Management of temporary aquatic habitats in an agricultural landscape

Examples from Western Victoria

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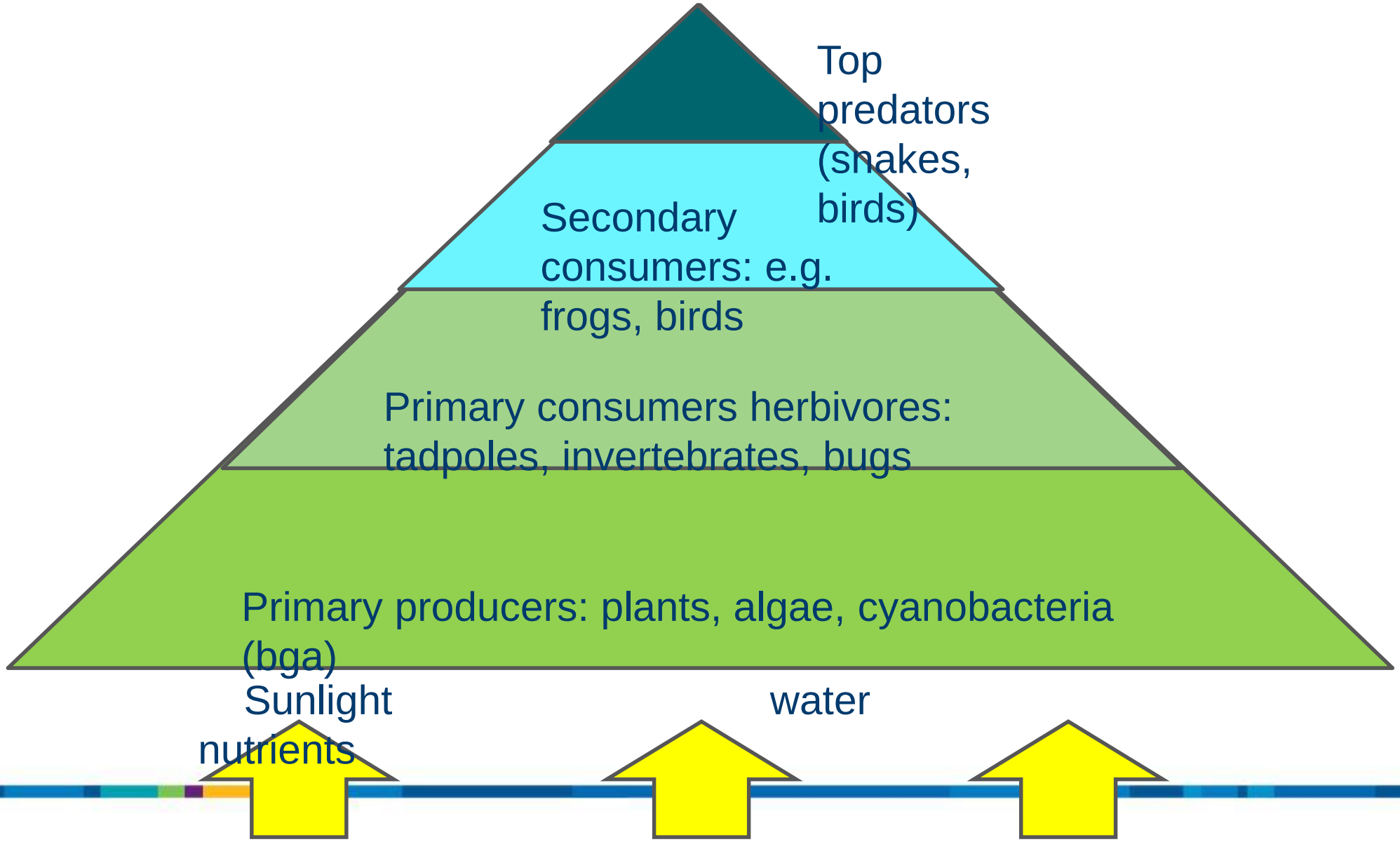
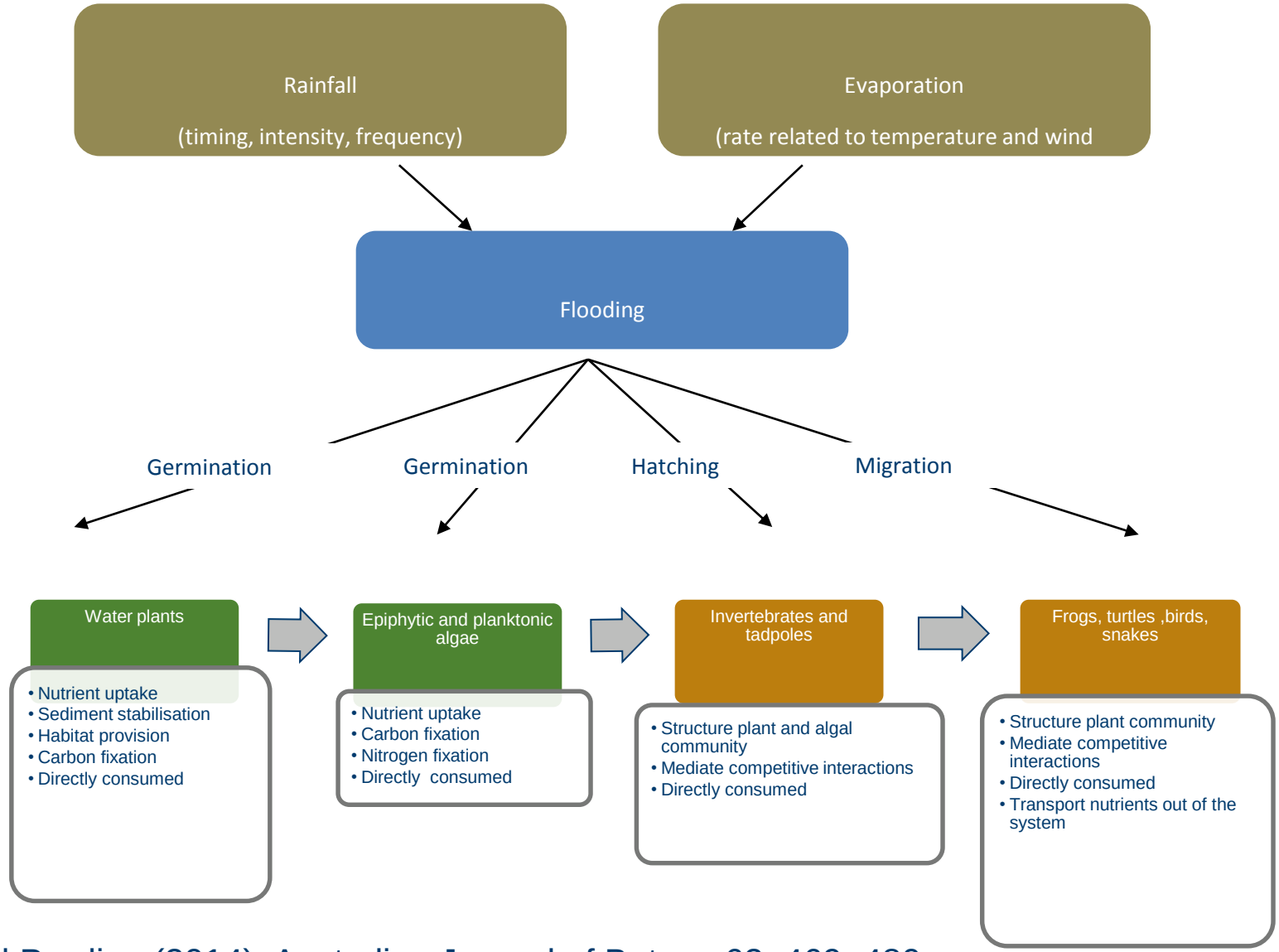
Wetland biomass, diversity





