




Frugivores, pollinators, seeds, and genes: tracking long-distance dispersal and its consequences

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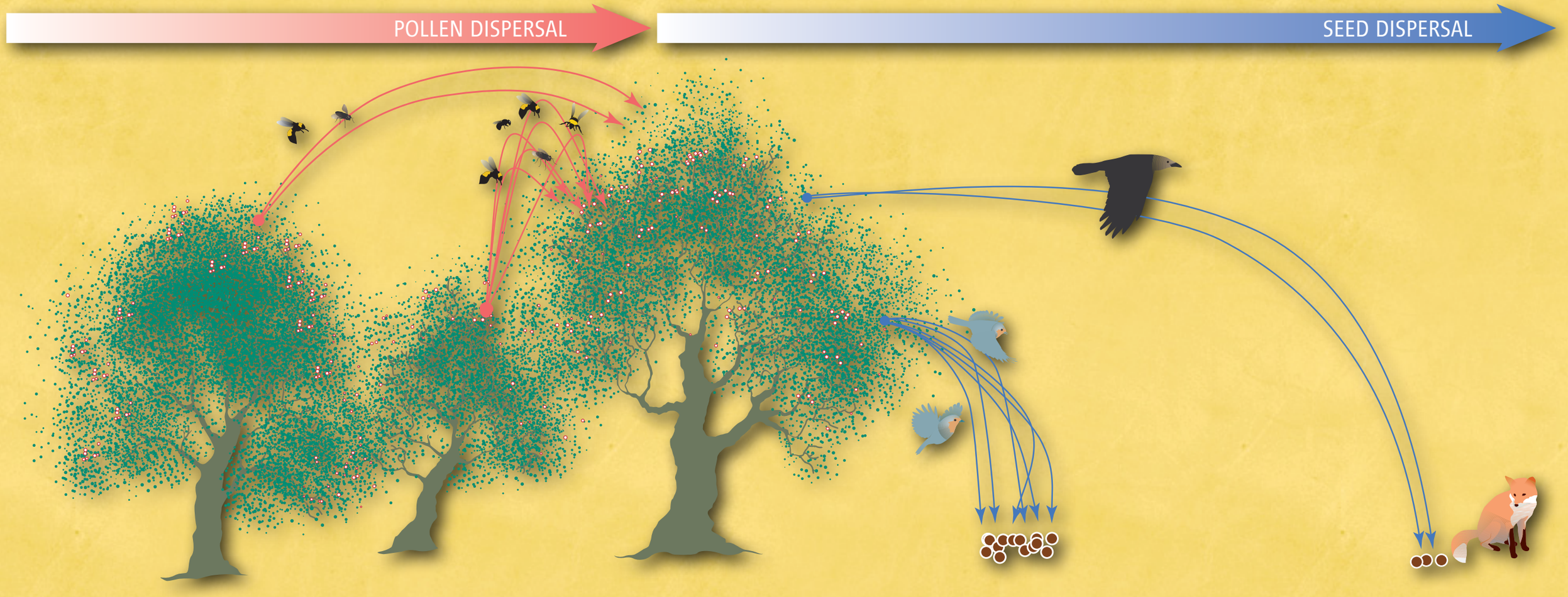
EVERYTHING DISPERSES TO MIAMI
December 14 - December 16, 2012
The University of Miami, Coral Gables, Florida

The functional ecology of interactions

- Dispersal, near (geitonogamous)
- Dispersal, far (xenogamous)
- Fruit set

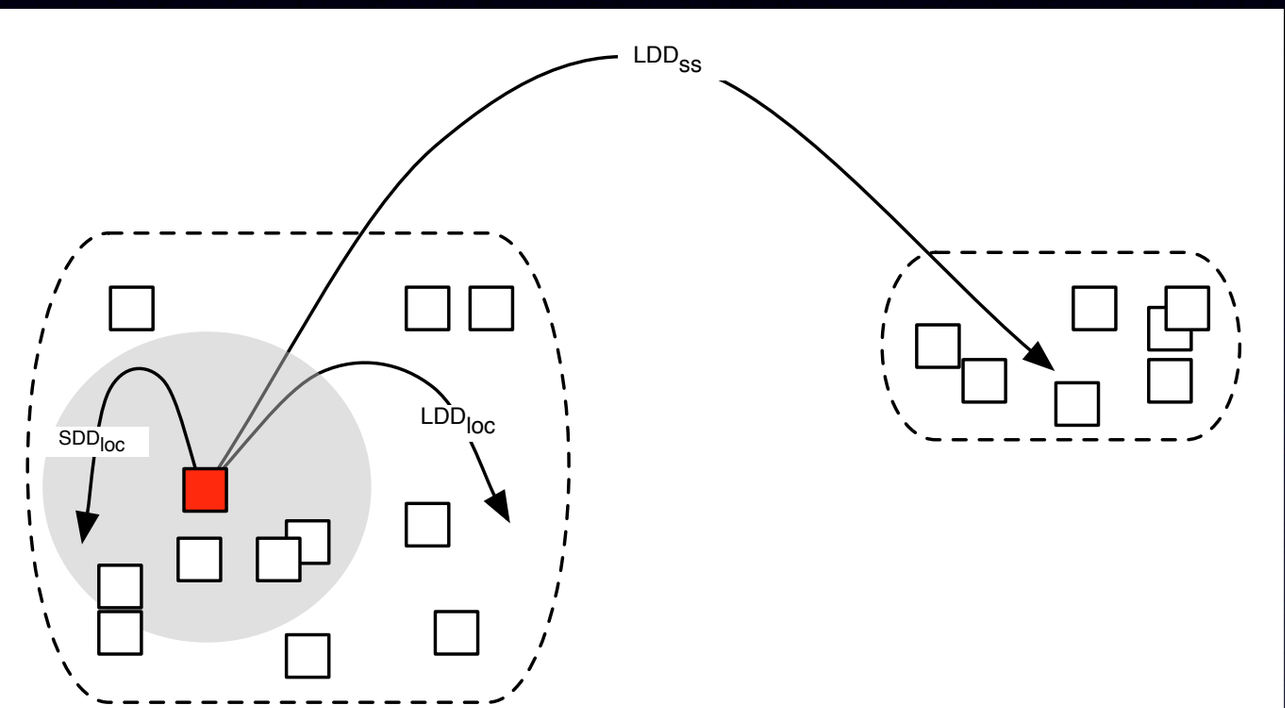
- Dispersal, near (*in situ*)
- Dispersal, far (colonization)
- Fruit removal



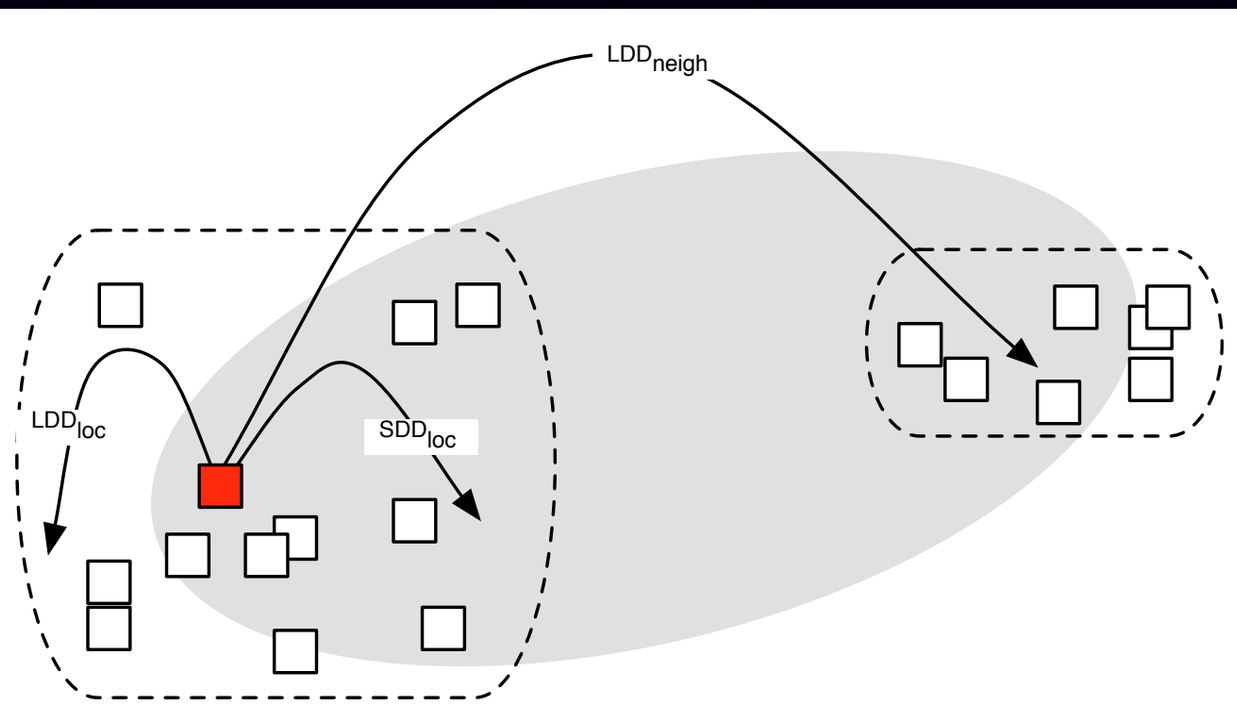
Jordano, García, Godoy, and García-Castaño (2007) *PNAS*

- What is an LDD?
- *In situ* vs. LDD: consequences
- LDD: case studies

When is it LDD?



