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WAY OUT WEST

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Presentation: Interactions of native and introduced species in coastal habitats

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Winner 2013 Quinovic student award

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Direct and indirect interactions of native and introduced species in coastal habitats

My PhD-thesis



by

Susanne C. Krejcek

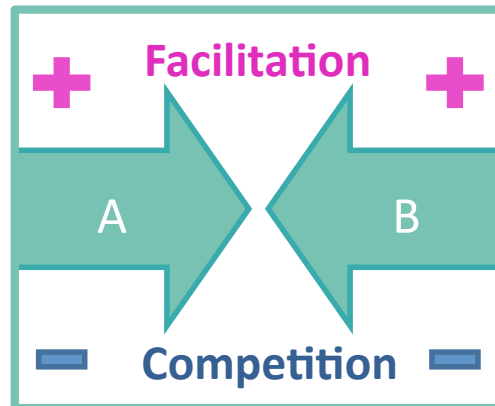
Supervisors: Stephen Hartley, David Bergin and Jon Sullivan



Direct and indirect interactions

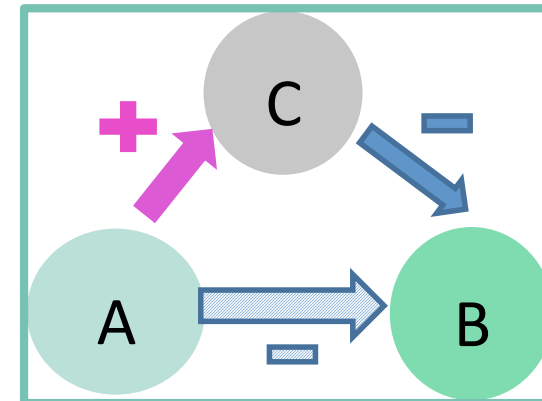
Direct interactions (chapter 2-3):

- Competition
- Facilitation



Indirect interactions (chapter 4-5):

- Apparent competition
- Apparent facilitation



(Levine, 1976; Holt, 1977)



Marram management



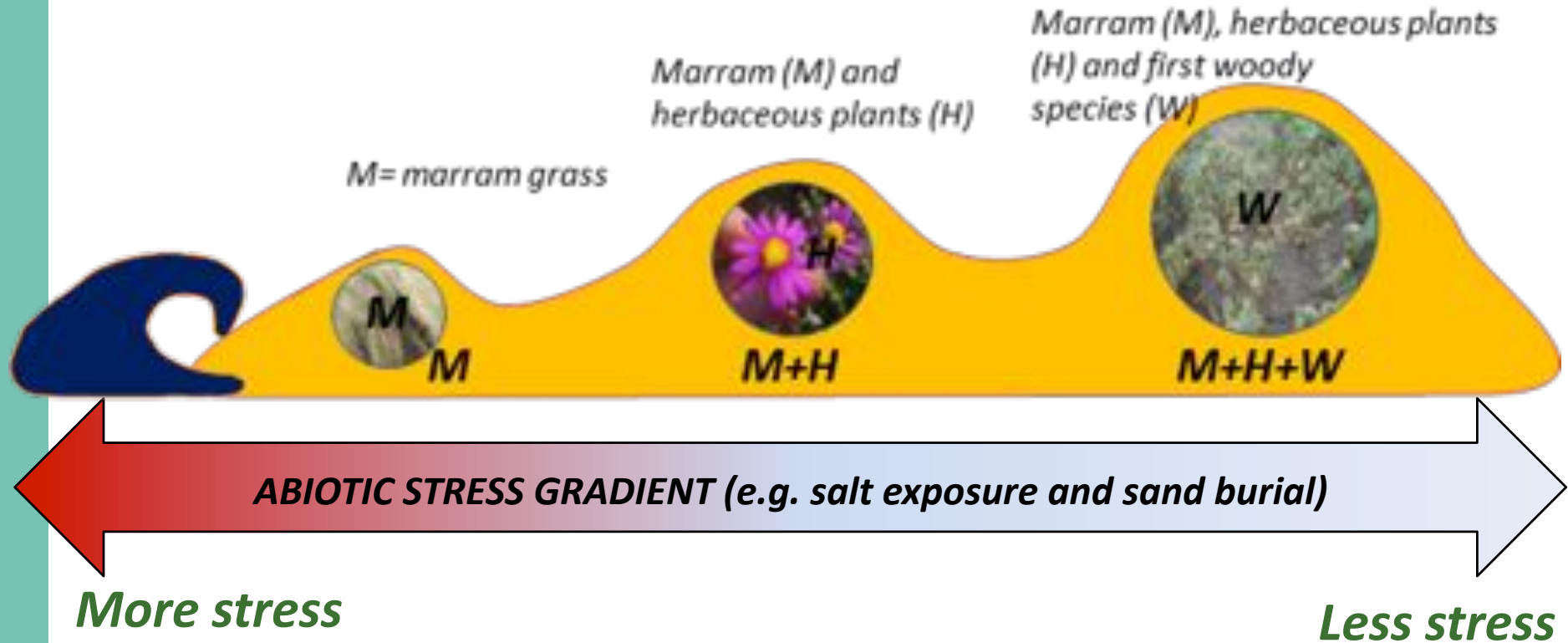
*Spraying of marram + mulching with
or without plantings*



Stress gradient hypothesis (SGH) (Bertness & Callaway, 1994):

