Importance of species concept to studying community assembly: genetic delimitations of Amazonian tree species complexes.

Ivan Scotti, Caroline Scotti-Saintagne

> a bold statement:

Plant (especially *tree*) species (sometimes) do not exist
At least, *not if one expects them not to share genes.*

Phylogenetic tree view, no gene sharing: **Twigs do not overlap**

Phylogenetic tree view with gene sharing: Non-overlapping **twigs insufficient to describe the tree**

Should the overlap between gene pools be accounted for in community ecology? Does it matter?

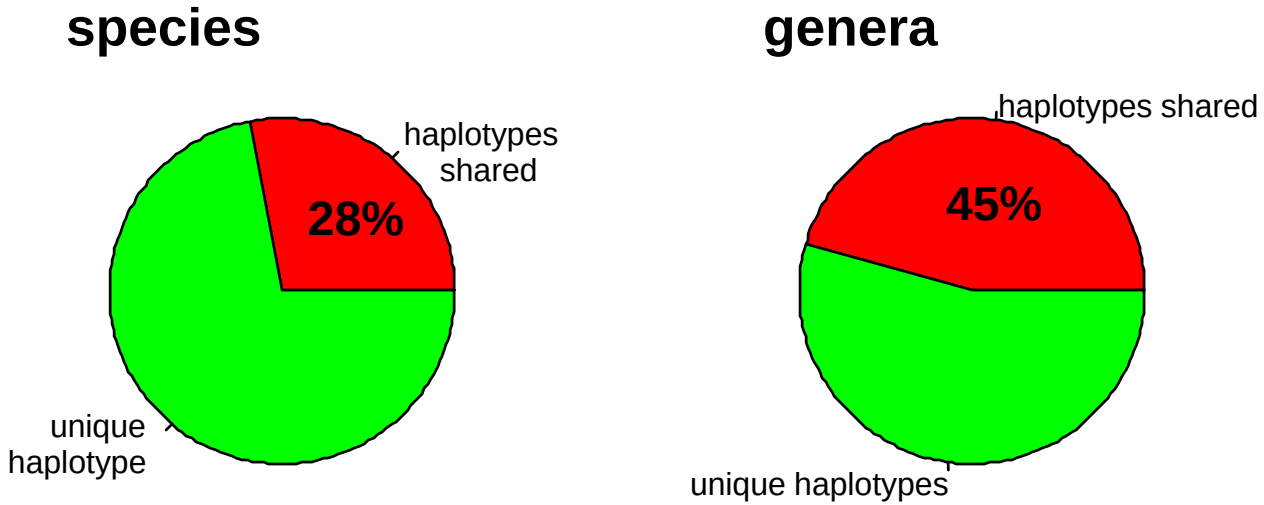
> a (reasonable) postulate:

Population-genetic level species-species interactions matter to community ecology if

- *they are relatively **widespread** and **strong***
- *they occur on the **same time- and space-scale** as ecological processes*

How widespread?

Evidence from across-species haplotype sharing

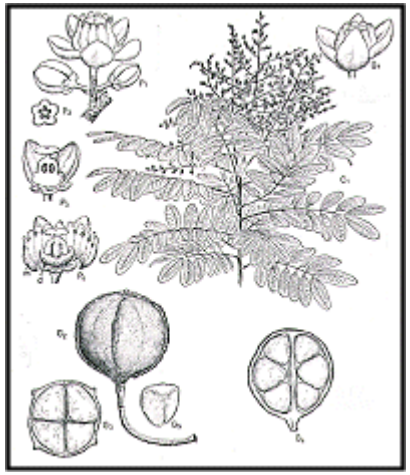


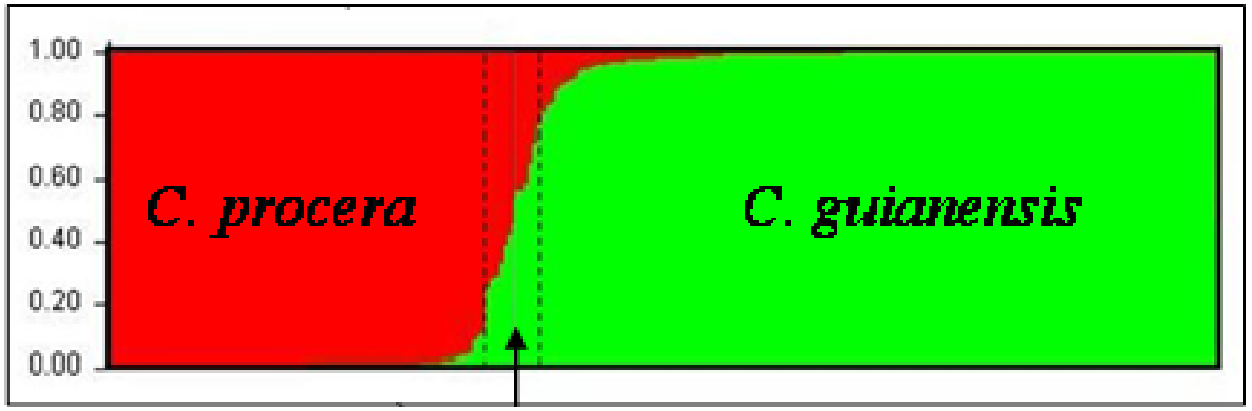
An example from chloroplast DNA sequences from 2-5 samples from **222 species** and **46 genera** of tropical rainforest trees
(source: Henri Caron, INRA, Molecular Atlas Consortium)

There is widespread (apparent) gene flow among congeneric species

How effective?