Casanova and Powling (2014), Australian Journal of Botany 62, 469–480

Biodiversity values

Wetlands

- c. 100 spp of angiosperms, ferns, mosses and charophytes
- 150 algal taxa (species, subspecies, varieties)
- 25 macroinvertebrates (Robson), 300 (Butcher)
- 15 + birds (temporary residents, nesting)
- 5 frogs (Growling grass frog = endangered)
- 2 snakes (Tiger snake, Brown snake)
- 2 marsuipials (Fat-tailed Dunnart, Eastern Grey Kangaroo)
- 1 mammal (Swamp rat)

Ecological role

HABITAT

- Endemic species of algae
- Rare species of frog
- Rare species of reptile
- Vulnerable and rare birds

PEST CONTROL (of pasture and crop invertebrates, feral mice, mosquitos)

CARBON CYCLING

FIRE RETARDANT

GROUND-WATER RECHARGE

CULTURAL VALUES (Indigenous, post-settlement)

1835 vs Now

Plant, invert, mammal diversity?

- Marsupials reduced (some extinct), mammals increased (rabbits, foxes, sheep, cattle), native plant regeneration decreased, increased exotic plants

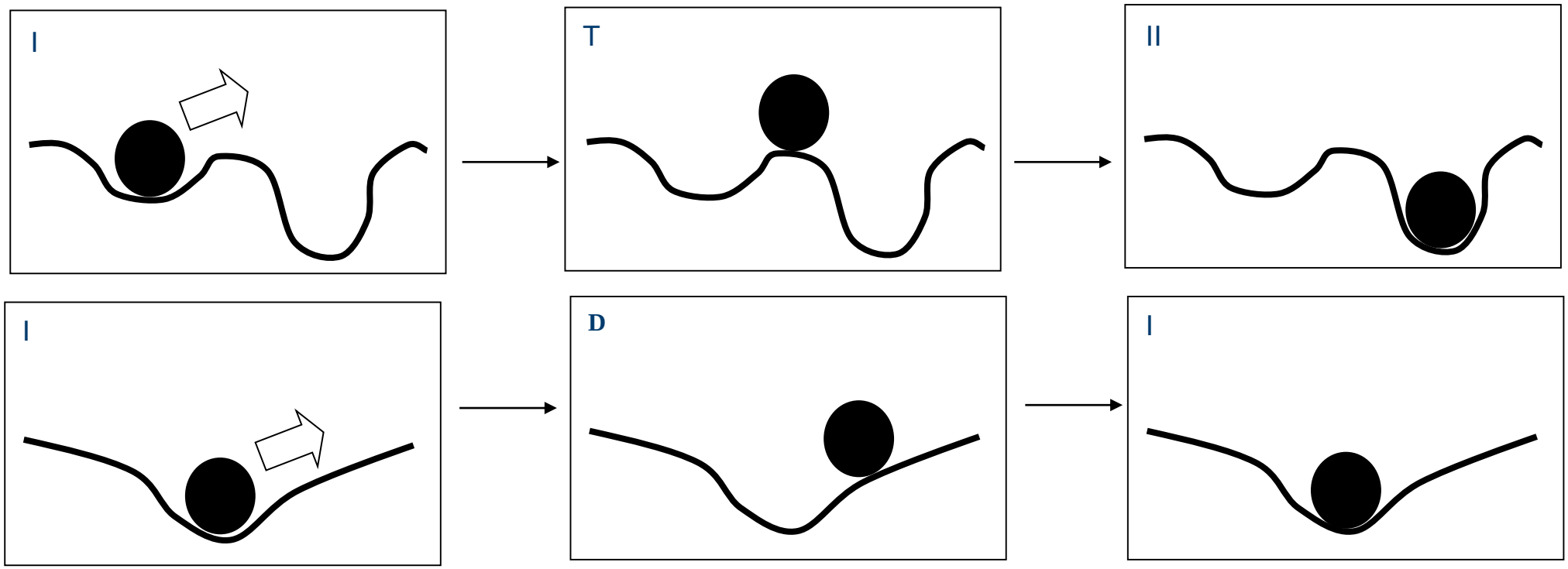
Soil conditions

- Compaction, higher nutrient levels, loss of topsoil

Salinity

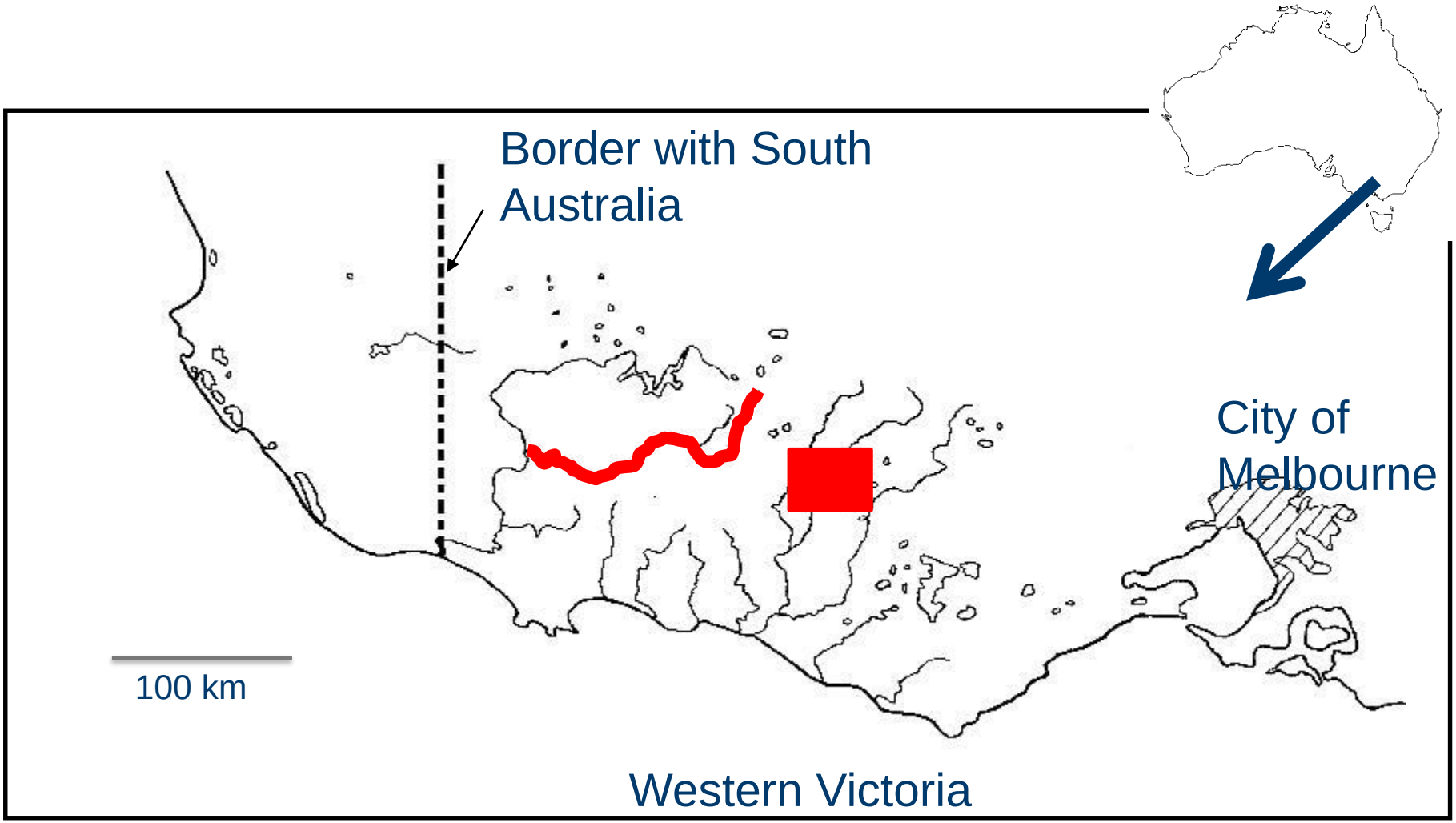
- Rising ground water (clearance of trees and perennial veg.), increased salinities

Decade	Number of times swamps have filled per decade	average duration of dry times per decade (years)	Longest dry period (years) per decade
1918-1927	4	2.25	2.5
1928-1937	9	0.875	1.5
1938-1947	6	1.33	3.5
1948-1957	7	1.35	4.5
1958-1967	5	1.3	3.5
1968-1977	8	1.0	3.5
1978-1987	9	0.7	1.5
1988-1997	7	0.67	1.5
1998-2007	4	2.2	5.5
2008-2014*	4	2.3	3.5
Average	6.3	1.27	2.8



The cup and ball analogy (after Laycock 1991 in Briske 2003). In the top row, according to state and transition models, (I) grazing (the broad arrow) moves the community (ball) over a threshold (T) to a new stable state in the range of environmental condiitons (II). The depth of the cup is related to the magnitude of disturbance required to cross a threshold. In the bottom row, according to equilibrium (successional theory), (I) grazing moves the community to a new part of the range of environmental conditions (D), when grazing is removed, the system returns to the same stable condition (climax community, I).

