Abstracts

Teses de Doutorado

PANSONATO, Marcelo Petratti

Drivers of tree similarity, distribution and abundance in two environments of the Atlantic Rainforest

Abstract: Understanding the drivers of change in species distribution and abundance in tropical and subtropical forests is one of the central themes in plant ecology. One of the most consistent pattern of ecological communities is the decay of similarity with geographic distance - the distance decay. However, different abiotic and biotic conditions may affect the patterns of distance decay, species abundance, and species distribution. In this context, the coastal regions of the Atlantic Forest represent a study system well suited to investigate these issues. In these regions, there are two contrasting environments that occur contiguous throughout the entire latitudinal extension of the Atlantic Forest: the restinga forests, considered a recent and harsh environment to plant development and dense ombrophilous forests, considered an old and less restrictive environment. In this study, we first evaluated the changes in composition of tree species along the geographic space and the factors that determine these changes, then we investigated how species populations vary in their abundances and distributions in these environments. In the first chapter we studied the relative effects of geographic distance, climate and species dispersal ability in two environments (which present edaphic and geological age contrasts) on tree species similarities between different sites in the coastal region of the Atlantic Forest. We found that similarity in species composition varies greatly among the environment types and the effect of different factors considered can change not only between the environments, but also between the northern and southern biogeographic regions of the Atlantic Forest. Although we expected the recent and harsher environment to have a more homogeneous species composition, we found a lower species similarity in this environment than in the old and less restrictive environment. The dispersal ability of the species contributed to increase the similarity between sites that are far from each other, as shown by their interaction with geographic distance. However, this relationship was found in the most recent environment in the southern sector of the Atlantic Forest and in the oldest environment of the northern sector. Our main conclusion is that studies that use only climate data and infer the effect of dispersal on similarity based only on the effect of geographic distance can overestimate the effect of climate. In the second chapter, we investigated how tree species populations vary in their local and regional abundances, and in their range of distribution in both types of environment. We also analyze if some functional traits of these species are related to the observed patterns. We found that differences in patterns of species distribution and abundance occur at both local and regional scales. We found a striking effect of edaphic and geological age differences on several species populations. Many species that occur with low abundance and/or have restricted distribution in the old and less restrictive environment may occur with higher abundances in the recent and harsh environment. The effect of functional traits was more pronounced on regional abundance than on local species abundance. The trait value that best characterized the species that occur with greater abundances in the most restrictive environment was the small leaf area. In the older environment, greater dispersion ability was related to wider regional distributions. We conclude that the lower species richness - metric often used in the delimitation of areas to be conserved - found in the more restrictive environment does not mean that it should not be prioritized, since large species populations that are not abundant in the richest environment can be found in these less diverse environments. Our study has revealed some patterns

that bring new information about the drivers that structure tree communities and populations of in tropical and subtropical forests. The use of this study system made up of two contrasting but contiguous environments in the Atlantic Forest allowed us to verify that interspecific differences in the dispersal ability of tree species is an important process for floristic relationships and should be considered in future studies. Finally, the conservation of Atlantic Forest tree species will benefit if priority is also given to environments associated with the coastal plains.

