



Pest hazard and impact

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Overview

- Key pest species
- Impacts of damage
- How key pests are affected by climate
- Current distribution and how this might change
- Adaptation strategies

Key pest species: 77% are defoliators

Pest species	Susceptible stage	Season of damage	Affected organs	Foliage targeted	Defoliation pattern
Anoplognathus sp	All	SPR, SU, AUT	Leaves, shoots	Juvenile, adult	**Entire crown**
Gonipterus spp	All	SPR, SU	Leaves, shoots	Juvenile, adult	Top-down
Heteronyx spp	All	SPR, SU, AUT*	Leaves, shoots	Juvenile, adult	Top-down
Liparetrus spp	Seedlings and trees <2 yo	SPR, SU, AUT	Leaves, buds, shoots	**Juvenile**	Entire crown
Mnesampela privata	Seedlings and young trees	SU, AUT	Leaves	Juvenile	Bottom up
Paropsis, Paropsisterna, Chrysomelid spp	All	SPR, SU, AUT	Leaves, buds	Juvenile, adult	**Top down**
Uraba lugens	**All**	SPR, SU, AUT, WIN	Leaves	**Juvenile, adult**	Bottom up
Creiis lituratus	All	SPR, SU, AUT	Leaves	Juvenile	Top-down
Essigella californica#	**Post-canopy closure**	AUT, WIN, SPR	Needles	1 YO needles	Bottom-up
Cyclaneusma minus	Post-canopy closure	SPR, AUT	Needles	1 YO needles; not current needles	Entire crown
Dothistroma septosporum	All	SPR, SU	Needles	**Any age**	**Bottom-up**
Kirramyces eucalypti	All	SPR, SU, AUT	Leaves	Juvenile	Top-down
Teratosphaeria spp	Before phase change	SPR, SU, AUT	Leaves	Juvenile	Top-down
*Puccinia psidii^*	Young	SPR, SU, AUT	Leaves, tips	Juvenile	Top-down
Quambalaria spp	**Pre-canopy closure**	SPR, SU	Leaves, tips	Juvenile	Top-down

The others…

Pest	Regions	Host species	Significance
Stem pests			
Giant wood moth	NSW, Qld	Eucalypts	H, localised
Five spined bark beetle	NSW, Qld	Pines	H, localised
Eucalypt stem borer	All states	Eucalypts	H, localised
Sirex wood wasp	NSW, Vic, Tas, SA, Qld	Pines	H
Root pests			
Phytophthora root rot	Tas, NSW, WA	Eucalypts, pines	H

Quantifying defoliation impacts

- Defoliation ‘treatments’:
  - Severity: 0, 20, 40, 60, 80% leaf/needle loss - THRESHOLDS
  - Early *vs* later-age
  - Bottom-up *vs* top-down
  - Single *vs* chronic
  - Spring *vs* autumn
- High and low productivity sites selected (8 in total)
- Low, moderate and high soil fertility applied
- Standard silviculture
- Average of 20 model runs per scenario

