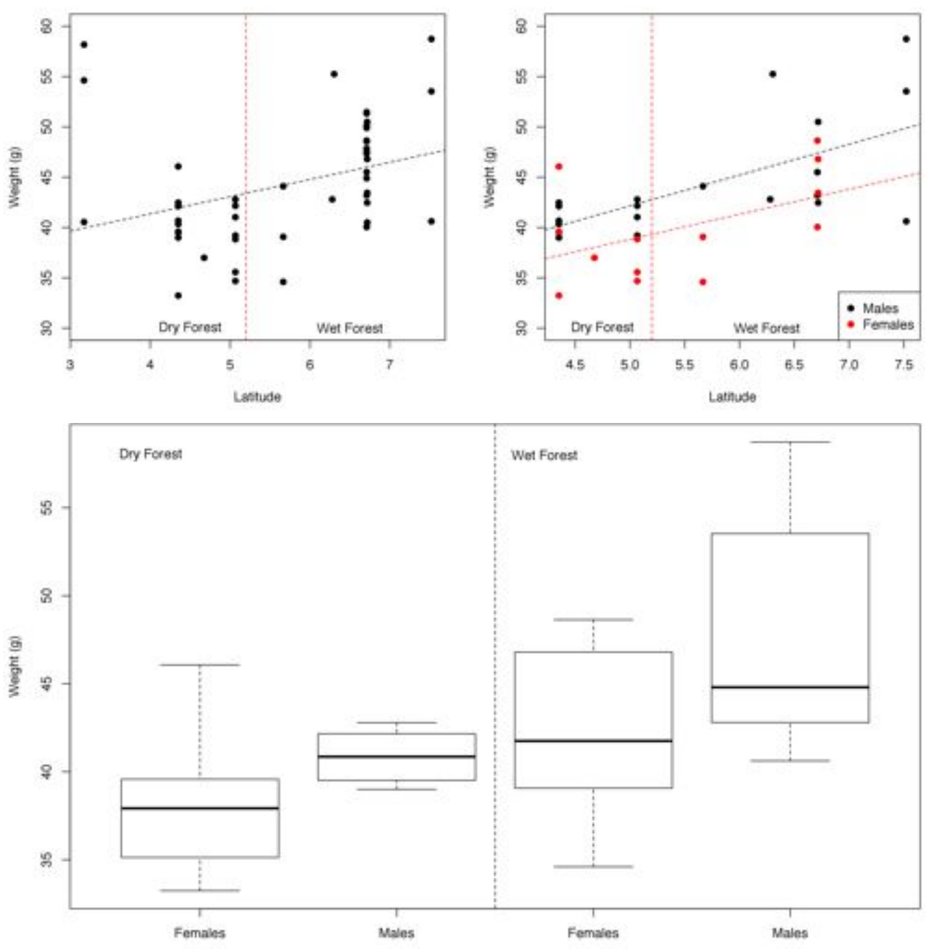

Figure 3. Regression (top) showing increase in body weigth along with precipitation and boxplot (bottom) showing differences between sexes and types of forests. The red vertical line indicates the limit of the dry forest.

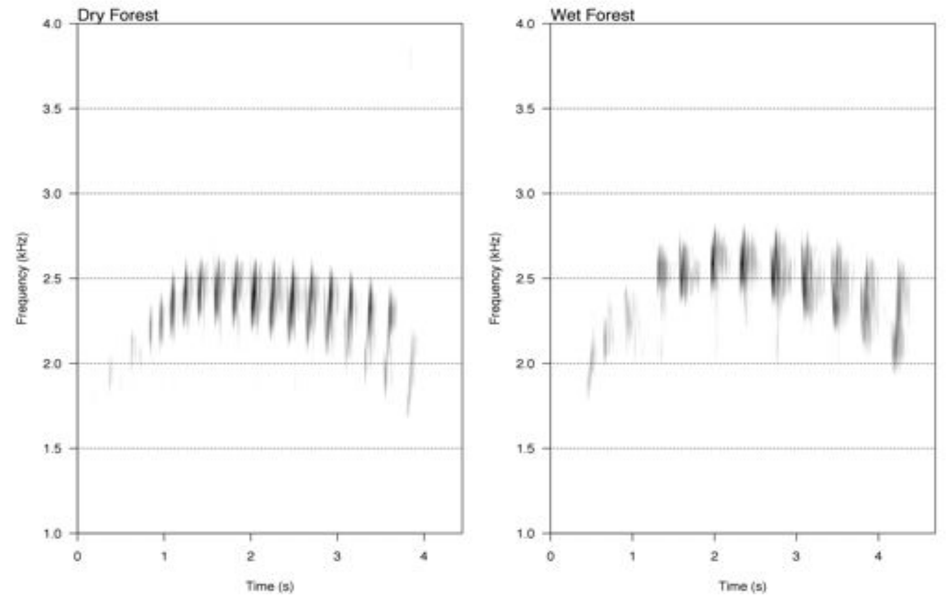

Figure 4. Spectrograms showing typical songs of dry and wet forest individuals.

Conclusions

Our data suggests that there is divergent selection along the gradient based on the differences between dry and wet forest individuals of the Cocoa Woodcreeper. We are performing genetic analysis to quantify the amount of gene flow between populations in the valley to determine the level of genetic differentiation between individuals of different types of forests. Further analysis in the additional four species will allow us to determine if the pattern is general to all bird species.

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