MELITO, Melina Oliveira

Effects of forest fragmentation on biomass in tropical forests

Abstract: In spite tropical forests are the most important terrestrial global carbon sinks due to carbon storage in aboveground biomass, it is also the primary target of deforestation. The conversion of Tropical forests into anthropogenic areas might disrupt biological flux and also lead to severe microclimatic changes at forest edges. These combined effects can trigger profound changes in plant composition through both high mortality of fragmentation-sensitive species and proliferation of disturbed-adapted species which will ultimately impacts carbon storage. Thus, our main objective in this study was understand the role of human-induced disturbances in modulate the dimension of biomass loss at tropical forests. We applied a systematic literature review searching for empirical evidences that edge effects can drive biomass loss in tropical forests (Chapter 2). Our findings highlighted the gap of knowledge about the pattern and process related to biomass loss in tropical forests. To strengthen this understanding, we formulated a conceptual model linking landscape structure and patch-level attributes to severity of edge effects affecting aboveground biomass. Our model hypothesizes that habitat amount, isolation, time since edge creation, and the synergism between edge distance, patch size, and matrix type are the main drivers of biomass loss in anthropogenic tropical forests. We thus used a large plant dataset (18 503 trees ≥ 10 cm dbh) from 146 sites distributed across four Mexican and four Brazilian rainforest regions to test our conceptual model predictions, specifically the influence of forest cover, site isolation, edge distance, patch size and type of matrix on biomass (Chapter 3). We observed that carbon-rich sites presented species that are typical of old-growth forests (shade-tolerant, large-seeded, zoocoric) contrasting to carbon-poor sites composed by disturbed-adapted species (pioneer occupying the understory). Large shade-tolerant trees (≥ 40 cm dbh) were impacted severely by the combination of forest loss and edge effects. Edge distance, patch size, and the amount of open-matrix strongly influence small shade-tolerant trees (≤ 20 cm dbh). Although our results do not fully corroborate the initial predictions of the conceptual model, they support the idea that landscape composition interact with patch structure and ultimately impacts biomass stocks in fragmented tropical forests. Finally, we further investigated if the disturbance level of the region influences plant-structure responses to forest loss (Chapter 4). Biomass, but not plant density, was affected by forest loss in regions with intermediate disturbance levels, i.e. regions showing a combination of moderate deforestation (20-40% of remaining forest cover) disturbed during the past 30-60 years, high defaunation but harboring relictual populations of large-mammals, and areas mostly composed by heterogeneous matrices. In general, our findings highlight that both landscape composition and patch structure are the main drivers of biomass loss in Neotropical forests, and that the landscape context must be considered to obtain more reliable estimations of carbon emissions due to forest degradation. Landscape planning (e.g. restoration of forest cover) should be included in conservation strategies in order to sustain carbon storage. Moreover, we advocate that conservation initiatives will be less costly and more effective if implemented in areas under intermediate disturbance levels.

BERTONCELLO, Ricardo

Ecological restoration and structuring processes of plant communities

Abstract: Interspecific interactions are considered to be important structuring forces in early successional vegetation. Whereas competition seems to prevail in less severe environments, facilitation tends to increase in importance in harsh environments. Hence, facilitation is expected to play an important role in degraded tropical areas with high irradiance, heat loads, and evapotranspiration, where conditions are far from optimum for most forest species. Moreover, in order to understand complex structuring process of high diverse tropical forests, ecologists have realized the need for simplification. A promising way to do that is through the use of functional traits, which can be measured for any species and compared in different systems and different locations around the world. However, in these conditions, little is known about the role of species interaction on the relation of functional traits and species performance. In this scenario, we planned a restoration project on the southeastern Brazilian coastal plain to compare growth and survival of tree seedlings planted at two densities (isolated or aggregated) in a factorial experiment with nutrient addition. In the first chapter we analyzed survival, height, ground level diameter, and crown projection of 4,132 saplings from 19 species that ranged along a successional gradient, over an 18-month period. We used mixed-effect models to analyze the relationship between species performance and treatments, and Akaike's information criterion (AIC) to select the models. The best model showed higher survival in aggregated plantations (indicating facilitation) for non-pioneer species. In contrast, we found lower diameter growth in aggregated plantation (indicating competition). Fertilizer addition did not affect survival in clusters, but, surprisingly, it had a negative effect on isolated plants of both pioneer and non-pioneer species. On the other hand, fertilizer addition had a positive effect on diameter and crown projection growth in aggregated plantations (reducing competition), especially for pioneer species. Thus, whether facilitation or competition was the predominant interaction depended on the response analyzed. We concluded that, as establishment of non-pioneer species in disturbed sites can be challenging, restoration designs could take advantage of higher survival rates in clusters and use resource addition to ameliorate growth and decrease competition for limited resources. In the second chapter we used the core simple-measurable traits to investigate whether functional traits were related to growth and survival and whether there was a difference in the effect of the functional traits on plant performance of isolated individuals or of individuals subjected to interaction with neighbors. Our main findings were that for pioneer species, the greater the specific leaf areas (SLA), the greater the survival rates, but, under aggregated conditions, the greater the SLA the lower the survival rates. However, functional traits only partially explained saplings performance in a restoration context and more research is needed to understand its role in predicting seedlings outcomes, especially considering the potential applicability of this methodological approach. The manipulative character of ecological restoration broadens perspectives to use experiments to generate and test new hypotheses in ecology and to refine restoration models.