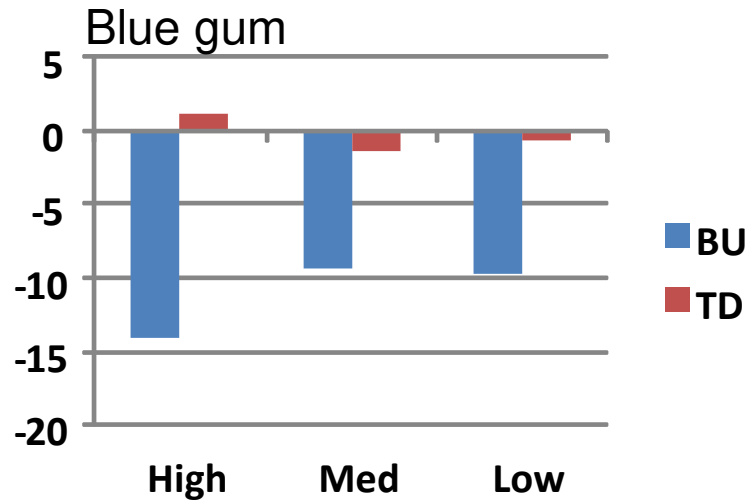
Defoliation thresholds

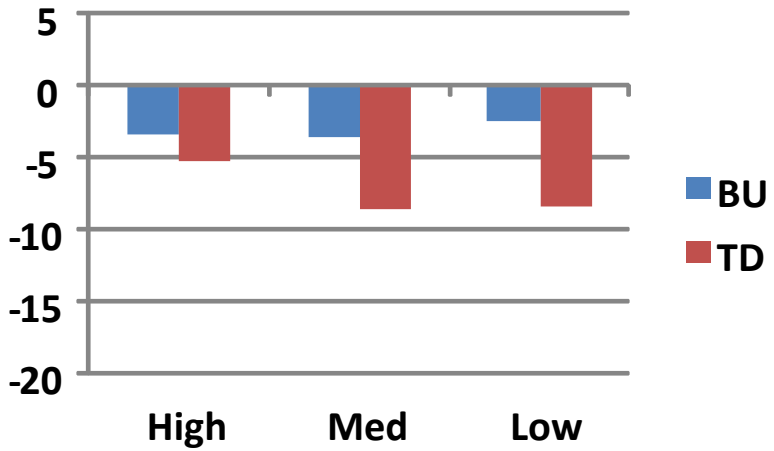
State	Productivity	Defoliation threshold*					
		Early			Later		
		High	Mod	Low	High	Mod	Low
SA-GT	lower	-	-	60%	-	60%	60%
SA-GT	higher	-	-	60%	-	60%	-
SW WA	lower	-	-	-	-	70%	70%
SW WA	higher	40%	-	-	-	70%	70%
Tas	lower	60%	40%	40%	70%	70%	-
Tas	higher	60%	60%	60%	60%	60%	60%
Vic-NSW	lower	50%	60%	60%	70%	70%	70%
Vic-NSW	higher	50%	60%	60%	60%	60%	60%

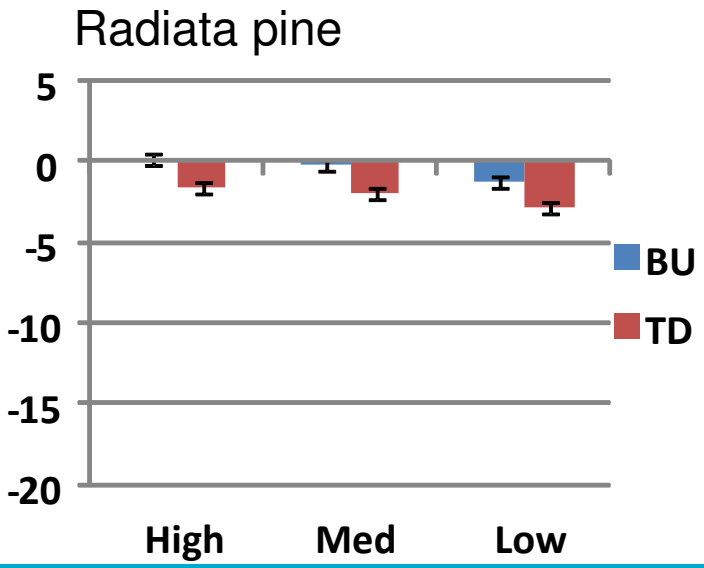
*level of defoliation that results in 5% reduction in harvest volume

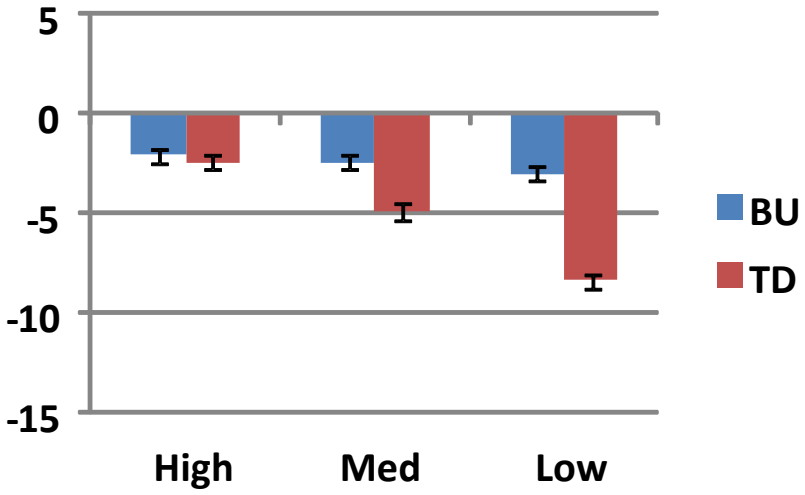
State	Productivity	Defoliation threshold					
		Early			Later		
		High	Mod	Low	High	Mod	Low
SA-GT	lower	-	-	60%	70%	60%	60%
SA-GT	higher	-	-	60%	80%	75%	65%
SW WA	lower	-	-	60%	80%	75%	60%
SW WA	higher	-	-	60%	-	75%	65%
Tas	lower	-	-	60%	-	-	60%
Tas	higher	-	-	70%	-	70%	65%
Vic-NSW	lower	-	-	70%	80%	65%	60%
Vic-NSW	higher	-	-	80%	80%	75%	65%

