

Fighting disease for human health and agricultural sustainability:

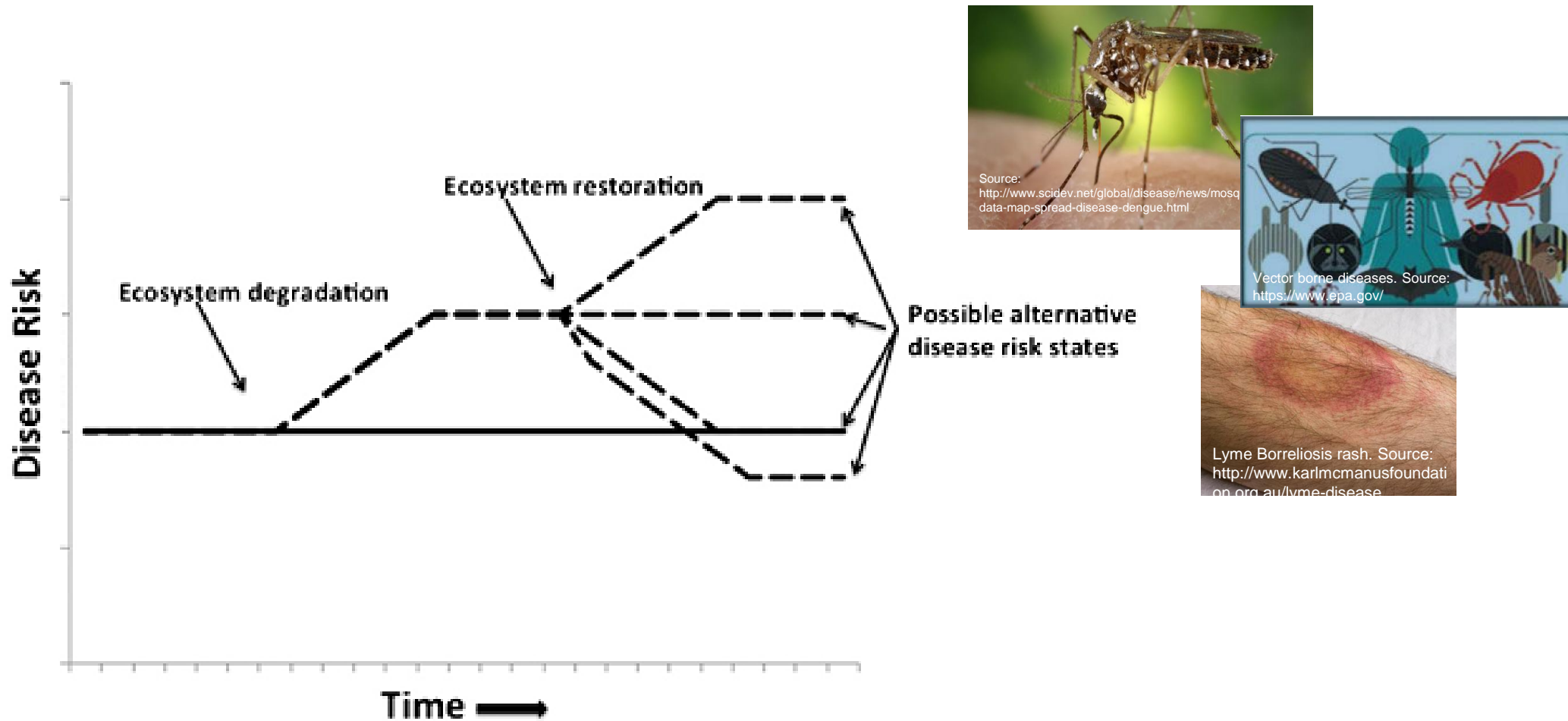
Can ecosystem restoration interventions aid disease regulation?



Charlotte Jones

- ▶ **Ecosystem health and restoration ecology:**
 - ▶ Disease regulation is an important ecosystem service
 - ▶ Degradation of ecosystems can increase disease risk to human populations
 - ▶ If that is the case, what happens when we restore them?

