BIOTIC AND ABIOTIC DIFFERENCES BETWEEN A RIPARIAN ENVIRONMENT AND SURROUNDING PRIMARY FOREST

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Abstract. (VRL) Riparian habitats often have different light, moisture and soil conditions than primary forest. We hypothesized that different physical conditions in riparian plots along the Quebrada Danta would lead to different forest structure and different species compositions than found in primary forest plots. However, we found the soils and forest structure to be similar in both habitats, and we cannot conclude, based on our limited sample that there are different species in the two habitats.

INTRODUCTION (CDW)

Riparian environments may contain different microhabitats from surrounding primary forest, due to differences in abiotic factors such as light, water availability and soil composition. Since different species could fill these different niches, diversity should be higher in primary forest containing rivers and streams than those without.

We examined the riparian environment along a tropical lowland stream and the surrounding primary forest. The river is not in a steep valley, and the canopy around it is more open than in the primary forest, allowing more direct sunlight to reach the riparian understory vegetation. The riparian habitat should also have higher water availability than surrounding primary forest. However, river dynamics such as soil erosion and deposition should cause the soil to be less firm than soil that has been immobile for long periods of time, such as those in uneroded primary forests. Flooding could also wash away organic matter from the flood plain, causing the organic horizon to be lower in riparian zones than in undisturbed forest, and causing large rocks to be more abundant close to the surface.

These differences in abiotic factors between a riparian environment and surrounding primary forest should alter the respective plant community structures, and cause different species to dominate in each habitat.

METHODS (VRL)

On 2 February 1995, we examined four riparian and four primary forest plots along the north fork of Quebrada Danta, off the Espavales trail in Corcovado National Park. We defined the riparian habitat as the shelf approximately one meter above the river bed. The primary forest was several meters above the riparian shelf and 5 m in from the edge of the riparian shelf. Plots were 2.5 m by 5 m.

Starting at the intersection of the trail with the stream, we used the stream as a transect. We set up one riparian plot on the first bend of the river upstream from the intersection and three plots on the first three bends of the river downstream. Each riparian plot was at the center of the shelf. We set a 40 m transect parallel to the downstream plots, in the primary forest. Primary plots were placed at 10 m intervals along the transect.

At each plot, we dug a pit in the center and measured the depth of the leaf litter, leaf detritus, humic and mineral layers. We also described the soil texture. To quantify plant community structure, we placed all vegetation (excluding lianas) into categories: herbaceous, woody <1 m, woody 1-3 m, and woody >3 m. In addition, we took DBH measurements of all trees >3 m tall in a 5 by 5 m plot, which included the 2.5 by 5 m plot.

Lastly, to quantify diversity, we used leaf morphology and other plant characteristics to identify the morphotype

of all vegetation <3 m. We counted the number of individuals of each morphospecies per plot and compared the plant diversity both within and between riparian and primary plots.

RESULTS (CDC)

We found no difference in depth between the organic horizons of the riparian and the surrounding primary forest habitat (Table 1a). Overall, the organic horizons in both habitats were very shallow (approximately 2-3 cm not including leaf litter), and thus made up very little of the overall soil profile. The major soil difference between the two habitats was in texture. The riparian habitat mineral soils were slightly darker in color, indicating potentially more organic constituents. They were also far less consolidated than the old primary forest clays, presumably due to their recent deposition in the dynamic stream channel environment.

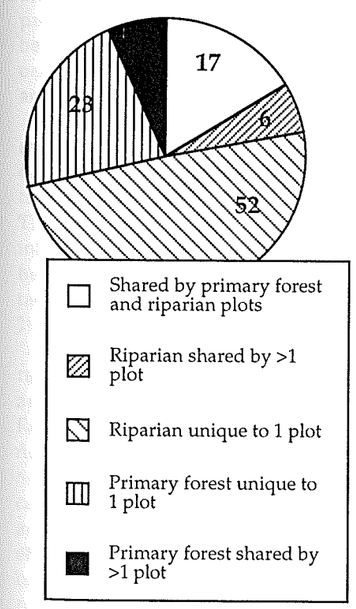

FIG. 1. Morphospecies overlap between the riparian habitat and surrounding primary forest habitat (based 106 morphospecies found in four 5x2.5 m plots). Species found in only one habitat were divided according to whether they were found in one or more replicate plot.

