Non-native mammals: their varying roles in a novel ecosystem

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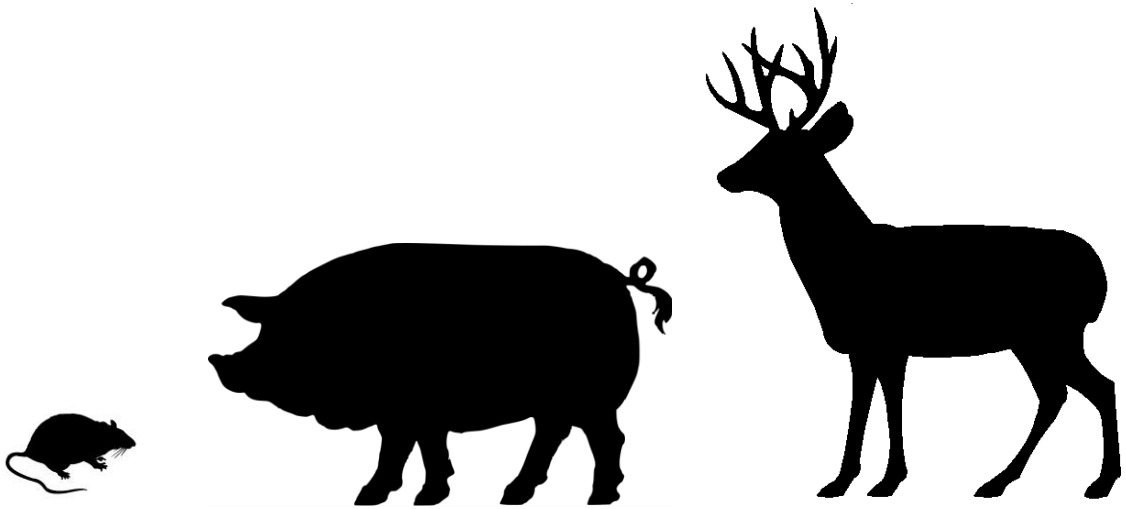
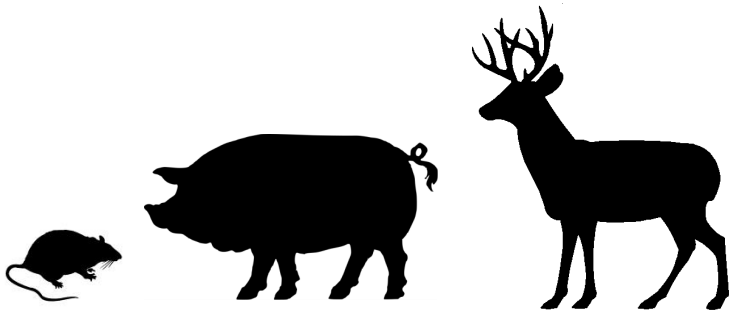


Novel ecosystems

- Systems with species assemblages historically unknown from that area
- Arise through species invasion, environmental change, or both – from anthropogenic causes
- Describes the majority of ecosystems in the world
- Describes Guam's bird-less habitats

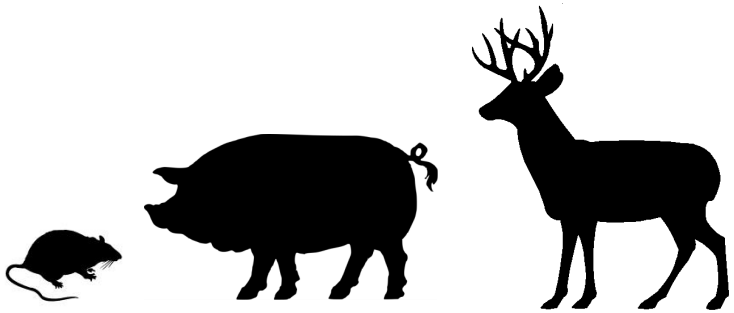


Mammalian introductions to the Marianas

Woodprint D'urville expedition from Guampedia

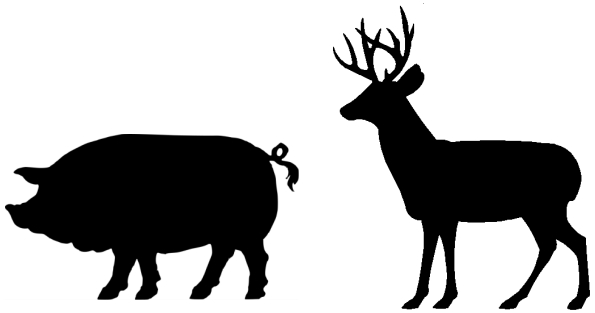
Print Lutke expedition from Guampedia

- Philippine deer (*Rusa marianna*) introduced to Guam 1770's
- Pigs (*Sus scrofa*) introduced to Guam 1660's
- Polynesian rat (*Rattus exulans*) no later than 1200-1000 AD, ship rat (*Rattus rattus*) with European explorers

