Mutualism between native and non-native species:

Global trends and Californian case studies

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California Invasive Plant Council; Rohnert Park, CA
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Smith Fellows

NSF

Presentation Outline

- Mutualism background
- Novel mutualisms in three systems
  - Common characteristics
  - Key patterns
  - Knowledge gaps
- Bird dispersal of non-native plants
  - Dispersal limitation
  - Targeted high-efficiency spread detection
  - Riparian invaders

Mutualisms: Background

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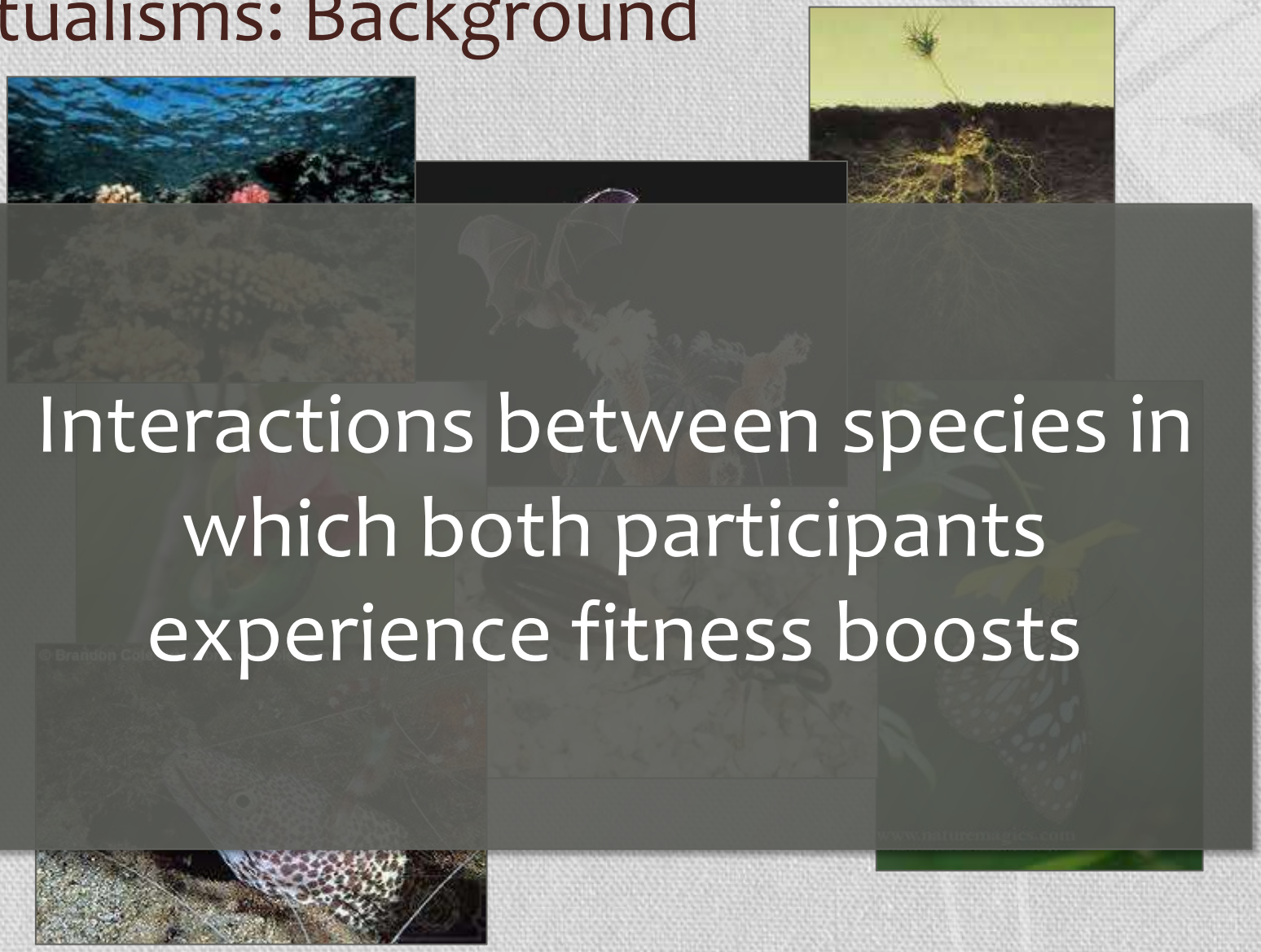

Interactions between species in which both participants experience fitness boosts

How do mutualisms arise?