Barriers to gene flow may sometimes be extremely porous





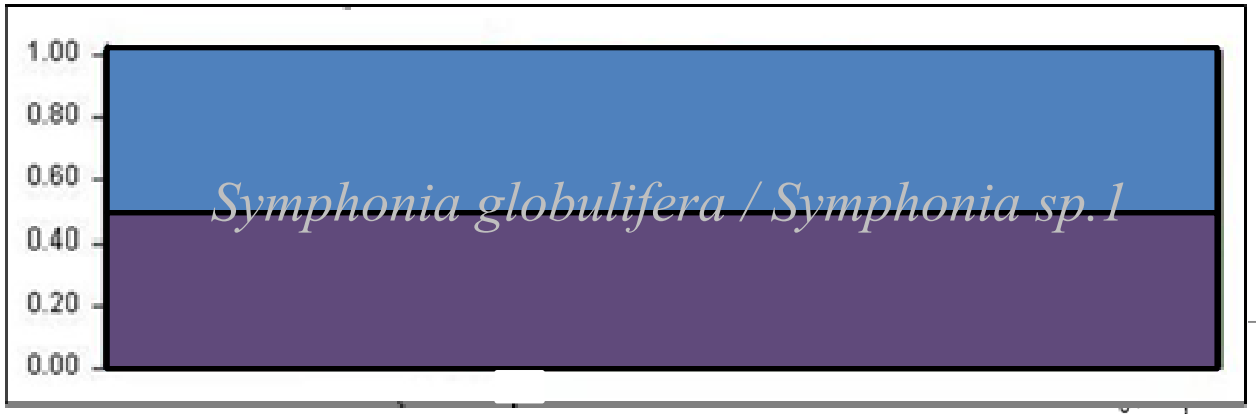
Duminil *et al.,* Mol. Ecol. (2006)

An example of Bayesian assignment of individual samples to groups. Species are clearly reconstituted based on this method, yet **several samples show intermediate values (hybrids?)**

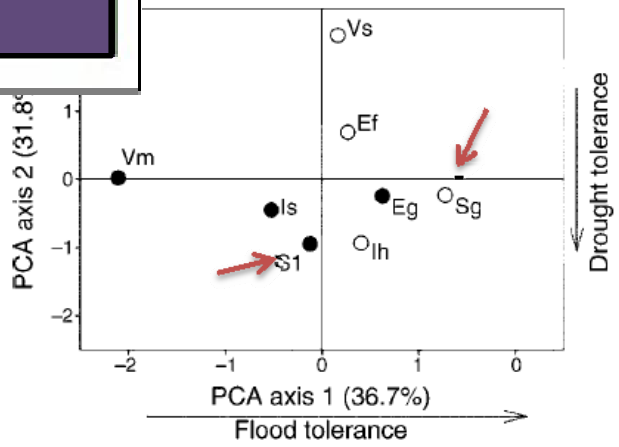
Interspecific gene flow may be recurrent.

How pervasive?

Genomes may be entirely shared by ecologically divergent (sub)species



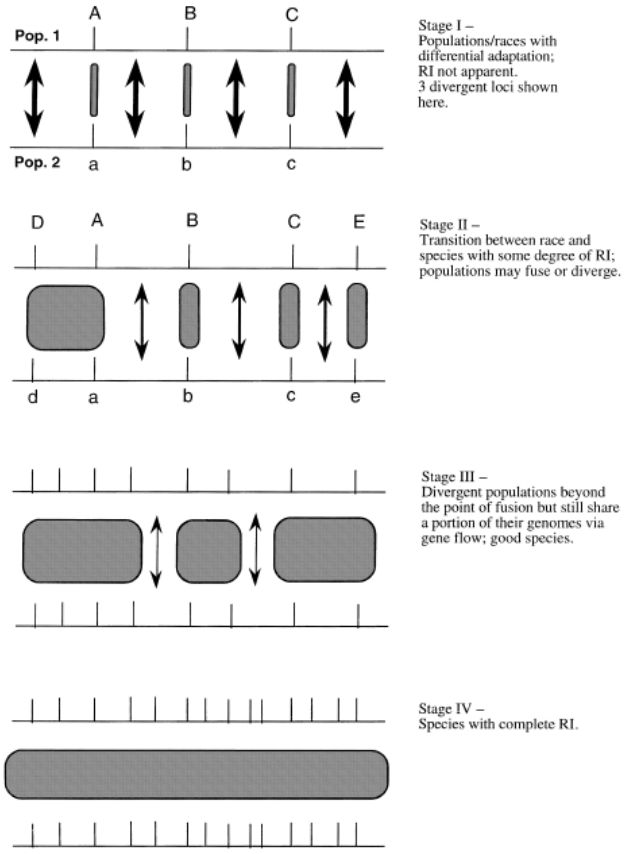
Gene flow can be very intense.



