

A seed dispersal mutualism facilitated by fire in the California Floristic Province

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Program in Ecology, Evolution, and Conservation Biology
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MEDECOS XII: Linking Science with Resource Management
08 September 2011
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Alt title: Recognizing the importance of animal caching as a seed “burial syndrome”

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evolution of fire adaptation



resist

exist

promote



adaptation

neutral

adaptation

living and dying with fire

- residual taxa
- colonizing taxa
- immigration
- local recruitment
 - fire-stimulated flowering (seed production)
 - serotiny (canopy seed storage)
 - seed bank (belowground seed storage)

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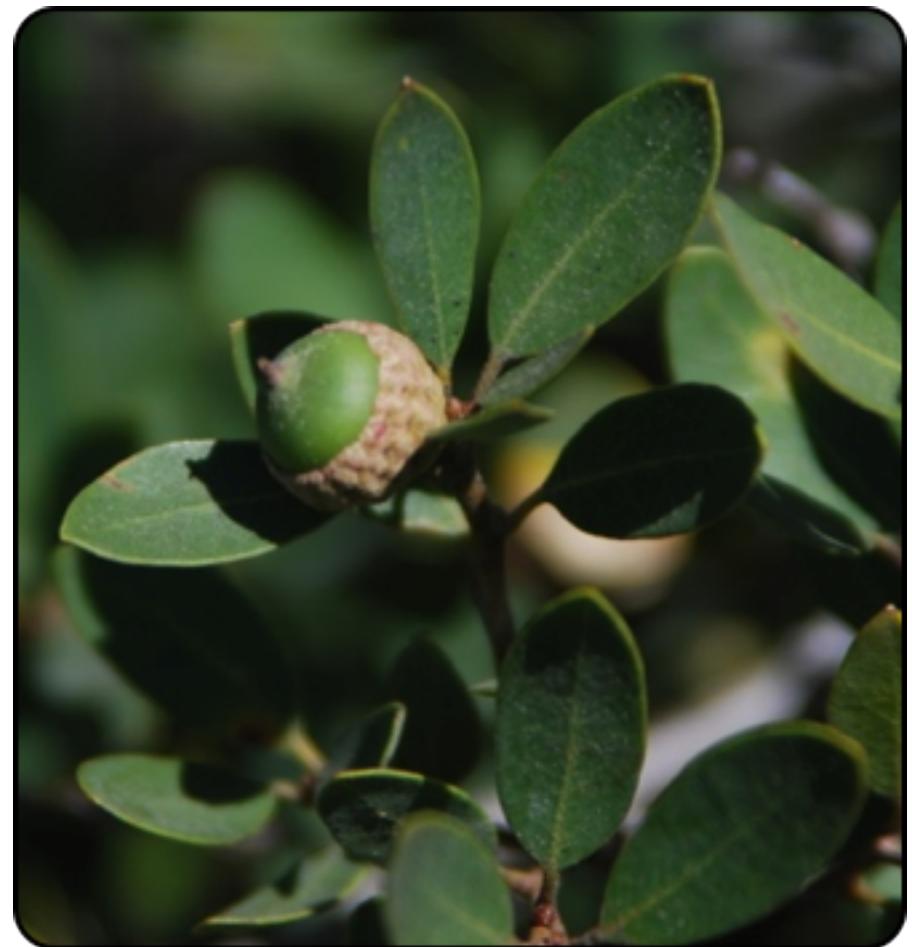
seed burial syndromes

- abiotic (autochory)
 - small seeds
 - burial structures
 - burial machinery
- biotic (zoochory)
 - attract scatter-caching animals

(Evangelista et al., *J. Ex. Bio.*, 2011)

scatter-caching

- syndrome: large, dry **nuts**
- animals: corvids, woodpeckers, sparrows, etc.; **rodents**



scatter-caching

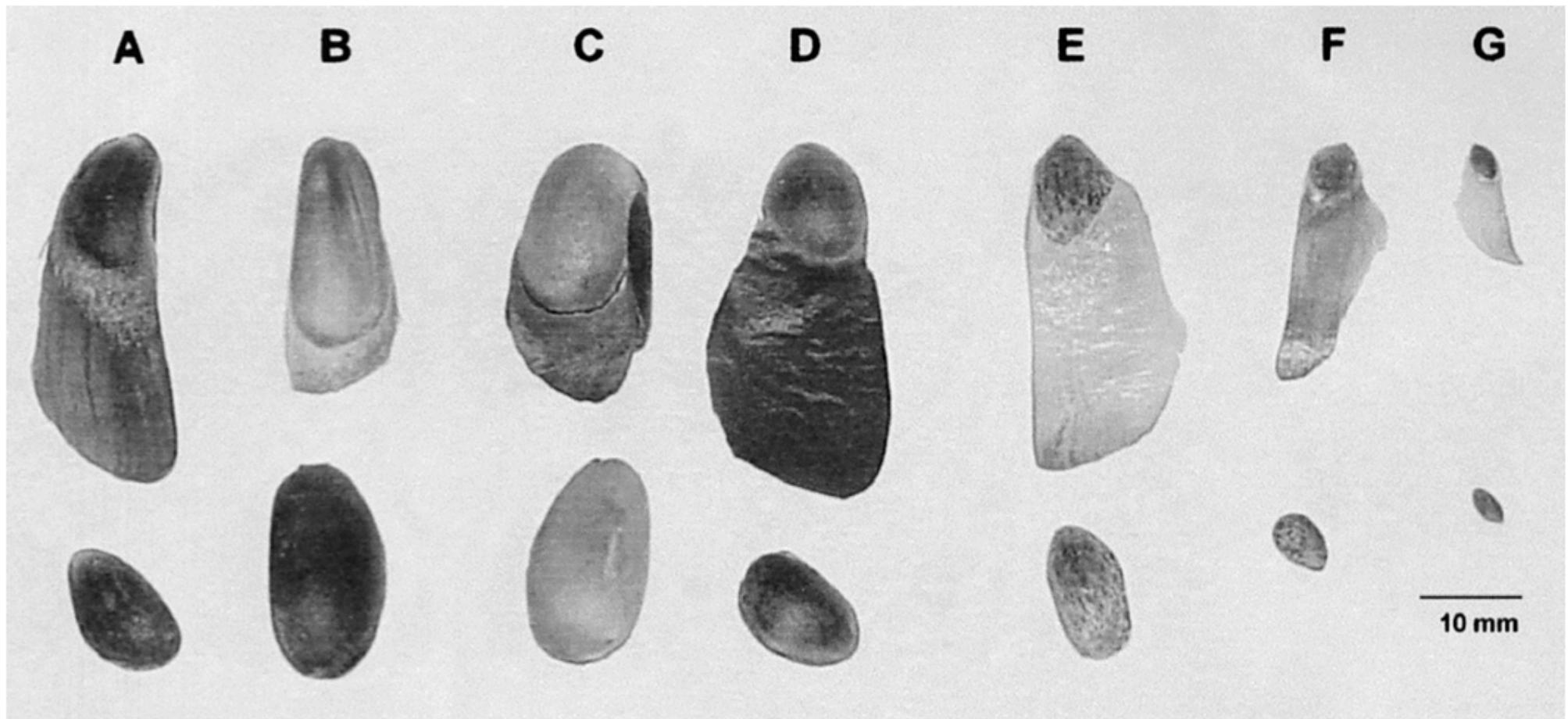


Figure 2. The seeds of three species of pines in the subsection *Sabinianae* (A–C) compared to four species of pines growing in the Sierra Nevada (D–G). Species are: A, Coulter pine; B, gray pine; C, Torrey pine; D, sugar pine; E, Jeffrey pine; F, ponderosa pine; G, lodgepole pine.