Wannon River


















Management options

Indigenous use, Kangaroo and Emu grazing, fire

Broad-acre, set-stock grazing by ruminants

Removal of rocks/debris/perennial spp, sown pasture

Cultivation of soil, addition of nutrients and pesticides, monoculture cropping

“Leave it alone”

Seasonal grazing by ruminants

Four investigations

- Veg survey and seed bank study of cropped and uncropped wetlands
- Veg survey and seed bank study of the Wannon River
- Grazing reduction trial at 7 sites along the Wannon, Before, After, Control, Impact
- Incidence and extent of cropping dry swamps

1. Effects of cropping

The plant communities establishing in cropped and un-cropped swamps were different

Cropping also affects quality of the seed bank of these wetlands

Cropping results in a reduced diversity and density of plants, although swamp plant communities retain some resilience

Casanova 2012. *Aquatic Botany* 103:54-59

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2. Effects of land use on the Wannon wetlands

- The plant community (cover of native species, number and cover of non-native species, number and cover of salinity-tolerant species, cover of structural species) were related to the run of the river.
- Other characteristics of the plant community composition varied in relation to channel characteristics and land use.
- Sites that were continuously grazed formed a discrete group independent of location along the river.
- Sites that were ungrazed also formed a discrete group independent of location along the river.
- Sites that were grazed in the dry-season fell into two groups in relation to grazing intensity.