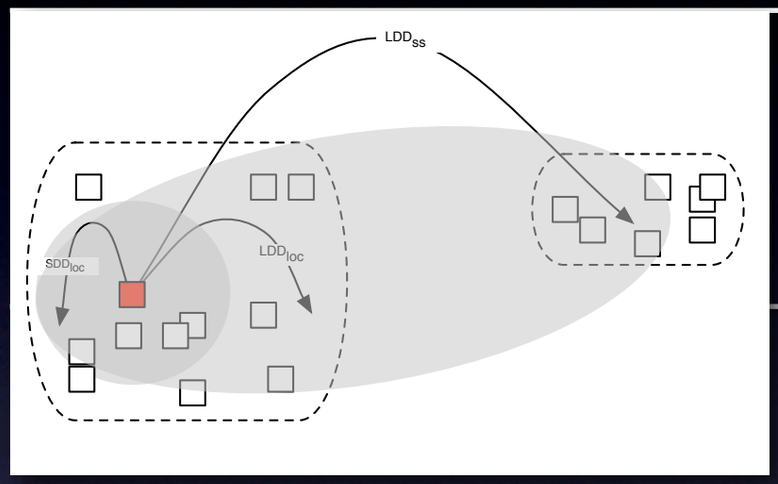
Geographic population limits as reference



Genetic neighborhood limits as reference

Jordano (2013), *in prep.*

A taxonomy of dispersal events

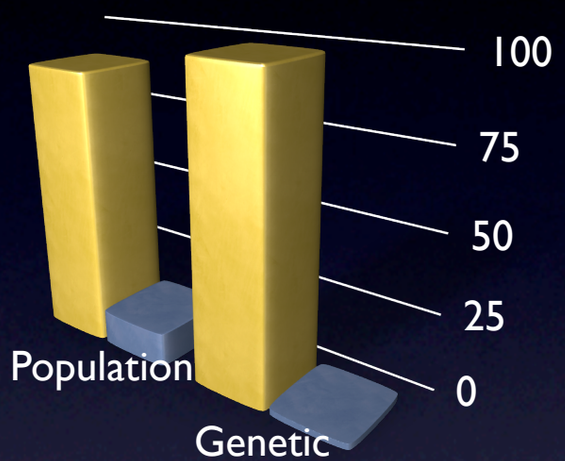


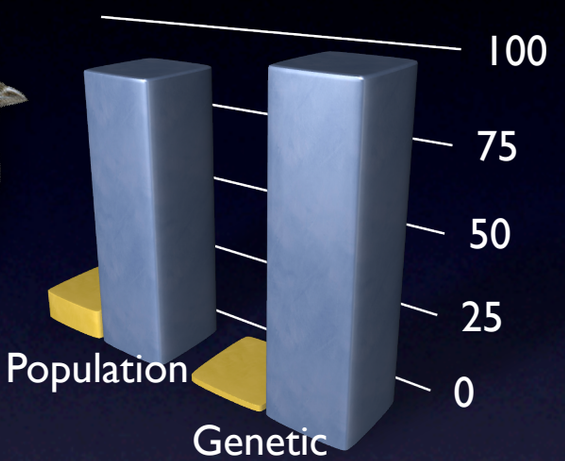
Genetic neighborhood	Population limit: Within	Population limit: Outside
Within	Local, short-distance dispersal *SDD$_{loc}$*	Within neighborhood, long-distance dispersal *LDD$_{neigh}$*
Outside	Local, long-distance dispersal *LDD$_{loc}$*	Strict-sense long-distance dispersal *LDD$_{ss}$*