ROCHA, Diogo Souza Bezerra

Plant diversity in Atlantic Forest in southern Bahia: an evaluation of the environmental effects on the composition and structure of the tree community

Abstract: The Atlantic rainforest is distributed over a wide latitudinal range, includinges altitudinal gradients, with altitude representing an indirect interference variable in vegetation patterns as a function of the variability of abiotic conditions (e.g. decrease of temperature and the availability of nutrients in the soil and increased rainfall). Therefore, this study aimed to evaluate the variation of

environmental factors and to determine what are its effects on the composition and structure of the tree communities at different altitudes. The first chapter presents a literature review of the main patterns of changes in vegetation composition and structure in altitudinal gradients of tropical montane forest. Abiotic variability among different altitudes were mainly characterized by decrease the temperature, even at small distances, related to a reduced diversity and height of the forest with increasing altitude. The second chapter presents a description of the variability of microclimate, from data of temperature, precipitation, vapor pressure deficit recorded in two altitudinal quotas from three montane forests in northern Atlantic rainforest. The microclimate in the region was characterized by intense rainfall throughout the year without a marked seasonality and a temperature reduction with increasing altitude. In the third chapter, we present an analysis of the relative importance of environmental factors (climate, topography and edaphic composition) and space influencing the richness, diversity and species composition patterns of tree communities of these montane forests in northern Atlantic Rainforest. We found 519 species in 5680 individuals sampled. Increases of the number of individuals and decreases in species richness along an increase in elevation were recorded. The reduction of diversity in relation to altitude was observed when considered a same locality, which was probably explained by role of topographic factors on a smaller scale, which shape diversity in different ways in each locality.. The topography and soil factors were both important to determine changes in species composition The spatial structure had no effect on the species composition. The areas at 500 m altitude presented weather and species composition more similar among the mountains while the areas at 800m were more distinct regarding the same factors. In addition, we observed greatest differences in species composition between sites of the same mountain than between sites at the same altitude in different mountains.

JURINITZ, Cristiane Follmann

Population ecology of two tree species in forest fragments in Southeast Atlantic Plateau

Abstract: One of the greatest challenges of ecology is to understand and predict the fluctuations in the biological populations. When we consider the human intervention in this understanding, we can, at the same time, make predictions about the future of the populations and understand better their natural processes of regulation and control. In this work we carried out a study about the ecology of populations of two shade tolerant tree species (Guapira opposita (Vell.) Reitz, that occupies the canopy and Rudgea jasminoides (Cham.) Müll.Arg., that occupies the understory) to answer the question of how the structure, population dynamics and seedling performance respond to environmental heterogeneity caused by disturbances related with fragmentation and secondary succession. In the first chapter we tested if the population structure, measured by size distributions, is related to the size and/or to the successional stage of the fragment. From the conclusions generated in this first study, in the second chapter we evaluated if population dynamics parameters, such as asymptotic growth rate and vital rates explain the variation in density and structure. In the third chapter we tested if the seedling performance of these species is affected by canopy openness and litter depth, which are known promoters of environmental heterogeneity in secondary forest fragments. In order to achieve this goal we marked and followed by two years (2007- 2009) populations of both species in six secondary forest fragments of different successional stages in the Southeast Atlantic Plateau. Regarding the population structure, Guapira showed variation associated to the degree of forest structuring, while for Rudgea the fragment size was the most important explanatory variable, what lead us to hypothesize that Rudgea is in risk of local extinction in the medium fragments. Regarding the analysis of population dynamics, Rudgea showed a population doubling time in the medium fragments 4.5 times greater than in the large ones, what lead us to conclude that this risk of local extinction can be mitigated or even reversed. For Guapira, the rates did not differ between the successional stages, being predicted stable populations in both (955;8776;1).

The analysis of the effect of the canopy openness and the litter depth in the seedling performance showed the importance of the interaction between these factors and the relevance of considering the different seedling ontogenetic stages. Through a new approach, we demonstrated how important is to consider complementary studies (structure and dynamics) in order to really understand what happens at population level. Besides, we highlight the importance of studies with dynamics in order to elucidate the demographic mechanisms that occur in each population. This knowledge is a fundamental tool for planning more directional management and conservation actions.