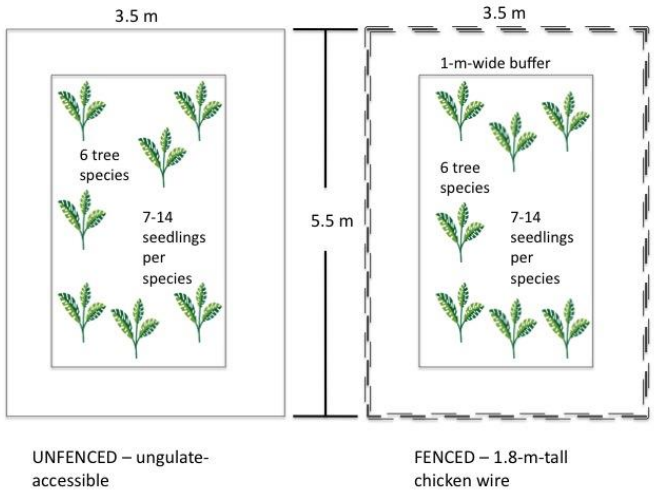


Deer and pigs: ecology in Guam

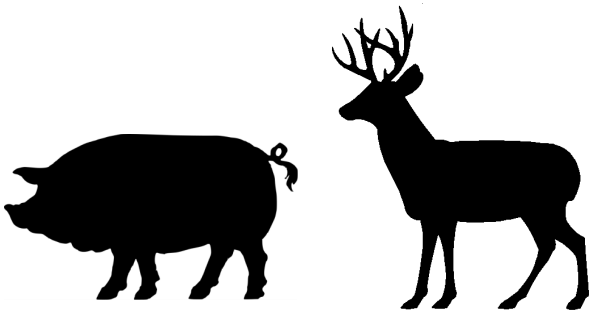
- Do they kill seedlings?
- Do they disperse seeds?
- How do they affect different forest characteristics?



Do deer and pigs kill seedlings?



- Set up paired treatments:
  - Fenced
  - Unfenced
- Planted six common species:
  - Mapunao (*Aglaia mariannensis*)
  - Ladda (*Morinda citrifolia*)
  - Ågao (*Premna serratifolia*)
  - Fagot (*Ochrosia oppositifolia*)
  - Papåya (*Carica papaya*)
  - Aplokåting (*Psychotria mariana*)