Jordano (2013), *in prep.*

A taxonomy of dispersal services

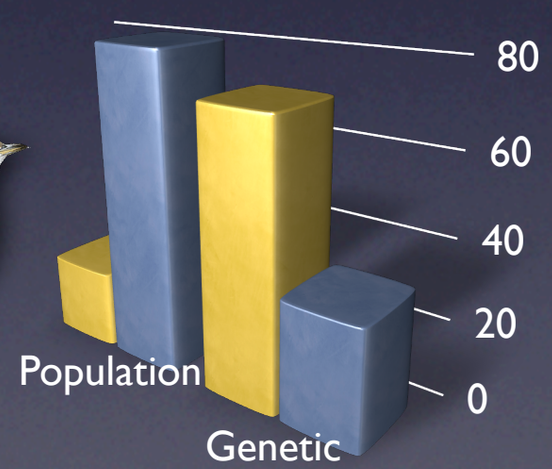
Prunus mahaleb





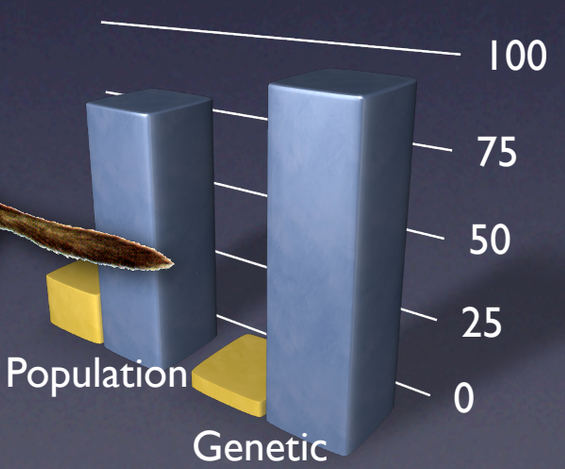
Within
Outside

Small birds



Turdus

Large birds

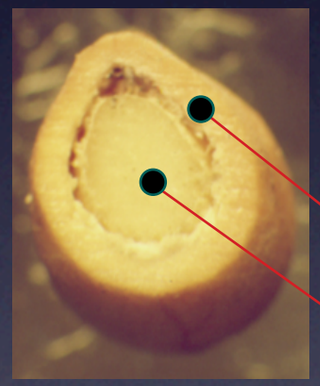


Mammals

Jordano (2013), *in prep.*

- What is an LDD?
- In situ vs. LDD: consequences
- LDD: case studies

Gene flow: pollen & seeds

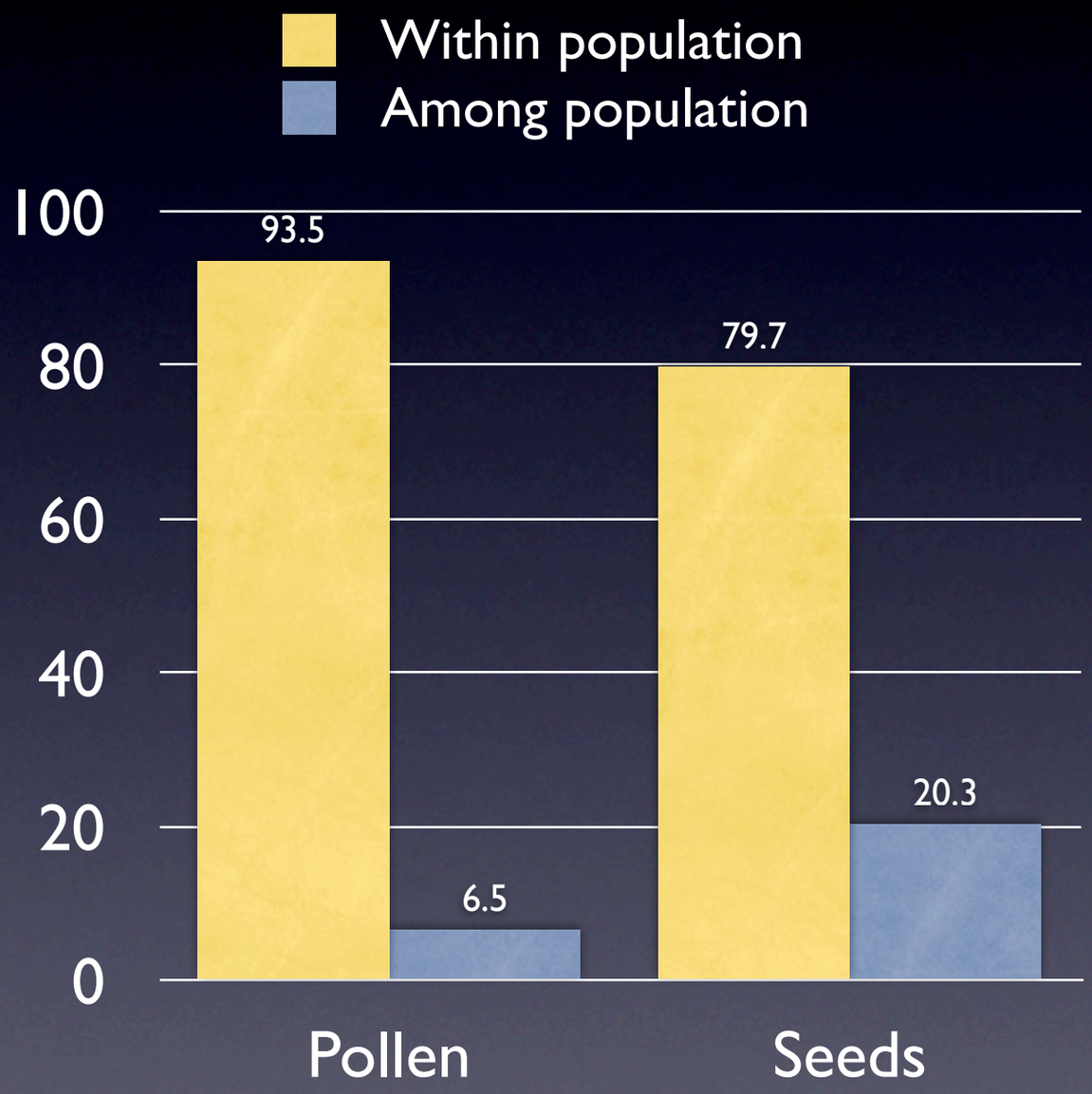


DNA Extraction

Endocarp

Embryo

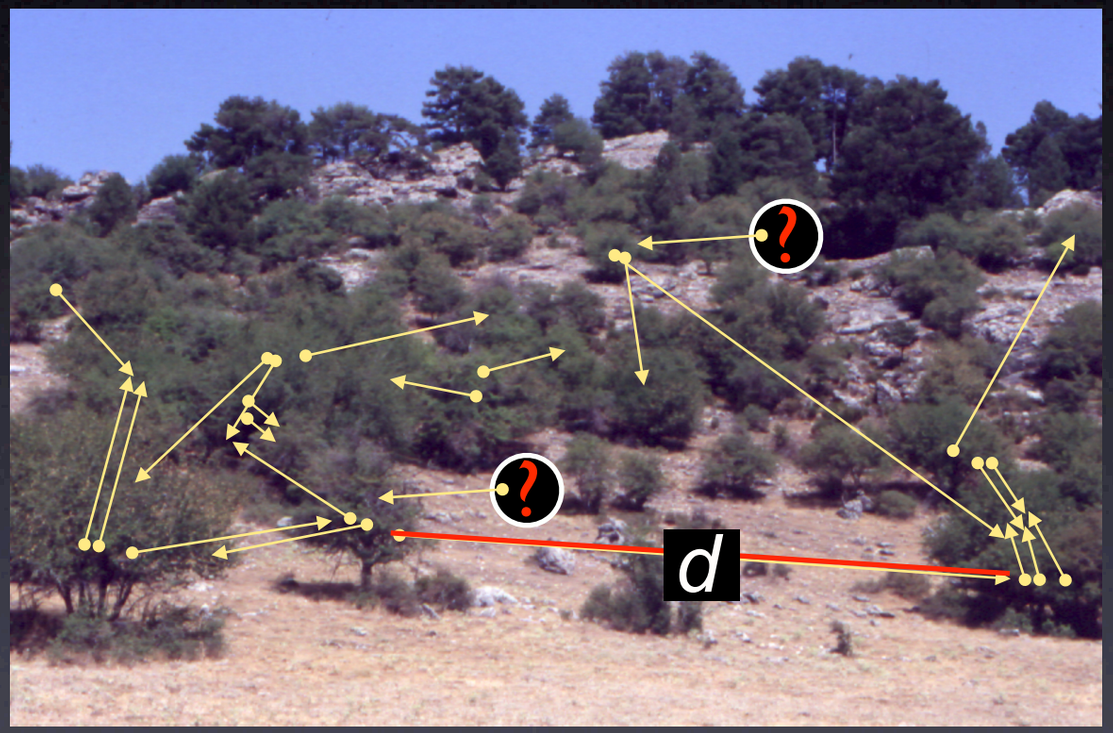
- Leaf tissue genotyping, adult trees.
- Embryo genotyping (known progenies) for pollen flow analysis.
- Dispersed seed genotyping (endocarp) for seed dispersal analysis.
- Microsatellite analysis.



Prunus mahaleb. Godoy & Jordano (2001) *Mol. Ecol.*
García *et al.* (2005, 2007) *Mol. Ecol.*

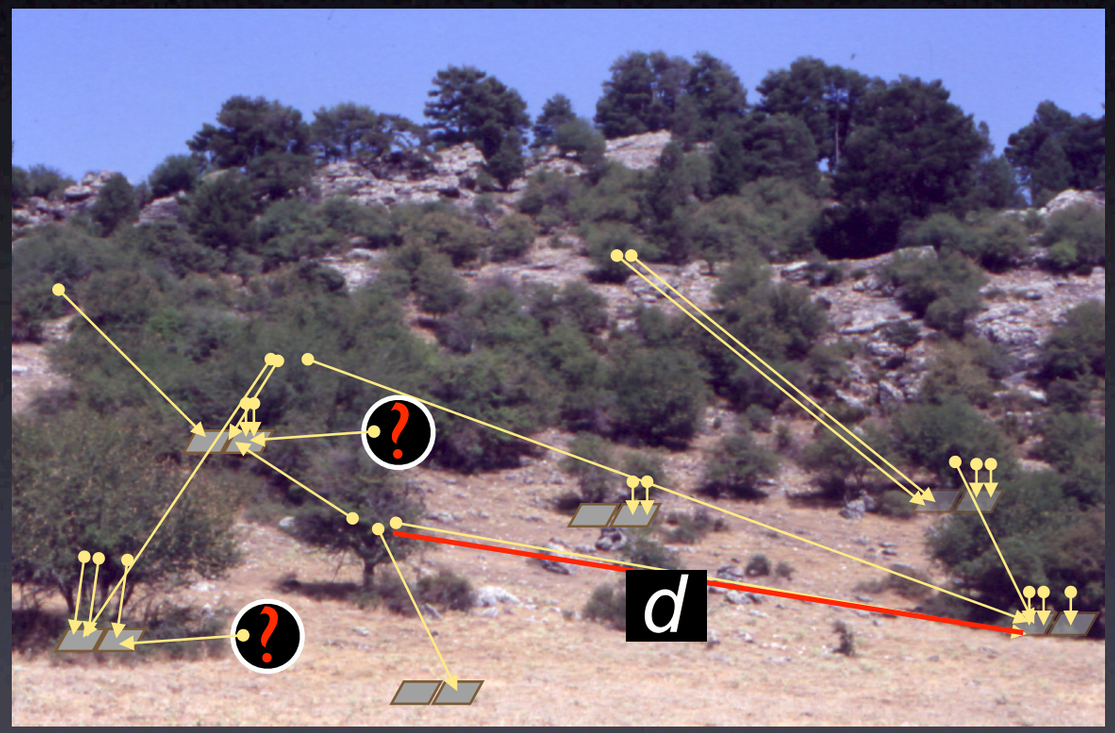
Pollen and seed shadows: dispersal events

Mating events



Bayesian assignment (MEMM) of pollen-donor tree for seeds sampled from maternal-tree canopies.
11 microsatellite loci; genotyping @35 trees and @700 embryos