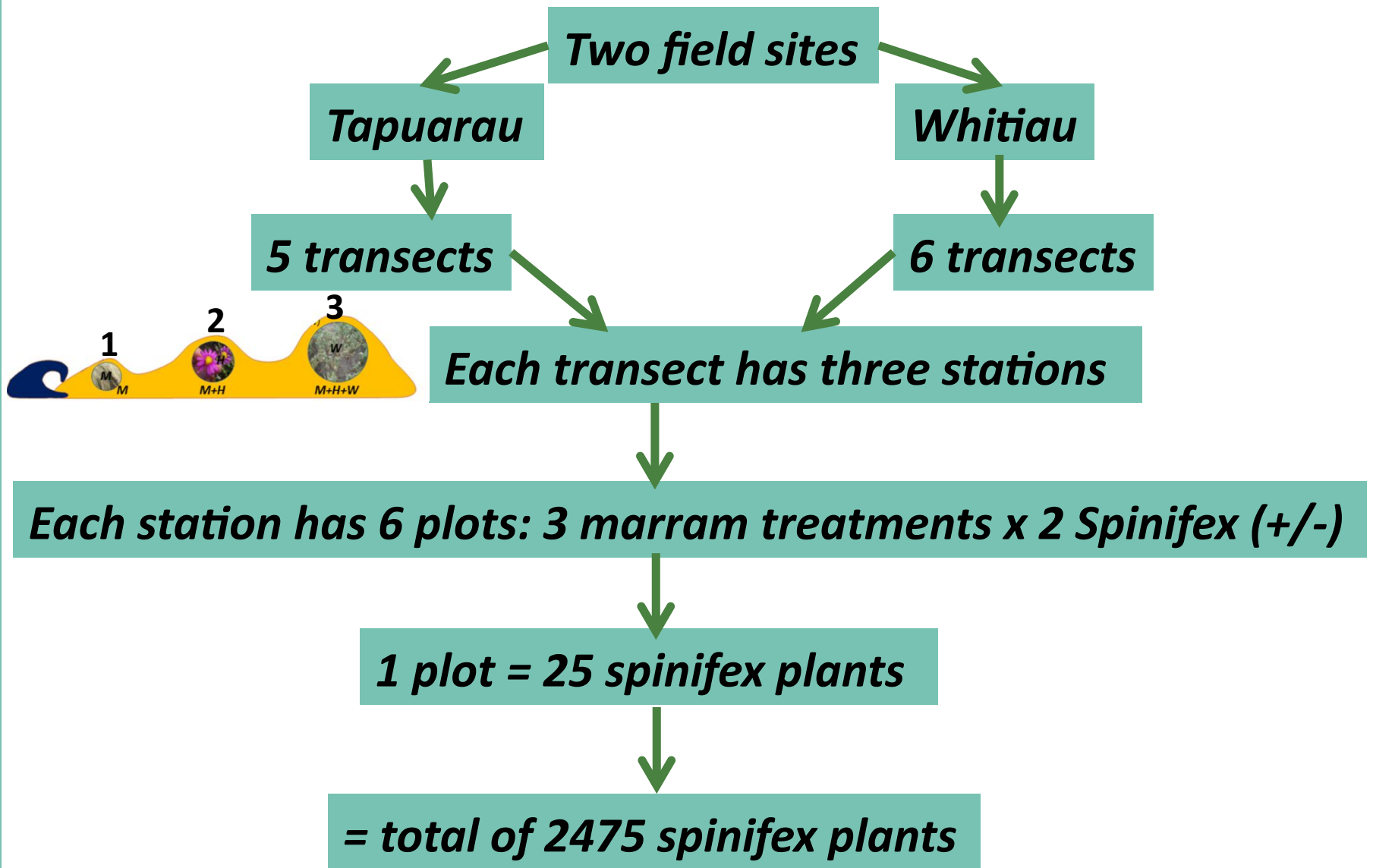


Chapter 2-3





Facilitation or competition along the stress gradient?





Experimental setup: Treatments per station



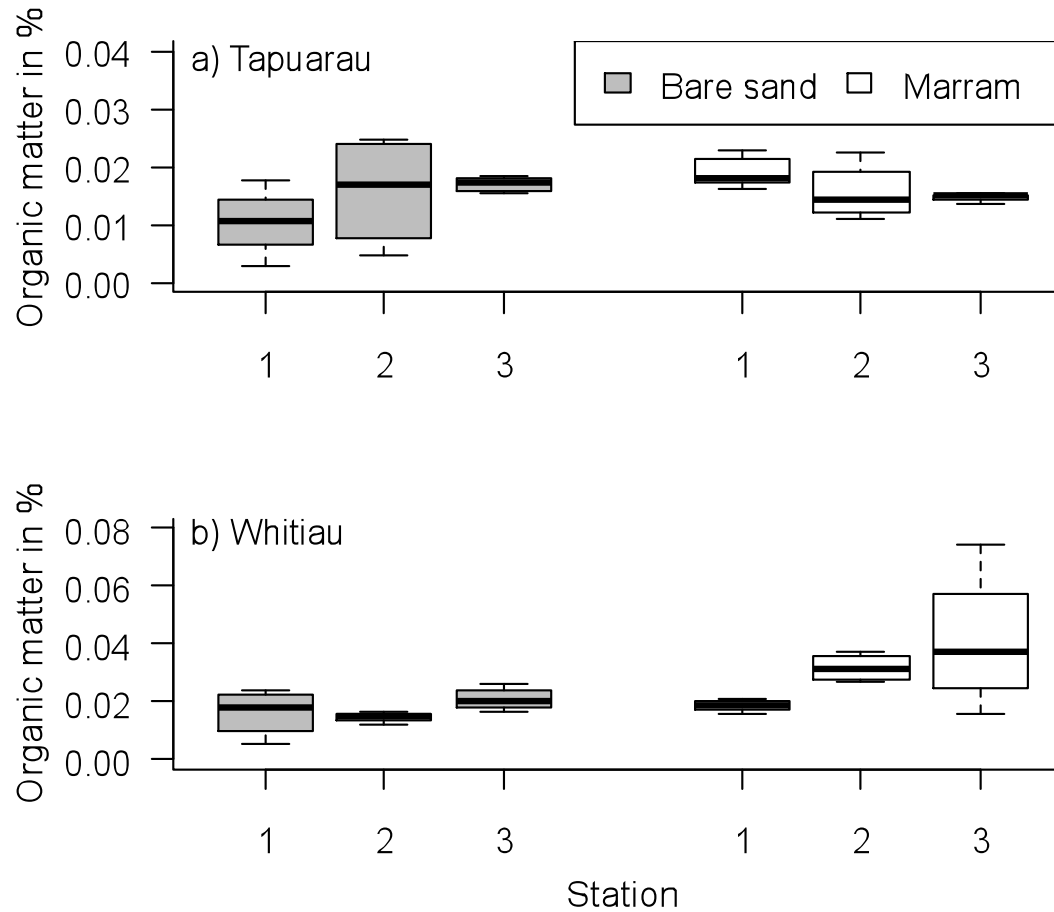
Spinifex planted in each treatment + unplanted control