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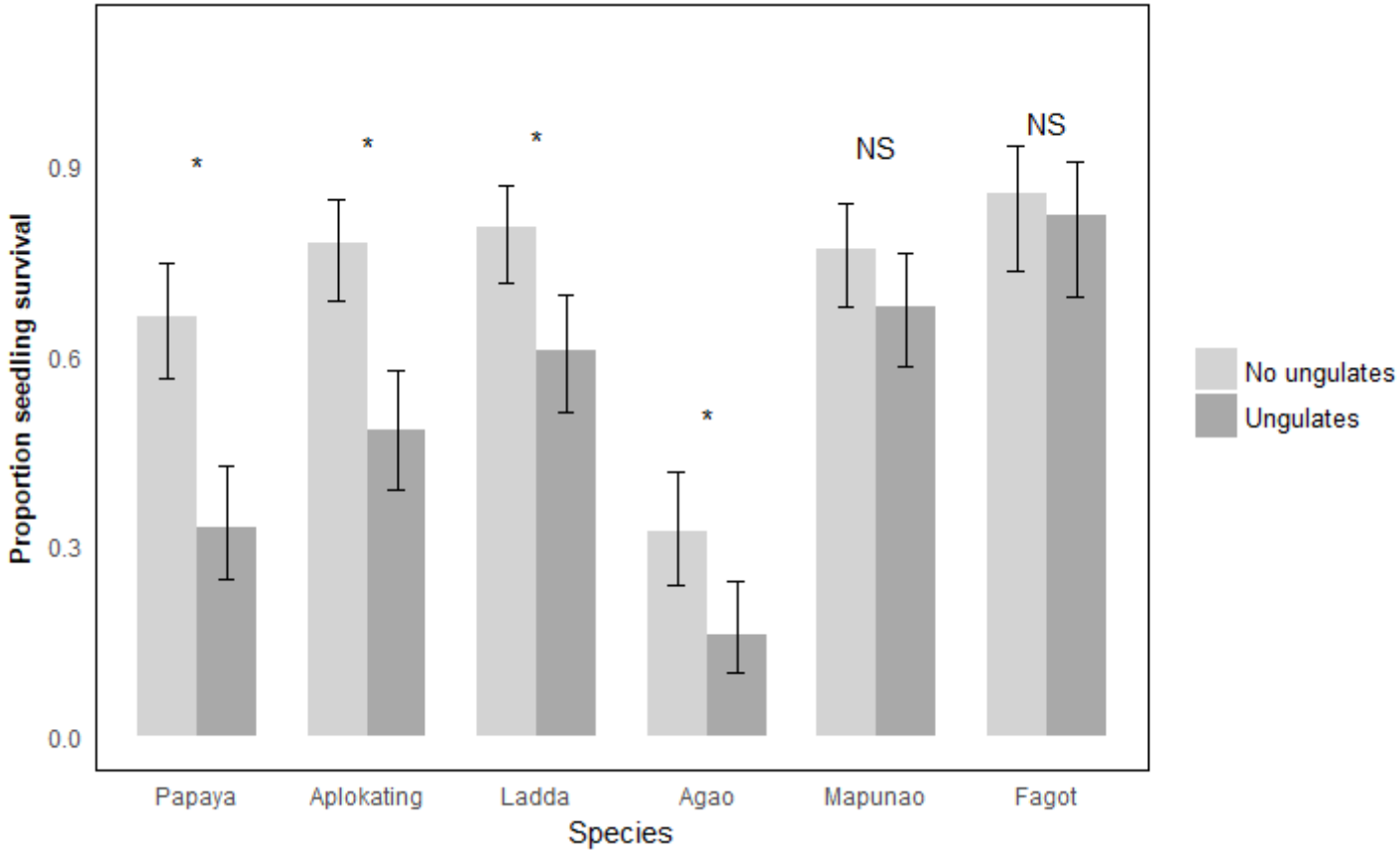
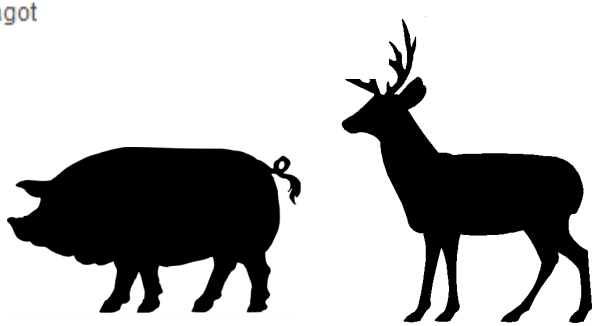
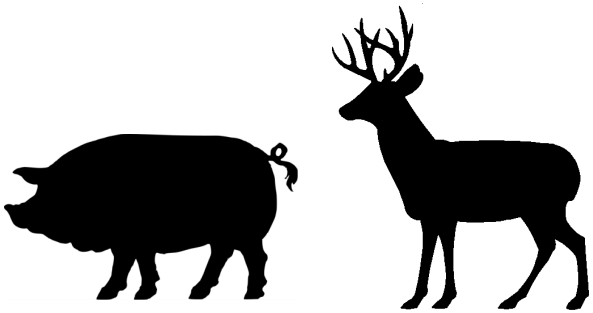




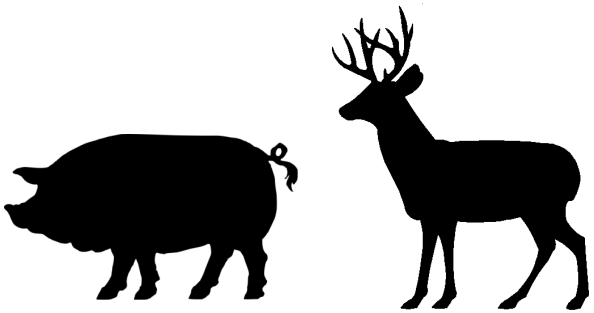
Do deer and pigs disperse seeds?