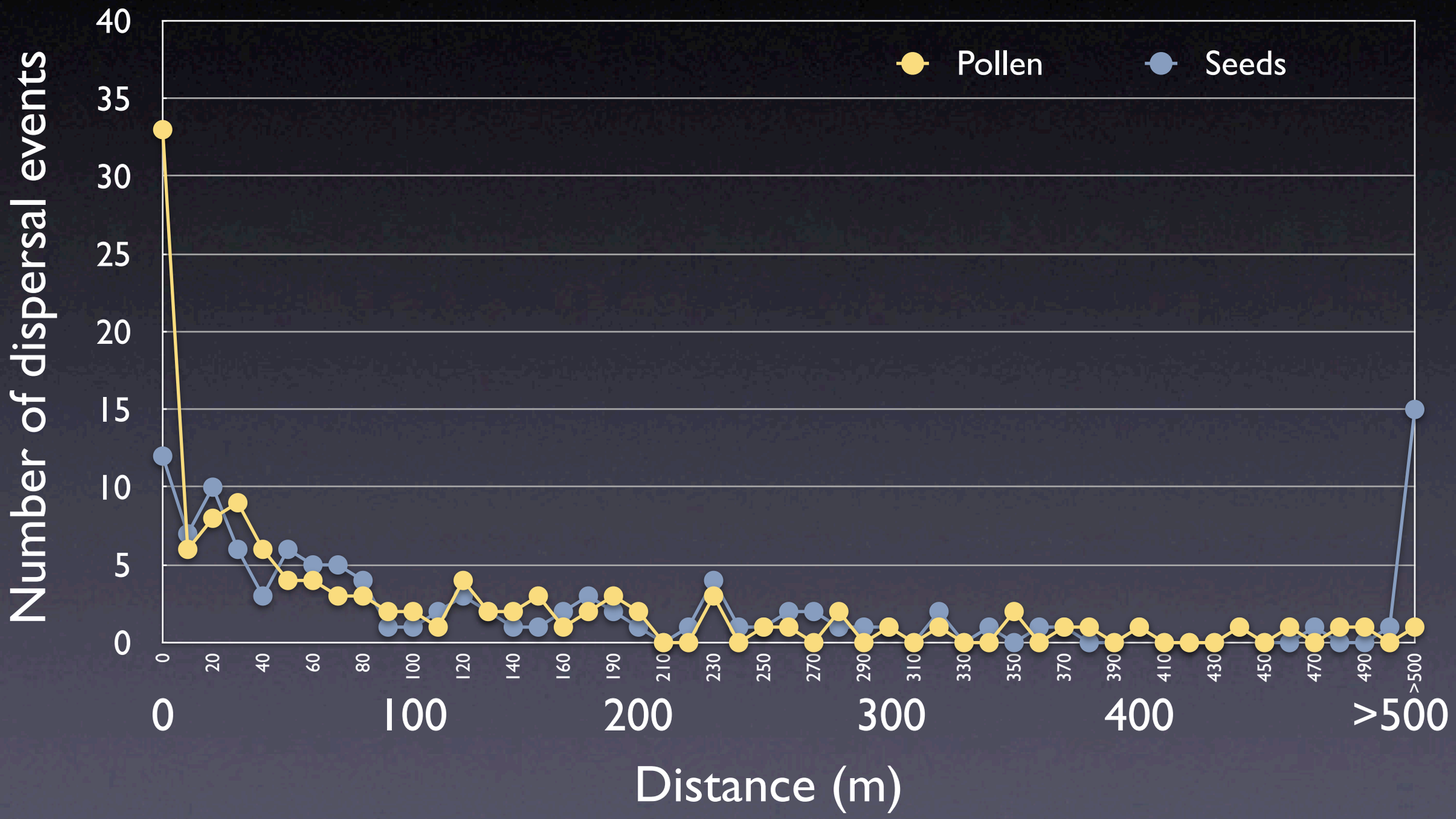
Dissemination events



Direct assignment of mother tree for seeds sampled in seed traps.
11 microsatellite loci; genotyping @200 trees and @650 seed endocarps

Godoy & Jordano (2001) *Mol. Ecol.*
García, Godoy and Jordano (2005, 2006) *Molecular Ecology*

Pollen and seed dispersal distances



Prunus mahaleb. García, Godoy and Jordano (2005, 2006) *Molecular Ecology*

Pollen dispersal: mating events

Seed dispersal: dissemination

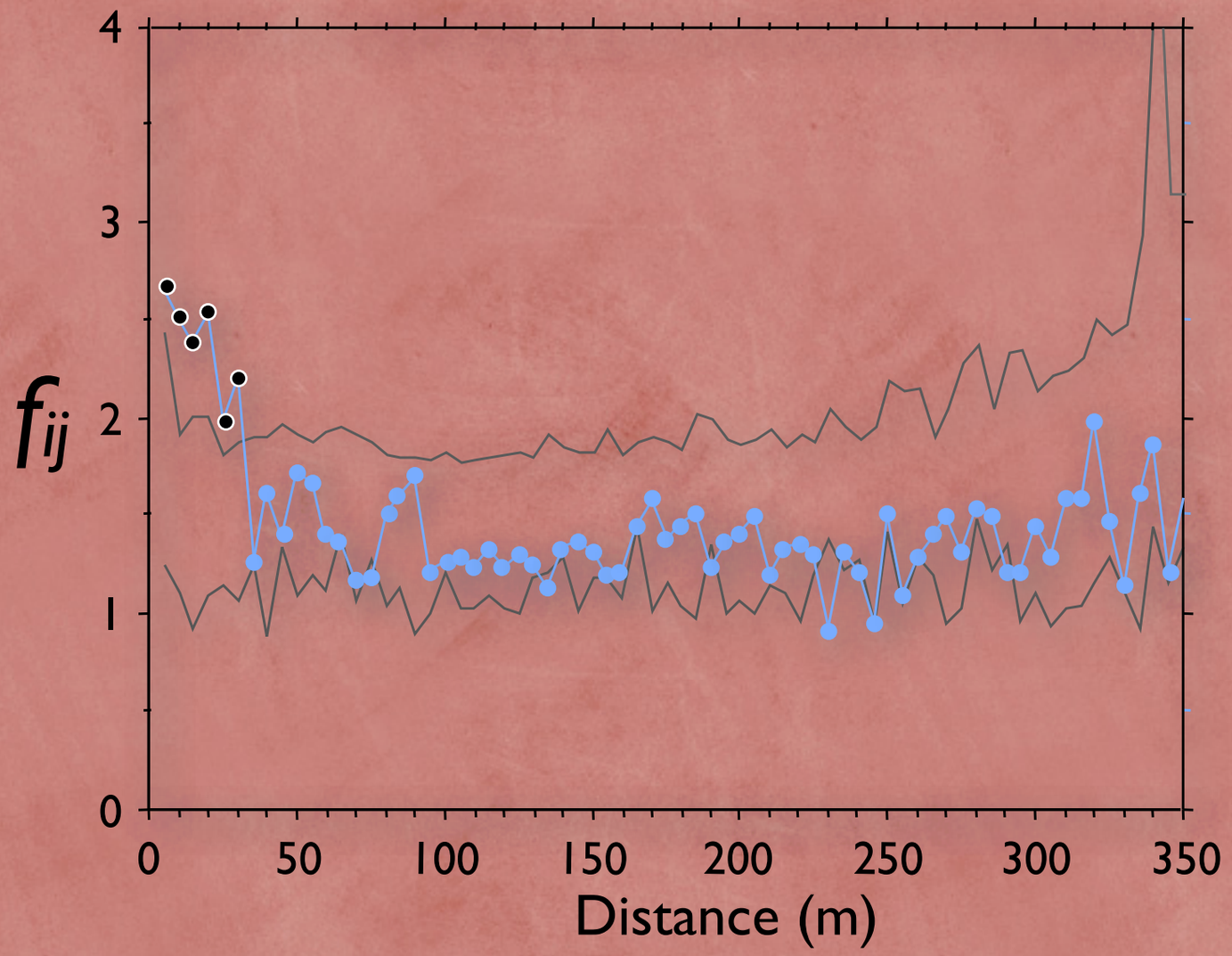
Tracing the dispersal events

Neighborhood size
Kinship structure
Assortative matings
Gene flow pollen

Fine-scale genetic structure in seed shadow
Correlated maternity
TDK
Gene flow seeds

Local genetic structure

Within populations. DNA microsatellite loci.
Adult trees.



Prunus mahaleb. Jordano and Godoy (2002)