Restoration trajectories



Possible restoration trajectories. Source: Speldewinde, Slaney & Weinstein 2015.

► Ticks and human health:

- Arachnids, exclusively blood feeding parasites
- Life cycle – eggs, larvae, nymphs and adult stages
- Diverse in habitats, hosts and behaviours
- Vectors of a number of pathogens
- Adverse effects caused by bites and allergic reactions

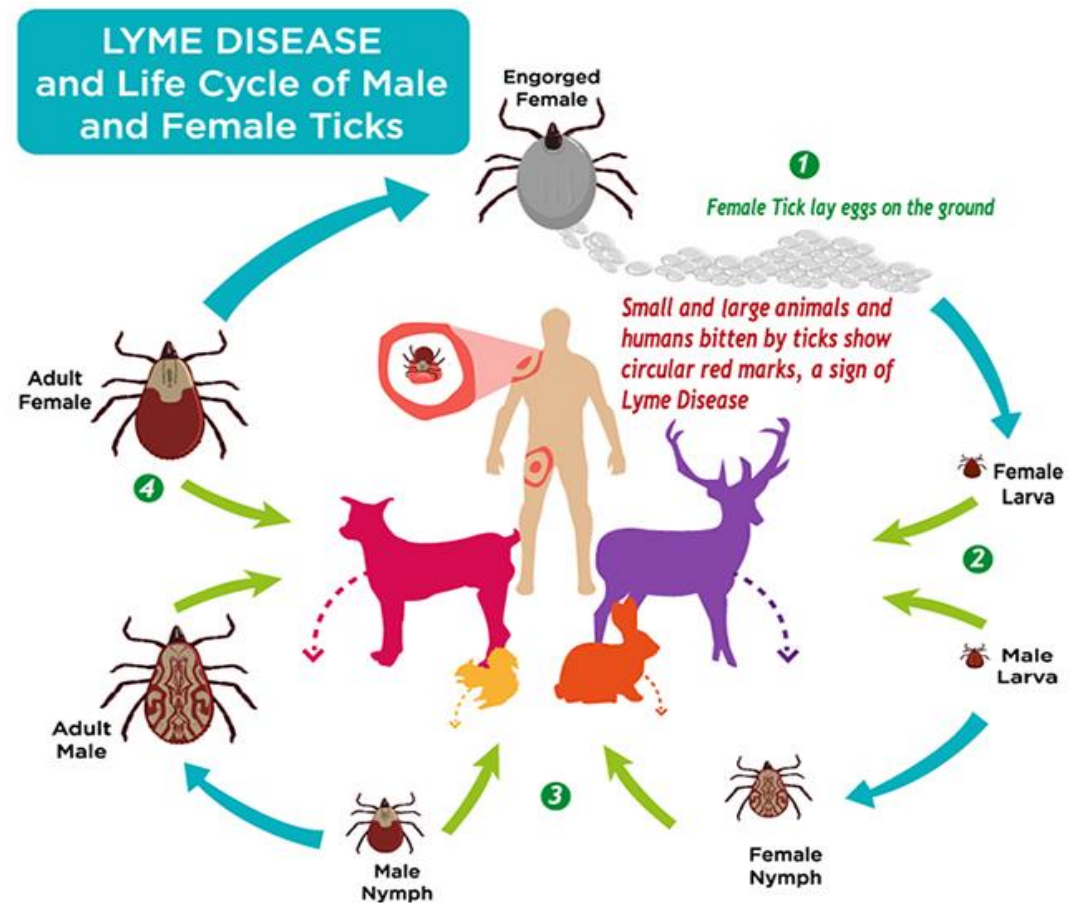


Adult ticks: genus *Amblyomma*, dorsal (left) and ventral (right) views. Source: C Jones 2016.