(Johnson et al., *Plant Eco.*, 2003)

scatter-caching

- syndrome: large, dry **nuts**
- animals: corvids, woodpeckers, sparrows, etc.; **rodents**



seed burial syndromes

	biotic burial
depth	scatter-larder
microsite	few seeds
deposition	immediate

seed burial syndromes

	biotic burial	abiotic burial
depth	scatter-larder	soil type, size, etc.
microsite	few seeds	few-many seeds
deposition	immediate	varies

manzanita: an example of biotic burial

preliminary observations

1.seedlings emerge

- after fire
- in clumps

2.despite its name, seeds more nutty than fruity

literature findings

1. seeds are sensitive to heat

2. seeds need charate for germination

hypothesis

**in fire-prone ecosystems, seed-caching
animals deposit seeds in safe microsites**

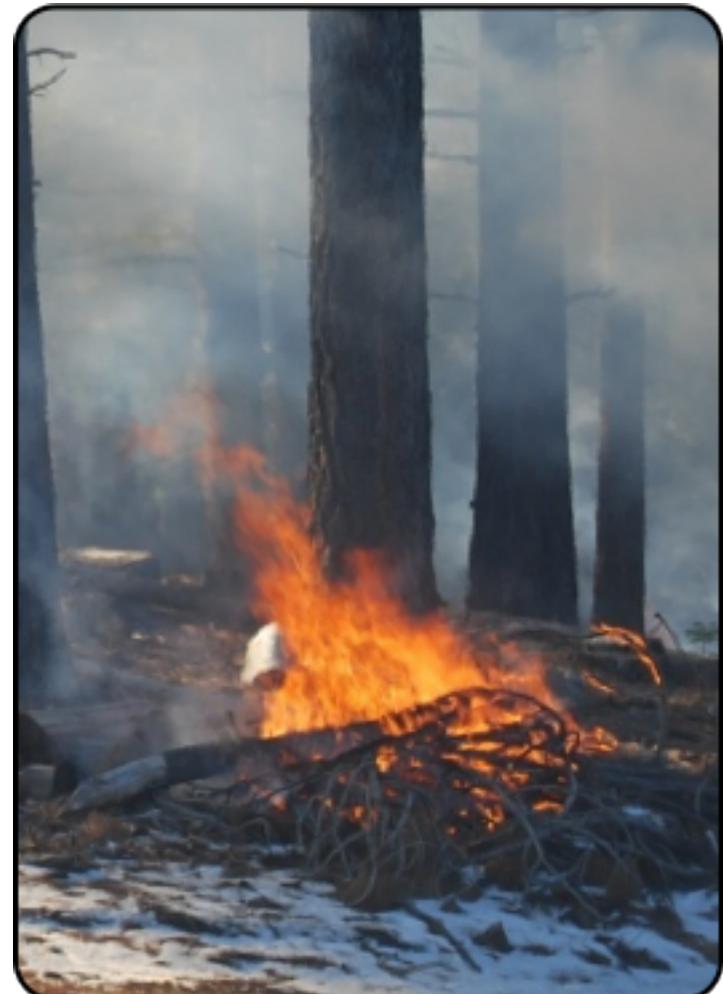
predictions

- 1. seed-caching animals disperse manzanita seeds,
not merely consume seeds**
- 2. seeds are dispersed to favourable microsites for
germination**

