Responses of Central Amazon Biodiversity and Carbon Storage to Altered Disturbance Regimes

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Introduction

•Quantifying ecophysiological and structural responses of Amazon forests to natural disturbances is urgent as global circulation models predict an increase in storm intensity and drought across the region.[1]

•Convective storms over the Amazon Basin form powerful microburst winds that can cause up to 2000 ha blowdowns.[2]

•Canopy damage from these catastrophic windthrows varies across the landscape,[2,3] thus forest processes and regeneration following the event are expected to be heterogeneous.

•This study is part of a larger collaboration focusing on the effects of altered disturbance regimes on Central Amazon biodiversity and carbon storage in Central Amazonia.

Objective and Hypotheses

•The objective of this study is to quantify the variability in forest structure, α-diversity, and turnover along a disturbance gradient in the Central Amazon.

•H1: Species composition, α-diversity, and turnover will vary significantly across the disturbance gradient.

•H2: Forest plots with high levels of canopy disturbance (i.e. 80-100%) will be floristically and structurally more similar to each other than to less disturbed and primary forest plots.

•H3: More disturbed forest plots will experience lower cost of wood production relative to less disturbed and primary forest plots.

Field Site

•ZF-2 Reserve (INPA); 80 km north of Manaus, Brazil (Figures 1,2,3)

•Broadleaf evergreen rainforest; dry season July - August

Figure 3. Map of ZF-2

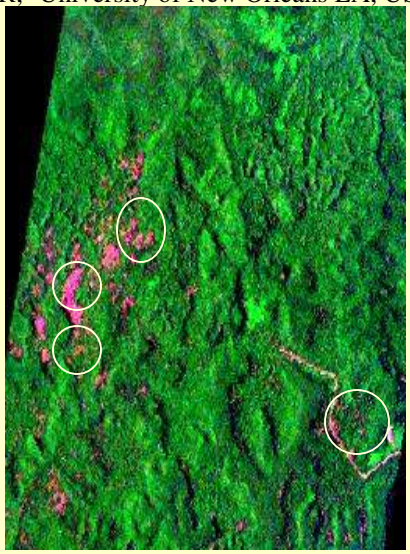

Figure 1. Hyperion image of field site. Magenta pixels represent >7% NPV.

Figure 2. Aerial photograph of 25-ha blowdown.

Methods

•We use hyperspectral-remote imaging to locate landscape-scale (e.g. 0.1-30 ha) forest disturbances.

•Five blowdowns from January 2005 were identified using four-endmember spectral mixing analysis (SMA). Values of non-photosynthetic vegetation (NPV) categorized the levels of canopy disturbance on a per pixel basis. Percent canopy damage was stratified into 5 classes (Table 1).

•30, 400-m² plots, one plot per canopy damage category with two plots in category 5, were established in which all stems ≥ 5 cm diameter at breast height are being identified.

•α-Diversity will be calculated in all plots. β-diversity will be calculated between plot combinations across the disturbance gradient. Variables will be compared across the disturbance gradient.

•Autotrophic stem respiration will be measured in 8 trees per plot. This will allow the cost of woody-tissue production to be compared between plots of varying disturbance.

Table 1. Disturbance classes defined by percent canopy damage

Disturbance class	Percent canopy damage
1	80-100
2	60-79
3	40-59
4	20-39
5	<20

Preliminary Results and Predictions

•Preliminary results indicate that species composition, diversity and turnover vary as a function of canopy-damage intensity. Additionally, forest structure, one year following the event, varies within the same blowdown site.

•The cost of woody-tissue production is expected to be less in highly disturbed plots. With the release of competition from neighboring trees, more carbon is expected to be available for growth allocation.

•Following a mega-disturbance event, biodiversity, carbon storage, and forest structure are heterogeneous within a landscape. Windthrow events do not affect a region equally, and canopy damage can vary even at small spatial scales.

•This study will increase our knowledge of how forests respond to disturbance events of varied intensities, lending insight into how Amazonia may respond under projected disturbance regimes.

References:
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