Dissertações de Mestrado

PARMIGIANI, Renan

Functional diversity along a stress gradient: A case study in sand coastal vegetation

Abstract: Understanding processes underlying community assembly is one of the main questions in community ecology. The influence of processes such as environmental filtering and competition can be observed in patterns of functional diversity patterns in plant communities. Competition, through competitive exclusion, limits similarities in ecological strategies in a given community. Environmental filtering, on the other hand, constrains the species that can be established in a given community, restricting the functional diversity. One can reasonably predict that the influence of such processes changes across environmental gradients, where the environmental filtering will exert more influence in more stressful environments, whereas competition will exert more influence in less stressful places. This study aimed to understand the influence of environmental filtering and competition on functional diversity in a plant community across a stress gradient. We expected an inverse relationship between functional diversity and stress. The stress gradient studied occurs in the restinga of the Cardoso Island State Park (Cananeia, SP). We sampled 41 sites, in which we found 104 species of vascular plants. We measured three traits: life form, leaf area and leaf economic spectrum (LES). We represented the environmental filter using edaphic variables that represent restinga environmental restrictions. We used Grime's strategies classification (CSR), to extract the component related to competitiveness of each species, and therefore, calculated the competition community weighted mean (CWM) of each plot as proxy of competition. We built linear mixed models (LMM) to represent different hypothesis related to functional diversity and selected the best models by Akaike Criterion (AIC). We evaluated functional diversity through three response variables in the models: functional richness (FRic), functional dispersion (FDis) and CWM. In the model selection of CWM for each trait, FRic for life form and FRic for all traits were predicted by the environmental filtering. The FRic of LES, FRic of leaf area and all models of FDis had the null model as the most plausible, discarding the influence of competition and environmental filter in functional diversity. The fact that there is a concentration of abundance around certain strategies explains why there is no difference in functional dispersion. We infer that environmental filter restricts some strategies, reducing functional richness or displacing functional space of the communities. The absence of competition affecting functional diversity suggests that limiting similarity exerts little influence on community assembly in the studied gradient, or that the consequences of similarity limitation is compensated by other process.

NOVARA, Luisa

Disturbance effect on life strategies: evolutionary and ecological dynamics

Abstract: Disturbance events impact life strategy diversity in communities and life strategy evolution

in populations. In the field of Ecology, disturbance occurrence is studied while an environmental factor that alters resource availability and populations abundance, causing competitive exclusion of less favorable life strategies depending on disturbance frequency and intensity. In the field of Evolutionary Biology, disturbance is evaluated as a pressure, depending on its spatial and temporal regularity, that determines the intensity of species' evolutionary response and, as a consequence, the adaptation towards the fittest life strategy. Although there is a separation between these two fields of knowledge, ecological dynamics influence evolutionary dynamics and the other way around. Studies that mix Ecology and Evolution are becoming more common, but few or none of them takes disturbance in consideration. Here, we use an individual-based model to generate contexts in which adaptation and competitive exclusion might act apart and together in order to understand how disturbance determines life strategies that occur in communities under ecological, evolutionary and eco-evolutionary dynamics. In the model, life strategy is an inheritable character defined for a trade-off between longevity and fecundity. Simulations from the evolutionary context were composed by one population under mutation acting, simulations from the ecological context by various species without mutation and simulations from the eco-evolutionary context by various species with mutation occurrence. We observed that disturbance was positively correlated with fecund individuals preponderance in all contexts but that disturbance effect on life strategy diversity varied between the different contexts. In the evolutionary and the eco-evolutionary contexts, life strategy diversity increased with disturbance raise, while in the ecological context diversity decreased. This result evidences the mutation role as a source of new life strategy variants when there is a high renovation of individuals given by raised mortality. Only in the eco-evolutionary context there was an interspecific heterogeneity peak on intermediate levels of disturbance. In this scenario, species reproductive isolation, in contrast to populations panmixy, allows species to differ in relation to its life strategies. In parallel to this, the constant input of new life strategy variants by mutation prevents the definite extinction of life strategies from the system. Therefore, when disturbance level is intermediate, productive species as well as long-lived ones are able to coexist. Given that the different contexts resulted in varied patterns of life strategies' relative frequency, this study evidences the importance of studying disturbance effect on communities structure and dynamics unifying processes that are typically separated between Ecology and Evolution fields.