Background

► Ticks and human health:

► ‘Dilution effect’



Generic 3 host tick life cycle. Source: www.dreamstime.com

Background

- ▶ **Ticks and agricultural sustainability:**
 - ▶ Lost productivity in livestock
 - ▶ Cost implications of tick control
 - ▶ Ticks become resistant to chemical control (acaricides)

TICKS IN THE CATTLE INDUSTRY

In Australia, the most common tick-borne diseases are borne by Cattle-ticks of the genus:



RHIPICEPHALUS

Diseases include:
Theileriosis
Babesiosis
Anaplasmosis
Cowdriosis (Heartwater)



**INCREASED
RISK OF
MORTALITY**



**DECREASED
MEAT
PRODUCTION**



**DECREASED
MILK
PRODUCTION**



**INCREASED
RISK OF
ILLNESS**

It is estimated that 30% of cattle herds in Australia are affected by tick-borne disease, the majority of which are grazing herds in Queensland, the Northern Territory and Western Australia.

Research objectives and hypotheses

► Objectives

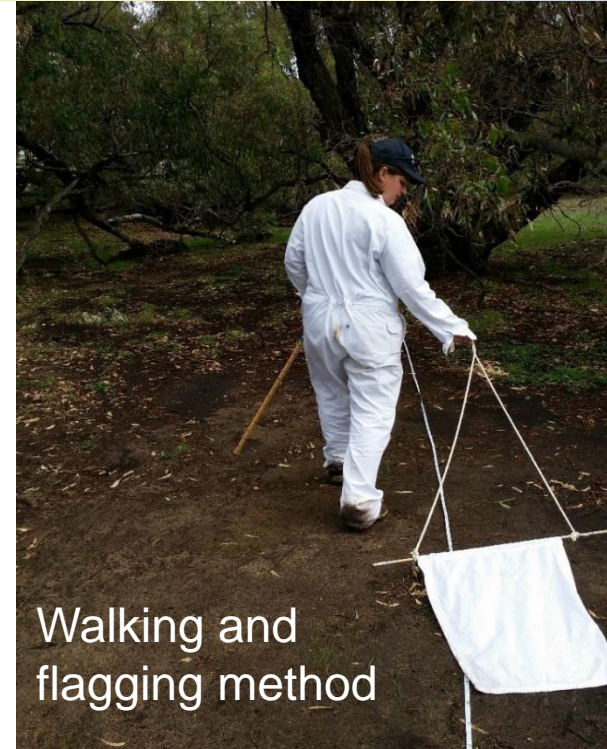
- Determine tick abundance and diversity at restored and non-restored sites of different condition levels
- Explore determinants of tick presence vs absence

► Hypotheses

- H_0 : no difference in tick abundance or diversity between restored and non-restored sites.
- Well vegetated areas with vertebrates present expected to have ticks present. Expected most ticks in degraded vegetated areas.

Methodology

- ▶ **Sampled at six sites in April-May 2016**
- ▶ **Tick collection:** walking and flagging methods.
- ▶ **Explanatory variables:**
 - ▶ Ecosystem structure (vegetation, vertebrates)
 - ▶ Ecosystem condition
 - ▶ Climate (temperature, pressure, humidity, wind conditions)



Scats and tracks



Vegetation structure

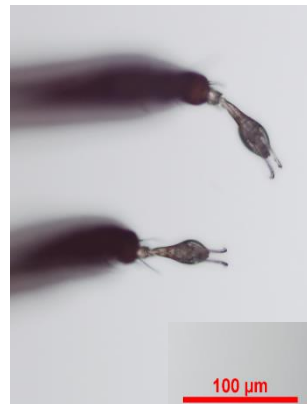
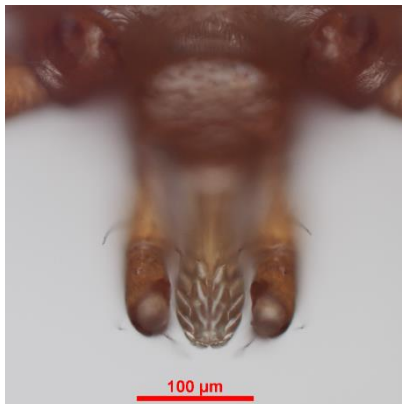
Methodology

Brave volunteers!