Defoliation pattern







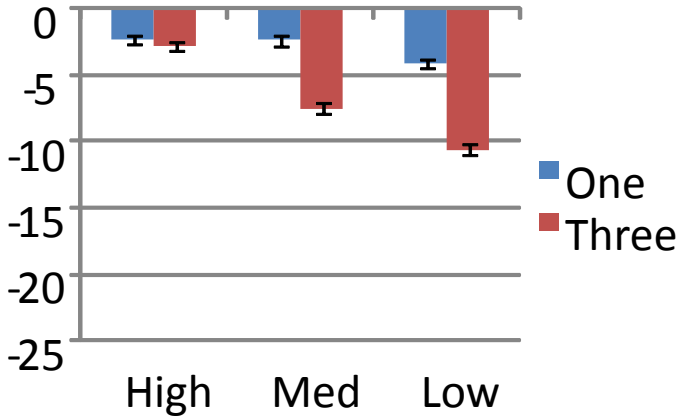


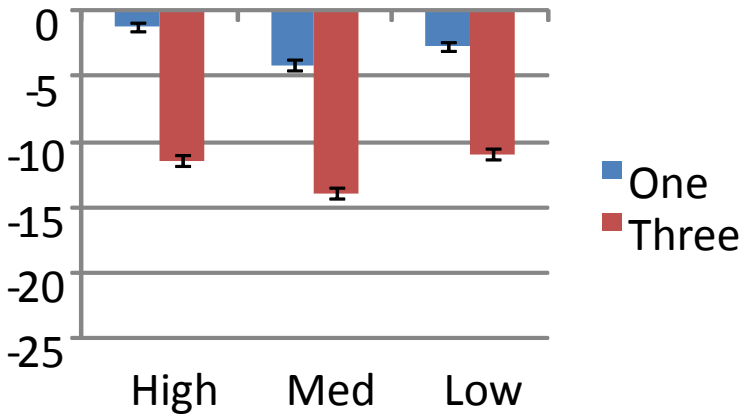
Early age

Later age

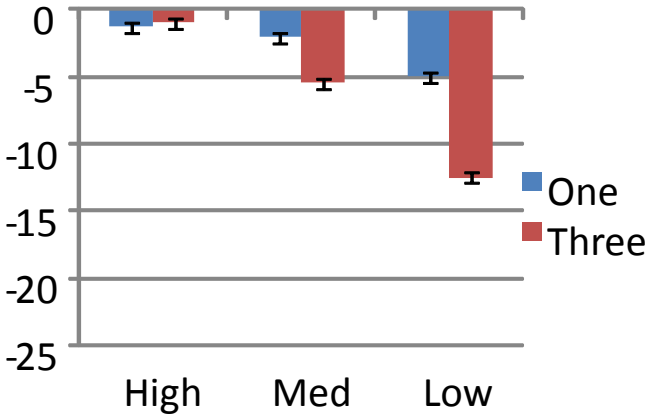
Defoliation frequency

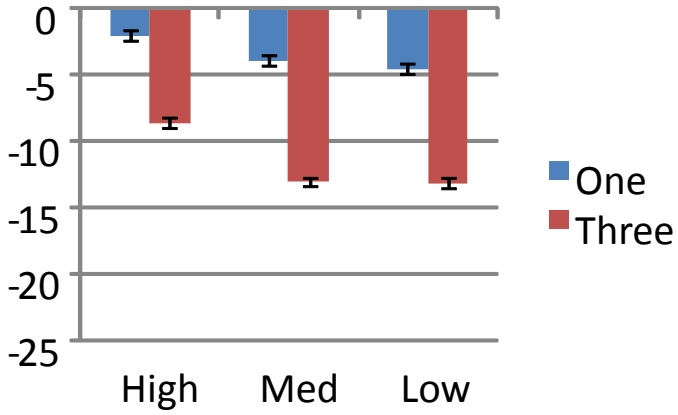
Blue gum





Radiata pine





Early age

Later age

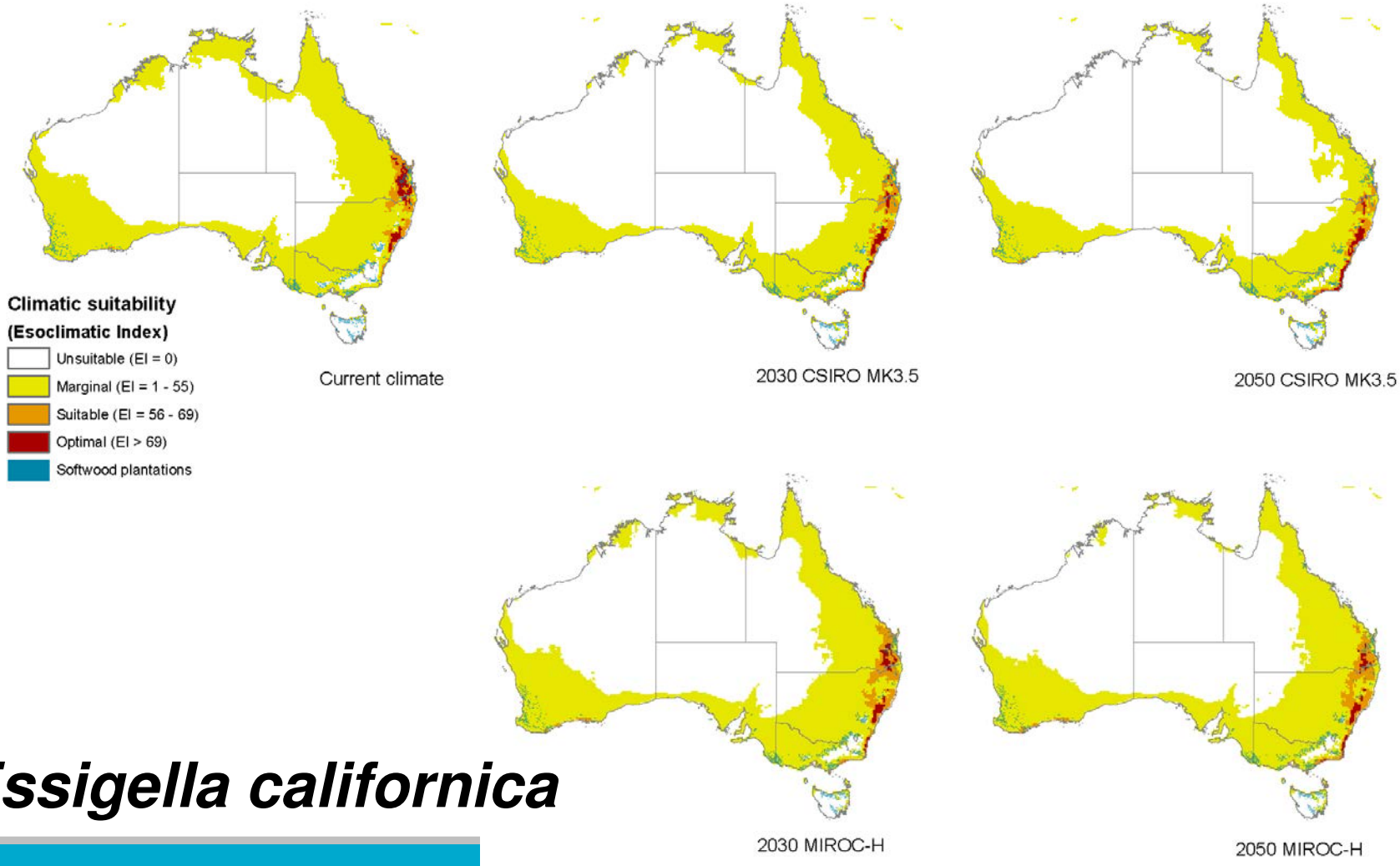
Summary

- Later age of more concern than early age
- Top-down generally of more concern – although bottom up for young *E. globulus*
- Single defoliation events generally of less concern than multiple events
- Defoliation thresholds:
  - Between 40 – 80% defoliation reduces stand volume by >5%
  - What is the economic threshold?