VENDRAMI, Juliana Lopes

Functional diversity in a restinga forest

Abstract: Understanding the processes underlying the origin and maintenance of species diversity in communities is a central goal in ecology. Among the numerous processes proposed to explain the organisms' diversity, we can highlight environmental filter and limiting similarity. Environmental filter operates by restricting the variation and distribution of organisms in a given environment, while the process of limiting similarity acts by pressing differentiation in the organisms' characteristics, because the coexistence of individuals depends on difference in resource utilization. The functional approach has been used to test the processes responsible for species coexistence and consists in the comparison of species functional similarities in a community through their traits. The combination of different traits in an organism defines its ecological strategy and, therefore, their distribution on habitats. Restinga forests are suitable to test species coexistence hypotheses in communities, because it presents a well marked environmental gradient, which is defined by resource availability. Thus, this study aimed to evaluate: i) the effect of soil condition (drained and flooded) on functional traits and on ecological strategies of restinga trees species and, ii) the effect of functional traits on plant´s habitat preference. We conducted this study in an area of high restinga at Cardoso Island (SP), which comprises two soil types: drained and flooded. We collected five functional traits (leaf area, specific leaf area, leaf thickness, leaf dry matter content and wood density) of 44 tree species. We

selected 30 individuals of each species, 15 in each soil type. We used model selection for statistical analyses, being linear models to assess soil type effect on trait and ecological strategies variances and linear mixed models to assess ecological strategies mean values. We found soil effect on the coefficients of variation of leaf dry matter content (LDMC) and of specific leaf area (SLA), which was higher in the flooded soil. In the case of SLA coefficient of variance, the effect was only significant when we excluded the palms from analyses. We found no soil effect on the other functional traits and on ecological strategies variation, neither on ecological strategy type. As for the results, it was found that in the flooded soil, limiting similarity is the dominant process structuring this community. This result differs from those reported by other tropical forests researches. We found no effect of traits and ecological strategies on habitat species preference, with the exception of LDMC and SLA coefficients of variations. Again, for SLA coefficient of variation, the effect was only significant when we exclude Euterpe edulis (juçara palm) from analyses. This result reinforces the importance of phenotypic plasticity to define species occurrence in different habitats.

MELLO, Thayná Jeremias

Biological invasion in oceanic island: the case of *Leucaena leucocephala* (Leguminosae) in Fernado de Noronha

Abstract: Biological invasions are among the main causes of biodiversity loss on the planet. Isolated environments such as oceanic islands and disturbed environments are considered more prone to invasion. For plants, the invasion success may be related to advantages in competition with native species, which may occur through the production of allelopathic substances. Among the 100 most invasive species on the planet is the legume *Leucaena leucocephala*, which produces substances with putative allelopathic effects and is established on tropical oceanic islands worldwide. In Brazil, the invader was introduced on the island of Fernando de Noronha, where it occupies vast areas. Despite the relevance of this island for biodiversity conservation, important information for the management of the invasion, as its extension and determinants, do not exist. In this work we use experiments to investigate allelopathy as a mechanism associated with the invasion and to evaluate the effect of L. leucocephala on the establishment of Erythrina velutina, a native species common on the island, but often absent from invaded areas. We found no evidence of allelopathic effects of *L. leucocephala* in the germination of *E. velutina*, but the exotic reduced the growth and survival of the native. The negative effect is enhanced when *L. leucocephala* is associated with *Capparis flexuosa*, the only native species often found in heavily invaded areas. When alone, the effect of *C. flexuosa* on *E. velutina* varies from positive to neutral, indicating that the balance of interactions between native species is altered in the presence of an exotic. Additionally, we describe the current distribution of *L. leucocephala* and its expansion in the last 20 years in Fernando de Noronha. We also investigate the environmental and anthropic factors determining the invasion and the impact of *L. leucocephala* on the plant community. We found that *L. leucocephala* is widely distributed throughout the island, densely populating most places where it occurs. The area occupied by the species increased about 40% in the last 20 years, and there are no environmental restrictions for the establishment of exotic, although it is favored by farming. In invaded areas, the number of dominant native species decreased by almost half and we observed a tendency towards homogenization of the community. It is likely that the high degree of human disturbance in Fernando de Noronha poses dispersal limitations and modifies the environments making them unsuitable to the establishment of natives. However, there are strong evidences that *L. leucocephala* is driving ecological changes on the island that influence in native species loss. Considering the biological importance of Fernando de Noronha, actions to control the expansion of exotic and to restore the invaded areas are urgent.