Methodology

- ▶ **Tick identification:** to the genus level using 60x and 100x magnification microscopes.
- ▶ **Data analysis:** Logistic regression models looking at tick presence or absence.



Adult ticks: genus *Ambylomma*, mouthparts (left), pulvilli (centre), anus and genital aperture (right).

Findings

- ▶ Ticks were present at 25.37% (n=17) of the 67 transects.
- ▶ 480 tick specimens collected, range 1-287 per transect.
- ▶ More ticks collected on clothing than flag.
- ▶ Three morphotypes found.
- ▶ Almost all (98.54%, n=273) were of the same morphotype.



Larval ticks: genus *Amblyomma*, dorsal (left) and ventral (right) views. Source: C Jones 2016.

Findings

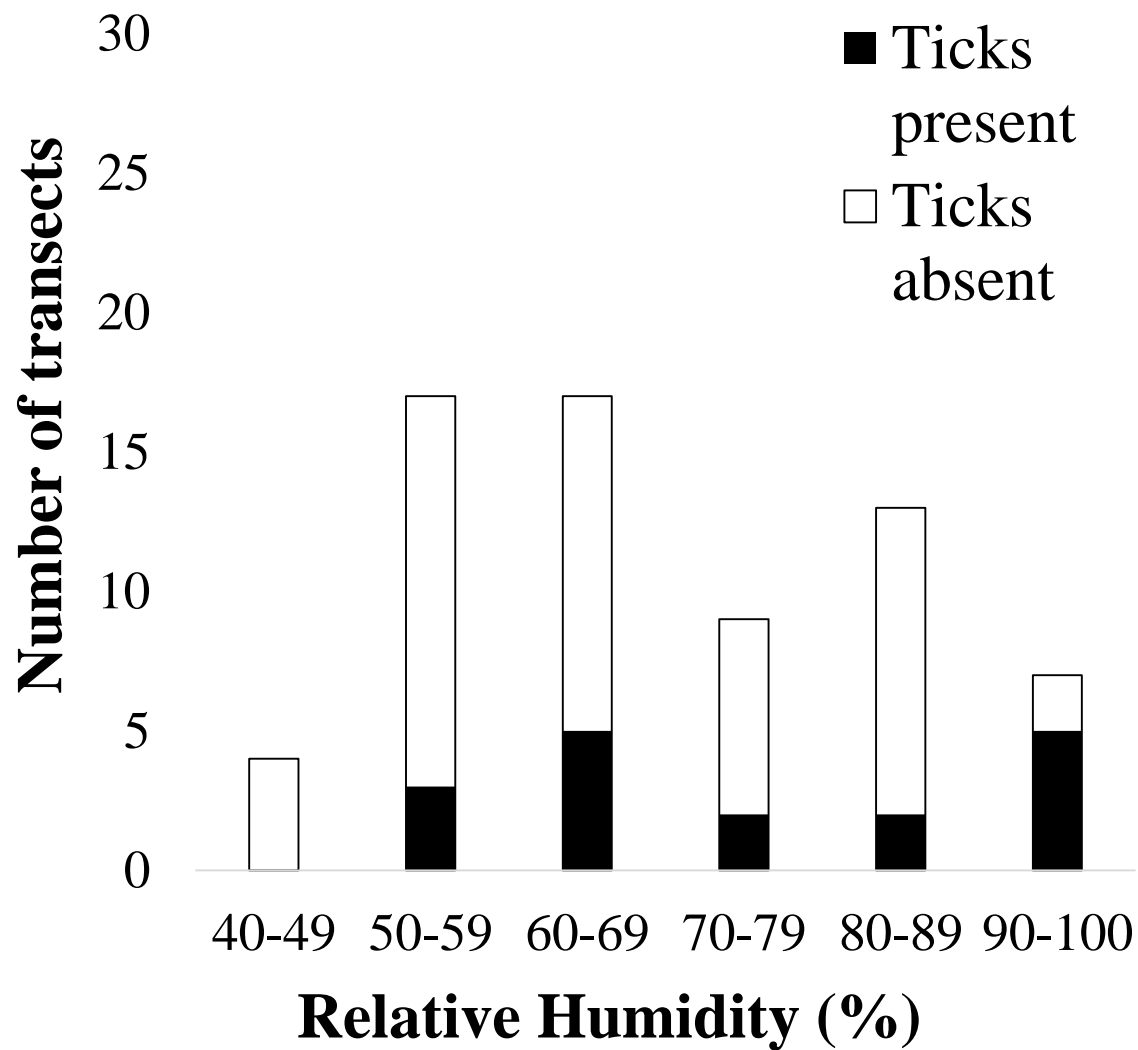
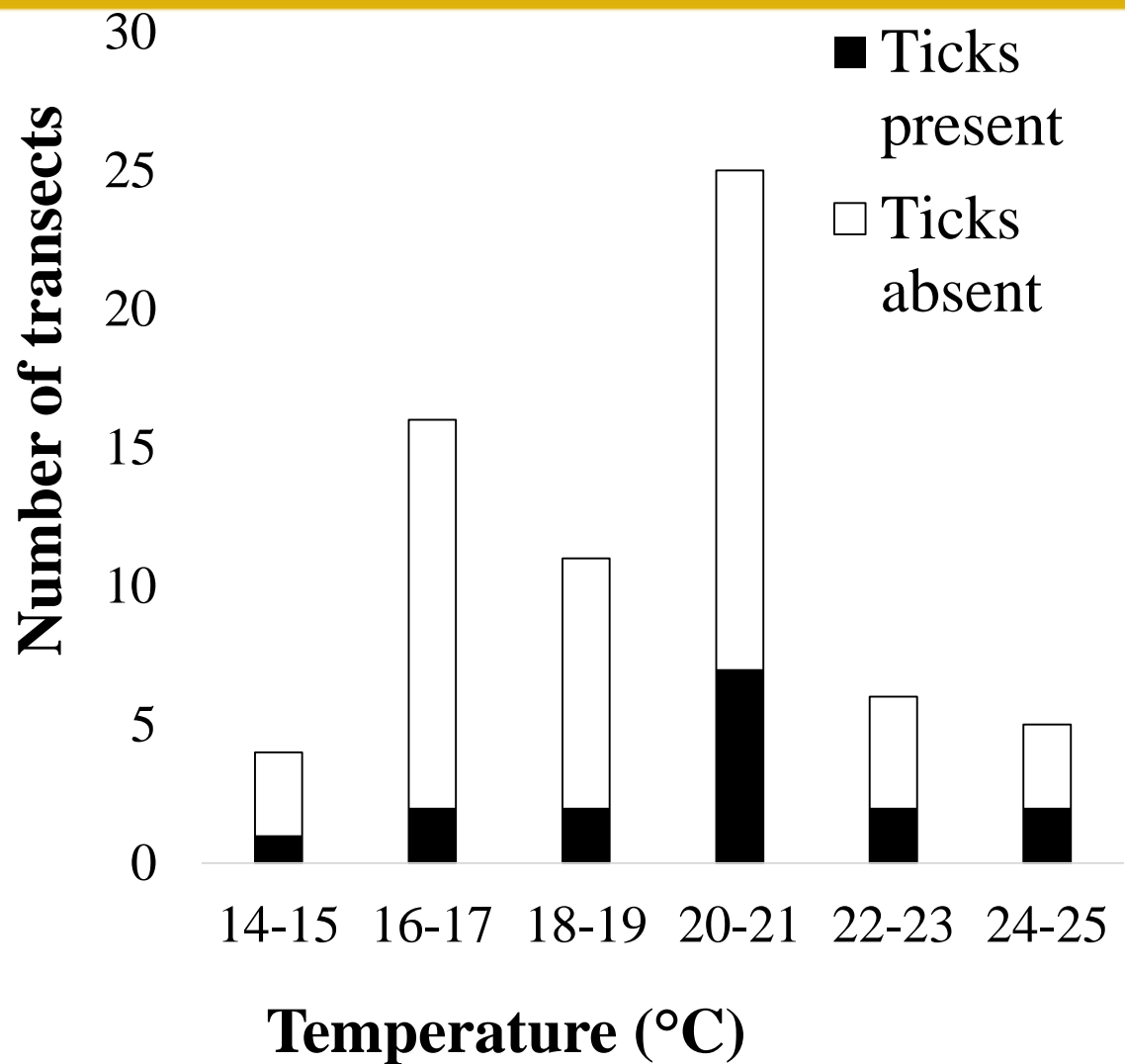
- ▶ Temperature, humidity and vegetation diversity drivers of tick presence
- ▶ Ticks present in both degraded and pristine condition, but not highly degraded
- ▶ No difference found between restored vs. non-restored
- ▶ Significant difference found between sites