experiments

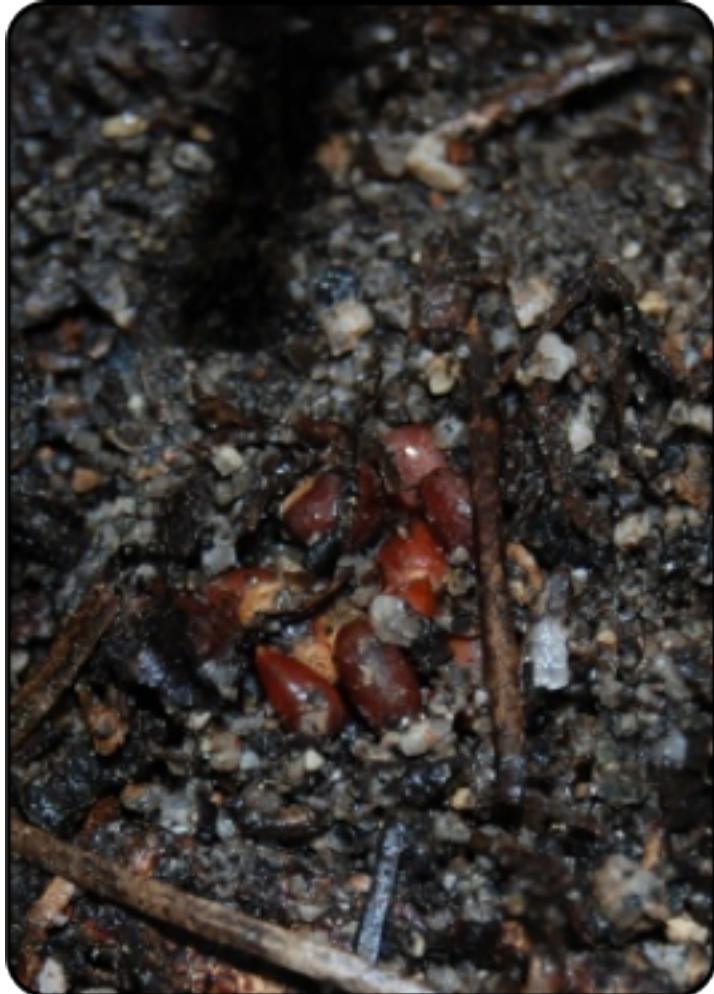


seed fates



germination
conditions

experiments

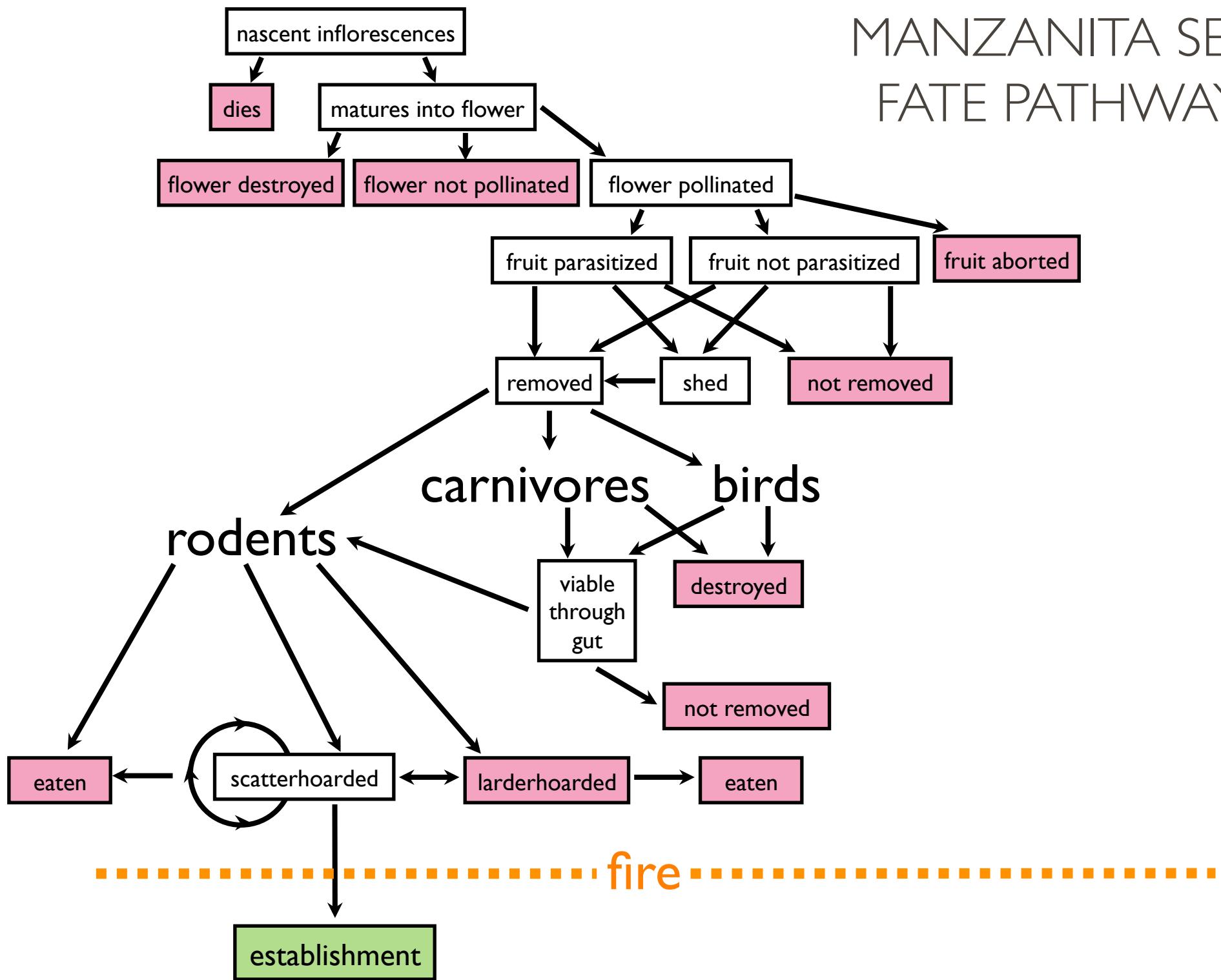


seed fates

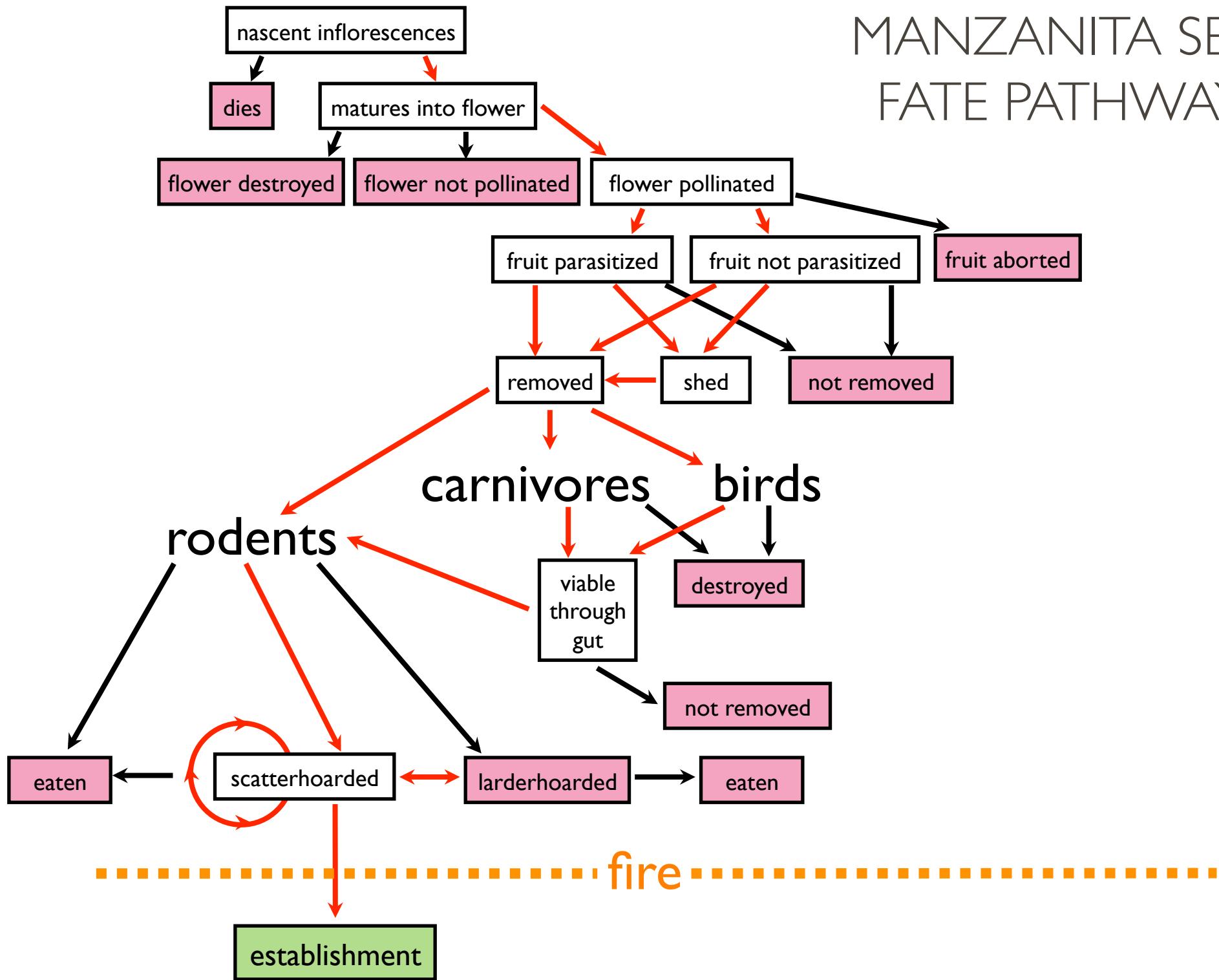


germination
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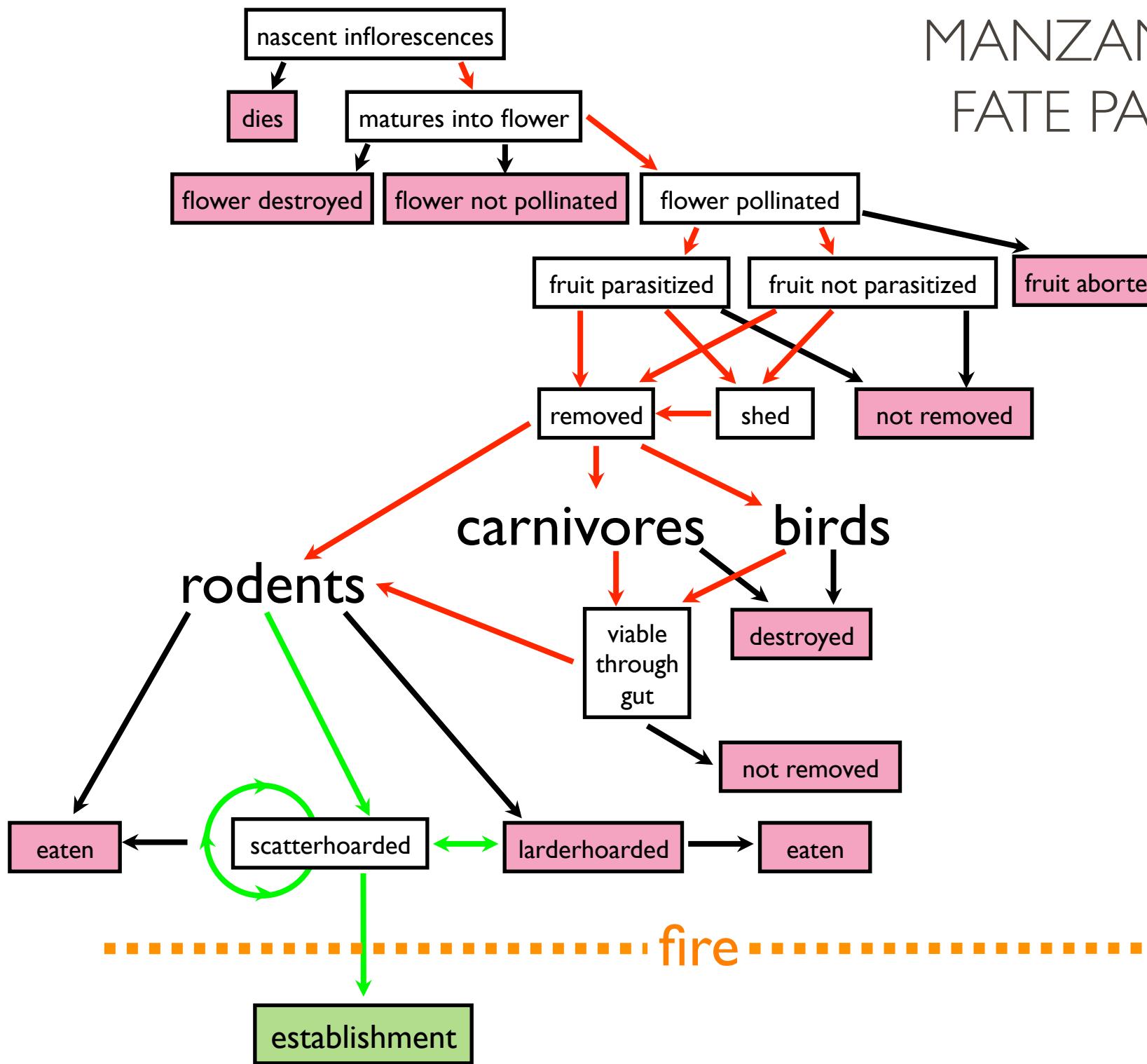
MANZANITA SEED FATE PATHWAYS