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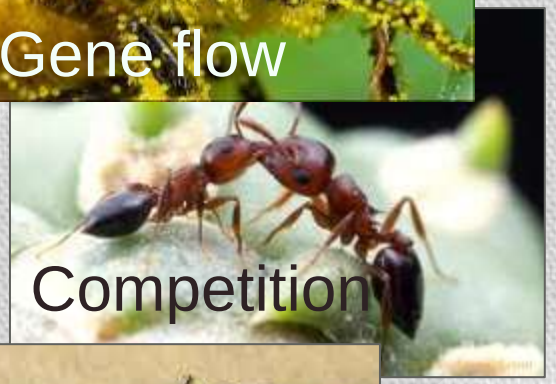
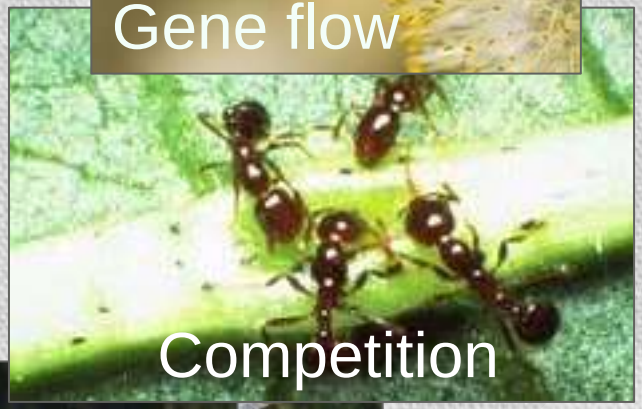
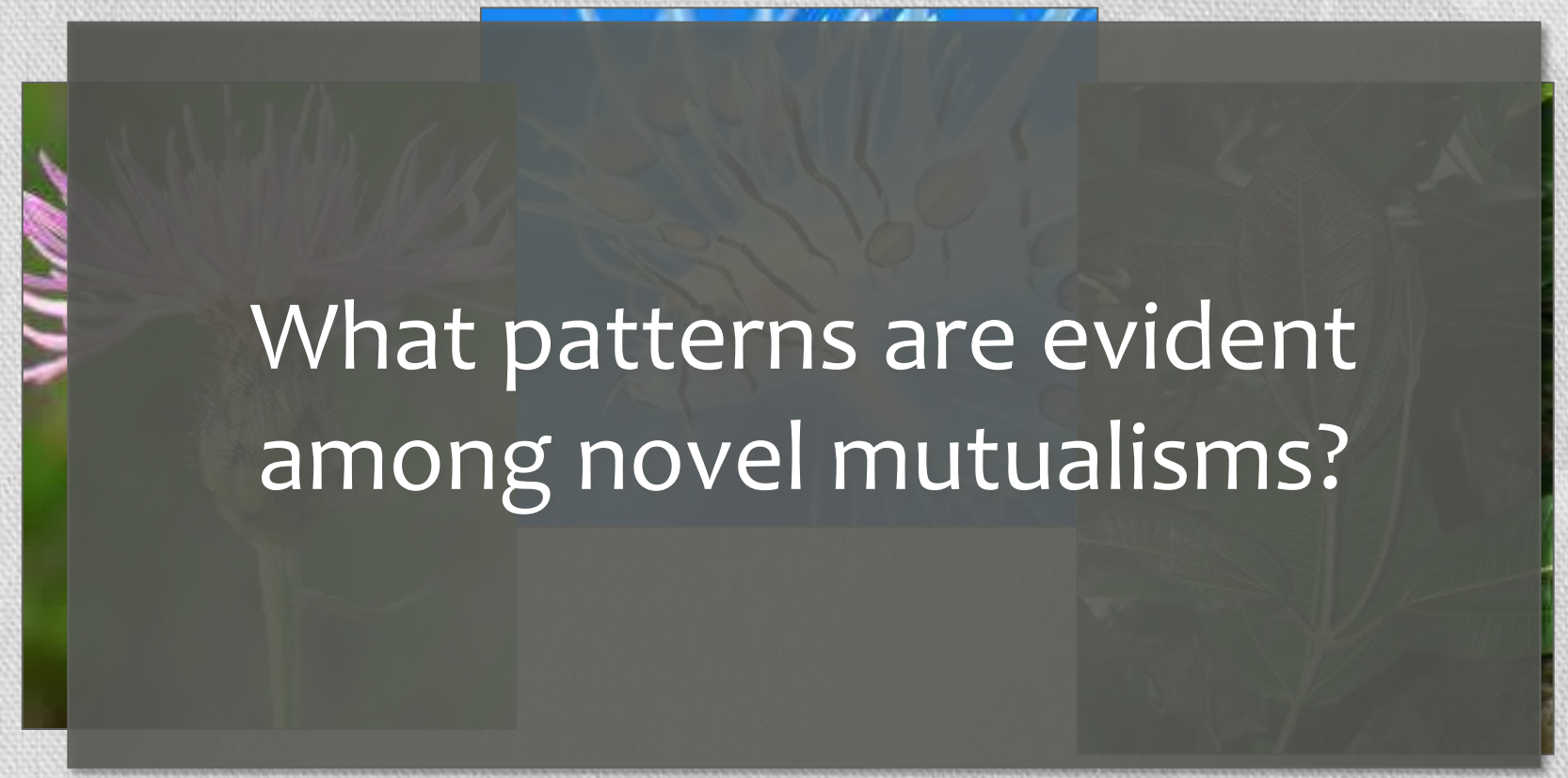