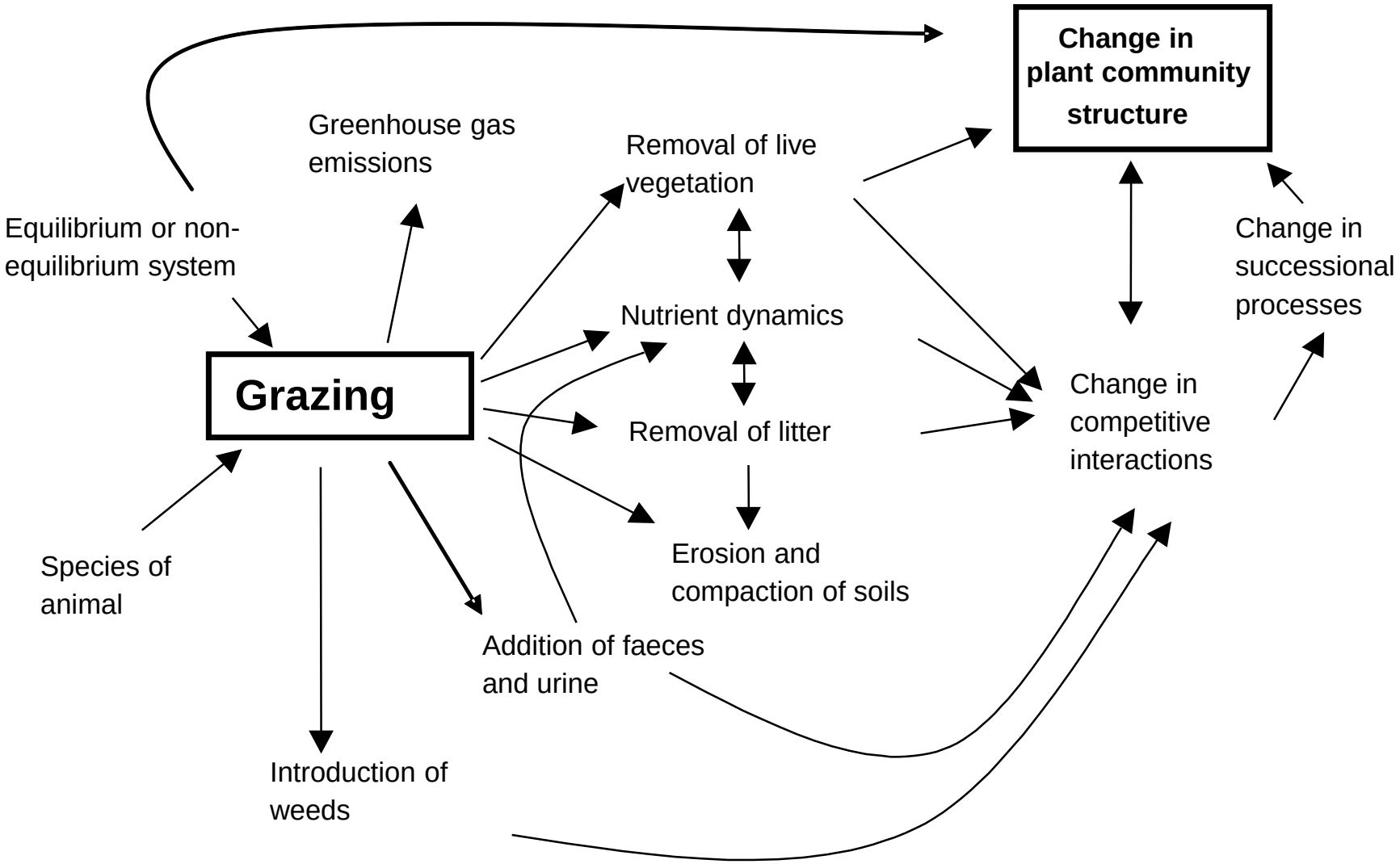
3. Dry-season grazing

Sites that had been grazed since the 1830s had a functional and diverse wetland plant seed bank.

A reduction in grazing pressure produced significant changes to the vegetation, interpreted as improvement in habitat values, on the ‘Floodplain’ and ‘Top of Bank’ hydrogeomorphic areas in relation to weediness, naturalness, faecal matter contamination and abundance of structural vegetation when compared to both the control sites.

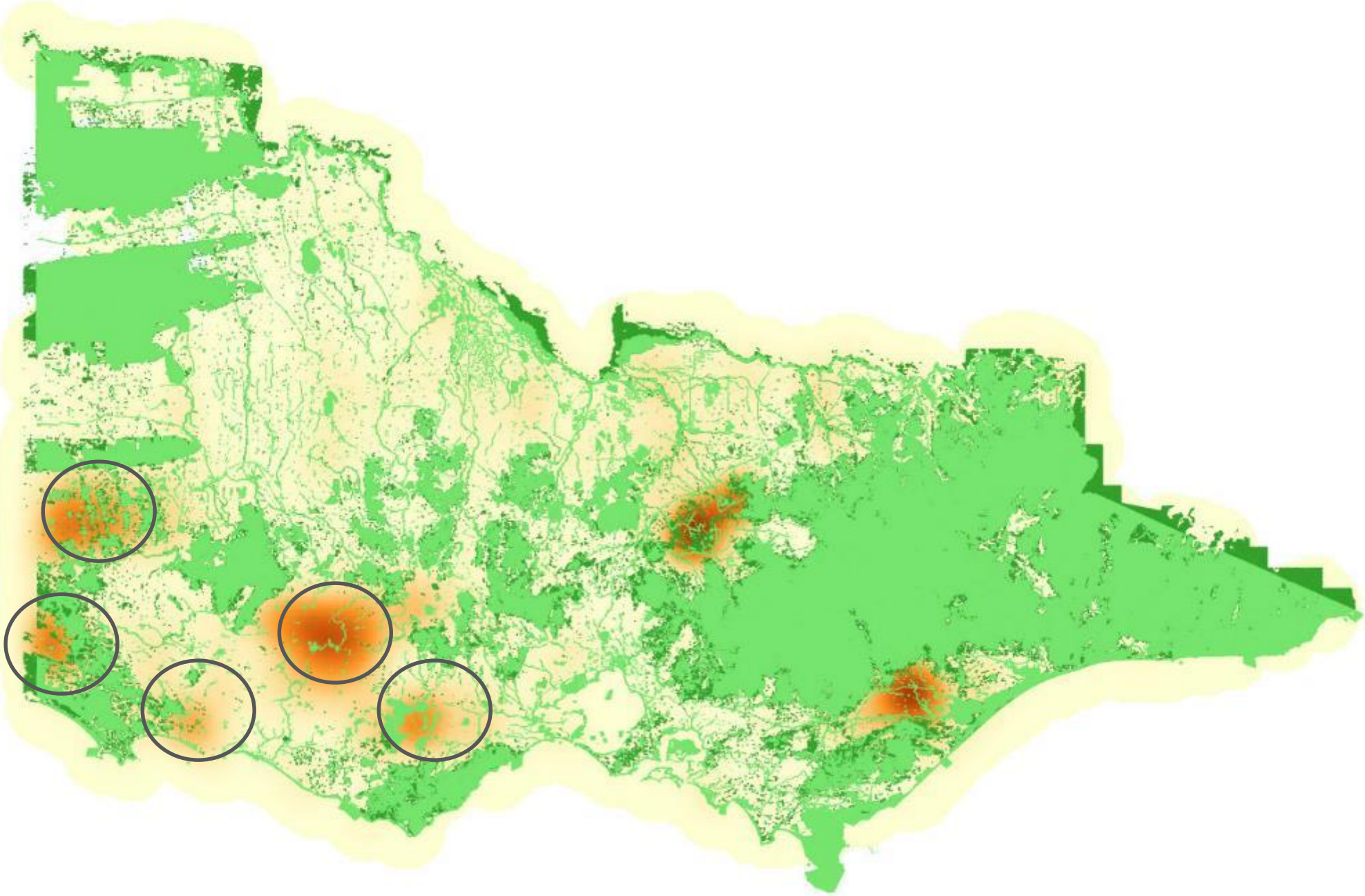
The ‘In-channel’ hydrogeomorphic area did not respond to grazing reduction.

