# Suggested research projects – EEB338, Tropical Ecology

The following research projects are suggested with particular reference to their feasibility, time constraints within the three-week course and low cost. Research projects belong to the following categories: projects related to forest habitats, to plants, to arthropods and to forest processes and interactions. Measurements should be calibrated with respect to distance walked, timing, area, weight, etc., so that samples are statistically comparable. The ultimate choice of research projects is free and under the responsibility of the student. Research projects are individuals (that is I will ask for individual written reports and oral presentations), but collaborative projects are most welcome. Students should be organized as to work together on related themes and never work alone in the forest. The written report should consist of a concise, standard scientific report of a few pages. The oral presentation should be prepared using PowerPoint or equivalent software and is expected to last about 15 minutes, plus 5 minutes for questions. The list and examples below are far from being exhaustive!!!

## 1. Projects related to habitats

### 1.1. Forest structure

**Aims:** measurements of canopy openness, incident light, forest physiognomy (profile diagrams), etc.
**Hypotheses:** nil hypotheses of forest homogeneity among sites and strata
**Sites:** our four study sites, plus the possibility to perform vertical transects with the two canopy cranes.
**Needed:** clinometers, tapes, luxmeters, digital camera, etc.
**Suggested reading:** Montgomery RA & Chazdon RL. 2001. Forest structure, canopy architecture, and light transmittance in tropical wet forets. *Ecology*, **82**, 2707-2718.
See also Richards, P.W. 1998. The Tropical Rainforest. 2nd edition. Cambridge University Press.

## 2. Projects related to plants

### 2.1. Census of particular plant groups, such as epiphytes

**Aims:** contrast floristical differences between the study sites
**Hypotheses:** nil hypotheses of vegetation homogeneity among sites and strata
**Sites:** our four study sites, plus the possibility to perform vertical transects with the two canopy cranes.
**Needed:** measuring tapes, plastic poles, plant press.
**Suggested reading:** Barthlott W, Schmit-Neuerburg V, Nieder J, Engwald S. 2001. Diversity and abundance of vascular epiphytes: a comparison of secondary vegetation and primary montane rain forest in the Venezuelan Andes. *Plant Ecology*, **152**,145-156
See also Condit R. 1998. *Tropical Forest Census Plots*. Springer-Verlag, Berlin, and R. G. Landes Company, Georgetown, Texas.

### 2.2. Leaf traits

**Aims:** contrast different leaf traits (sclerophylly, leaf area, leaf water, etc.) among study sites
**Hypotheses:** nil hypotheses of leaf trait homogeneity. Opportunity to assess relationships with herbivory (see 4.1).
**Sites:** our four study sites, plus the possibility to perform vertical transects with the two canopy cranes.
**Needed:** grided overhead transparencies, drying oven, plastic bags.
**Suggested reading:** Vendramini F, Díaz S, Gurvich DE, Wilson PJ, Thompson K & Hodgson JG. 2002. Leaf traits as indicators of resource-use strategy in floras with succulent species. *New Phytologist*, **154**, 147–157.

### 2.3. Riparian habitat quality

**Aims:** to constrast riparian habitat quality near four stream (vegetation transects). A similar exercise could be performed with regard to animal biomass.
**Hypotheses:** nil hypotheses of forest homogeneity
**Sites:** our four study sites, in the understorey, near steams
**Needed:** measuring tapes, plastic poles.
**Suggested reading:** Munné A, Prat N, Sol CA, Bonada N & Rieradevall M. 2003. A simple field method for assessing the ecological quality of riparian habitat in rivers and streams: QBR index. *Aquatic Conservation: Marine and Freshwater Ecosystems*, **13**, 147–163.

## 3. Projects related to arthropods

### 3.1. Butterfly transects

**Aims:** surveys of butterflies along transects in different habitats (edges, etc.)
**Hypotheses:** nil hypotheses of distribution
**Sites:** our four study sites, in the understorey.
**Needed:** butterfly nets, binoculars
**Suggested reading:** Thomas JA.1983. A quick method for estimating butterfly numbers during surveys. *Biological Conservation*, **27**, 195-211.
See also DeVries PJ (1987) The Butterflies of Costa Rica and Their Natural History. Volume I Papilionidae, Pieridae, Nymphalidae. Princeton University Press, Princeton, New Jersey

### 3.2. Pitfall traps: arthropod beta diversity

**Aims:** to assess beta diversity of litter arthropods among our study sites (particular groups)
**Hypotheses:** nil hypotheses of distribution
**Sites:** our four study sites, in the understorey.
**Needed:** drinking plastic cups, showels, flagging tape.
**Suggested reading:** Olson DM. 1994. The distribution of leaf litter invertebrates along a Neotropical altitudinal gradient. *Journal of Tropical Ecology*, **10**, 129-150.

