

MONITORING POLLINATING WILD BEES

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Why monitoring bees?

- **Concern on the maintenance of stable populations of wild pollinating bees.**
 - Retraction of the beekeeping activity in the northern hemisphere.
 - **Recognition of a “Pollination Crisis”:** are native pollinators declining?

Why monitoring bees?

- Concern on the maintenance of stable populations of wild pollinating bees.
- **Factors affecting bee abundance and diversity may include:**
 - Natural phenomena (e.g. severe rainy seasons or droughts).
 - **human impacts (e.g. deforestation, insecticide applications).**

Why monitoring bees?

- **Monitoring programs are important to:**
 - give us understanding of the dynamics of population and diversity variation in bee communities.
 - **give us the predictive power we need to:**
 - intervene on wild and cultivated landscapes
 - preserve wild bee populations and
 - **preserve the continuity of the pollination service they offer.**

Why monitoring bees?

- **The establishment of efficient monitoring programs depends on the solution of several methodological and analytical problems.**

What kind of methods should we use?

- **What are the aims of the monitoring program?**
 - How the abundance of bees (general or given taxa) is fluctuating through time or in response to any given factor.
 - How the species richness and/or taxocene composition is/are fluctuating through time or in response to any given factor.
 - **For specific crops, how the population of a given pollinator species is varying along the years.**

What kind of methods should we use?

- What are the aims of the monitoring program?
 - We may want to be more specific and monitor genetic variability or parasite infestation, for exemple.

What kind of methods should we use?

- What are the aims of the monitoring program?
- **The perfect method should yield reliable, unbiased data.**
 - **Traps**
 - Do not depend on collector skills.
 - **A given trap will be efficient to sample only a limited portion of a bee community.**

What kind of methods should we use?

- What are the aims of the monitoring program?
- **The perfect method should yield reliable, unbiased data**
 - **Hand net**
 - Depend on collector skills.
 - **Useful in many situation for most bee groups.**

Using target plant species

- Proposed and used previously by Frankie and collaborators (e.g. 1998).
- **Allows for abundant and diverse samples of bees with little sampling effort.**
 - Avoid waste of time in searching through patches with no bees.
 - **Avoid waste of time in sampling bad seasons and/or poorly attractive plants.**

Using target plant species

- Proposed and used previously by Frankie and collaborators (e.g. 1998).
- Allows for abundant and diverse samples of bees with little sampling effort.
- Useful in both natural and agricultural landscapes.
- Easily adapted to local conditions.
- **Easily included in comprehensive environmental studies.**

Using target plant species

- *Vochysia rufa* (Vochysiaceae) in *Eucalyptus* plantations in the “cerrado” (Brazilian savanna)



Using target plant species

- *Vochysia rufa* (Vochysiaceae) in *Eucalyptus* plantations in the “cerrado” (Brazilian savanna)
 - Visited by 85 (61%) of the about 140 bee species known to exist at the “Fazenda Brejão,” after 5 years of study.

Using target plant species

- *Vochysia rufa* (Vochysiaceae) in *Eucalyptus* plantations in the “cerrado” (Brazilian savanna)
 - Source of pollen and nectar; visited by a wide diversity of forms:
 - tiny to large bees;
 - solitary to eusocial;
 - ground, and cavity nesting;
 - pollen generalists and specialists;
 - oil collecting bees;
 - “buzz” and conventional foragers etc.

Using target plant species

- *Vochysia rufa* (Vochysiaceae) in *Eucalyptus* plantations in the “cerrado” (Brazilian savanna)
 - Blooms each year.
 - **Long blooming season (more than 4 months) with relatively steady flower production through out.**

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 - **Blooms during dry season.**

Using target plant species

- *Vochysia rufa* (Vochysiaceae) in *Eucalyptus* plantations in the “cerrado” (Brazilian savanna)
 - Blooms each year.
 - Long blooming season.
 - Blooms during dry season
 - ➔ **Easy to schedule sampling!!!**

Using target plant species

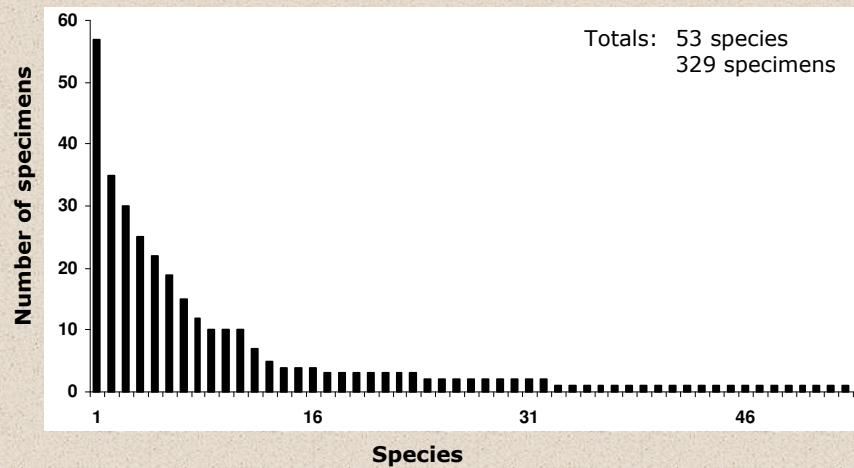
- *Vochysia rufa* (Vochysiaceae) in *Eucalyptus* plantations in the “cerrado” (Brazilian savanna)