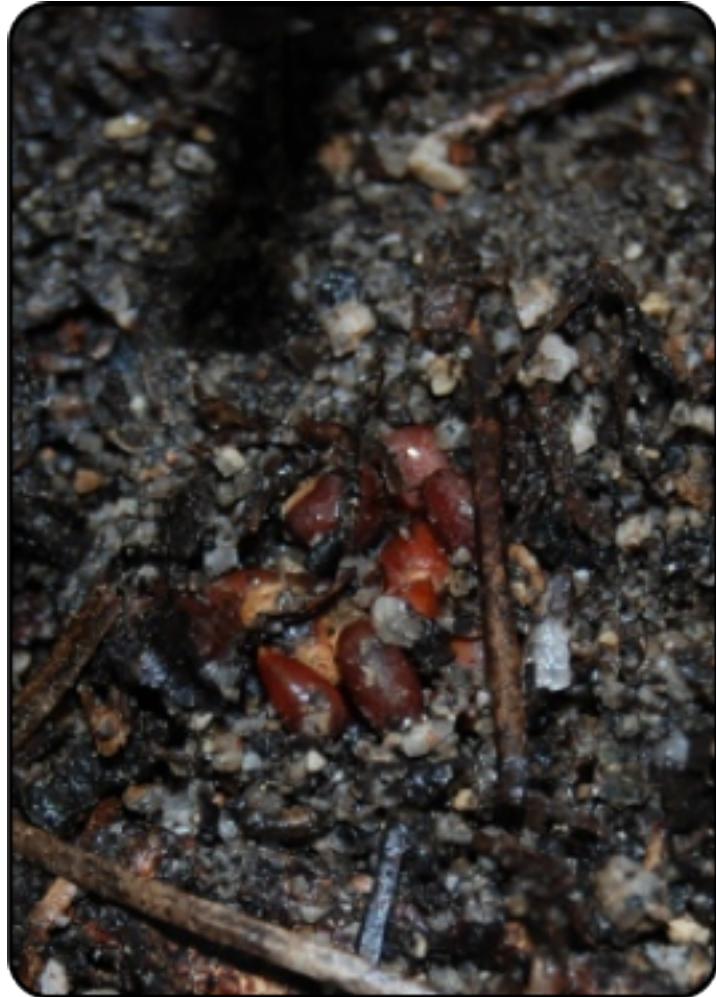


MANZANITA SEED FATE PATHWAYS

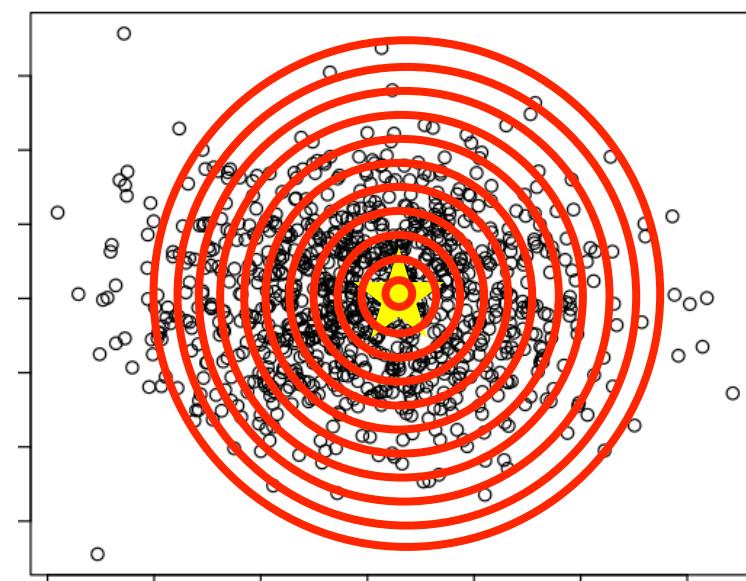
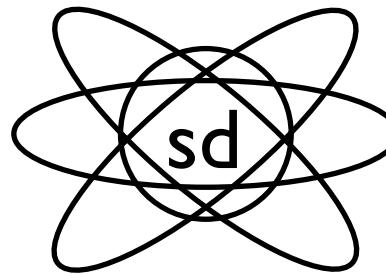