Stress gradient

Organic matter content



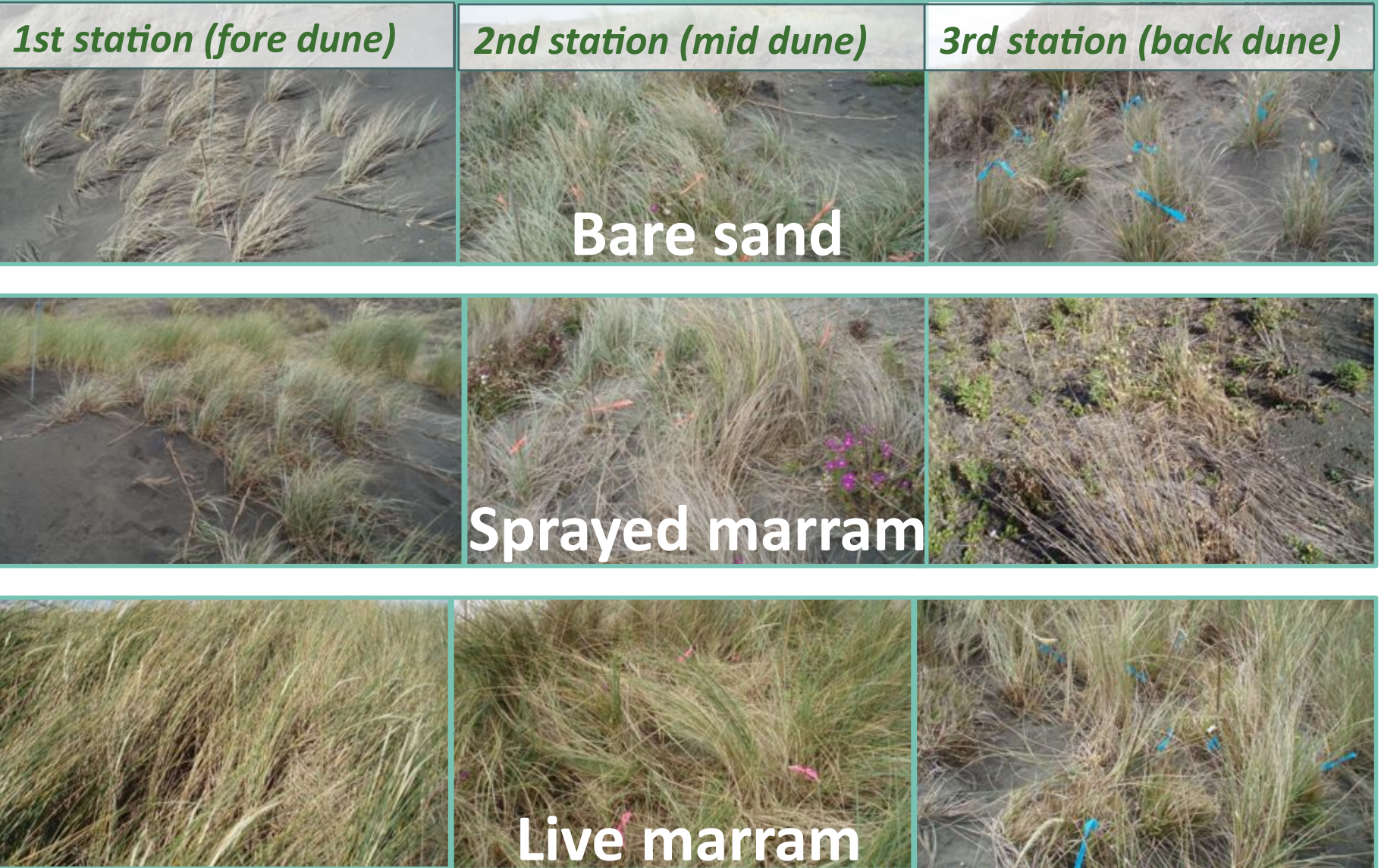


Data collection





Marram- facilitator or competitor of spinifex?





Marram- facilitator or competitor of spinifex?