Designed to:

- a) follow changes in bee abundance, species richness and species composition through time.
- b) try to associate such changes to different natural and anthropogenic factors.
- c) to compare changes in cerrado reserves and cerrado stripes between *Eucalyptus* blocks.**

A few special problems

- Rare species



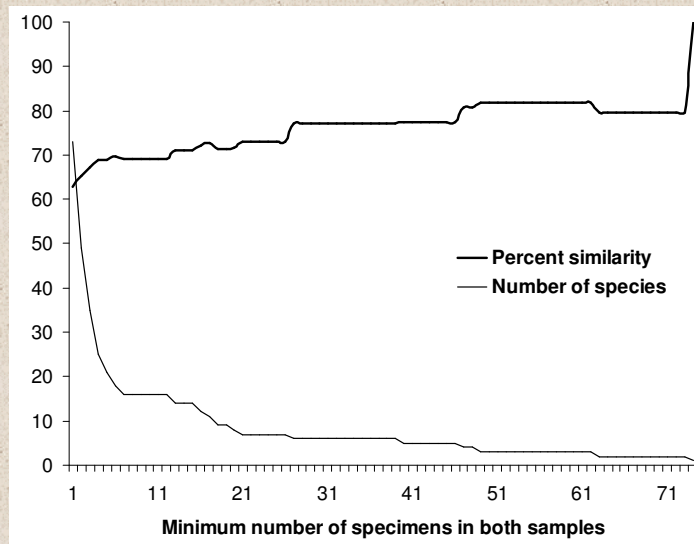
Number of specimens of each bee species collected on flowers of *Vochysia rufa* in four sites at the cerrado of "Fazenda Brejão" (2001).

A few special problems

- **Rare species**

→ Rare species appear in samples mostly by chance.

- What is the effect of a large number of rare species on our understanding of changes in time and/or space?



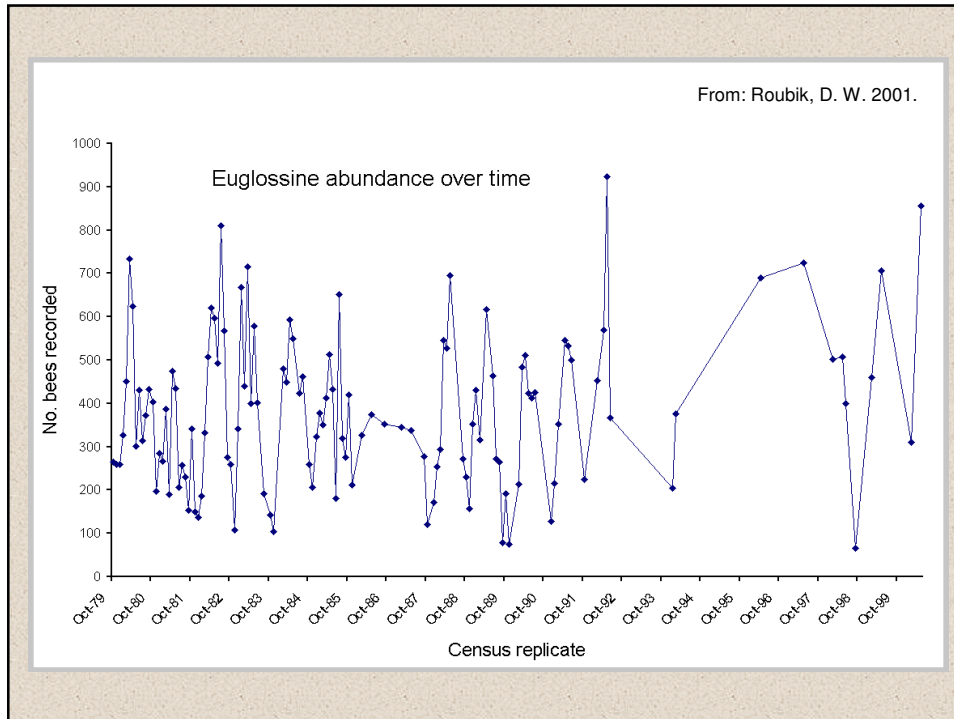
Effect of the elimination of species from the samples on the similarity of the species composition between 2001 and 2002.

A few special problems

- Rare species
- **Spatial heterogeneity**
 - Environment (especially natural ones) are rarely homogeneous.
 - **Sample of bees will yield different species at different sites in the same area.**
 - Enough replicates should be used to cover such variation (high standard deviations).

A few special problems

- Rare species
- Spatial heterogeneity
- **Assessing the effects of specific factors**
 - **Fluctuation of bee populations is normal and can be drastic, even in the absence of human impact.**



A few special problems

- Rare species
- Spatial heterogeneity
- **Assessing the effects of specific factors**
 - **How to associate ups and downs with specific factors?**
 - Our data inappropriate due to steady abundance, species richness and species composition.
 - **Is this a mere coincidence or a pattern for the cerrado?**

Final remarks

- The establishment of monitoring programs for pollinating bees is important.
- Different methods for sampling and analyzing data will be necessary for different aims and different situations.
- Definition of standard protocols for similar conditions is needed.
- **The choice of adequate protocols and statistical methods are of great importance.**