- Collected pig and deer scats
- “Planted” scats
- Identified germinants



Do deer and pigs disperse seeds?

		Deer		Pig	
Species	**Average seeds per fruit**	**No. of scats with this species**	**Average seedlings per scat**	**No. of scats with this species**	**Average seedlings per scat**
Morinda citrifolia	164	0	na	20	55.95
Ficus prolixa	189	0	na	3	82.33
Carica papaya	721	1	1	16	16.63
Vitex parviflora	1-2*	1	1	0	na
Passiflora suberosa	26	1	8	3	4.33
Mikania micrantha	achene	1	1	0	na
Coccinia grandis	126	0	na	3	1
Chromolaena odorata	achene	0	na	1	1
Leucaena leucocephala	18*	0	na	1	1
unknown		1	0.1	4	2



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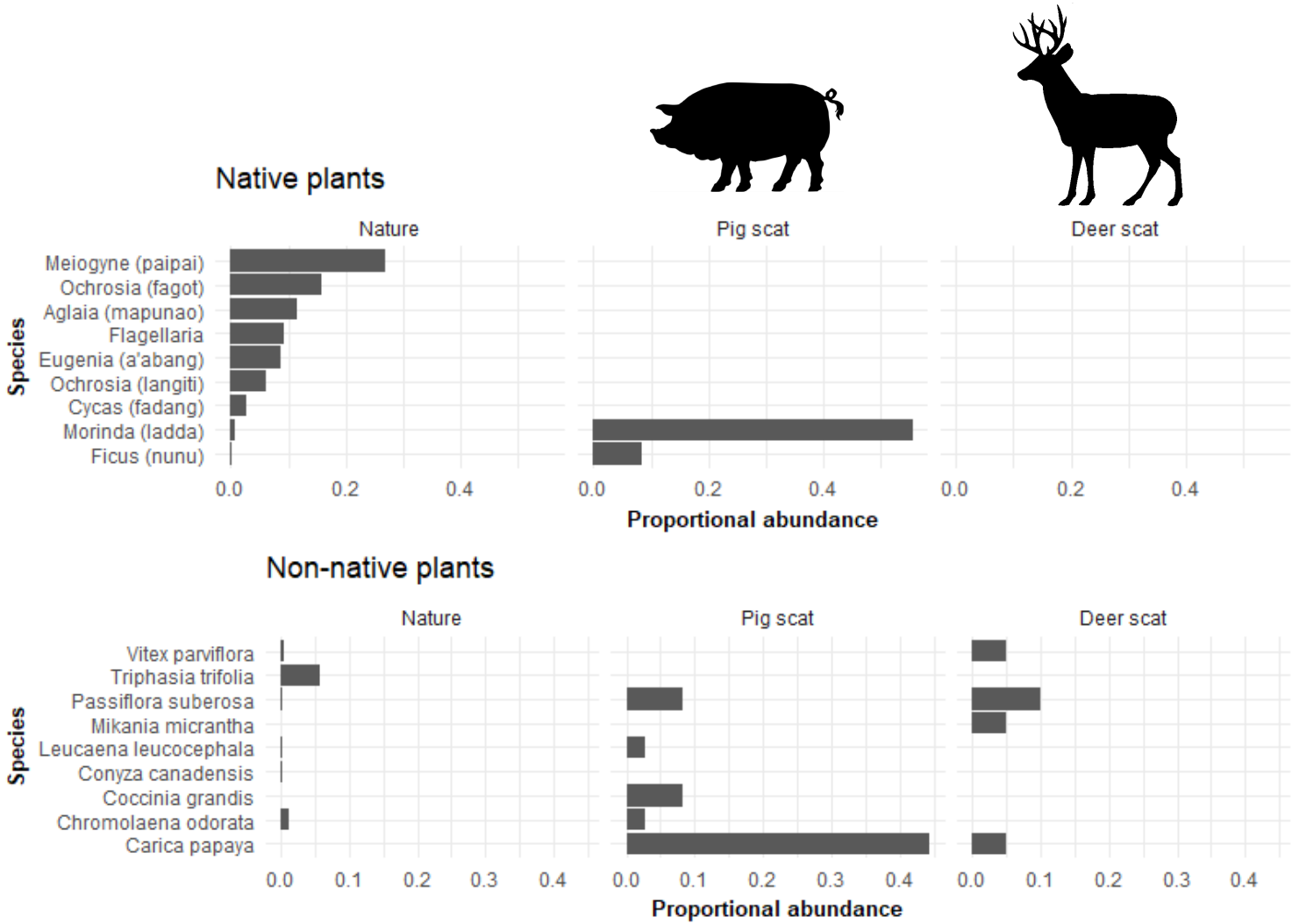
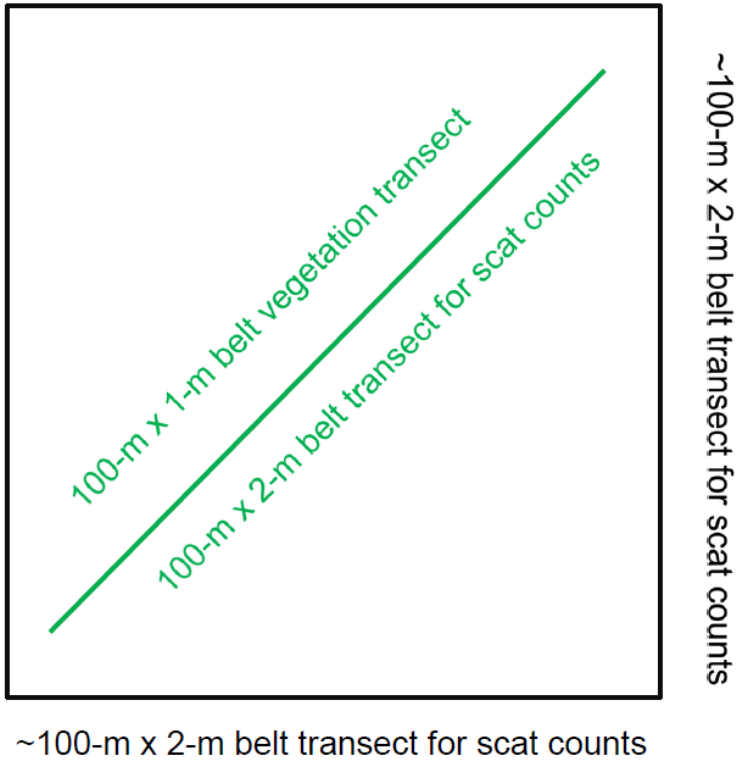
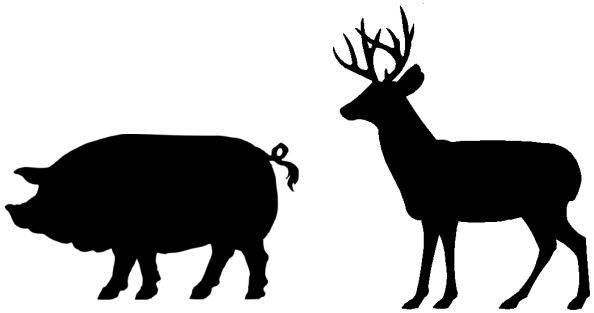