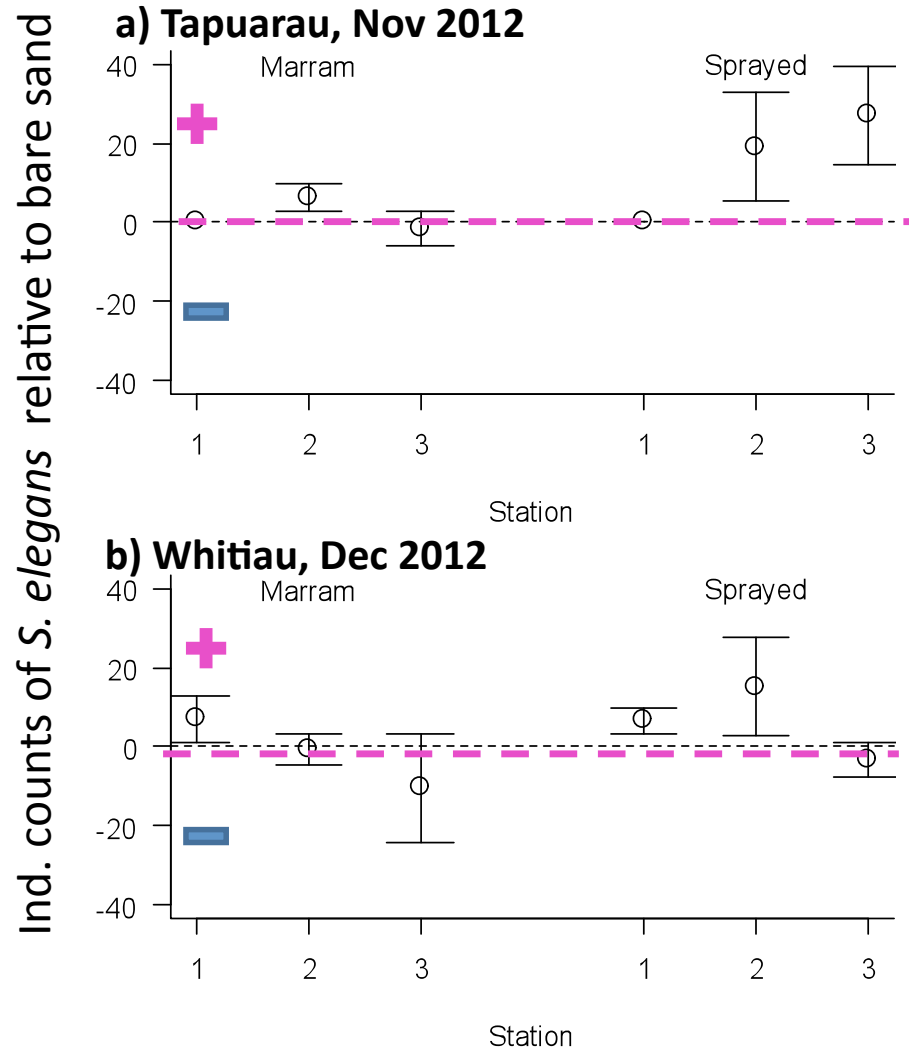
Spinifex growth in dependency of marram cover

Predictor	numDF	denDF	F-value	p-value
marram cover	1	25	34.19	<.0001
treatment	2	25	7.97	0.002
station	2	25	3.637	0.041
marram cover:station	2	25	4.075	0.029
treatment:station	4	25	4.126	0.011

- *Sprayed marram provided better facilitation than live marram and (partly) followed SGH*
- *Spinifex growth was greatest closest to the sea*
- *Similar patterns for live and sprayed marram*



Population dynamics and SGH



Best in sprayed marram further away from the sea



Abundance greatest in sprayed marram with medium distance to the sea



Population dynamics and SGH



- *Senecio elegans*, *Conyza canadensis*, dandelions and legumes were facilitated by sprayed marram grass compared to live marram grass
- Grasses other than marram and spinifex performed best in bare sand, in the absence of competitors
- Species diversity increased with distance to the sea, but did not differ significantly amongst treatments



Discussion & conclusions chapter 2 and 3



- Growth measurements supported SGH better than survival
- SGH debate ongoing (e.g. Lortie and Callaway 2006, 2006, Maestre et al., 2005, 2006, 2009, Santoro et al. 2012, Zarnetzke et al, 2013)
- Differences for field sites are probably due to the fact that one field site is eroding while the other is accreting+ weed exposure



Use dead marram for exposed, but not very weedy sites

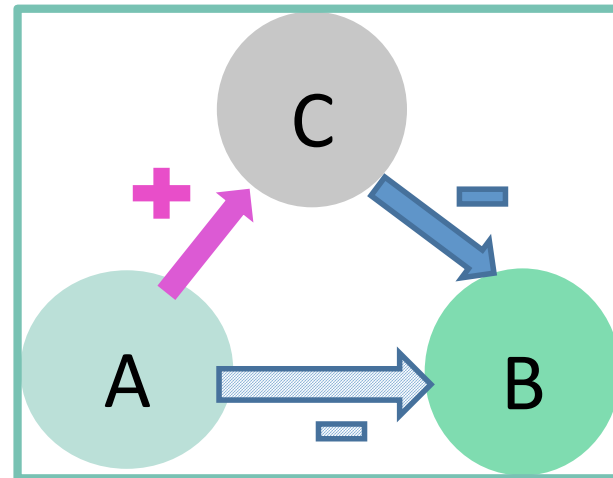




Indirect interactions & spatial scales chapters 4+5

Senecios were chosen as focal coastal plants because:

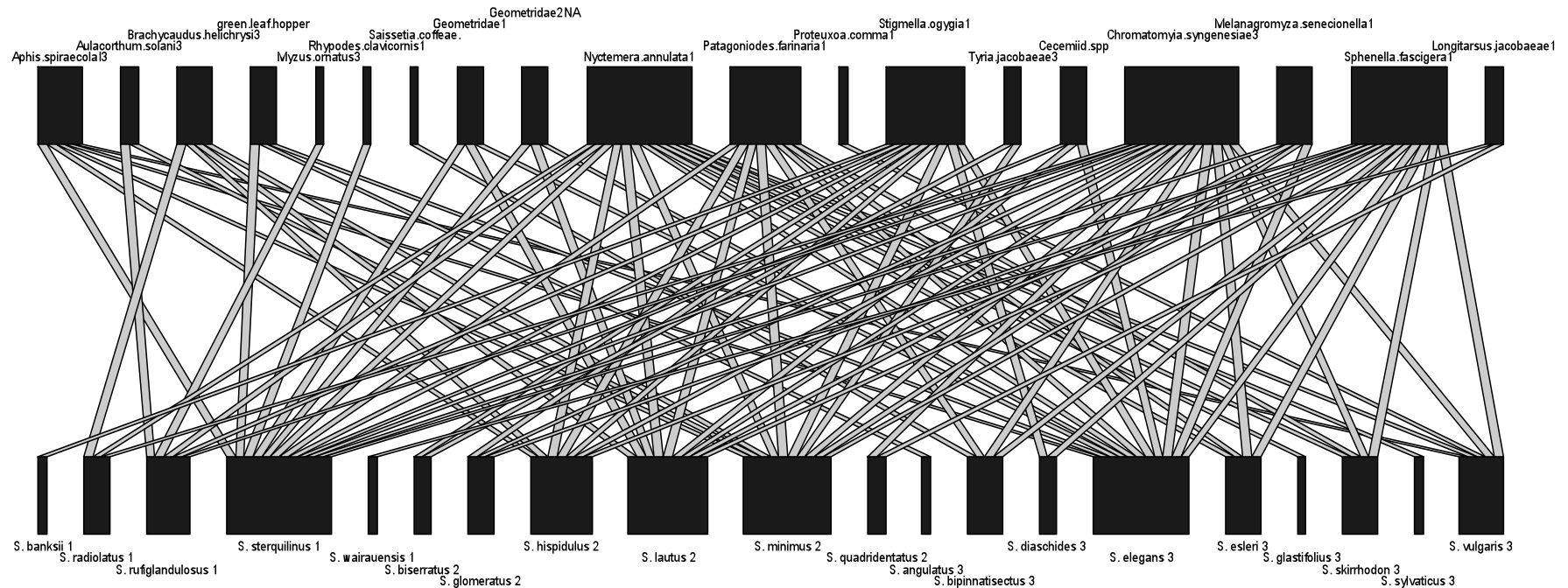
- One of the species richest plant genera (around 3000 species)
- Both closely related native and introduced species grow in close proximity





Senecio food webs in New Zealand

Literature review/meta analysis of plant-insect associations



No evidence for segregation between native and introduced species in the associations they form



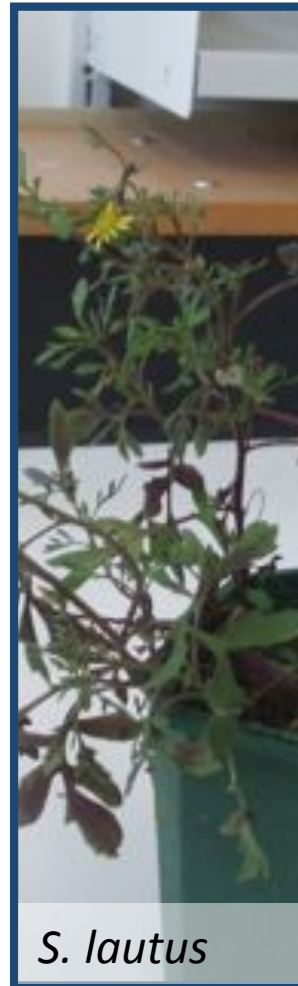
Senecio food webs in New Zealand



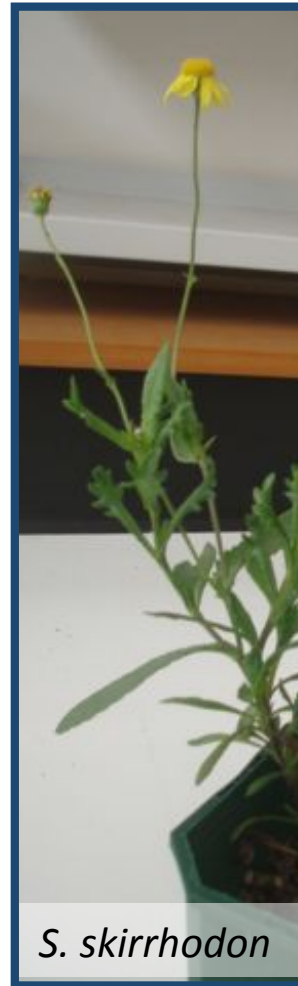
Considered *Senecios* (blue line = experiment)