Mutualisms and non-native species



Novel mutualism review

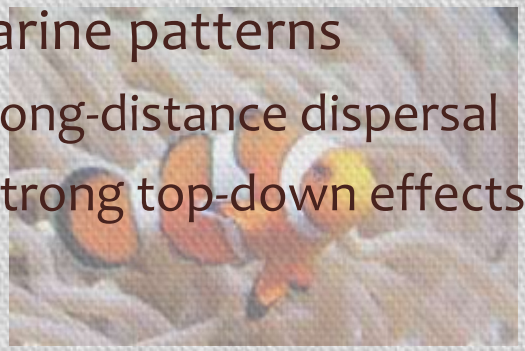


Dr. Ben Sikes, UT-Austin

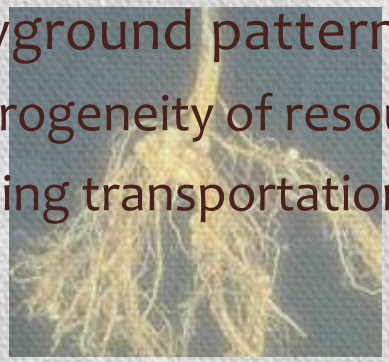
Dr. Keryn Gedan, SERC

Novel mutualism review

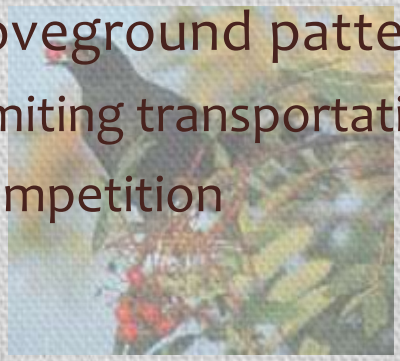
- Marine patterns
  - Long-distance dispersal
  - Strong top-down effects



- Belowground patterns
  - Heterogeneity of resources
  - Limiting transportation



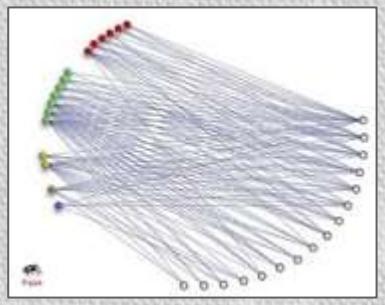
- Aboveground patterns
  - Limiting transportation
  - Competition