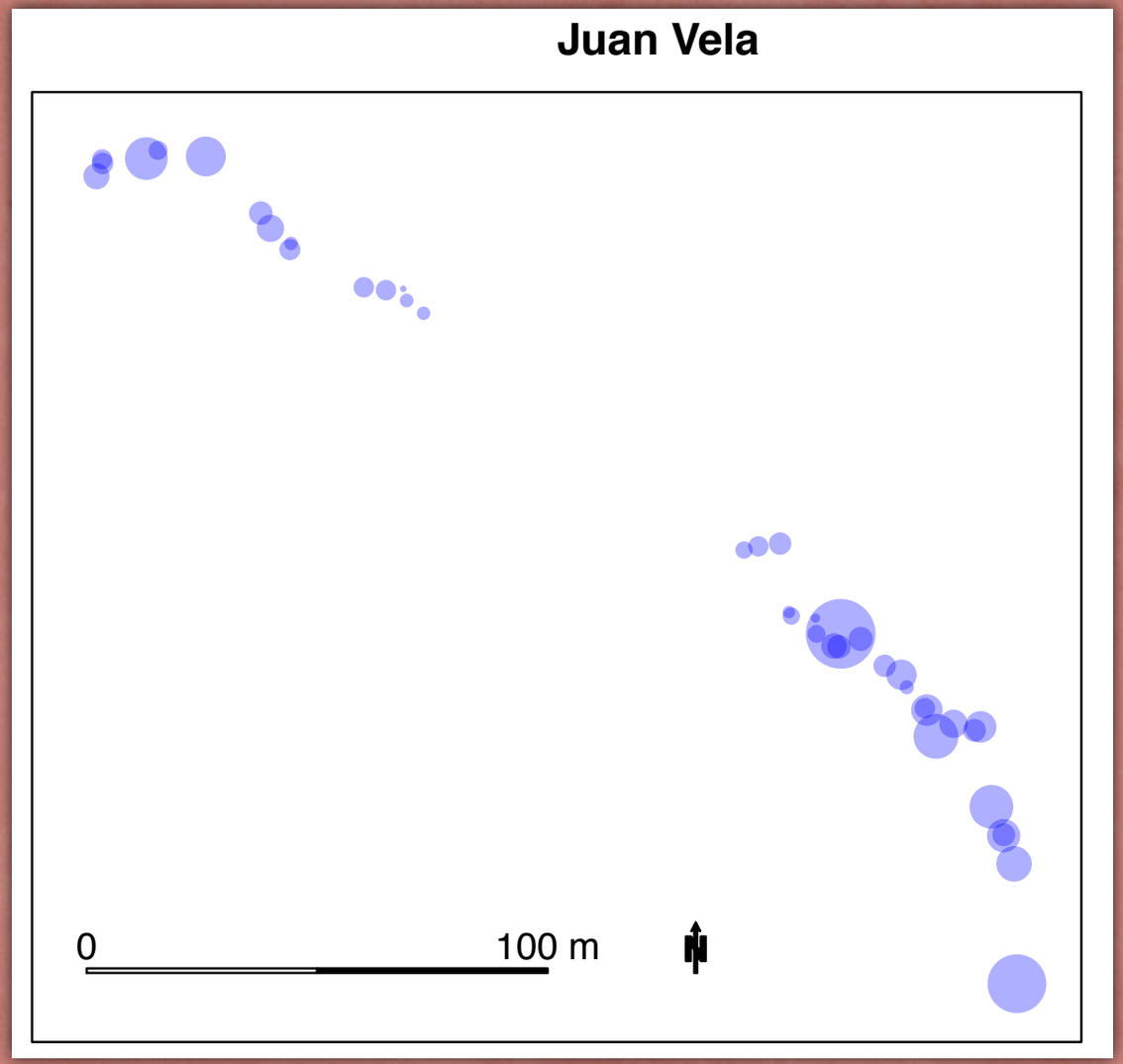
- What is an LDD?
- In situ vs. LDD: consequences
- LDD: case studies
  - Mating networks
  - *TDK* estimates: frugivores and seeds

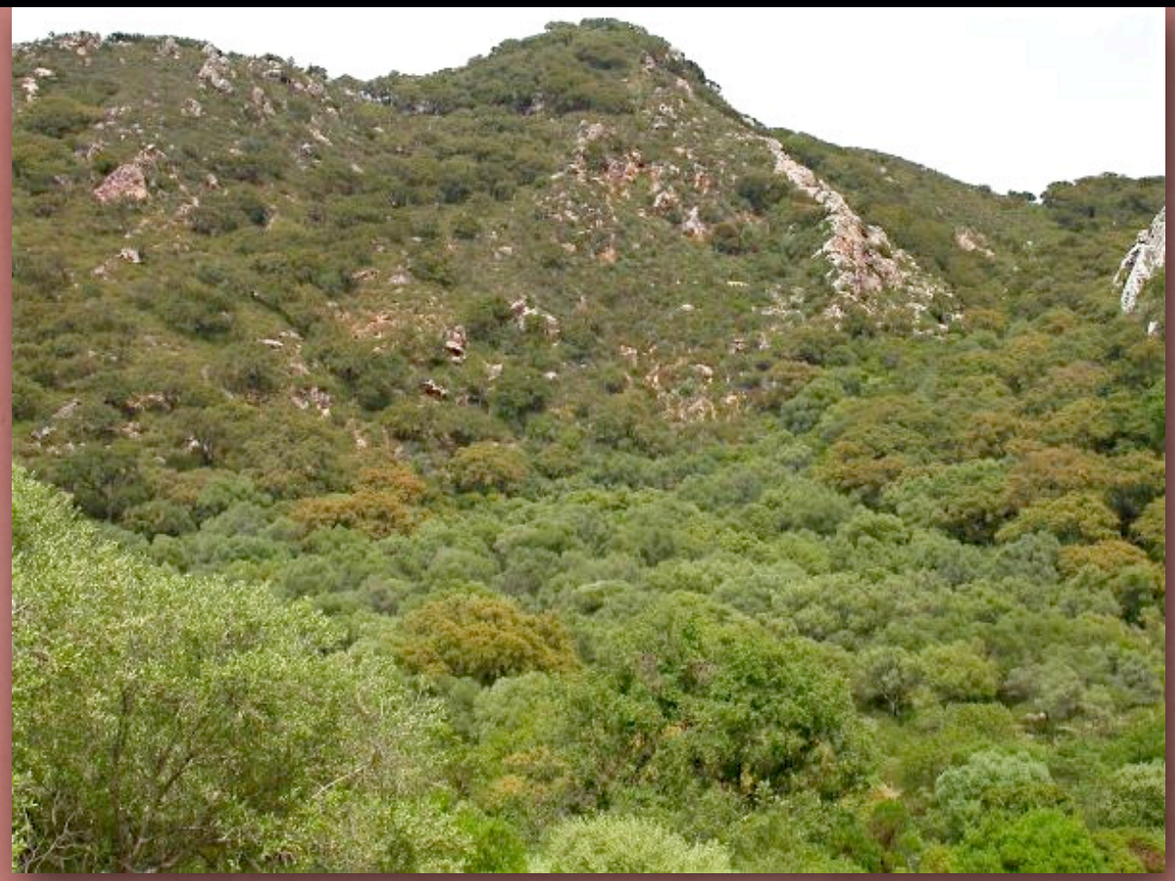
Two key questions

- Which is the source tree for seeds? and for pollen?
- Which is the dispersal agent who took the seeds or pollen grains there?

Mating networks: pollen dispersal

Frangula alnus (Rhamnaceae)