Implications of climate change for pests: distribution, activity, damage

Impact	Potential outcome
Warmer MAT	Increased number of **insect generations** per year
	Decreased **winter mortality** resulting in more rapid population build-up
	Increased **late-season damage** resulting in potentially greater impact on growth
	Range shifts to higher latitudes and elevations
Decreased precipitation	Increased risk from pests such as **stem borers**
	Possible decreases in risk from **foliar pathogens**
More extreme precipitation events	May favour **foliar pathogens** if high relative humidity occurs
	May wash **insect**s and larvae from leaves
More variable precipitation	May favour some **root pathogens** e.g *Armillaria* spp
Elevated CO_2	Increased development and **reproductive rates** in some insect guilds
	Increased fecundity and aggressiveness in some necrotrophic and biotrophic fungi

Distribution and abundance



Essigella californica

Climatic suitability: eucalypt pests

Pest species	Climatic suitability class	Area of estate in each class (ha)	% of estate in each class				
			Current	2030		2050	
				CSIRO 3.0	Miroc-H	CSIRO 3.0	Miroc-H
Eucalypt pests							
Autumn gum moth	Unsuitable	245258	9	16	15	24	17
	Marginal	12138	5	3	2	3	4
	Suitable	101693	37	39	35	35	31
	Optimal	129976	48	40	47	38	48
Mycosphaerella leaf disease	Unsuitable	50591	19	13	11	13	11
	Marginal	125895	46	54	44	54	39
	Suitable	76103	28	26	36	27	40
	Optimal	15743	6	6	8	6	9
Eucalypt rust	Unsuitable	188510	70	70	69	70	69
	Marginal	13057	5	5	2	11	3
	Suitable	42078	15	20	20	16	20
	Optimal	24687	9	4	8	2	7
Gum laef skeletonzer	Unsuitable	184706	68	68	68	76	65
	Marginal	16963	6	15	9	10	17
	Suitable	6855	26	5	8	8	4
	Optimal	59808	22	11	15	5	14
Total eucalypt estate		268332					

Climatic suitability: pine pests

Pest species	Climatic suitability class	Area of estate in each class (ha)	% of estate in each class				
			Current	2030		2050	
				CSIRO 3.0	Miroc-H	CSIRO 3.0	Miroc-H
Eucalypt pests							
Pine pests							
D. septosporum	Unsuitable	8483	0.8	2	1.5	4	2
	Marginal	25540	3	5	3	6	3
	Suitable	398103	40	56	35	58	38
	Optimal	545963	56	37	61	31	57
E. californica	Unsuitable	288284	29	15	19	7	13
	Marginal	541592	55	70	69	89	76
	Suitable	79204	8	14	9	4	9
	Optimal	69208	7	0.07	2	0.01	0.05
S. noctilio	Unsuitable	14467	1	3	3	5	3
	Marginal	10816	1	0.02	0.02	1	0.01
	Suitable	326003	33	30	24	32	20
	Optimal	626802	64	67	73	62	77
Total pine estate		978089					

Adapting to change

Strategic	Operational
Industry-wide pest monitoring network	Use IPM to identify control measures
Develop pest distribution and damage database	Regular pest monitoring
Profile potential new pests	
Tools for assessing risk and impact and ways of building resilience	Manage hazard (eg species choice) or avoid high risk sites
	Maintain plantation resilience through management: -spacing, fertilising, species choice
	Promote recovery with spacing, fertilising, weed control
	Control pests when thresholds are exceeded
	Define operational windows for control

Summary

- Large uncertainties about how climate change will affect hosts and pests
- Site-specific assessments probably required to understand impact
- Tools for understanding changes in risk and linking to impact
- Monitoring pests and health assessment of hosts critical for understanding risk and impact of climate change

Thank you