Novel mutualism review

- Novel mutualism characteristics
  - Facultative

  - Diffuse



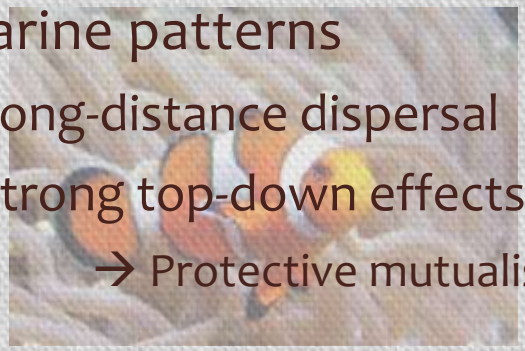
  - Free resources

Novel mutualism review

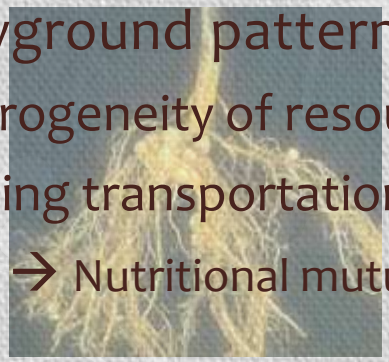
- Key patterns emerging
  - Aboveground examples
    - Seed dispersal: Himalayan blackberry
    - Pollination: Yellow starthistle, iceplant
    - Shared attraction: Camphor tree
    - Ant protection: *Cecropia*
  - Belowground
    - Mycorrhizal fungi-root relationships: Spotted knapweed
  - Marine
    - Native *Diopatra* polychaete-Non-native *Gracilaria* alga

Novel mutualism review

- Marine patterns
  - Long-distance dispersal
  - Strong top-down effects
    - → Protective mutualisms



- Belowground patterns
  - Heterogeneity of resources
  - Limiting transportation
    - → Nutritional mutualisms

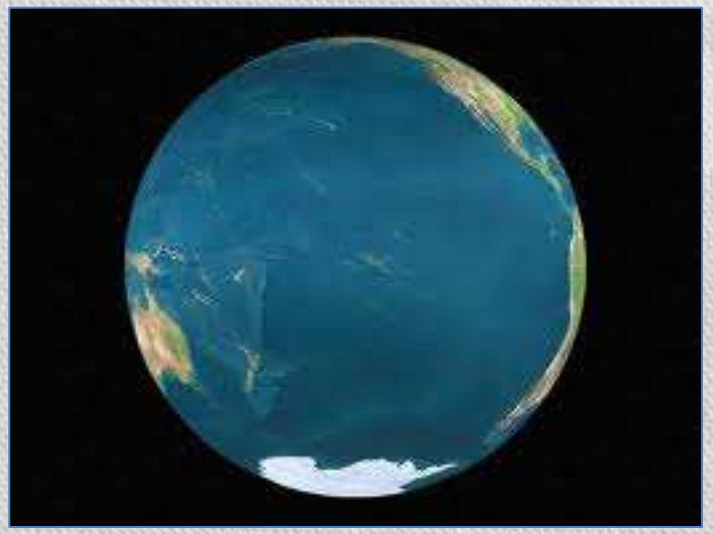


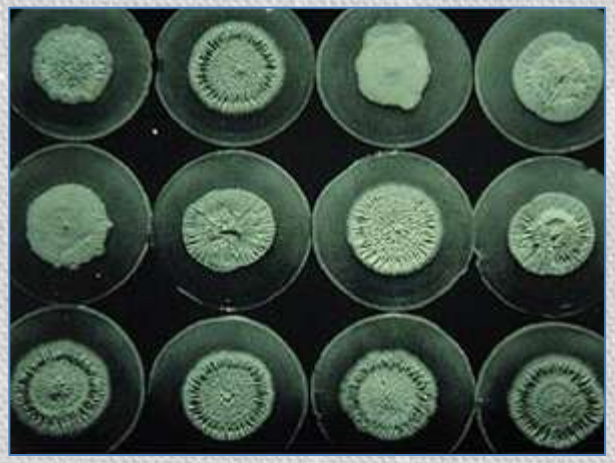
- Aboveground patterns
  - Limiting transportation
  - Competition
    - → Reproductive mutualisms

Mutualisms provide access to limiting resources and a competitive edge

Novel mutualism review

- Information gaps
  - Marine???
  - Microbial mutualisms





Novel mutualism review

- Take-home messages
  - Novel mutualisms are common
  - Non-native species can benefit
  - Limiting factors guide frequency
  - Typically facultative and diffuse
  - Research gaps remain

Case study:

Bird-mediated seed dispersal of non-native plants in California

Fleshy-fruited plants and birds

Dispersal limitation

Proportion removed	Fruit loads
Chinese tallow: 24%	38,462
Olive: 88%	10,642
Privet: 77%	712,820
Toyon: 94%	105,983

From frugivory to spread

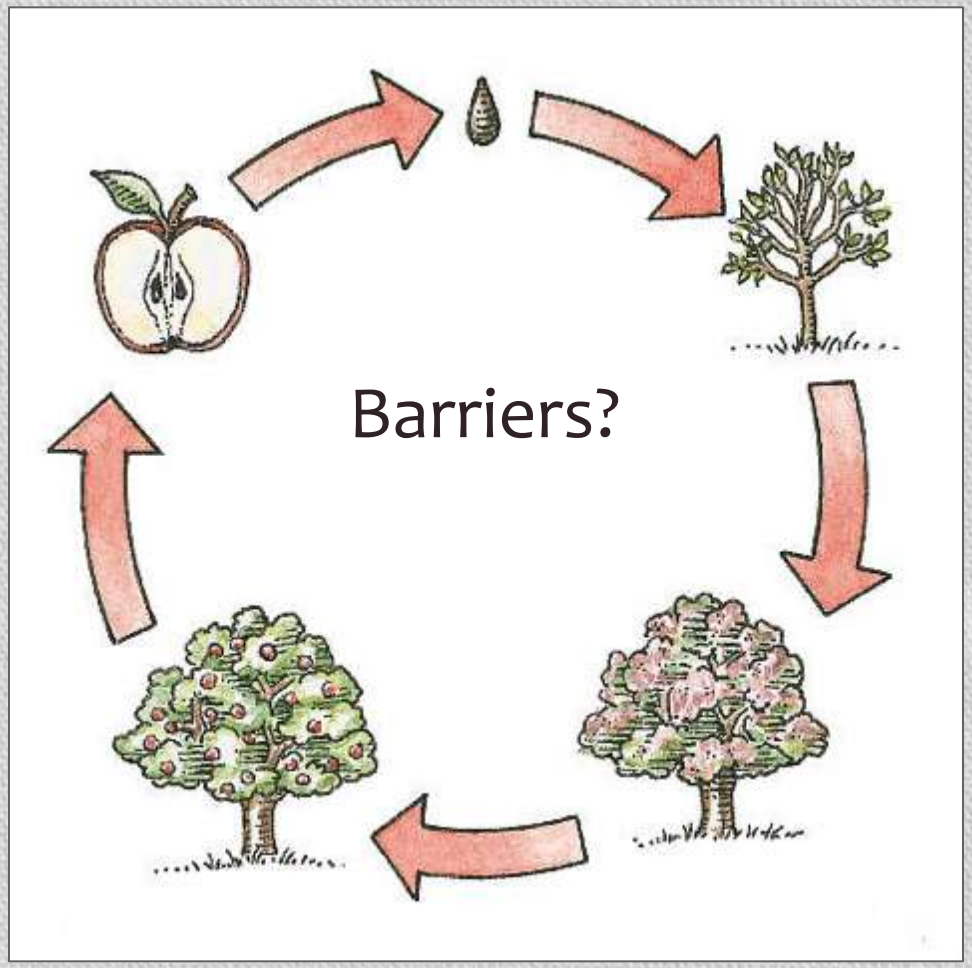


Image by Kayla Etheridge & Christina Beck

From frugivory to spread

Photo credit: University of Illinois

Directed Dispersal

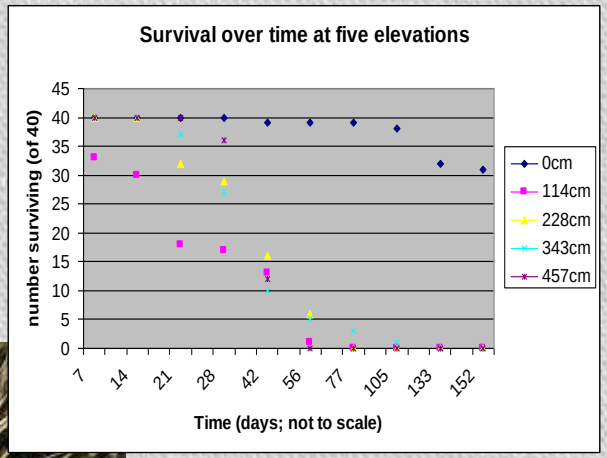
American Society of Landscape Architects