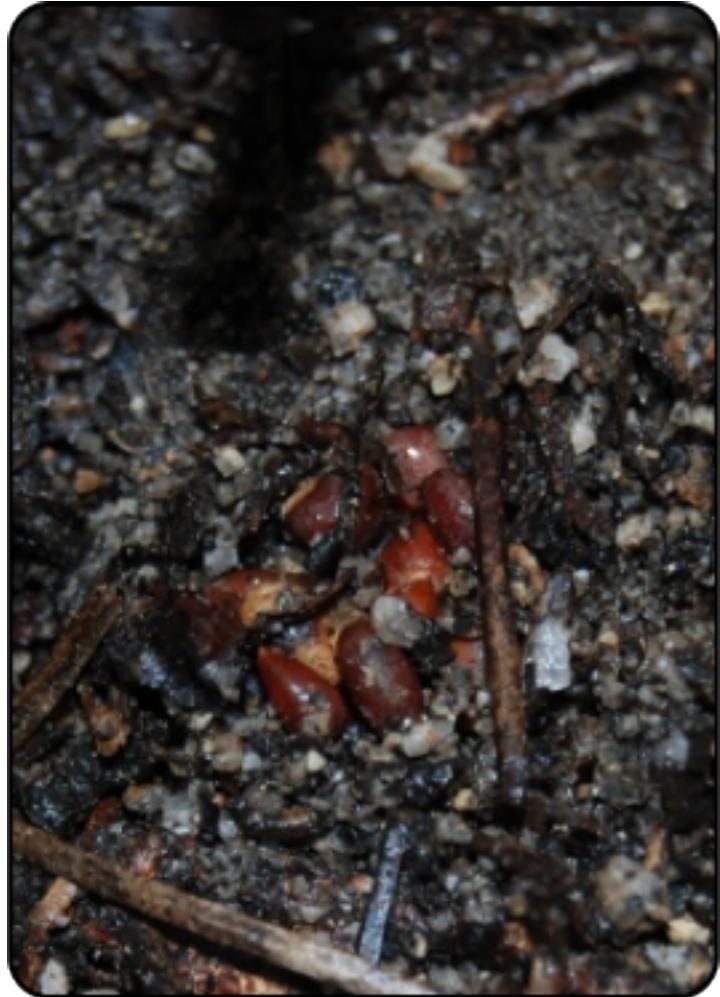
MANZANITA SEED FATE PATHWAYS





seed fates





seed fates

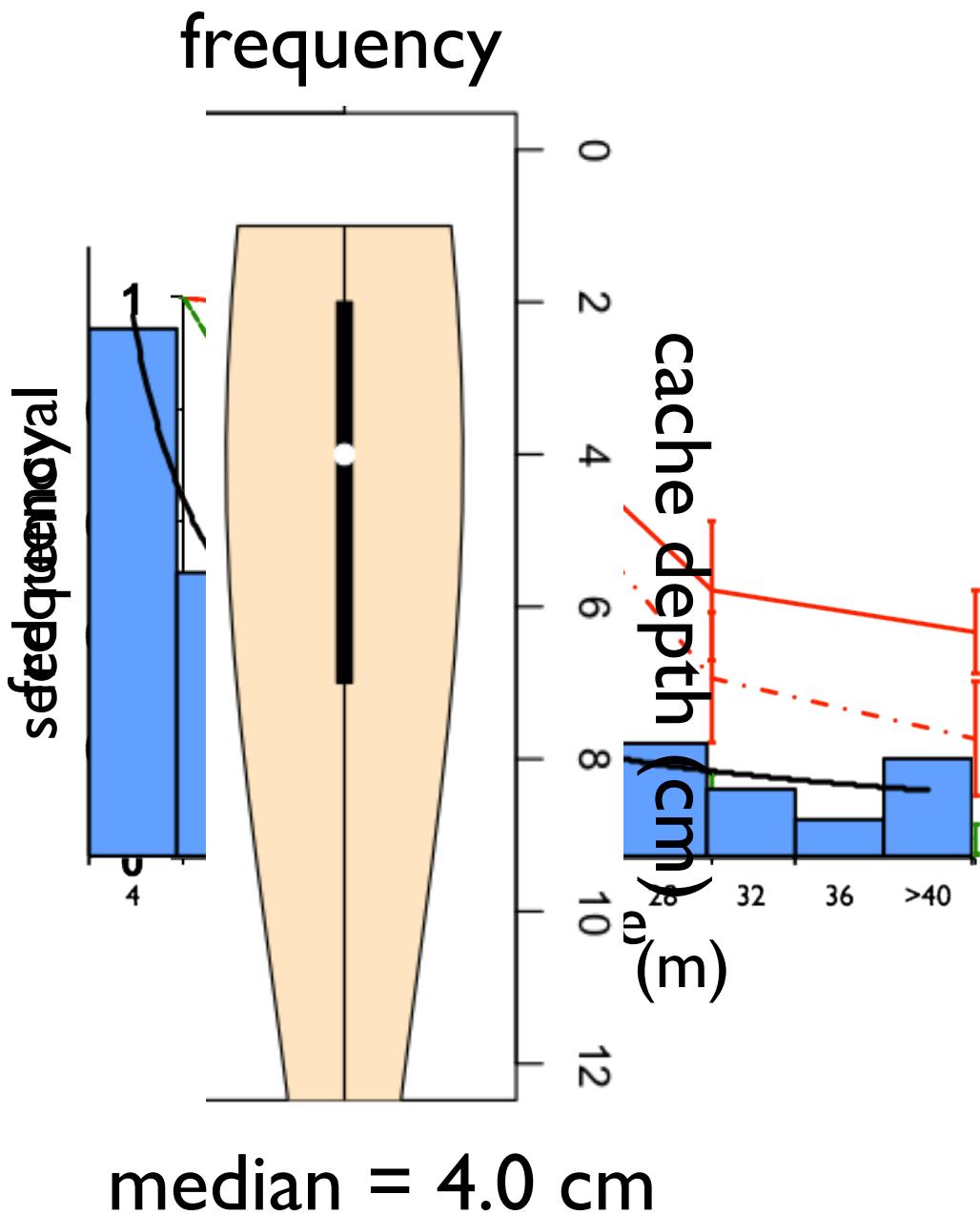




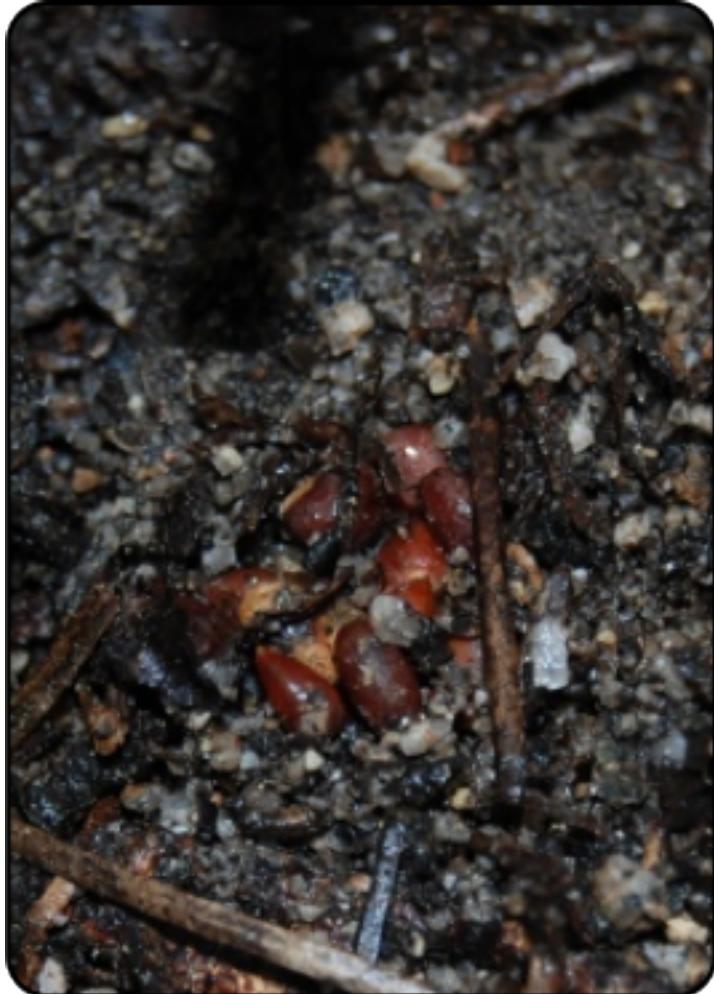
calvertphotography.com

caches found: 139
seeds recovered: 1,896
trials: 11

QuickTime™ and a
Motion JPEG OpenDML decompressor
are needed to see this picture.