We found a significantly higher density of small woody seedlings (< 1 m) in the riparian plots (x=40.75, SE=6.10) than in primary forest plots (x=16.00, SE=3.58, Table 1b). All other structural differences were not significant. Overall, there was a high variability in the densities of different structural categories between plots both within each habitat and between habitats (i.e., SE= 15-95% of mean).

We found a trend toward more individuals and more morphospecies per plot in the riparian habitat, though this difference was not significant (Table 1c). We also found no difference in diversity (as indicated with the Shannon-Wiener index) between the two habitats. While we found only 17 morphospecies out of 106 to occur in both riparian and terrestrial habitats, we found an even smaller number of morphospecies shared in more than one replicate plot for each habitat (Fig. 1). The majority of the morphospecies were unique to one plot and did not overlap between any of the eight plots.

DISCUSSION (JLM)

Contrary to our expectations, the soils in the riparian habitat had similar organic layers and were no rockier than the soils in the terrestrial habitat. Although we did find differences in the texture of the mineral layers, we do not consider the soil conditions in the two habitats to be markedly different.

These similar abiotic conditions may result in more similar forest structure in riparian and primary forest than originally predicted. The only significant difference in structure occurred in the woody <1 m size class. We attribute this difference to better germination conditions, including higher light and moisture, in the riparian habitat.

Since there were few abiotic and structural differences between the riparian and terrestrial habitats, it is unlikely that plant species would differ. Although we

found only 17 species in common between the two habitats, we also found very few species in more than one replicate plot of the same habitat. Our sample size may not have been adequate to encounter enough individuals to determine the habitat restrictions of these morphospecies. Therefore, we have no evidence that the riparian habitat contains morphospecies not found in primary forest. Additionally, the diversity indices were similar between the habitats, indicating again that the species compositions of theplant communities were not very different.

In summary, the lack of morphospecies overlap between replicate plots makes it difficult to assess the contribution of the riparian habitat to the overall diversity of the primary forest. Additionally it is difficult to determine the effects of differing light levels between the riparian habitat and surrounding primary forest. Future studies directly comparing species in riparian areas to species in recently disturbed areas in primary forest would provide additional insight into the degree to which the riparian habitat contributes to the entire forest's diversity.

Table 1 (a-c). Characteristics of the riparian habitat (adjacent to and 1 m above the stream bed) and surrounding primary forest (5 m away and three meters above stream bed), along the north fork of the Quebrada Danta, Corcovado N.P., Costa Rica. *= significant difference.

	Riparian habitat	(SE)	Primary forest	(SE)	t	P
a) Soil Profile						
litter depth (cm)	5.63	(0.95)	6.50	(1.78)	-1.03	0.38
humic, leaf matter depth (cm)	1.75	(0.29)	2.75	(1.32	-1.36	0.27
b) Plant community structure						
woody 0-1m (ind/plot)	40.75	(6,10)	16.00	(3.58)	9.31	0.003*
woody 1-3m (ind/plot)	2.00	(1.41)	7.50	(2.10)	-2.02	0.14
woody basal area (cm^2/m^2)	29.85	(28.37)	95.13	(73.90)	-1.42	0.25
palm spp. (ind/plot)	2.75	(0.85)	1.00	(0.41)	2.05	0.13
musacious spp. (ind/plot)	0.75	(0.48)	1.25	(0.48)	0.78	0.50
fern (ind/plot)	.75	(0.48)	1.00	(0.41)	0.24	0.79
other herbaceous (ind/plot)	14.50	(6.29)	7.50	(4.71)	0.72	0.52
c) Species composition						
individuals/plot	66.50	(9.50)	42.75	(2.25)	2.07	0.13
morphospecies/plot	23.25	(2.25)	18.25	(2.17)	1.45	0.24
diversity (shannon index)/plot	2.38	(0.15)	2.32	(0.18)	0.35	0.75