Findings

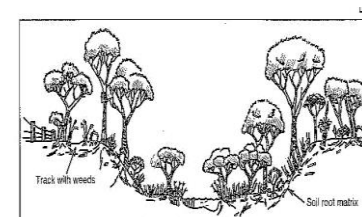
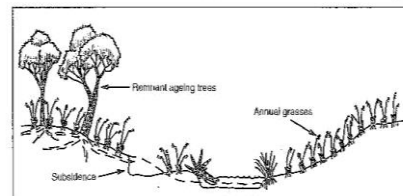
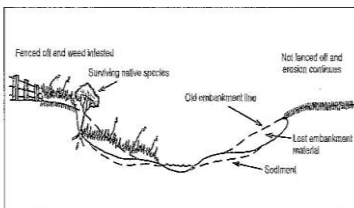
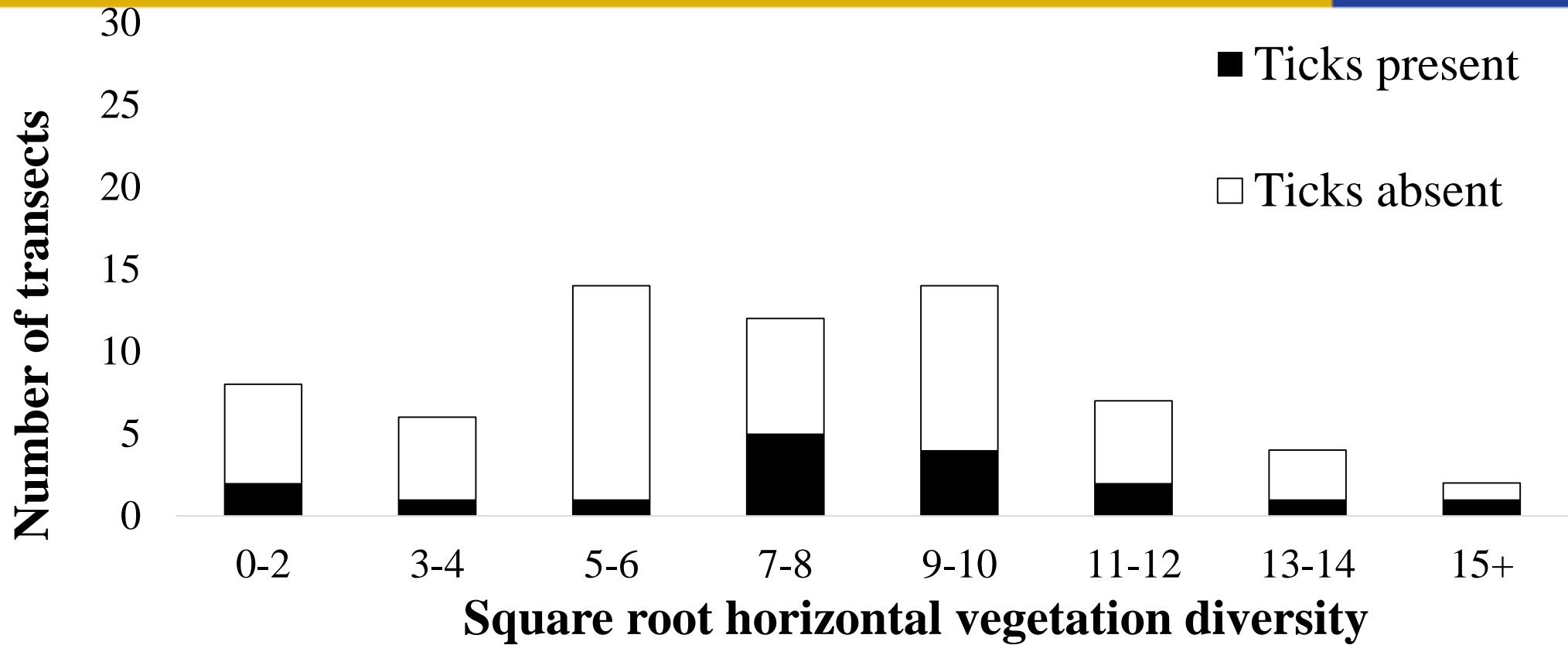
► Regression results:

Variables significant at $\alpha=0.05$	Standard Estimate	p value	AIC	Measure of model fit
Intercept	13.42	0.0017	72.32	70.23
Humidity	0.0553	0.0119		
Horizontal vegetation diversity	0.0105	0.0353		
Temperature	0.3306	0.0313		

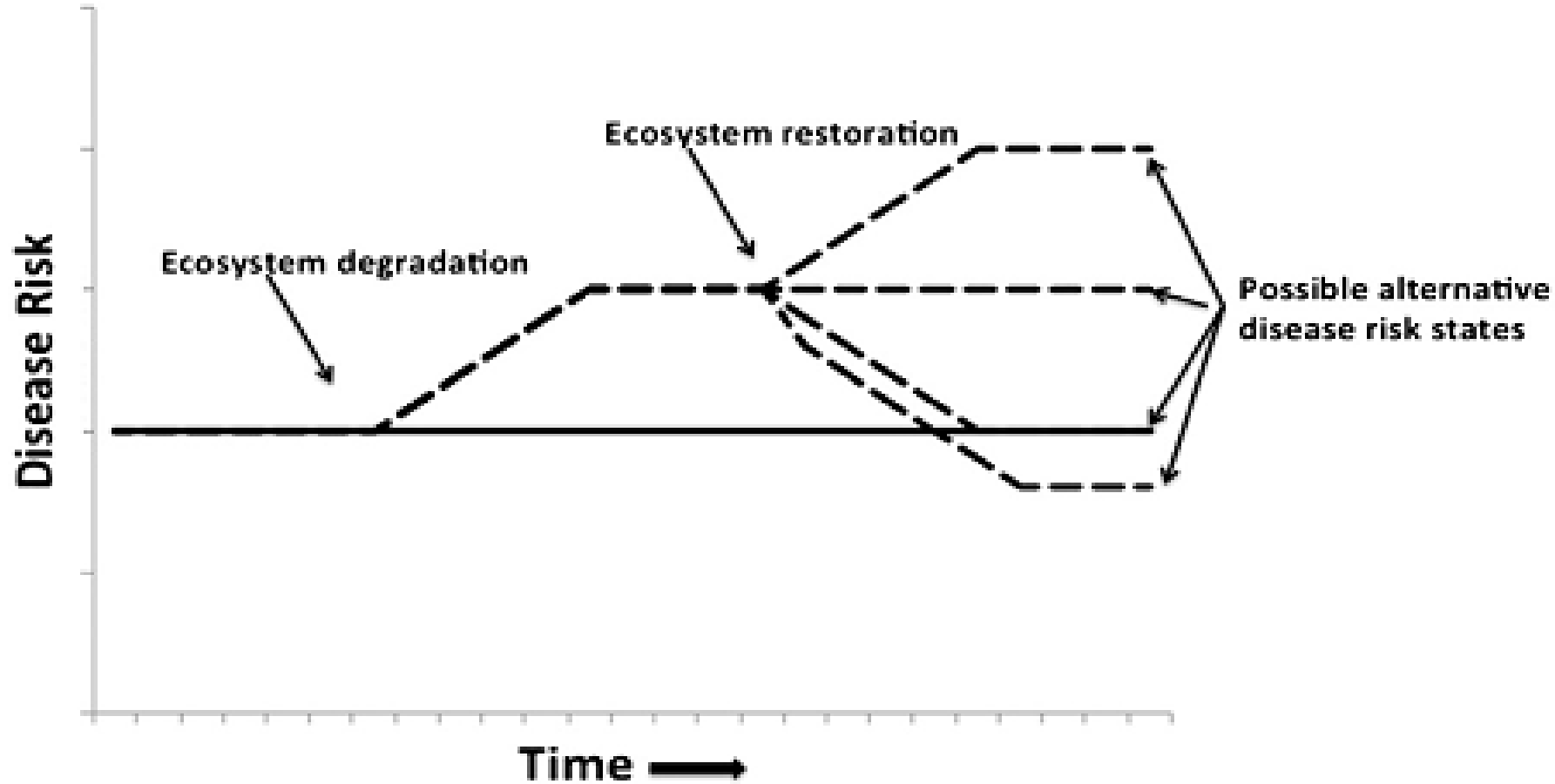
Findings



Findings



Restoration trajectories – where are we?



Possible restoration trajectories. Source: Speldewinde, Slaney & Weinstein 2015.

Conclusions and recommendations

▶ Key findings:

- ▶ Tick presence linked to humidity, temperature, vegetation diversity.