How do deer and pigs affect different forest characteristics?



- Belt transects were used to survey forest-community composition.
- Larger belt transects were used to count scat and estimate ungulate abundance.



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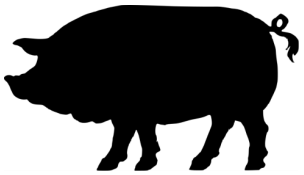
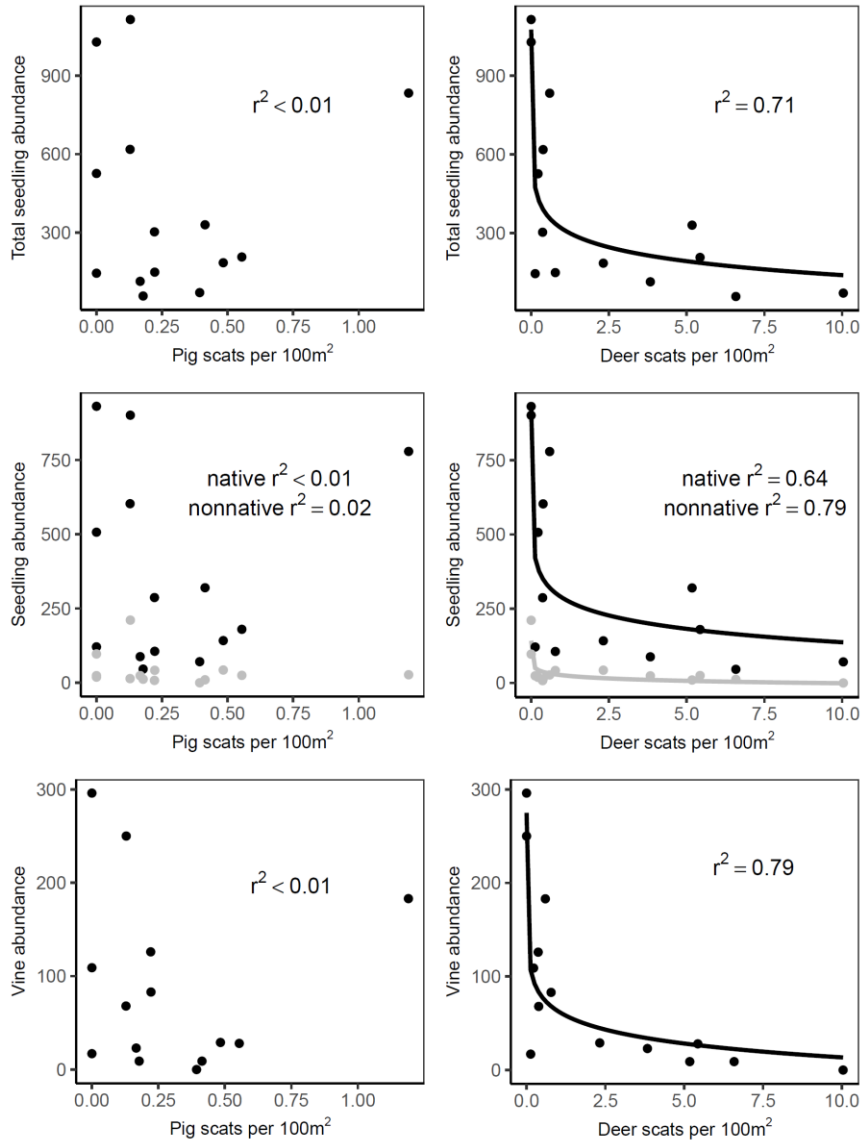
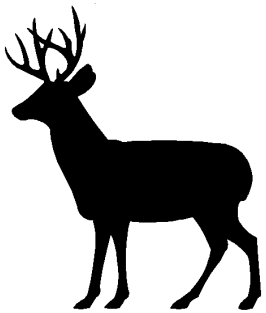
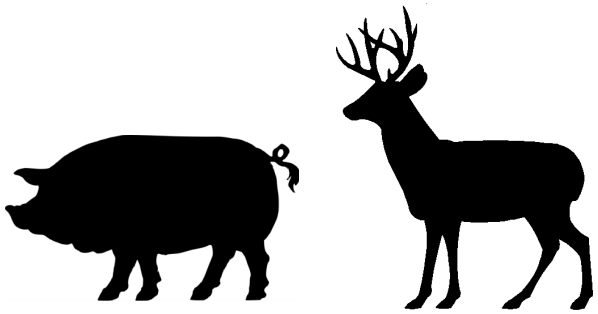






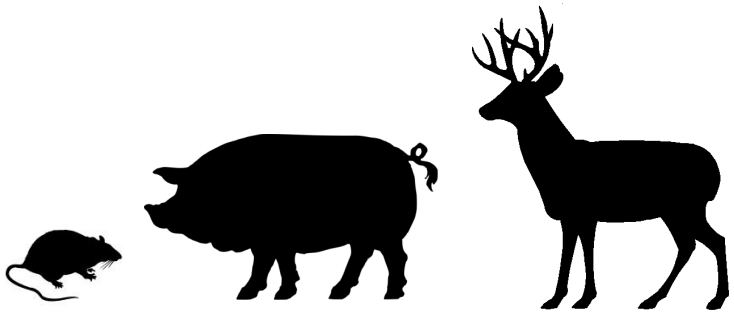
Takeaways from deer and pig studies

- Deer strongly linked to declines in seedling and vine abundance
- Pigs disperse seeds of both native and non-native plant species
- Deer appear to be more detrimental in limestone karst forest sites
- Important to make distinctions between species and habitats in consideration of novel ecosystems



What about rats?