S. elegans



S. lautus



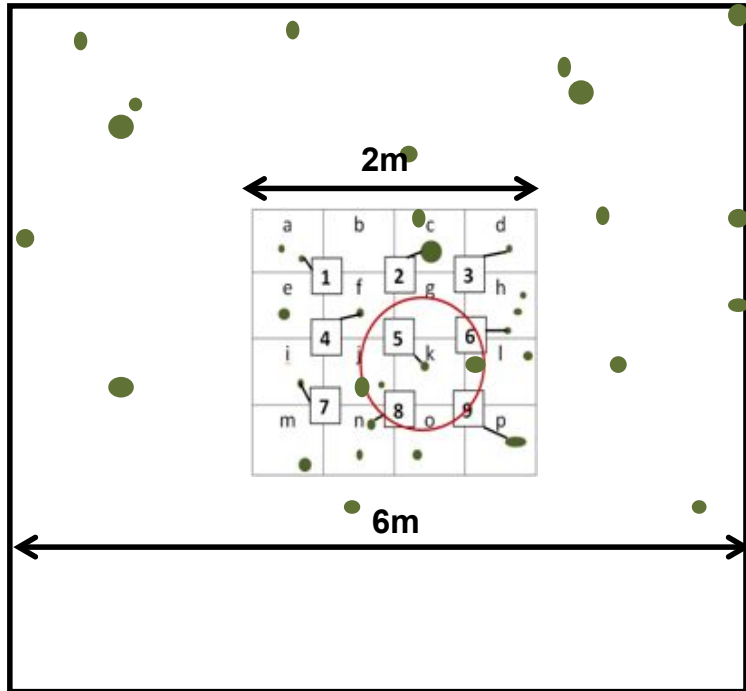
S. skirrhodon



S. sterquilinus

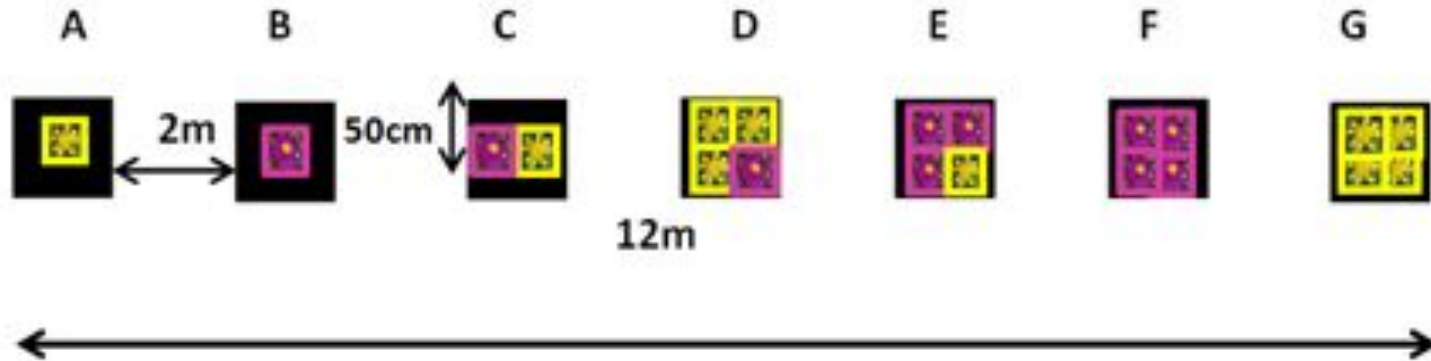
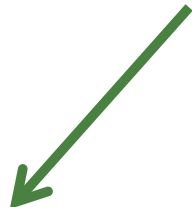


Insect herbivore host plant choice



← Natural surveys

Field experiment





Insect herbivore host plant choice



Senecio food web from field survey data



Insect herbivore host plant choice

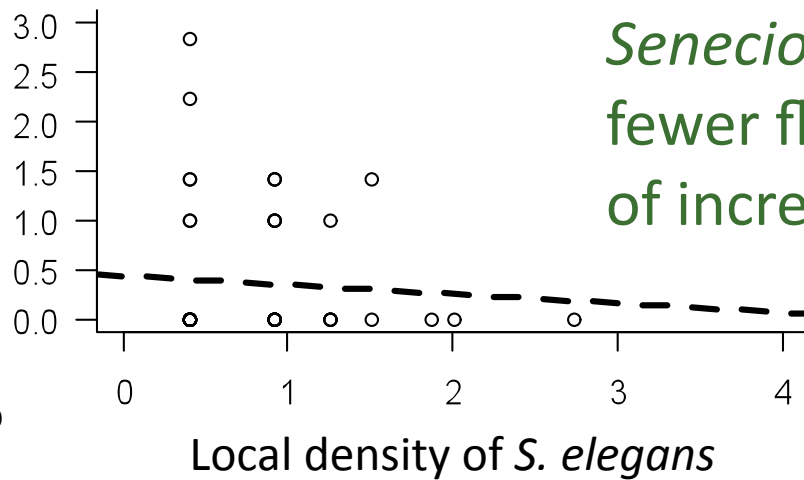


Sphenella fascigera (mating on *S. Skirrhodon*)



Insect herbivore host plant choice

S. fascigera in stems of *S. lautus*



Senecio lautus stems are infected with fewer fly larvae in the presence of increasing numbers of *Senecio elegans*