experiments

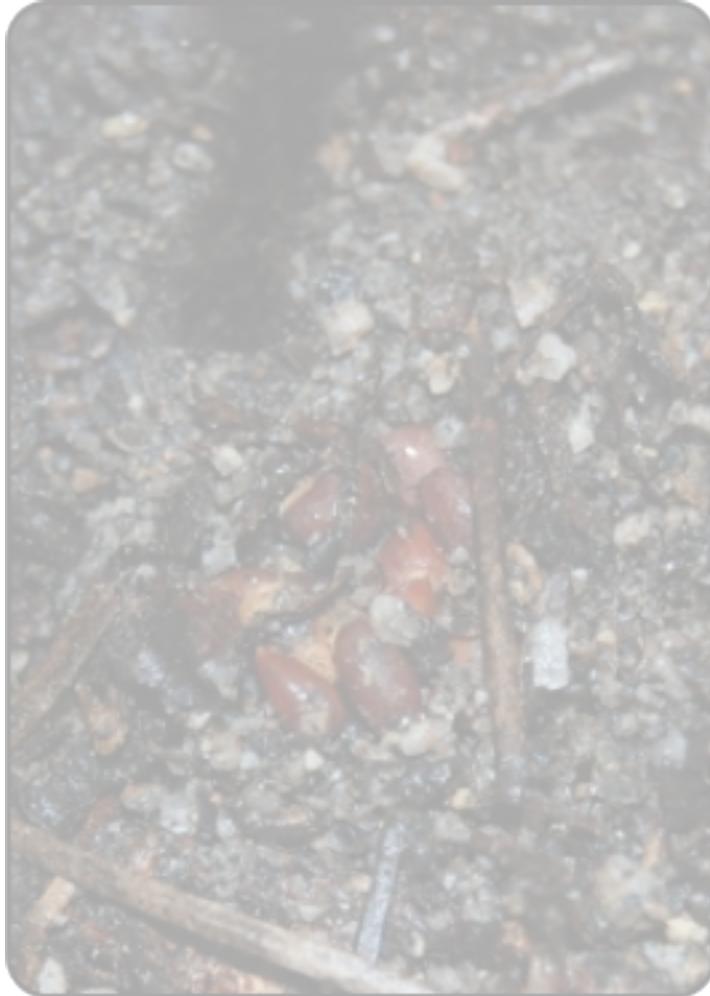


seed fates

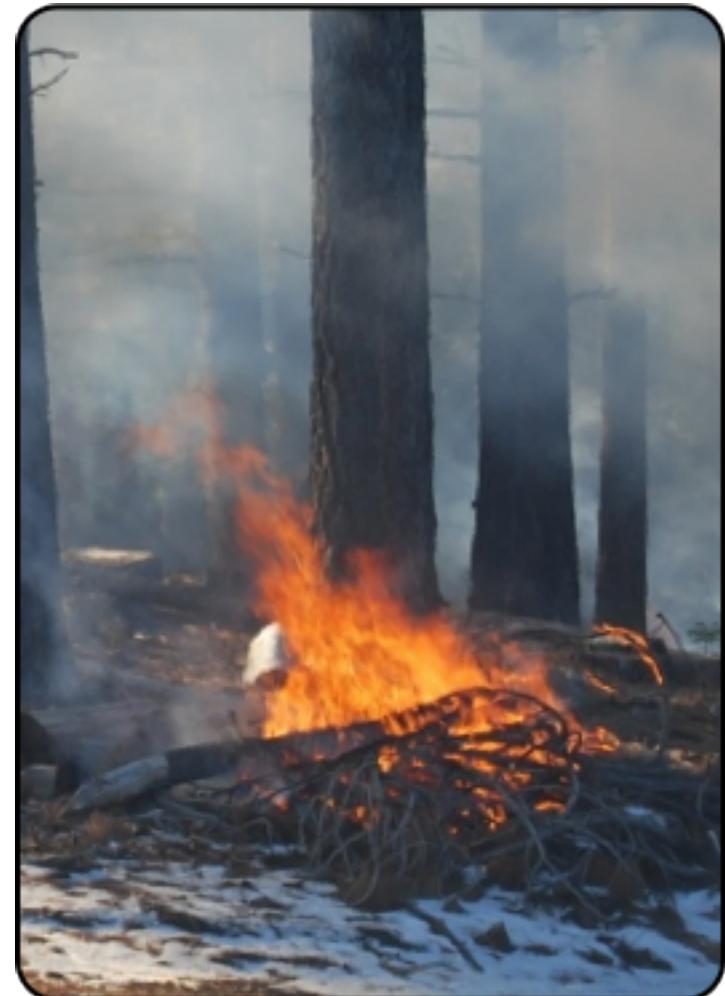


germination
conditions

experiments



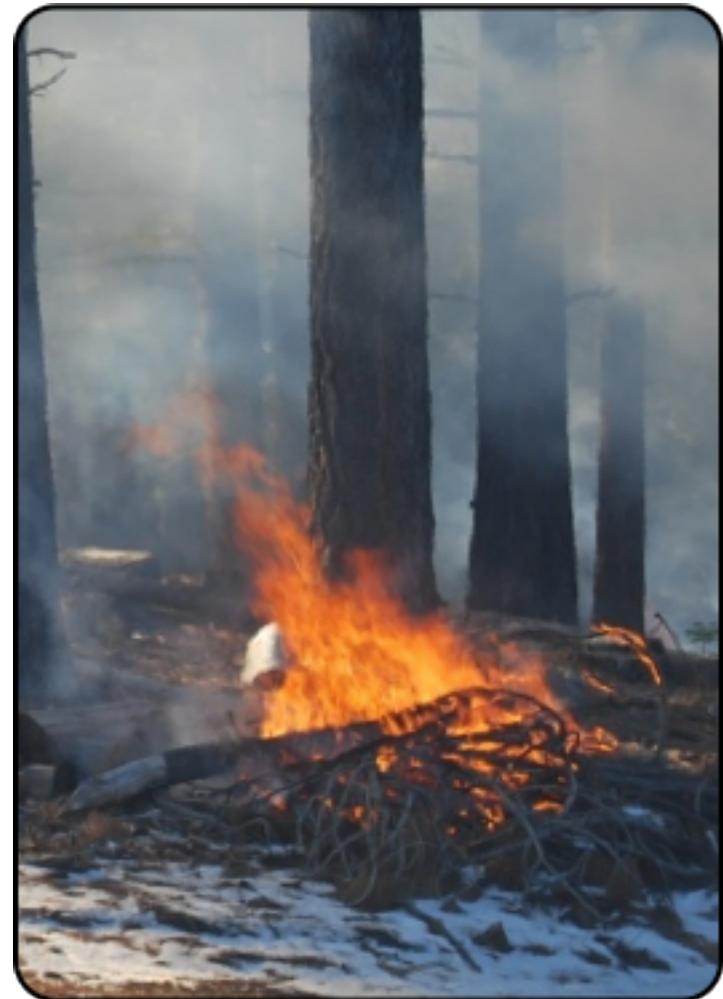
seed fates



germination
conditions

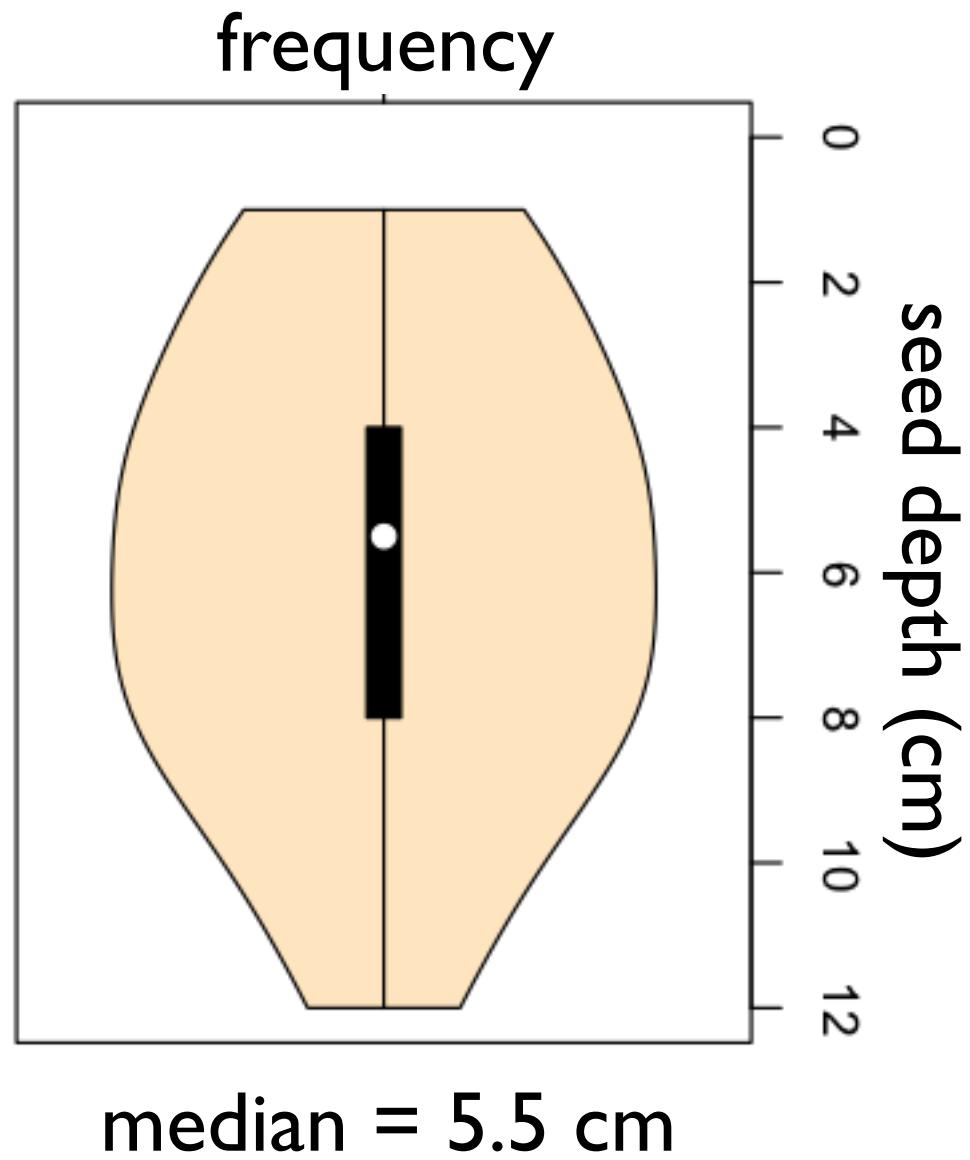
experiments

germination depth



germination
conditions

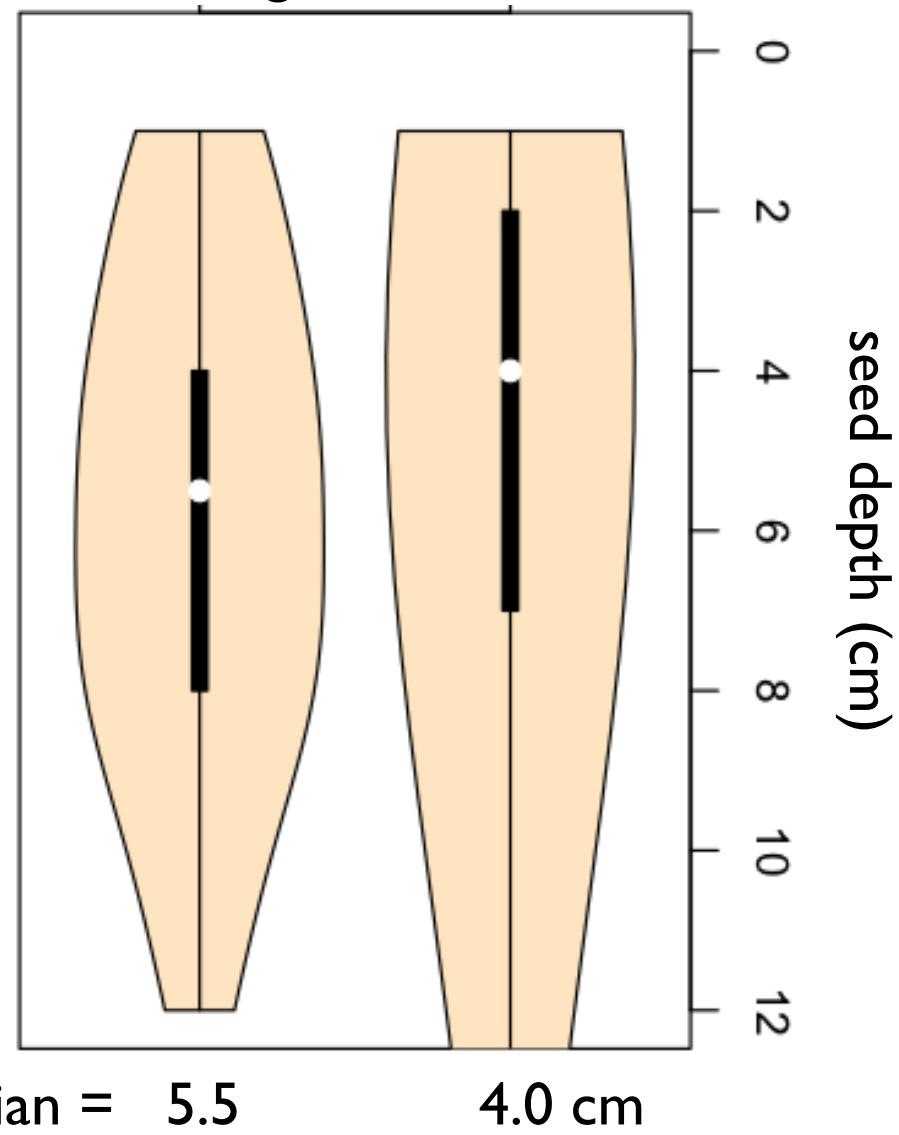
germination depth



germination depth



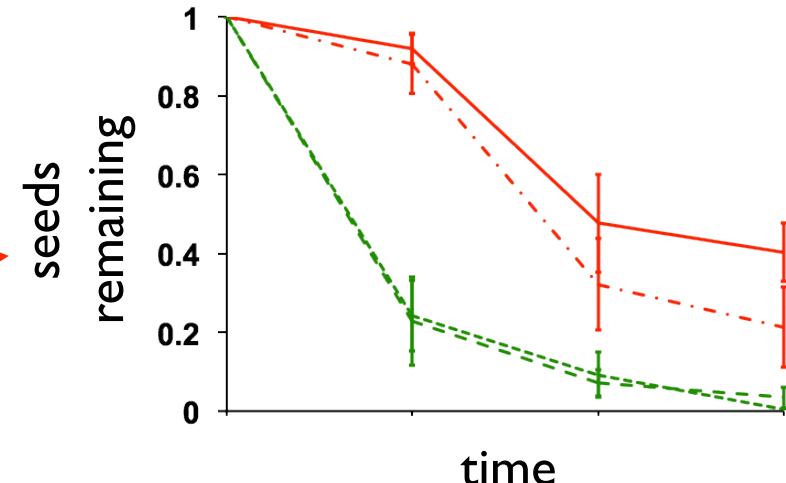
seedlings cached seeds