- Known to be harmful
  - Direct predation on native wildlife
  - Out-compete native fauna
  - Spread disease
  - Destroy seeds
- Can they disperse seeds?
  - Evidence that some small seeds can survive gut passage



What about rats?

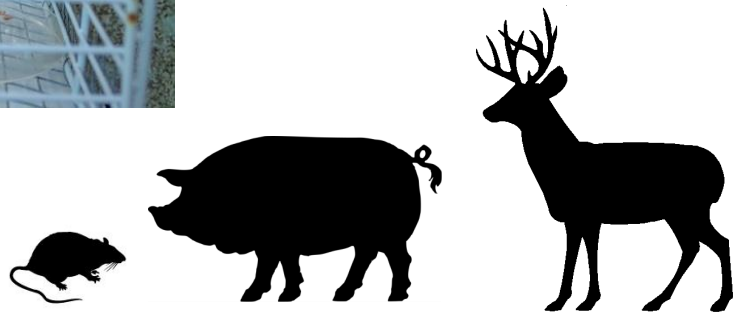
Feeding trials

1.) Trap wild rats (black rats or *Rattus rattus*)

2.) Collect fruits from limestone karst forest areas of Guam

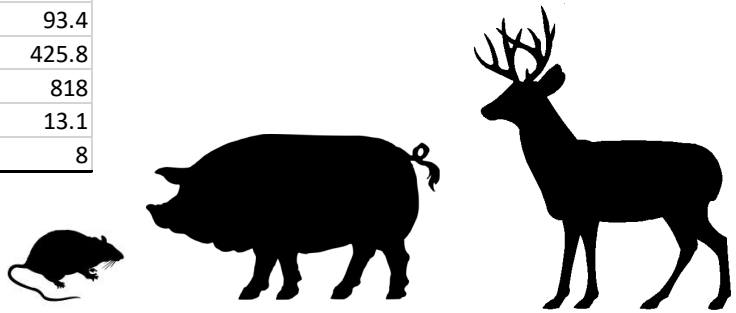
3.) Feed rats collected fruits

4.) Recorded what happened to fruits and seeds



What about rats?

species	native?	#fruits added	#seeds handled	#fruits remaining	#seeds in scat	approx #seeds destroyed
aglaia	native	60	55	35.15	0	0
aidia	native	72	15	44.5	3	724.5
elaeocarpus joga	native	5	0	5	0	0
eugenia palumbis	native	5	0	2	0	3
eugenia reinwardtiana	native	14	11	9.5	0	0
ficus microcarpa	native	38	0.6	32	53	1146.4
ficus prolixa	native	4	0	3	5	241
flagellaria	native	44	4	33	1	6
maytenus	native	23	6	16	0	4.5
melanolepis	native	100	18	89	0	9.5
morinda	native	6	76	1.8	1	611.8
neisosperma	native	15	5	14.9	0	0
ochrosia	native	16	2	16	0	0
pandanus	native	9	6	3	0	0
pipturus	native	149	0.6	8	0	6344.4
premna	native	159	1	57	0	407
psychotria	native	6	4	3	0	2
averrhoa	non-native	5	1	3.75	0	8.625
carica papaya	non-native	7	379	0.15	0	1210.2
leucaena	non-native	9	21	3.8	0	93.4
passiflora foetida	non-native	23	0	0	2	425.8
passiflora suberosa	non-native	32	0	0.5	1	818
triphasia	non-native	39	35	2	0	13.1
vitex	non-native	14	6	7	0	8