Examples:
Chinese tallow, European olive, and glossy privet

Chinese tallow	European olive	Glossy privet
European starling	European starling	Cedar waxwing
American robin	Western-scrub jay	American robin
Northern flicker	Western meadowlark	Northern mo
Nuttall's woodpecker	American robin	Hermit thrus
Western-scrub jay	Wild turkey	Northern flic
Northern mockingbird	Western bluebird	Yellow-rump
American crow	Northern mockingbird	Western-scr
Cedar waxwing	American crow	American cr
Hermit thrush	Hermit thrush	
Black phoebe		

Chinese tallow (*Triadica sebifera*)

- Bird-dispersed and water-lovin'
- Riparian area growth



Bower et al. 2009. *Inv. Plant Sci. Man.*

Chinese tallow

- Barrier detection?

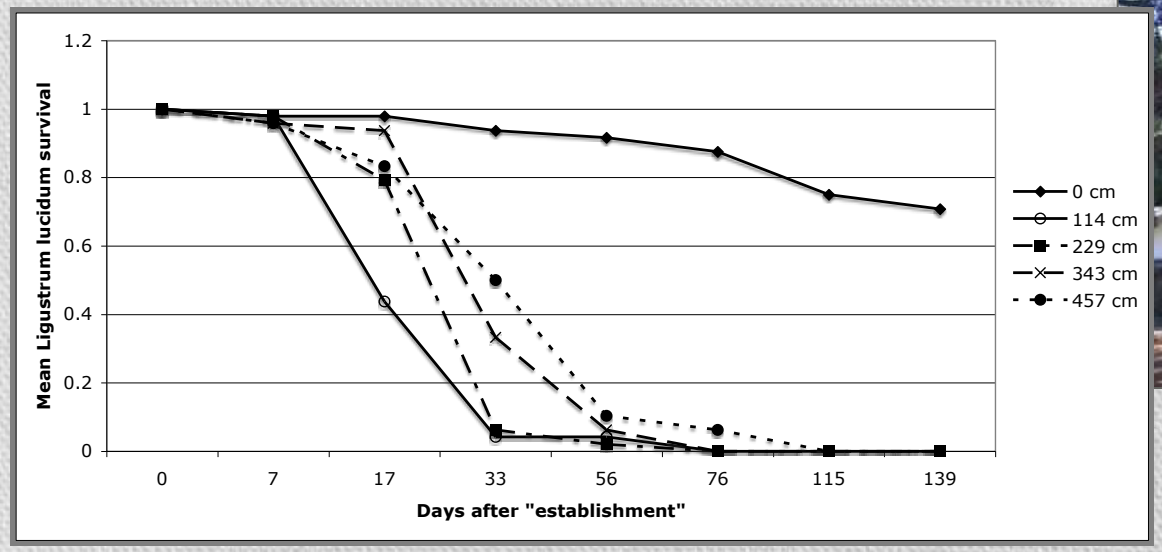
Potential barrier to invasion	Detected?
Seed production	No
Seed transport by dispersers	No
Seed germination	Not along waterways
Seedling survival	Not along waterways

Apparent invasion potential along waterways: High

Bower et al. 2009. *Inv. Plant Sci. Man.*

Glossy privet (*Ligustrum lucidum*)

- Bird-dispersed and water-lovin'
- Irrigated area growth



Aslan, Rejmánek, and Klinger. 2012. *J. Appl. Ecol.*

Glossy privet

- Barrier detection?