manzanita seed

dispersal summary

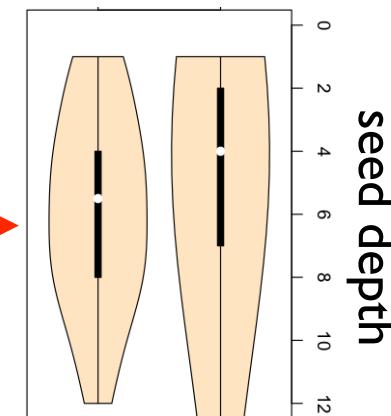
- removed largely by rodents



- rodents bury seeds in suitable microsites



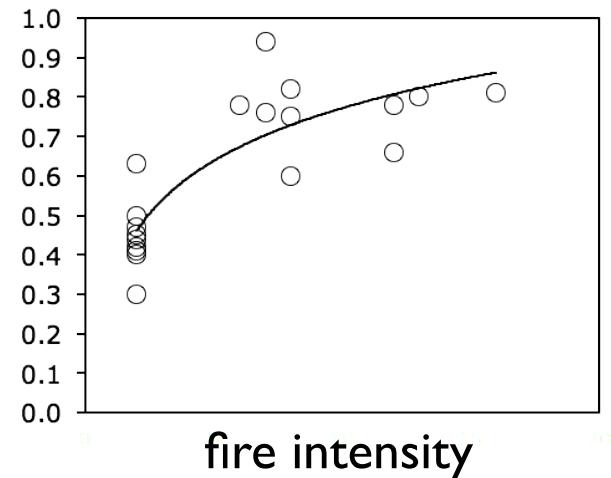
seedlings caches



- fire stimulates germination from caches



germination
from caches



acknowledgements

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UNR GSA
mom and dad



ubiquity

CFP

Mediterranean-type
ecosystems

Manzanita (*Arctostaphylos* spp.)