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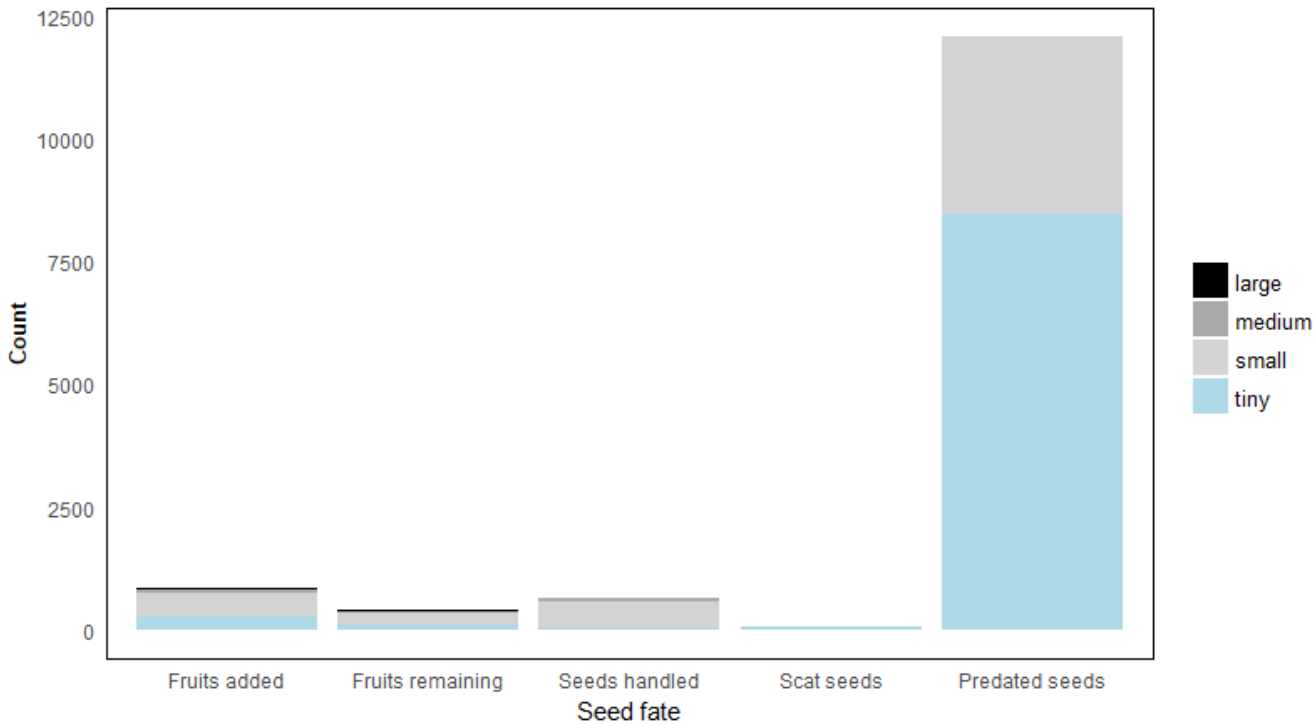
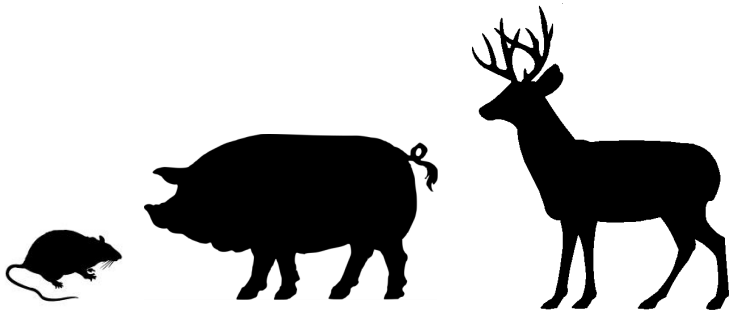
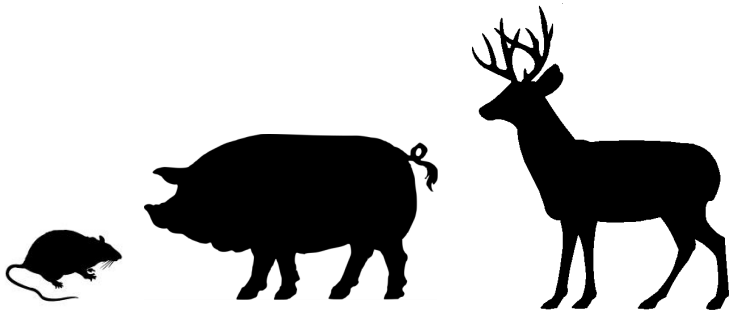




Future work

- Feeding trials
  - Continue with rats
  - Begin trials with pigs
  - Germination trials
- Estimation of environmental damage
- Forest trajectories for how to rebuild/restore functioning ecosystems in Guam
- Social science work



Si Yu’os Ma’åse’