Consequences of grazing

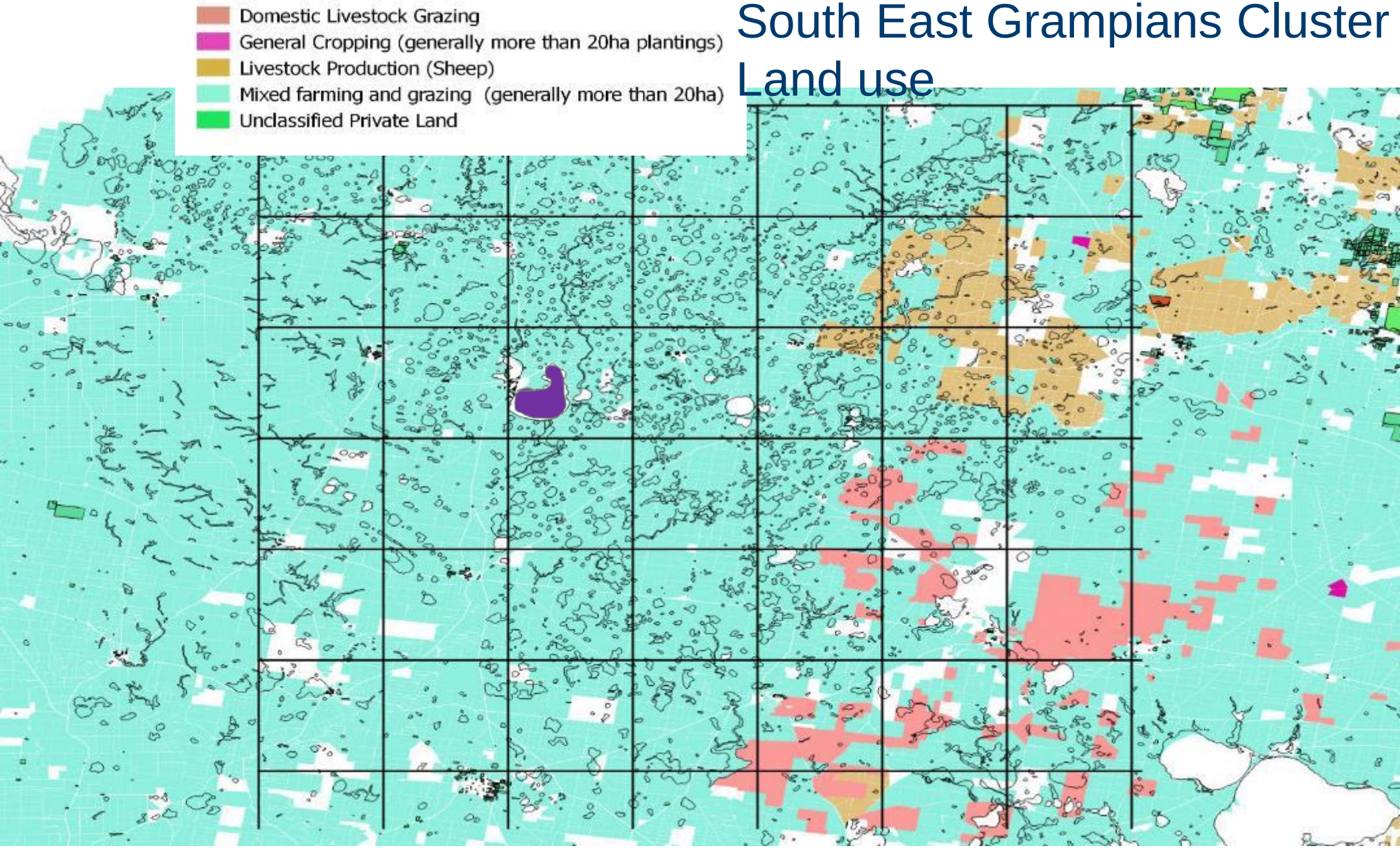


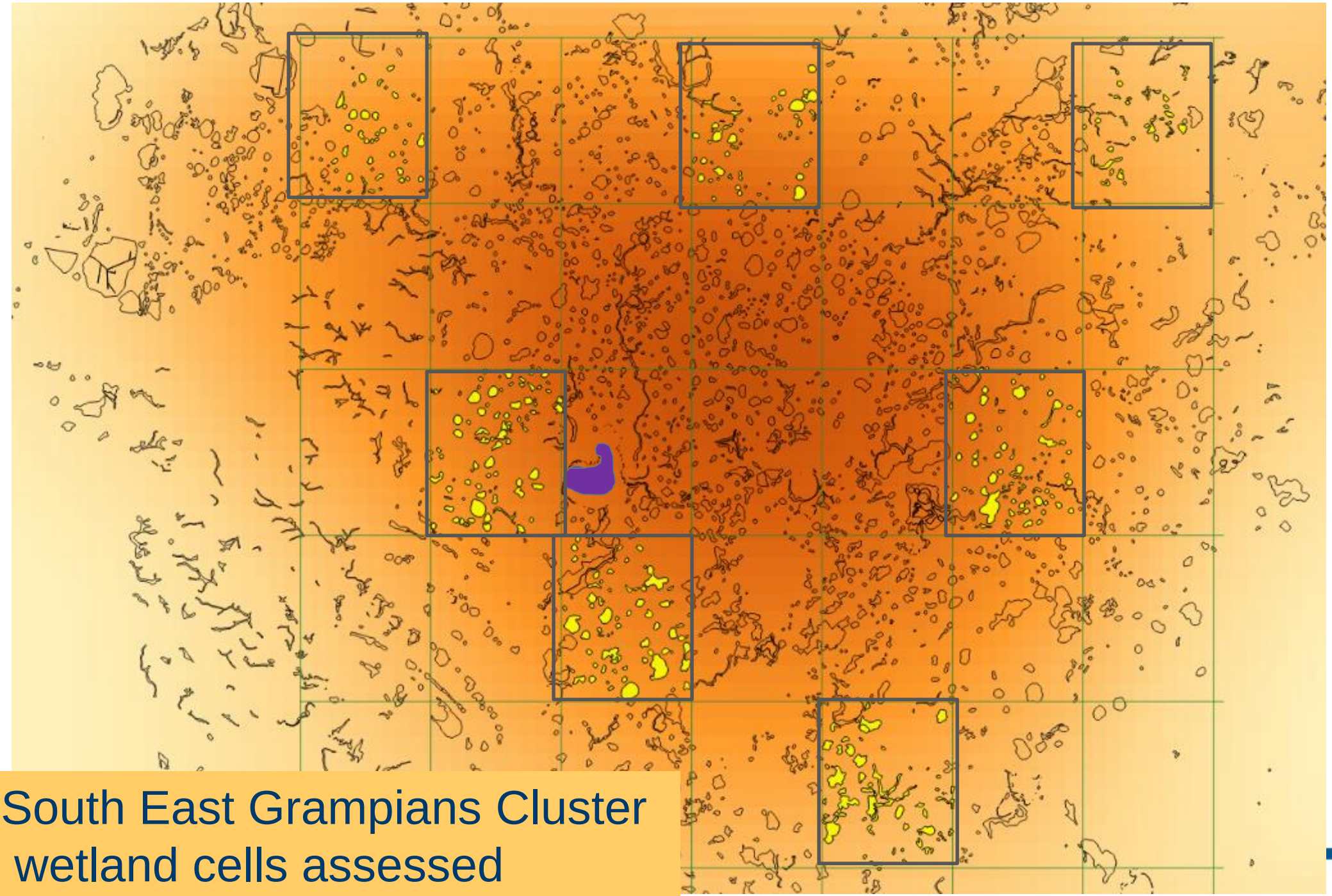
4. Incidence and extent of cropping

- What is the current incidence of cropping in swamps?
- What are the consequences of cropping in swamps?
- What are the future risks?