Potential barrier to invasion	Detected?
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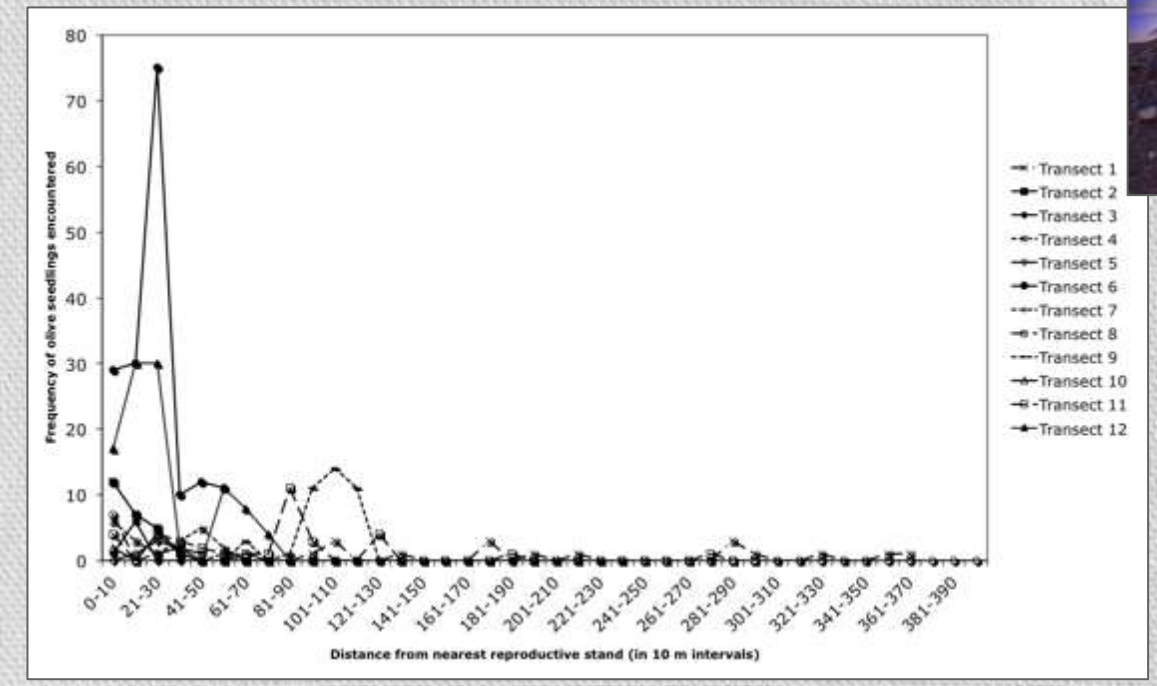
Apparent invasion potential along waterways: High

European olive (*Olea europaea*)

- Bird-dispersed and upland



Aslan, Rejmánek, and Klinger. 2012. *J. Appl. Ecol.*

European olive

- Barrier detection?

Potential barrier to invasion	Detected?
Seed production	No
Seed transport by dispersers	No
Seed germination	Low?
Seedling survival	Low?

Apparent invasion potential along bird dispersal pathways:
Low at landscape scale… but high in certain sites

Detecting spread of fleshy-fruited exotics

- Something will eat them
- Track likely dispersal paths
- Target habitat
- Early detection, rapid response
- Source population focus

Bird dispersal as key

- Under certain circumstances
- When to think about it
- Why to think about it

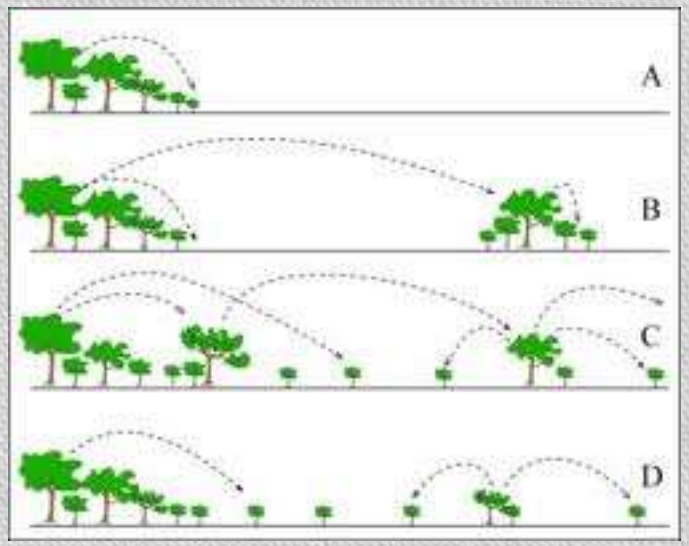


Image by Thomas Giesecke

Thank you!

- Marcel Rejmánek
- Rob Klinger
- Rejmánek Lab
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- Interns and volunteers!
- Countless wise advisors…
- David H. Smith Conservation Research Fellowship
- National Science Foundation

Questions?