### 3.3. Trunk fauna

**Aims:** contrast the fauna associated with tree trunks as collected with insecticide spraying
**Hypotheses:** nil hypotheses of distribution among bark types
**Sites:** our four study sites (trees with different bark types, smooth/rough), plus the possibility to perform vertical transects with the two canopy cranes.
**Needed:** insecticide sprays with rapid decay, such as the locally available Dos Tigre; brushes, plastic foils and bags.
**Suggested reading:** Menzel F, Kitching RL & Boulter SL. 2004. Host specificity or habitat structure? – The epicortical beetle assemblages in an Australian subtropical forest. *European Journal of Entomology*, **101**, 251-259.

### 3.4. Fauna associated with fungi

**Aims:** to contrast the fauna associated with fungi in different habitats
**Hypotheses:** nil hypotheses of distribution
**Sites:** our four study sites, plus the possibility to perform vertical transects with the two canopy cranes.
**Needed:** plastic bags
**Suggested reading:** Wertheim B, Sevenster JG, Eijs IEM & van Alphen JJM. 2000. Species Diversity in a Mycophagous Insect Community: The Case of Spatial Aggregation vs. Resource Partitioning. *The Journal of Animal Ecology*, **69**, 335-351.
See also Wheeler Q, Blackwell ME. 1984. Fungus-Insect Relationships. Columbia University Press, New York

### 3.5. Abundance of insect herbivores

**Aims:** to contrast the abundance of insect herbivores among sites/strata
**Hypotheses:** nil hypotheses of distribution among sites, strata
**Sites:** our four study sites, vertical profiles possibles.
**Needed:** sweep-nets, possibly also beating.
**Suggested reading:** Basset Y, Aberlenc H.-P. & Delvare G. 1992. Abundance and stratification of foliage arthropods in a lowland rain forest of Cameroon. *Ecological Entomology*, **17,** 310-318.

## 4. Projects related to forest processes and interactions

### 4.1. Herbivory, galls and mines

**Aims:** to assess herbivory/gall/mine abundance in different habitats and among different plant strategy (pioneer, shade tolerant)
**Hypotheses:** nil hypotheses of herbivory distribution. Opportunity to assess relationships with leaf traits (see 2.2).
**Sites:** our four study sites, plus the possibility to perform vertical transects with the two canopy cranes.
**Needed:** grided overhead transparencies, plastic bags.
**Suggested reading:** Lowman MD. 1984. An assesment of techniques for measuring herbivory : is rainforest defoliation more intense than we thought ? *Biotropica*, **16**, 264-268.

### 4.2. Pollination: observation of flower visitors

**Aims:** to contrast the abundance of flower visitors among sites/strata
**Hypotheses:** nil hypotheses of distribution among sites, strata, best formulated in using plants growing at all sites (e.g., Piper spp.).
**Sites:** our four study sites, plus the possibility to perform vertical transects with the two canopy cranes.
**Needed:** Entomological net, possibly sticky traps
**Suggested reading:** Roubik DW. 1989. Ecology and Natural History of Tropical Bees. Cambridge University Press, Cambridge.

### 4.3. Decomposition: suspended and ground soils

**Aims:** to evaluate arthropod abundance/functional diversity among study sites. A similar project could be performed in evaluating differences in the litter of latex vs. non-latex trees.
**Hypotheses:** nil hypotheses of distribution
**Sites:** our four study sites, plus the possibility to perform vertical transects with the two canopy cranes.
**Needed:** Berlese extractors, showels, plastic bags, etc.
**Suggested reading:** Nadkarni NM & Longino JT. 1990. Invertebrates in canopy and ground organic matter in a Neotropical montane forest, Costa Rica. *Biotropica*, **22**, 286-289.