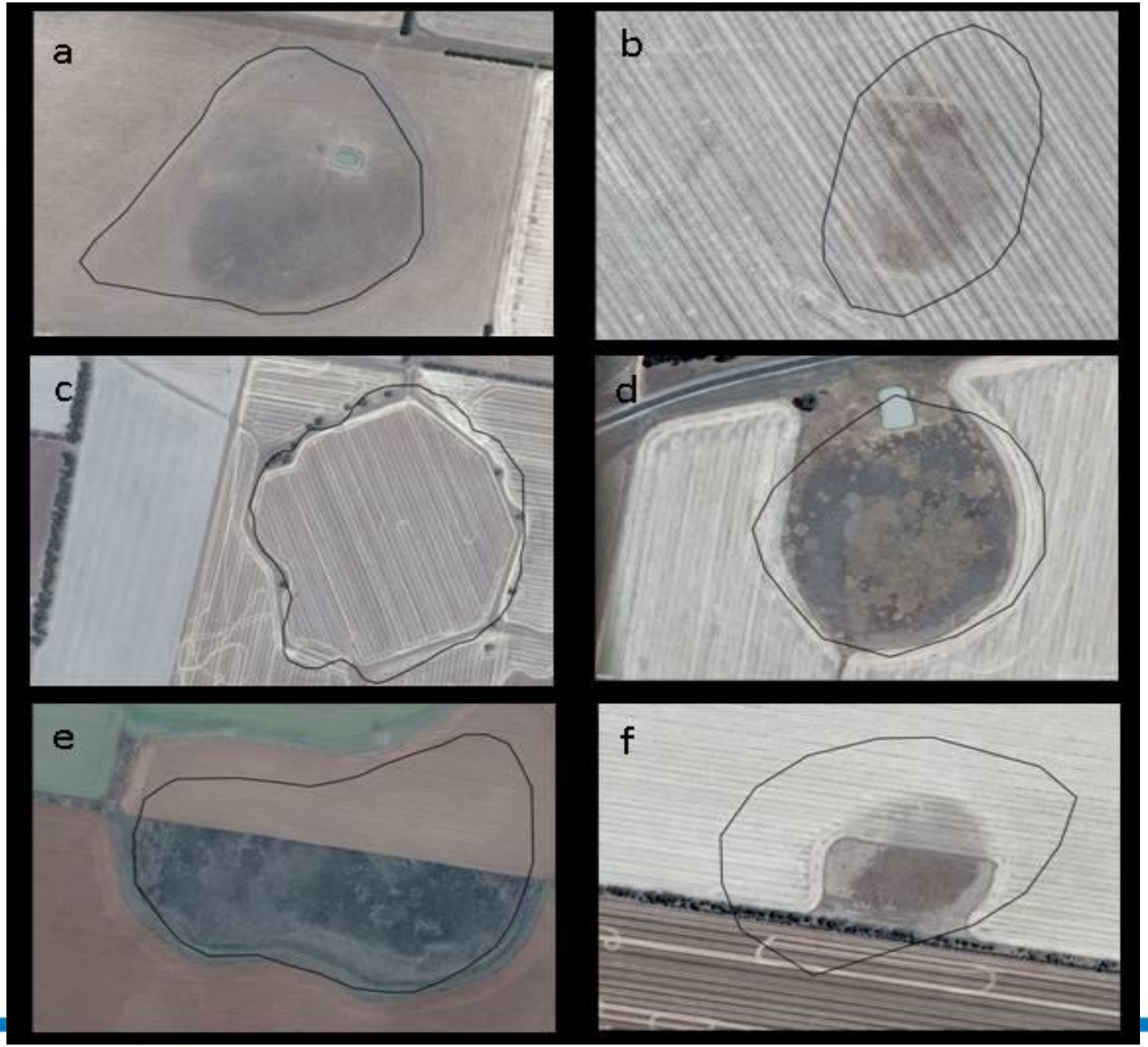


South East Grampians Cluster
Land use



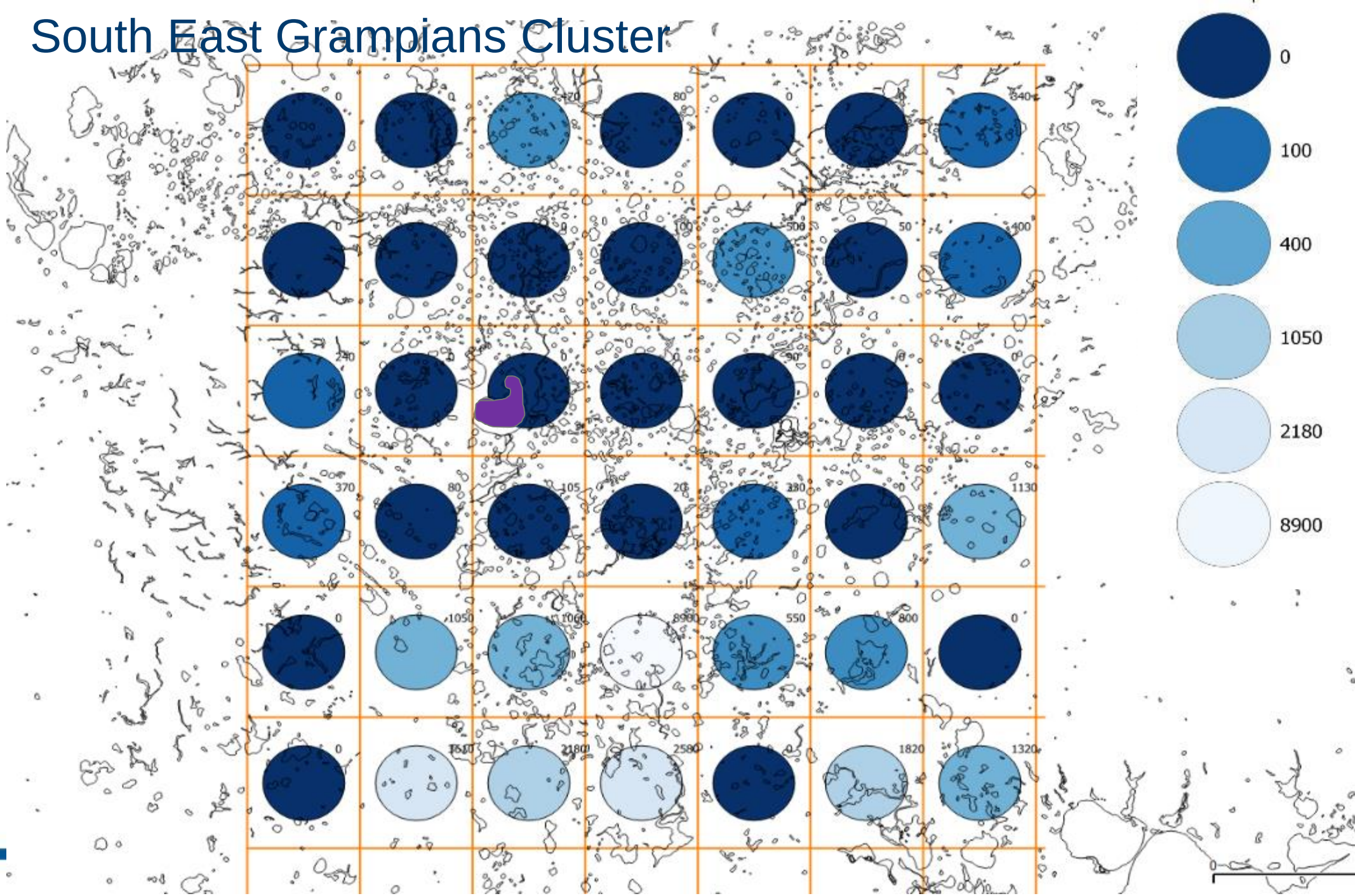


South East Grampians Cluster
wetland cells assessed



- Removal
- Reduction in size

South East Grampians Cluster



South East Grampians Cluster

Land use within the wetland	Number of wetlands	Proportion (%)	
Not cropped	251	55	
Cropped at the edges (part)	66	14	**45 % of all wetlands had some cropping**
Cropped at the edges and on the bed (part)	65	15	
Completely cropped	71	16	
Total number of wetlands assessed	453	100	

c.f. an estimate of 1/157 wetlands from data (collected 2011)


2/1/2012
2 Jan. 2012
Image © 2016 DigitalGlobe
Google
Visite guidée
Date des images satellite : 2/1/2012 37°31'35.80"S 142°57'33.33"E élév. 283 m