- ▶ Current condition/structure more important than restored or not.

▶ Management recommendations

- ▶ Greater consideration of ecology in tick borne disease management, both for human health and agriculture

▶ Future work

- ▶ Disease prevalence of tick specimens
- ▶ Replication to other study sites and across seasons/years

Questions?



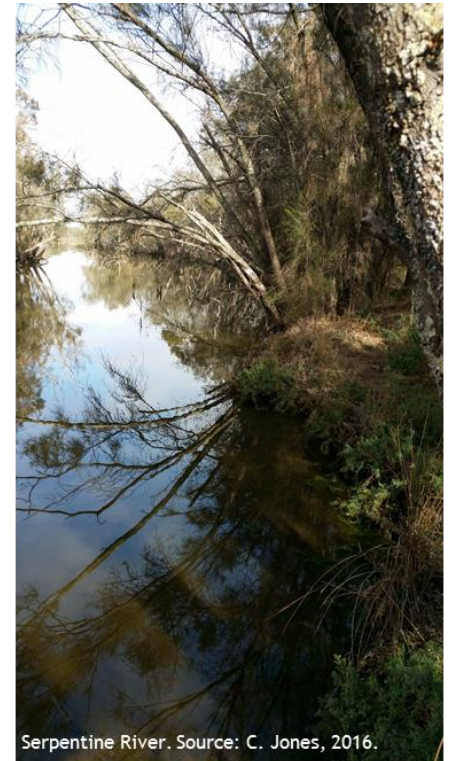
Ixodes tick. Source: <http://www.shutterstock.com>



Feeding *Ixodes* tick. Source: <http://www.shutterstock.com>



Restoration at Len Howard Reserve. Source: C. Jones, 2016.



Serpentine River. Source: C. Jones, 2016.