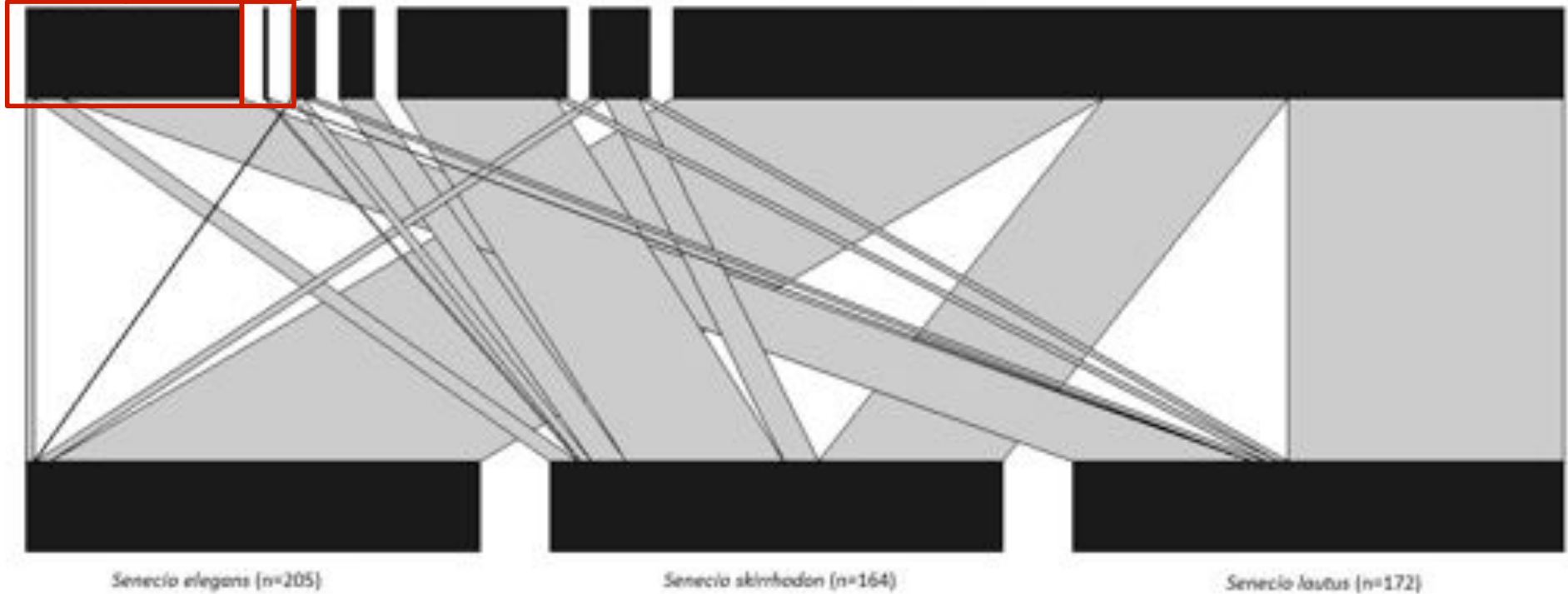
Predictor for <i>S. fascigera</i> in stems of SL	pos/neg	n u m DF	denDF	F-value	p-value
plant size	+	1	131	130.019	<.0001
fine scale density of <i>S. lautus</i>	-	1	131	17.477	<.0001
coarse scale density of <i>S. lautus</i>	+	1	105	0.204	0.653
fine scale density of <i>S. elegans</i>	-	1	131	5.845	0.017
coarse scale density of <i>S. elegans</i>	+	1	105	0.057	0.812



Insect herbivore host plant choice



S. fasc *S. fascigera* in stems



Experimental food web: Plant size important for host choice



Insect herbivore host plant choice

- Some evidence for apparent facilitation of *S. lautus* at fine scales in proximity of *S. elegans*
- Support for Resource Dilution Hypothesis- Higher plant densities = lower insect infestations
- Plant size positively correlated with infestations
- pers. observations of directly competing plants, hence net outcome interesting for future studies





Overall discussion and conclusions



- Net outcome of competitive and facilitative effects important
- Whether a species follows the SGH is dependent on species identity and the stress gradient
- Restoration plantings in sprayed marram follow SGH
- Introduced species have potential to exhibit apparent facilitation of a closely related congener at fine spatial scales, through interactions with shared herbivores





Additional chapter

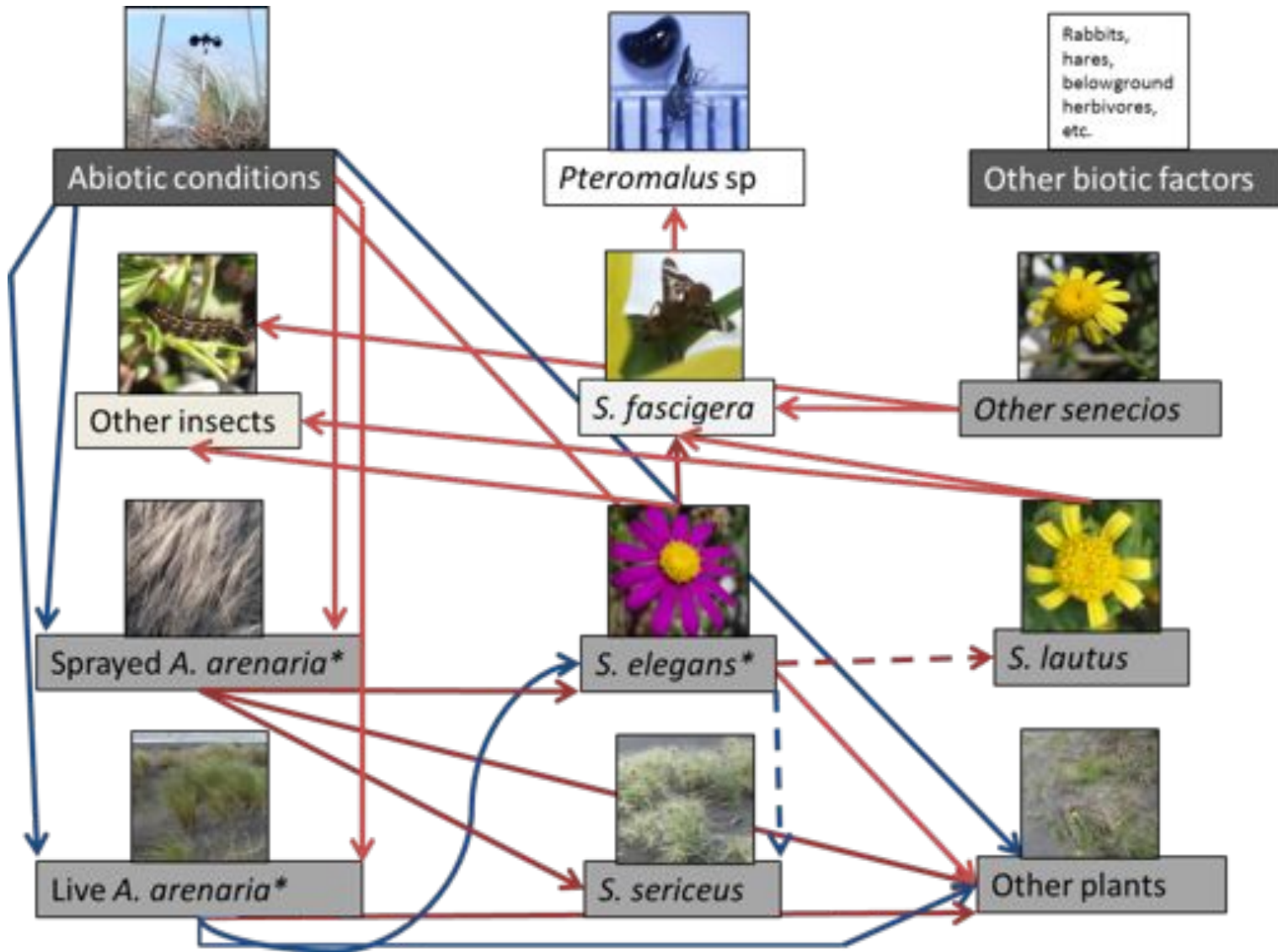
////////////////////////////////////
Parasitic wasps (*Pteromalus* sp) on *S. fascigera*