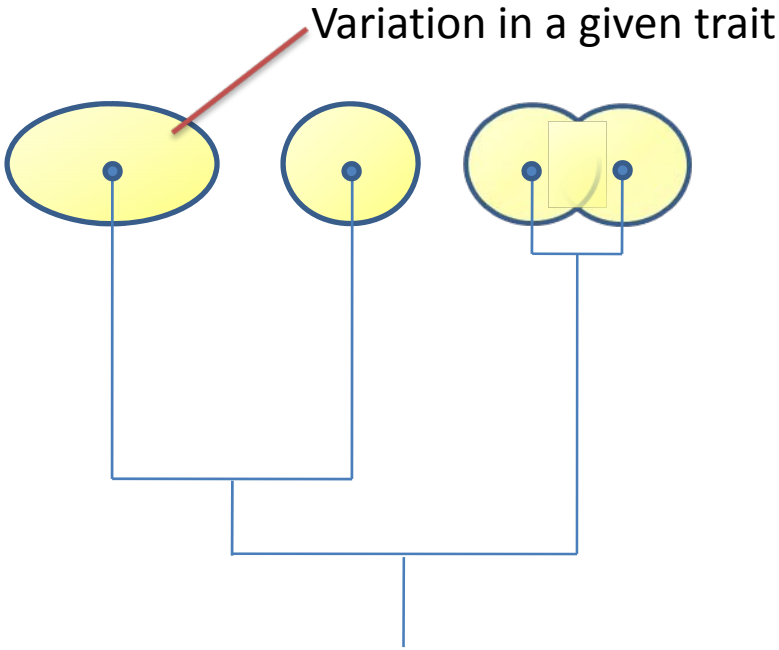
Baraloto et al. *Ecology* (2007)

Steady state between divergence and introgression?

Fuzzy species delimitations may be important in ecological processes



Wu, *J. Evol. Biol.* (2001)



Porous genomes, shared traits?

Do population-genetic processes happen on the ecological timescale?

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Natural selection and population dynamics

Ilik Saccheri[1] and Ilkka Hanski[2]

reciprocal effects of such evolutionary changes on population size [8]. The third approach is that of evolutionary biologists wishing to understand life-history dynamics in relation to environmental conditions, including population density [9], through the assessment of tradeoffs within the limits of the available additive genetic (co)variance [10]. There is a clear trend toward the increasing integration of these perspectives [11–13], reflected by a growing acceptance that the traditional dichotomy between ecological and evolutionary timescales is a false one.

The issue of timescale is nonetheless relevant while considering the role of natural selection in population dynamics. It is evident that life histories affect population

Genetics and ecology

TABLE 1. The ecological geneticist's creed.

Creed	Explanation
Explaining the abundance and distribution of organisms is a genetic problem.	The ecological amplitude of a species both within and among communities has a genetic component.
The forces maintaining species diversity and genetic diversity are similar.	An understanding of community structure will come from considering how these kinds of diversity interact.
Adaptation is a dynamic process, operationally definable, and not just an emotional matching of the character to the environment.	Fitness and the contribution of phenotypes to fitness can be measured in terms of the mortality and fecundity of individuals within populations.
Environmental change will be accompanied by changes in namics.	Genetic response is likely to result in compensatory chang-
The distinction between "ecological time" and "evolutionary time" is artificial and misleading.	Changes of both kinds may be on any time scale: in principle, evolutionary and ecological changes are simultaneous.
The genetic quality of offspring is as important as the quantity.	Sexual systems are concerned with regulating the genetic quality of offspring.
The view that there is always an "evolutionary play" within an "ecological theater" is artificial and misleading.	The "ecological play" often happens in the "evolutionary theater." Selection at the genic or cellular levels may have phenotypic effects with enormous ecological consequences. Genetic events may drive ecology, rather than vice versa.
Speciation is an ongoing and commonplace process, occurring constantly and persistently around us.	It is only deemed to be rare by taxonomists, and the use of Latin binomials by ecologists is at best a crude approximation.
Environments are most appropriately defined by the ecolo- indirectly by environmental measurements.	We can recognize three types of environments: external, pretation have important consequences for population and evolutionary dynamics.
A population to an ecologist is not the same as it is to a geneticist.	Understanding the contrasting way in which the term is used is essential for unifying ecology and genetics.

Antonovics, *Ecology* (2003)

> next:

Assess the correlation between genetic and ecological divergence in species complexes

Date divergence and introgression events

Search for the causative links between environment and genetic diversity