FREY, Gabriel Ponzoni

Phylogenetic structure and demography of trees in a coastal Brazilian white sand forest

Abstract: One of Ecology's biggest goals is to explain the patterns of species' diversity and to understand the processes that generate and maintain this diversity in natural communities. Classical competition theory predicts that two species will be able to coexist only when there is divergence in the use of resources, i.e., competition imposes a limiting similarity among species that allows co-occurrence of species with divergent ecological strategies. On the other hand, the physical environment may impose restrictions to the range of possible ecological strategies of species. Environments with limited resources or adverse conditions will allow the survival of species with more specific strategies, a process known as environmental filtering. These two processes will generate opposite effects on the structure of communities, as more similar or more different ecological strategies will be selected. There is still the possibility that both processes are occurring simultaneously, or neither are important for the community. In both cases, a neutral or random pattern is expected. Using the proportional contribution (elasticities) of the three demographic vital rates - survival, growth and fecundity - to the finite rate of increase of population as a mean of inferring the ecological strategy of trees in a community, we intended to answer the question: “What process is responsible for the structuring of tropical tree communities?”. Data was collected in a Restinga forest 10.24 ha permanent plot. All individuals with more than 15cm of perimeter at breast height were marked, identified and had their diameters at breast height registered for two censes. Elasticities of the three vital rates for 89 tree species were obtained with an Integral Projection Model (IPM). IPMs are modern tools more robust than classical matrix models, commonly used in demographic studies. We defined an ecological space in the triangle where ecological strategies are plotted according to elasticities of the three vital rates. We also generated a molecular phylogeny based on rbcL and matK chloroplast markers, and used it to obtain the phylogenetic distance between all pairs of species. We calculated the phylogenetic signal of ecological strategies using the correlation between ecological distances in the ecological space and phylogenetic distances. We assumed ecological strategies to be conserved in the phylogeny. Species could be classified into four demographic groups in ecological space, distributed mainly in a growth-survival axis. This is expected for trees. No phylogenetic signal was found for the ecological strategies. This can mean that either both processes are structuring this community, or neither is important. Our study uses a new methodological approach and presents new results that contradict recent literature, on which environmental filtering is repeatedly accounted as the main process structuring tropical communities. Confirmation of this pattern for other communities may bring further understanding of structuring of tropical communities.

ZANELATO, Daniela

Tree communities in restinga forests: the role of trade-offs and natural enemies in the regeneration niche

Abstract: The objective of the current research was to investigate if the existing patterns in the adult tree communities can be generated by differences in the aspect related to the regeneration niche of species. Our model of study were two restinga's forests located at the Cardoso Island, on the South coast of São Paulo state. The tall resting forest (TRF) is an older formation, geologically speaking, and it hás closer canopies than the short resting forest (SRF). In the first chapter, we investigated if the abundance inversions of adult trees existing between the TRF and the SRF could be generated due to the differentiated performances of these species at the stage of the seedling, due to the action of the

environmental light filter. We assumed as a hypothesis that the species show a worst performance in the stage of seedling in the forest where they are less abundant as adult, due to a trade-off between growth and survival. We expected that the mortality by pathogens was the main cause for the mortality of plants in the more shaded forest. We achieved a manipulative experiment in field with six tree species, in which one-month-old seedlings after germination were transplanted in the two forests and in the nursery. We followed the performance of the species in the two studied forests for nine months. There were no differences in the performance of the two species, except the survival of the Clusia criuva (in the expected way) and of the Tapirira guianensis (opposite to the expected way).Different from what was expected, the main cause of the mortality of all the species was the severe herbivory, and it was not possible to observe a conflict between the growth and the survival of them. In the second chapter, we investigated if the differences in the size of the seeds among the zoochoric tree species can generate differences in the patterns of the adult community and if those differences occur due to an action of the environment lighting filter or only by the differences of the dispersion capacity of the species. We followed the seed rain of the zoochoric tree species for four years in both forests and we could check that the active dispersion capacity of them is negatively related to the size of the seeds, as it can be predicted by both the hypothesis (environmental filter and dispersion capacity). Besides, the relationship between the average production of seeds and the size of the seeds presented a triangular pattern, as species with big seeds always provide low productions. We compared the seeds average sizes and the range of the seeds sizes of the individual plants and of the adult species in both forests (DAP_> 5 cm. We could verify that the TRF presents average size of seeds and range of the seeds's sizes that were bigger than in SRF. Furthermore, the SRF floristic composition is nested in the TRF composition. Therefore, we assumed as a hypothesis that the differences in the dispersal capacity of species, plus the age differences of the forests, are responsible for the distribution of the seeds sizes of the adult plants present in both forests. Finally, in chapter 3, we made a literature review about the role of the soil microorganisms in the specific site of the regeneration of the tropical tree species. We found studies that focus only on the action of the fungi as far in positive interactions (mycorrhizal fungi) as in negative ones (pathogenic fungi). We discussed the main factors and the characteristics associated to the mortality caused by the soil pathogens, as well as the relationship proposed by the pioneer studies which were not confirmed nor tested.