No evidence for a refuge (plant stems versus flower heads)





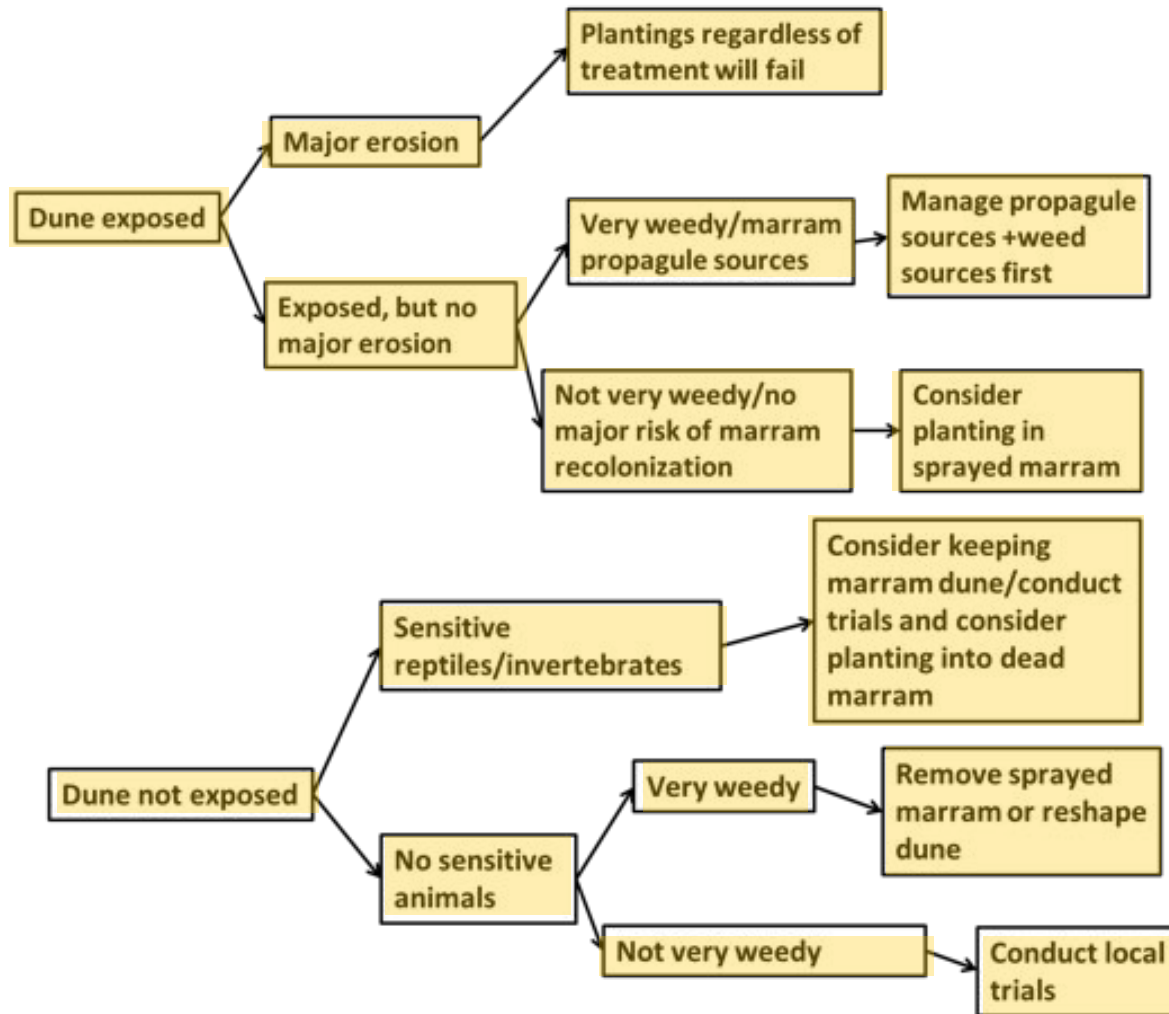
Overall discussion and conclusions





Overall discussion and conclusions

Implications for dune management:





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Thank you for your time and interest 😊



Please feel free to ask any questions!

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