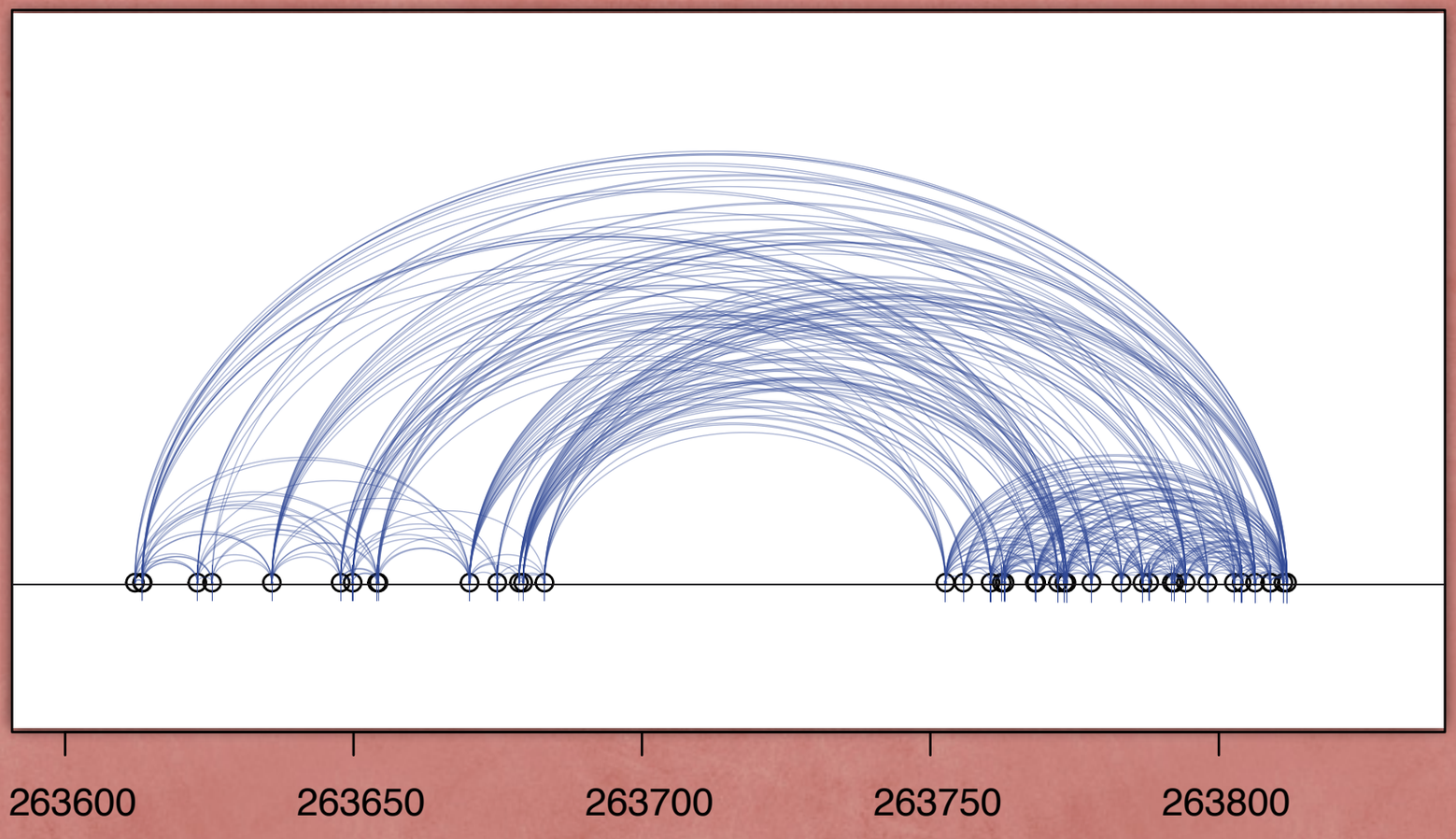


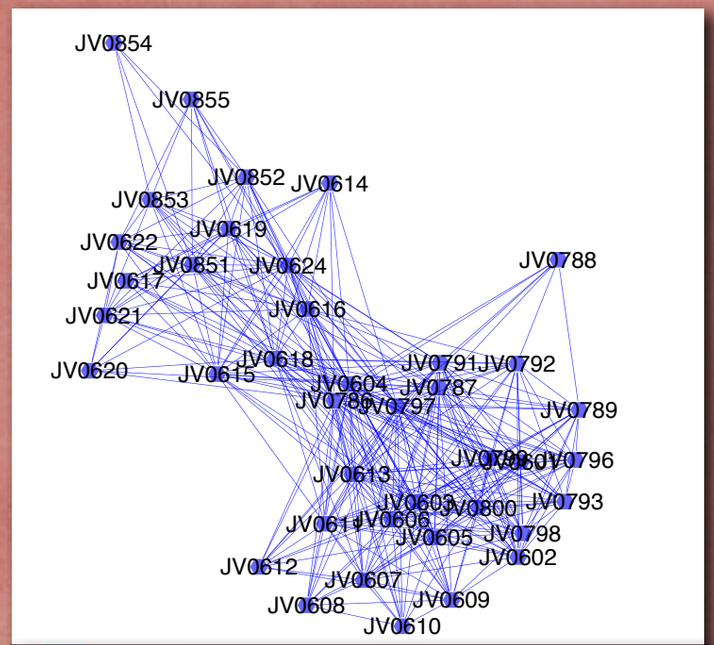
Rodríguez, Hampe and Jordano (2013) *in prep.*

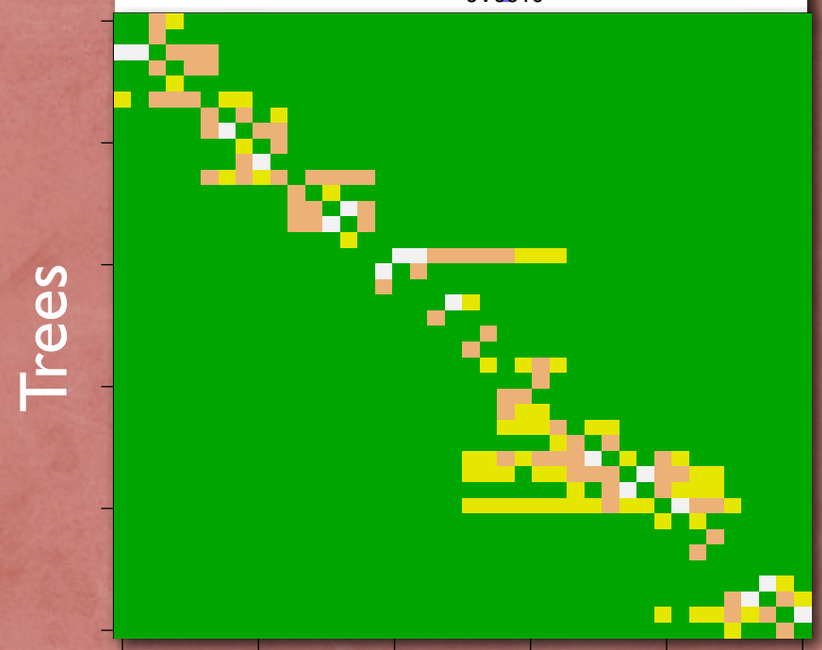
Mating networks: pollen dispersal (2)

Frangula alnus (Rhamnaceae)

Population: Juan Vela. MEMM inference of mating events.



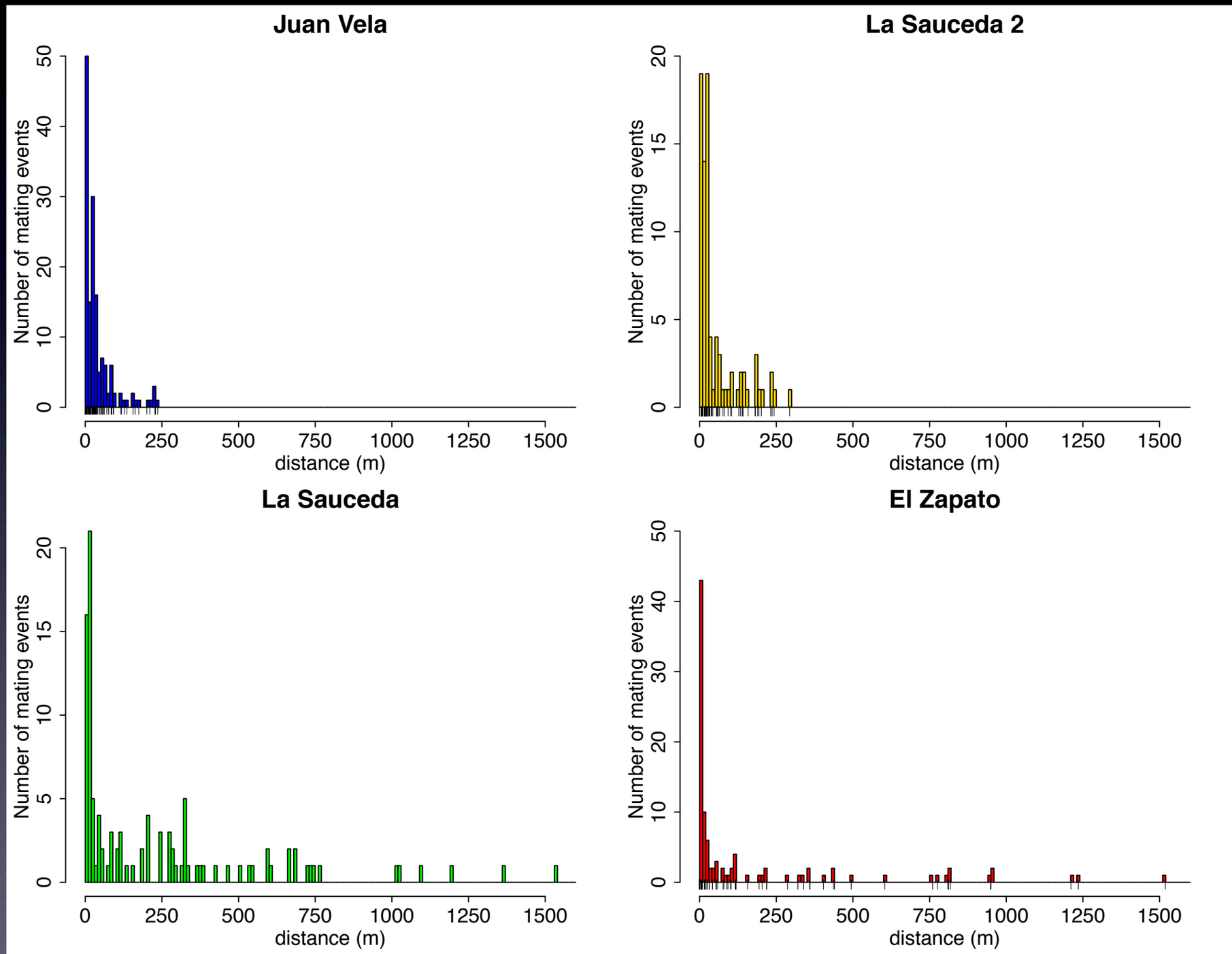




Rodríguez, Hampe and Jordano (2013) *in prep.*
Klein, Carpentier and Oddou-Muratorio (2011). *Meth. Ecol. Evol.*
Moran and Clark (2011). *Molecular Ecology*

Mating networks: pollen dispersal (& 3)

Describe mating patterns inferring individual male fecunfity, the pollen dispersal kernel and the resulting mating network.