VAZ, Marcel Carita

Diversity of ecological strategies of the dominant tree species from a terra-firme forest in Central Amazonia

Abstract: Plants have several ways to solve their problems such as resource limitation, herbivory damage or water loss. How a plant solves one of these problems can be considered a tactic and all the tactics together constitutes an ecological strategy. The strategies are possible only because plants have a series of traits that directly affect ecological performance of these plants. These functional traits, therefore, reflect the ecological strategies of species. Based on this rationale, we described the 157 dominant tree species in a terra firme forest of Central Amazon according to thirteen functional traits (among leaf, vegetative and regenerative traits). Our goal was to simplify the ecology of tropical forests, so far focused on species identity. Since these forests have a lot of species that are in general very rare, the patterns of species composition of these communities are very complex and unclear. By shifting focus to diversity of strategies, instead identities, we unveiled an interesting pattern of dominance among the strategy types: Although there are eleven different types of strategies in the forest studied, 61% of the species were of only one type. In addition to a greater number of species, only one type responded by 52% of the tree biomass of the forest sampled, which indicates that this is the optimal strategy. However, as the dominance does not vary considerably

between species, it is possible that the benefit generated by the use of the optimal strategy is offset by the number of species who also use this strategy. We conclude that the neutral pattern found in the distribution of dominances among species and the dominance pattern found among the types are mainly the result of peculiarities of the species set, in particular the large number of the two most common strategies. But how so many similar species can have been originated? To answer to this question, we tested three hypotheses: 1) the rate of speciation was greater than the rate of ecological divergence; 2) species converged recently or evolved parallelly; and 3) allometric relations or tradeoffs between traits restricted the diversity of strategies. We found evidences that partially support these three hypotheses. As phylogenetic diversity was lower than ecological diversity, it is possible that the species studied resulted from recent speciation, which is compatible with the refuge theory. According to this theory, several species would have originated in Pleistocene refuges during the glaciations, which might have enhanced rates of allopatric speciation that was not necessarily followed by ecological divergence. On the other hand, the positive effect of phylogenetic signal in strategy diversity reveals that current species ancestors were ecologically more different from each other than current species are. This indicates that there was a recent convergence of strategies, which is consistent with the hypothesis of Lake Amazonas, which covered the area studied until the early Pleistocene. The large relative amount of silt in the soil of the studied area strengthens the suspect that the bed of this Lake should have provided a great ecological opportunity for species that were adapted to drier and poorer soils. Finally, we found evidence that only the diversity of strategies linked to leaf traits is severely limited by tradeoffs and allometric relations.

STUART, Julia

Do nitrogen fixing legumes facilitate other tree species in a Restinga Forest?

Abstract: Many studies have been proving the importance of positive interactions to the distribution and diversity of species in plant communities. Positive and negative interactions occur simultaneously and the net effect of a species on another is the product of these combined interactions. The objetive of the present study was to evaluate if nitrogen fixing legumes facilitate other tree species in a nitrogen poor environment. We studied the effect of the presence of legumes on the density of species and individuals belonging to two different layers (DBH > 1 cm and 1≤ DBH ≥ 10 cm) around them and also patterns of spatial association between the legumes and other tree species, using a null models approach. The results obtained were dependent on the legume species considered. In chapter 1, the legume Balizia pedicellaris (DC.) Barneby & J.W.Grimes presented higher species density around it, for both layers, although there was no effect on the density of individuals. The species Ormosia arborea Harms did not present effect on the density of species and individuals around it. For the first layer Andira anthelmia (Vell.) J. F. Macbr. did not show effect on the densities, but this species presented a negative effect on the density of species and individuals of the upper layer (1 ≤ DBH ≥ 10 cm), in opposition to our hypothesis. In chapter 2, the spatial association patterns were also distinct between the legume species that showed different species identity associated and different kinds of association (positive or negative). The results indicate that, in spite of belonging to the same functional group, the legumes influence the species around them differently, depending on their morphological and physiological characteristics, as the ability to fix nitrogen in some systems or even the ability to produce alellopathic compounds.