Pines (*Pinus* spp.)

Oaks (*Quercus* spp.)

CA bay laurel (*Umbellularia californica*)

CA buckeye (*Aesculus californica*)

CA black walnut (*Juglans californica*)

Buckthorn (*Rhamnus* spp.)

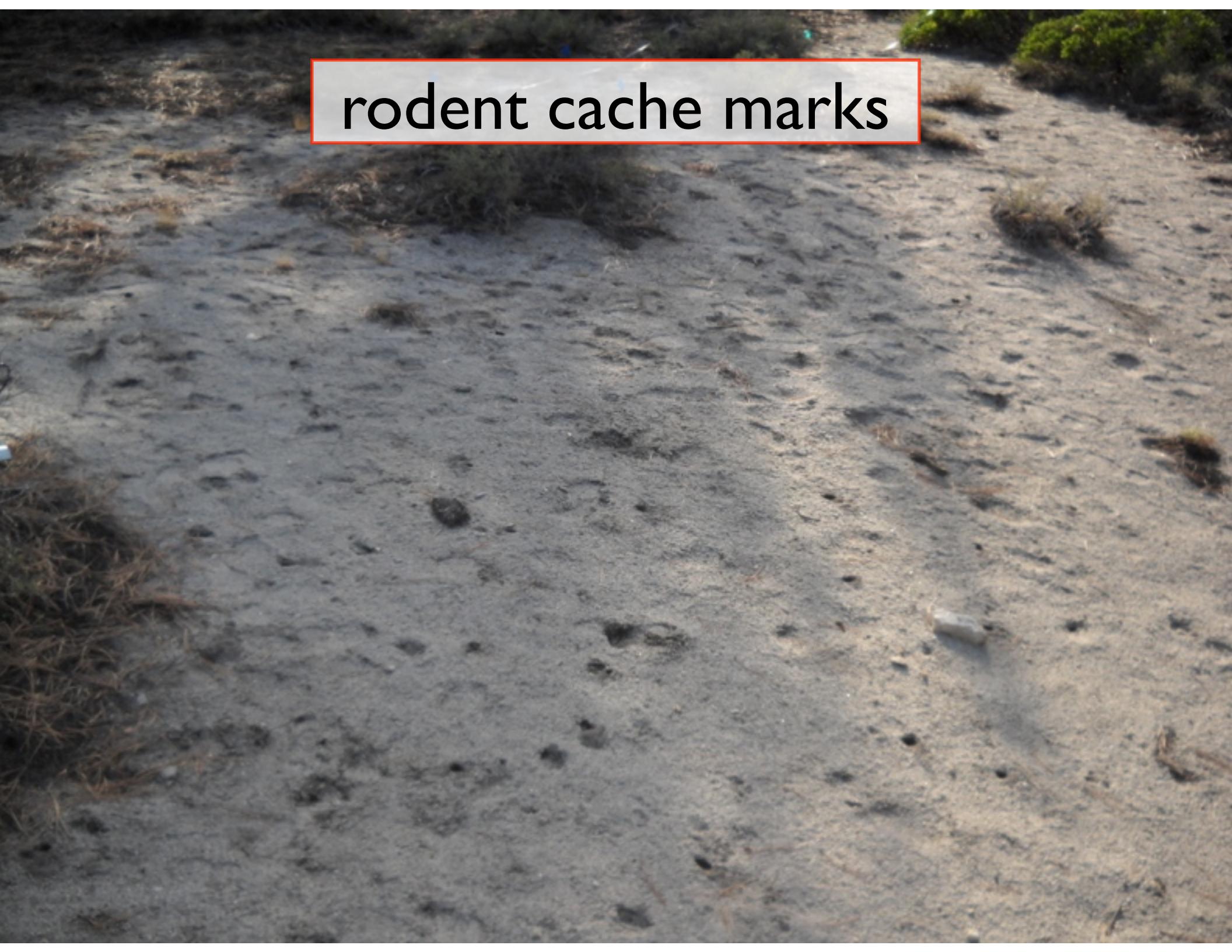
Sumac (*Rhus* spp.)



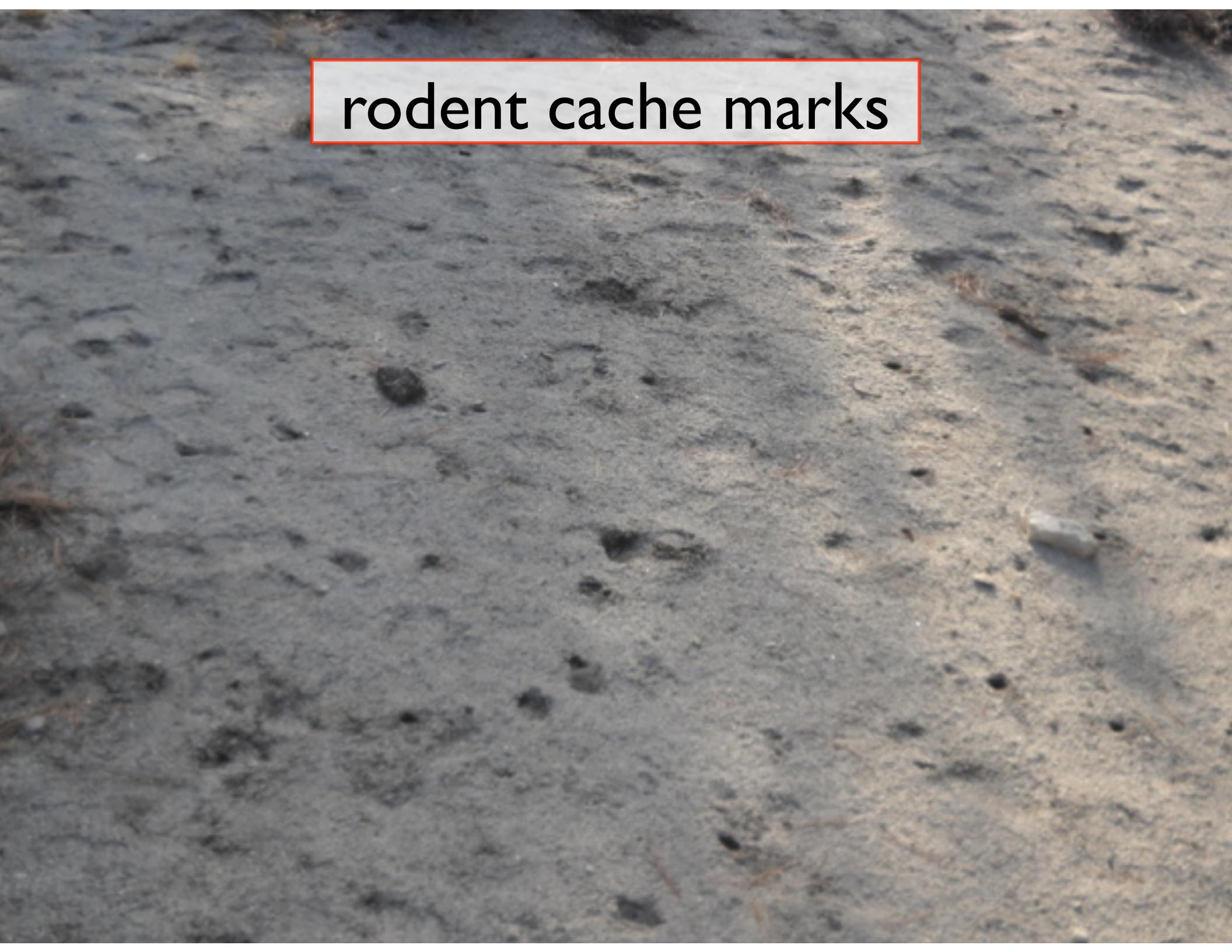
rodents as secondary dispersers



rodent cache marks



rodent cache marks



rodent cache marks $n = 35$