Rodríguez, Hampe and Jordano (2013) *in prep.*

Total dispersal kernels

Small birds

Erithacus, Phoenicurus, Sylvia

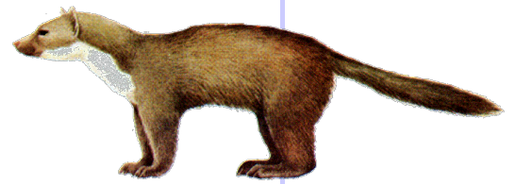
Turdus

Large birds

Corvus, Columba

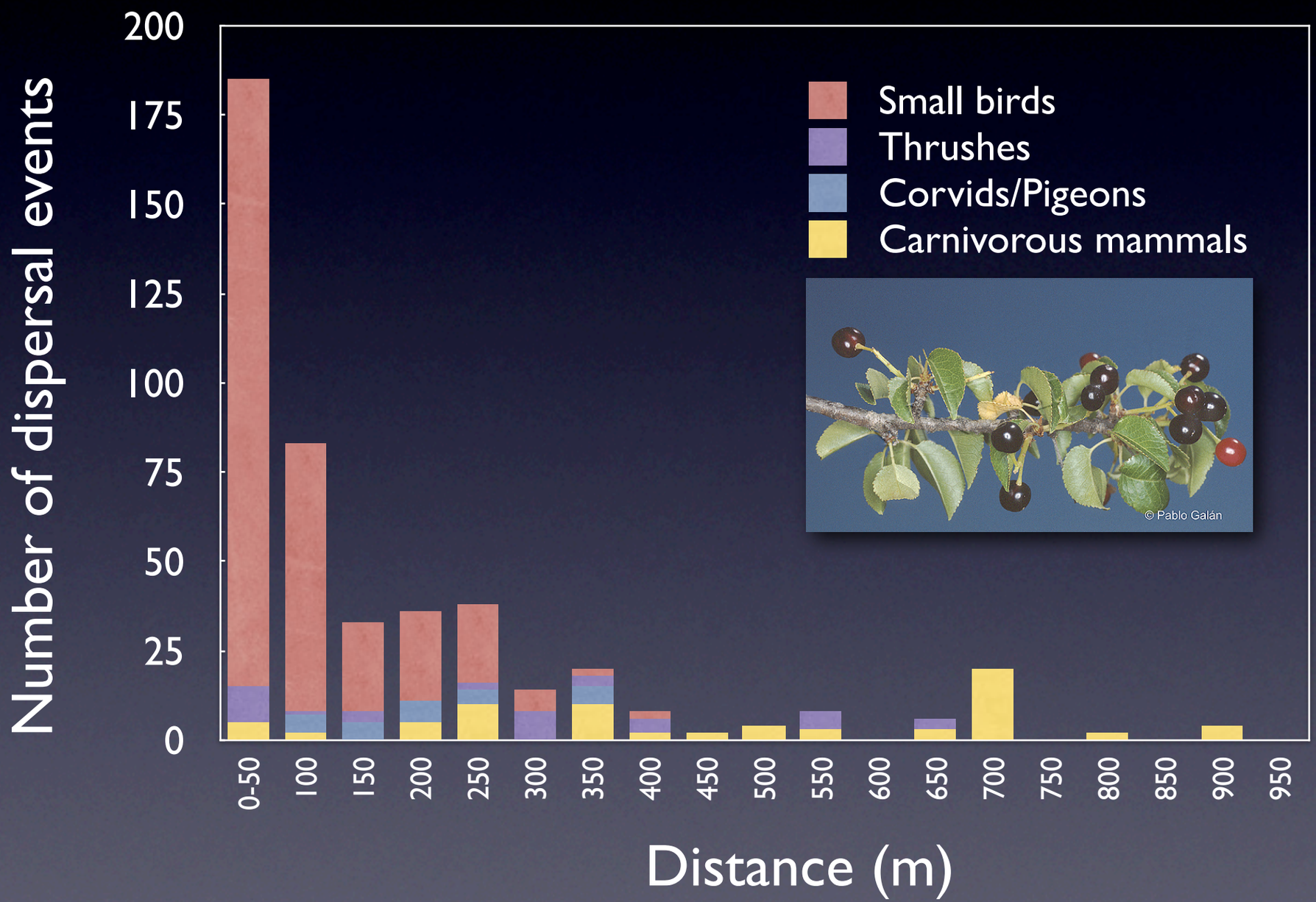
Mammals

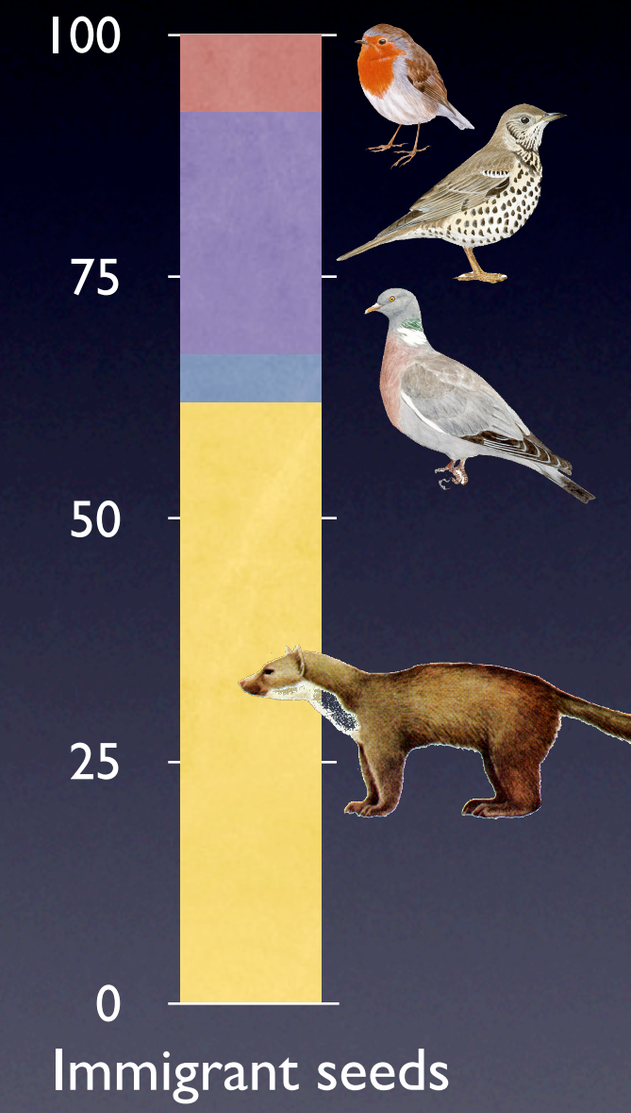
Martes, Vulpes, Meles



Prunus mahaleb. Jordano *et al.* (2007) *PNAS*
Jordano (2013) *In prep.*

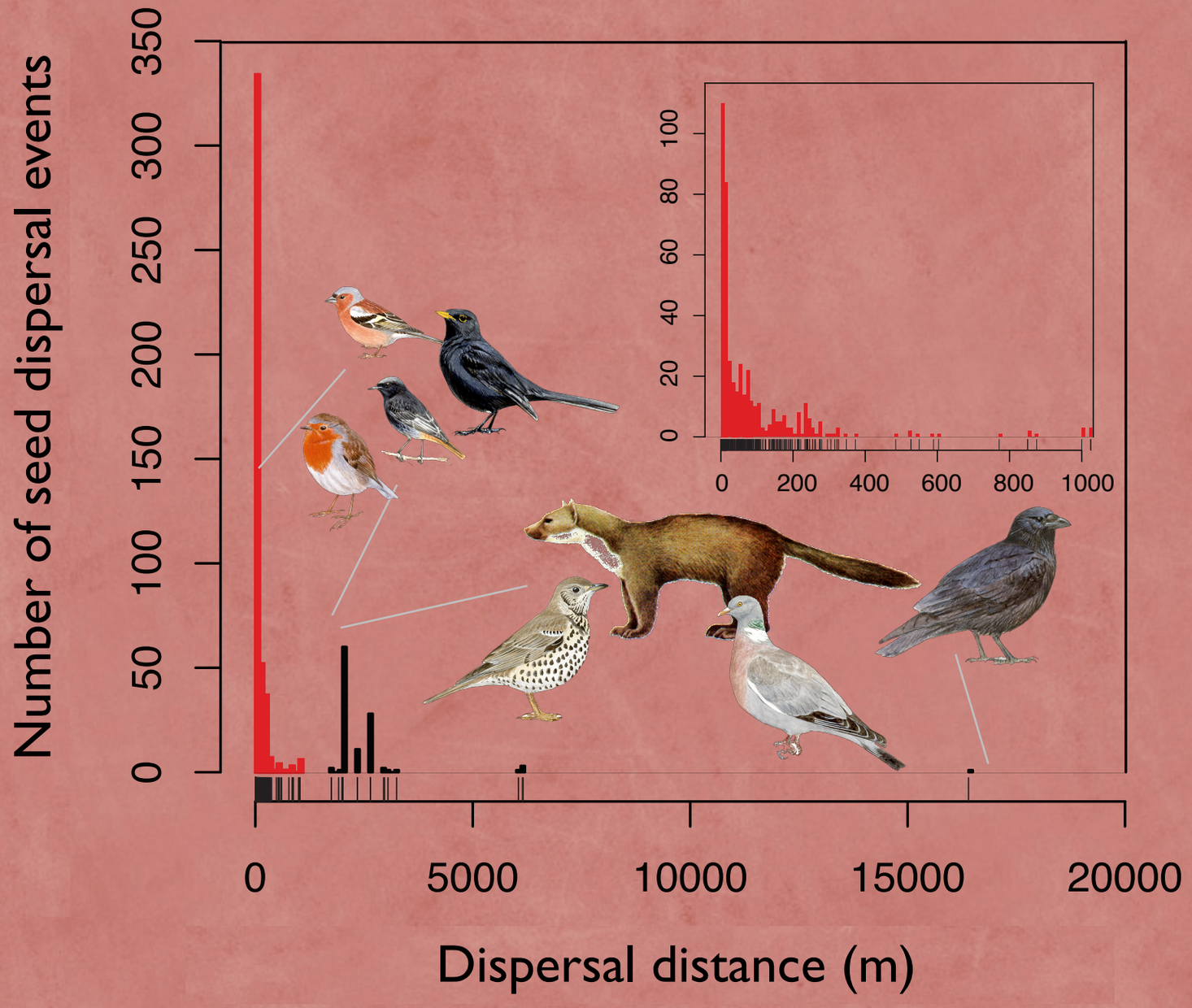
Total dispersal kernels (& 2)