PANNUTI, Márcia Ione da Rocha

Aspects of spatial pattern, habitat association and herbivory density-dependent of

Calophyllum brasiliense Camb. (Clusiaceae) in restinga alta florest, Ilha do Cardoso, Cananéia. SP, Brazil

Abstract: Several theories, including different factors and mechanisms, have been postulated to explain the high tree species coexistence in tropics, which remains an unsolved question that continues to pose a challenge to plant ecologists. Population-level tree dynamics studies contribute to a better understanding of the processes acting on community-level. The aim of the present study was to investigate some aspects related to the dynamics of a common tree species, *Calophyllum brasiliense* Camb. (Clusiaceae), in a Restinga Alta forest in Ilha do Cardoso, Cananéia, SP. We investigated if seedling survival and fitness were related to density-dependent herbivory, tested if the species presented an association with soil habitats and characterized its spatial patterns distribution in the study area. In General Introduction (Chapter 1) we enumerated the main theories developed so far to explain high tropical diversity, which include many processes acting on the tree species dynamics. Traditionally, models focused on density-dependent factors were frequently contrasted with models based on habitat or niche partitioning, but we know nowadays that both are acting simultaneously to determine community structure. For this reason we described in general lines both models. We also discussed how detected spatial patterns of a species may give account for underlying processes responsible for the generated patterns and the need of experimental tests after such inferences. Additionally, we resumed Janzen-Connell model which embases next chapter and was also the starting point of this dissertation. We did a brief contextualization about Janzen-Connell model and reviewed main results of investigations of its effects in others study areas using alternatives methodologies. As the next two chapters were developed in the same study area and with the same species, we also included their descriptions in the general introduction. In order to test the Janzen-Connell model (Chapter 2), we designed an experiment to evaluate *C. brasiliense* seedlings survival and fitness under three treatments: protection against herbivory, distance from conespecific adults and tree parental density. We found that the distance and density-dependent effects did not act as predicted by the model for our study species. Despite the high herbivory damages it suffered, its seedlings showed tolerance and compensatory growth responses. We proposed that pressure by host-specific herbivores seems to be widespread in the study area instead of aggregated around conespecific densities. Patterns detected also suggest that soil moisture is a better predictor for the species survival than herbivory. On chapter 3, therefore, we tested if density of this species presented any association with soil habitats, as suggested in chapter 2. We used an approach conjunct with the spatial distribution, permitting the inference of other underlying processes possibly related to the species dynamics besides the micro-habitat. We characterized the spatial distribution patterns using two complementary second-order point pattern statistics, K-Ripley and O-ring, and tested the habitat association using the torus translation procedure that incorporates spatial autocorrelation between conespecific stems. Besides detecting clumped distribution patterns, with variable critic scales with the analyzed size classes, we also detected a positive habitat association with temporally flooded soil (Neossolo), where its relative density was 30% greater comparing to others soils types. Adult stage was also positively associated with Neossolo and, in the other hand, was negatively associated with Espodossolo arênico, which is characterized by lower moisture soil levels. Young stage corresponded to only a quarter of all species stems and did not show any association with soils habitats. We suggest that flooding and anoxic conditions tolerance, as well as the occurrence of hidrocory among its dispersion types, the main factors favorable to survival and fast ontogenetic development in these soil conditions. We used information about C. brasiliense ecology from other studies to infer or exclude possible related factors with its spatial distribution and the habitat association and Janzen-Connell tests to complement these supposed factors. On Final Considerations we synthesize all proposed and tested information about underlying processes acting on C. brasiliense dynamics and suggest that the clumped spatial pattern detected may be an interaction result of three main factors: (1) differential association with both temporally flooded and unflooded soils, (2) occurrence of three simultaneous and complementary seed dispersal agents (gravity, bats and water) and (3) high

density-dependent intra-specific competition through ontogenetic stages. We finalize proposing a hypothetic scenario with testable predictions about the species spatial pattern detected to *C. brasiliense* in the study area. These results attribute to grouping acting effects of both abiotic and biotic processes the possible answer to complement our understanding about tree spatial patterns founded, as suggested by other studies in the tropics.