### 4.4. Ant-plant mutualisms

**Aims:** To assess herbivory and liana colonization on *Cecropia* trees, depending on their colonization by *Azteca* ants.
**Hypotheses:** nil hypotheses of no effect with ant colonization
**Sites:** our four study sites, in the understorey.
**Needed:** grided transparent overhead transparencies
**Suggested reading:** Longino JT. 1989. Geographic variation and community structure in an ant-plant mutualism: Azteca and Cecropia in Costa Rica. *Biotropica*, **21**, 126-132.
See also www.evergreen.edu/ants/ANTPLANTS/CECROPIA/Cecropia.html

### 4.5 Ant predation pressure

**Aims:** To evaluate the occurrence of dominant ants among different habitats and/or to investigate the effects of baits (sugar = energy vs. thuna = protein).
**Hypotheses:** nil hypotheses of distribution/dominance
**Sites:** our four study sites, plus the possibility to perform vertical transects with the two canopy cranes.
**Needed:** tuna and sugar baits, cotton, pins, flagging tape
**Suggested reading:** Yanoviak SP & Kaspari M. 2000. Community structure and the habitat templet: ants in the tropical forest canopy and litter. *Oikos*, **89**, 259–266.
Kaspari M &Yanoviak SP. 2001. Bait use in tropical litter and canopy ants - evidence of differences in nutrient limitation. *Biotropica*, **33**, 207-211.

### 4.6. Bird predation on caterpillars

**Aims:** to assess rates of bird predation on fake caterpillars among different habitats
**Hypotheses:** nil hypotheses of distribution
**Sites:** our four study sites, plus the possibility to perform vertical transects with the two canopy cranes.
**Needed:** plasticine, flagging tape.
**Suggested reading:** Loiselle BA & Farji-Brener AG. 2002. What's up? An experimental comparison of predation levels between canopy and understory in a tropical wet forest. *Biotropica*, **34**, 327-330.

### 4.7. Influence of forest edges

**Aims:** to contrast arthropod abundance/diversity and other processes such as herbivory or predation at increasing distance from forest edges.
**Hypotheses:** nil hypotheses of forest fragmentation
**Sites:** our four study sites, in the understorey
**Needed:** sweep-nets, pitfall traps, butterfly transects, beating, transparencies, ant baits, etc.
**Suggested reading:** Didham RK, Hammond PM, Lawton JH, Eggleton P & Stork NE. 1998. Beetle Species Responses to Tropical Forest Fragmentation. *Ecological Monographs*, **68**, 295-323.

## 5. A few examples of past projects (titles of presentations):

Factors Affecting Liana Abundance and Biomass
A survey of helical handedness in tendrils, climbers, and lianas across temperate and tropical forests of Panama
Environmental Determinants of Stomatal Density in Tropical Plants
The Effects of Forest Characteristics and Disturbance Gradients on Epiphyll Coverage in Three Different Panamanian Rainforest Sites
Influence of sunlight on leaf sizes of two tree species in a tropical rainforest (*Cordia alliodora*/ *Luehea seemannii*)
The Distribution of Mycorrhizae in Juvenile Plants Near Freshwater Streams Across Four Tropical Forests in Panama
Examining magnitude and penetration distance of edge effects on leaf litterfall across three different Panamanian forest formation types
A Comparison of Understory and Canopy Tree Architecture, Leaf Arrangement, and Leaf Size
Fauna associated to Bromeliads
Leaf Damage categories on *Inga* plants by herbivorous insects
Müllerian Body Production as Herbivory Response & Defense in *Cecropia*
Patterns of Leafcutter Ant Foraging in Different Neotropical Forests
Gall Diversity, Abundance, and Correlations with Leaf Herbivory at Four Rainforest Sites

Gall abundance along vertical gradients in a lowland neotropical forest: the impact of leaf age
Microhabitat-Specific Activity Levels in Neotropical Butterflies
Beta-Diversity of Butterfly Assemblages in Panamanian Rainforests
An Estimation of Butterfly Diversity: Testing the Effectiveness of a Modified Pollard Transect
Habitat-specific arboreal termite nest prevalence in tropical forests (Isoptera: Termitidae)
Abundance and temporal response of ants to nitrogen-rich bait in the litter and canopy of tropical forests
Ant Nutrient Preferences in Edge vs. Inner Forest
Ant bait preferences along moisture gradients in tropical rainforests
Relating Physical and Structural Variables of Foraging Trails Within Atta colombica Leafcutter Ants
An Analysis of Leaf-Cutter Ant Foraging Rates and the Importance of Traffic Density
Hitchhiking behavior in Atta colombica: Effects on simulated congestion
Avian Species Richness and Forest Structure in Panamanian Rainforests

Yves Basset, 3 December 2008