Prunus mahaleb. Jordano *et al.* (2007) *PNAS*

Super-LDD events: how to robustly estimate?

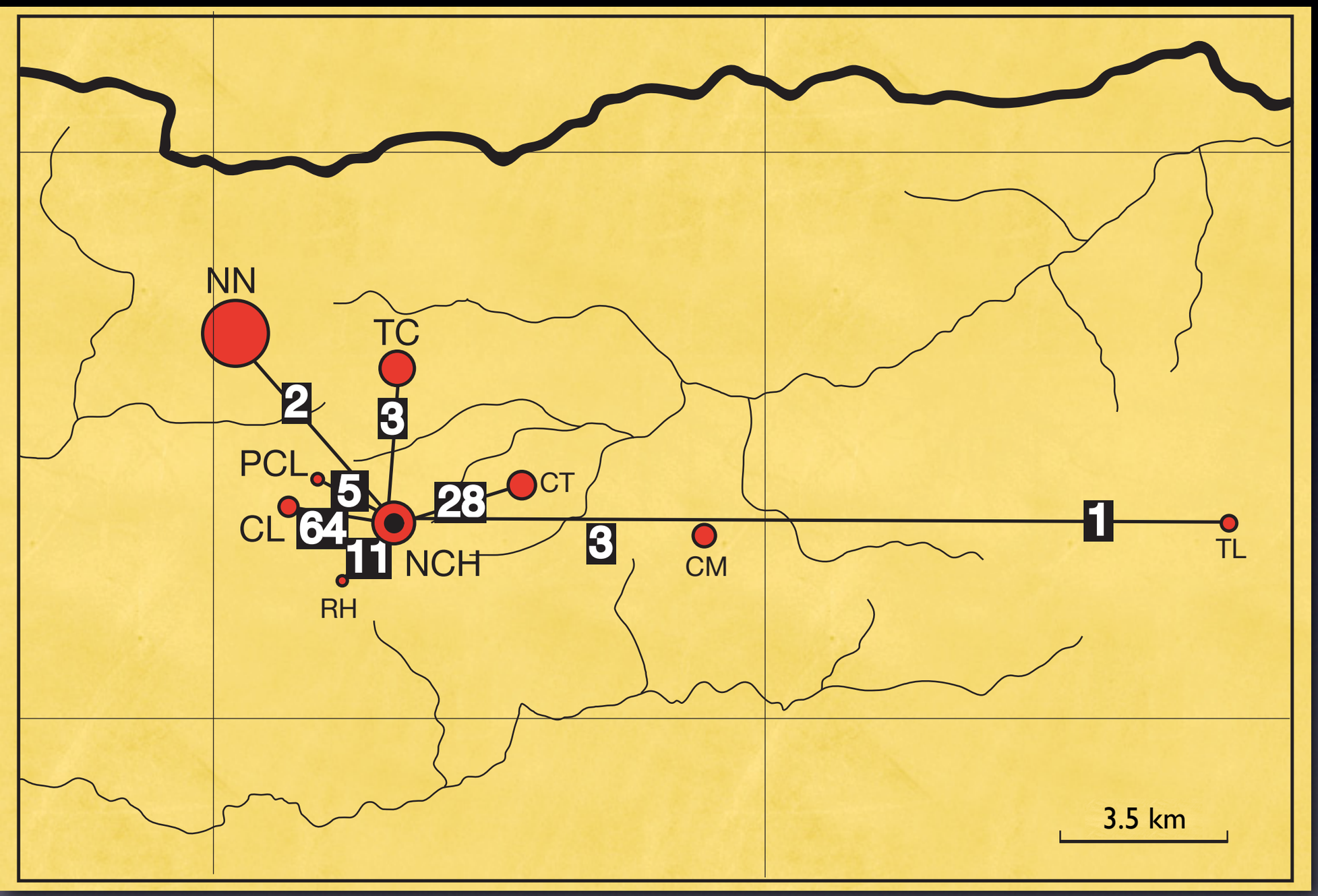


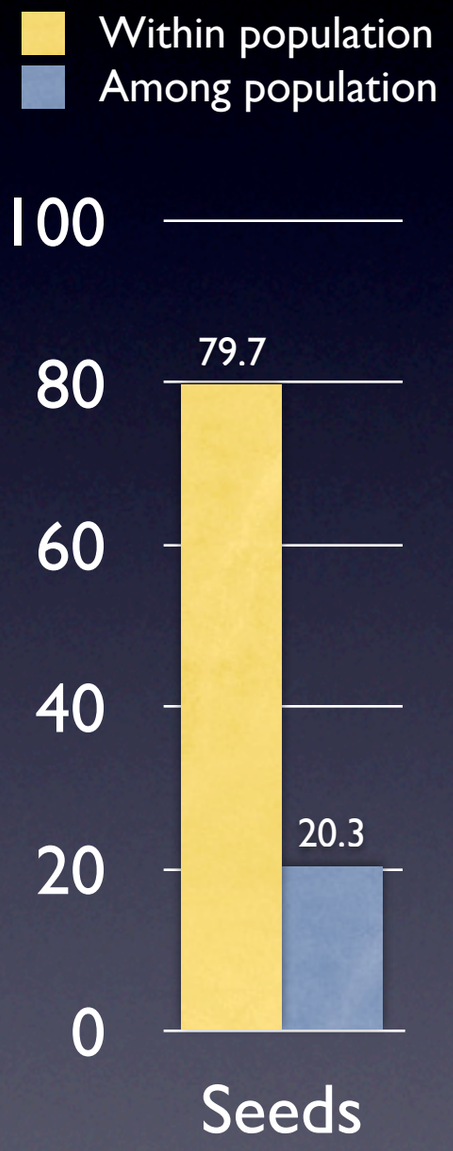
N= 533 seeds

Corvus corone, pellet

Prunus mahaleb. Godoy & Jordano (2001) *Mol. Ecol.*
Jordano *et al.* (2007) *Proc. Nat. Acad. Sci. USA*

Extending the seed shadow





Jordano and García 2013, *in prep.*

Defaunation: *Euterpe* loss of ecological services

Galetti *et al.* (2013) *in prep.*

Non-Defaunated

Defaunated

Euterpe edulis
(Arecaceae)

Turdus albicollis
Turdus leucomelas
Turdus rufiventris
Turdus flavipes
Turdus amaurochalinus
Baryphtengus ruficapilla
Trogon viridis
Procnias nudicollis
Pyroderus scutatus
Selenidera maculirostris
Myiodinastes maculatus
Ramphastos dicolurus
Ramphastos vitellinus
Carpornis cucullata
Pitangus sulphuratus
Turdus subalaris
Lipaugus lanioides
Cyanocorax caeruleus
Penelope spp.
Pteroglosus bailloni
Aburria jacutinga

Defaunation: *Euterpe* loss of ecological services

Galetti *et al.* (2013) *in prep.*

Defaunated

Non-Defaunated

Euterpe edulis
(Arecaceae)

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Turdus subalaris
Lipaugus lanioides
Cyanocorax caeruleus
Penelope spp.
Pteroglosus bailloni
Aburria jacutinga

Ongoing research lines

- Gene flow networks in spatially-structured metapopulations
- Role of frugivore (seed)-mediated gene flow *vs* pollen-mediated gene flow
- Gene flow patterns influenced by changes in the frugivore community
- Estimating frequency and extent of LDD events for pollen and seeds

¡Gracias!

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