26 Jan. 2014
Image © 2016 CNES / Astrium
Google
Date des images satellite : 26/1/2014


12/5/2016
15 Nov. 2015
Image © 2016 CNES / Astrium
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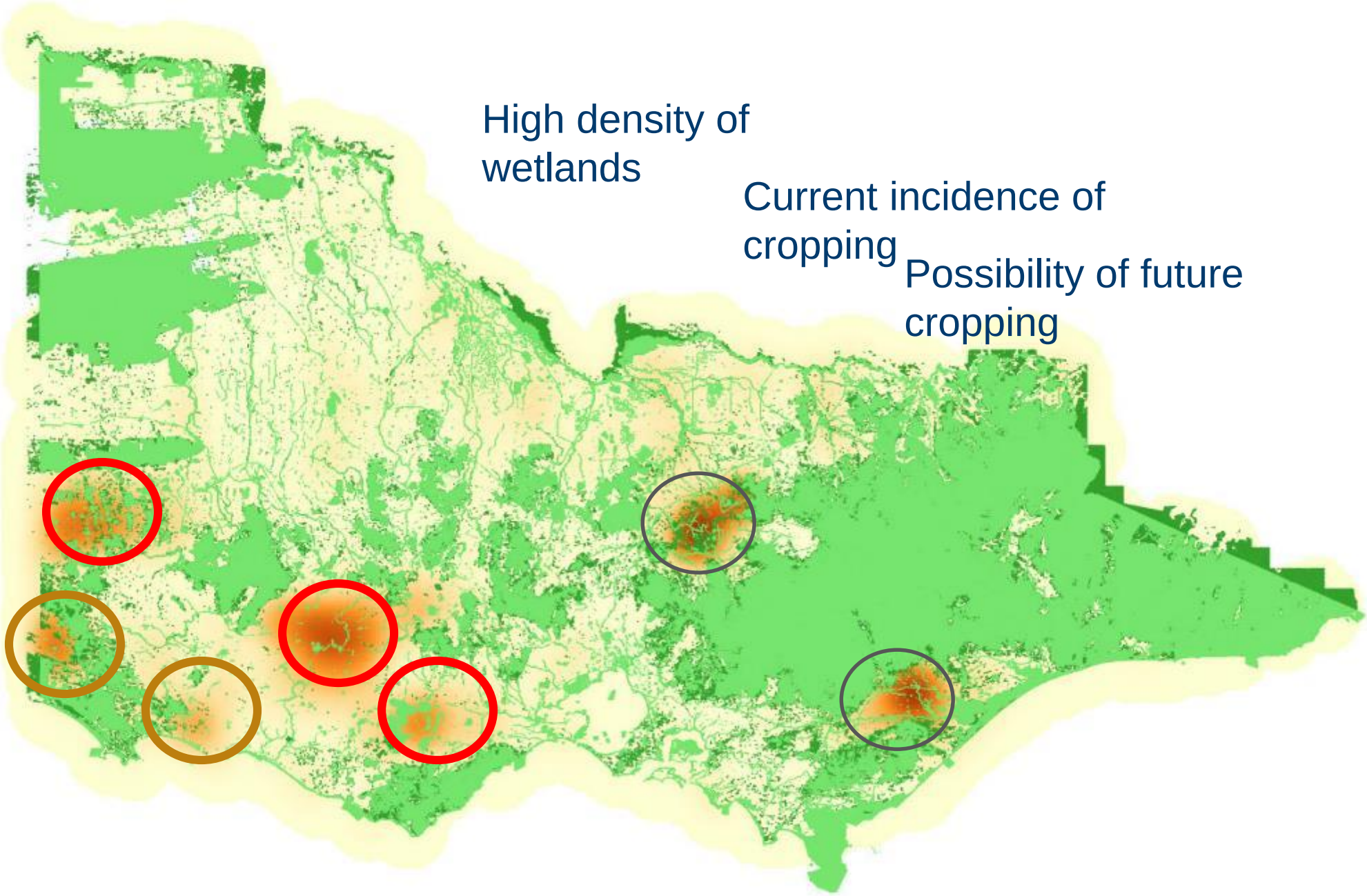
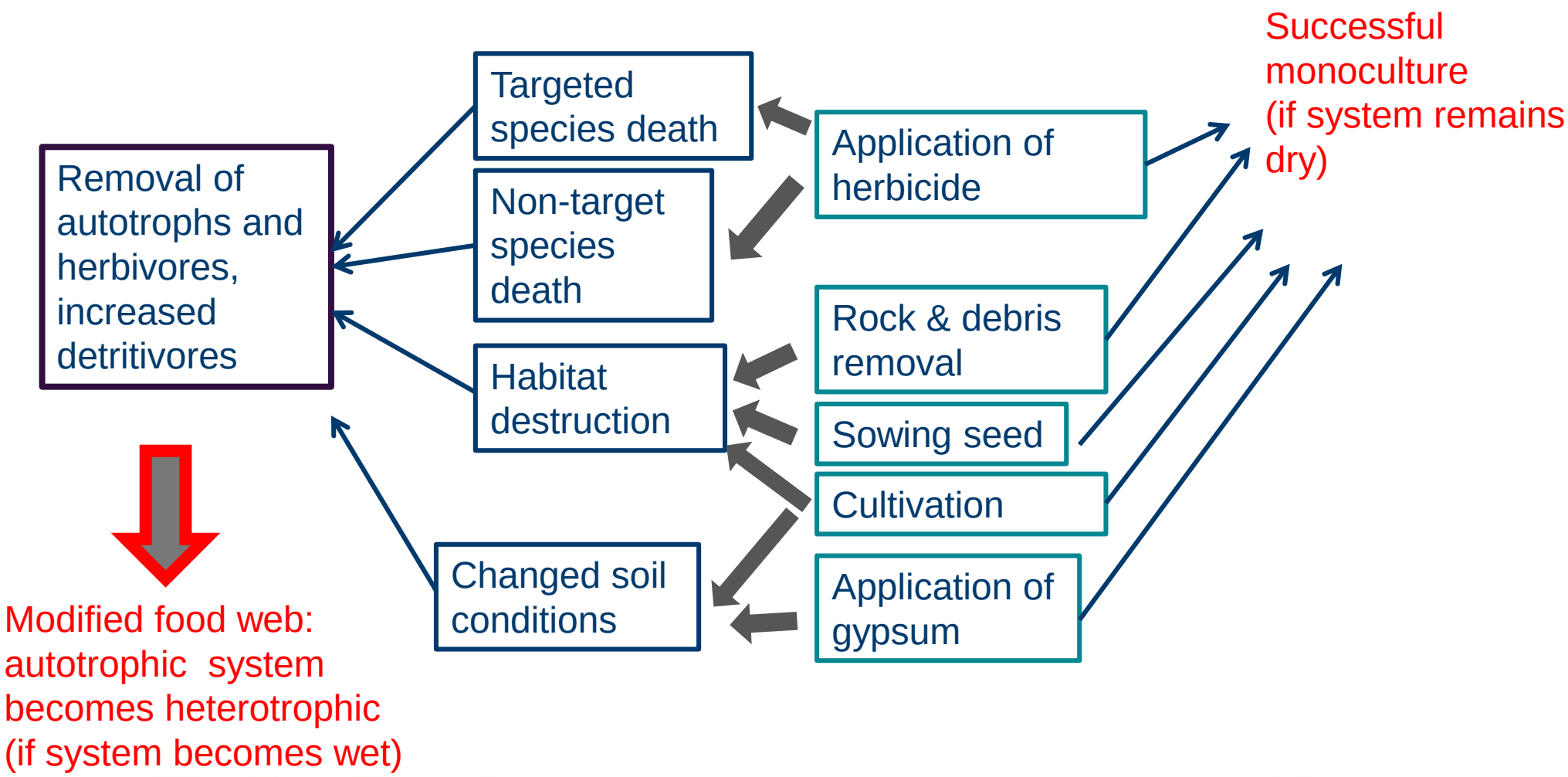
Visite guidée
Date des images satellite : 15/11/2015 37°31'07.55"S 142°57'12.76"E élév. 281 m altitud


High density of wetlands
Current incidence of cropping
Possibility of future cropping

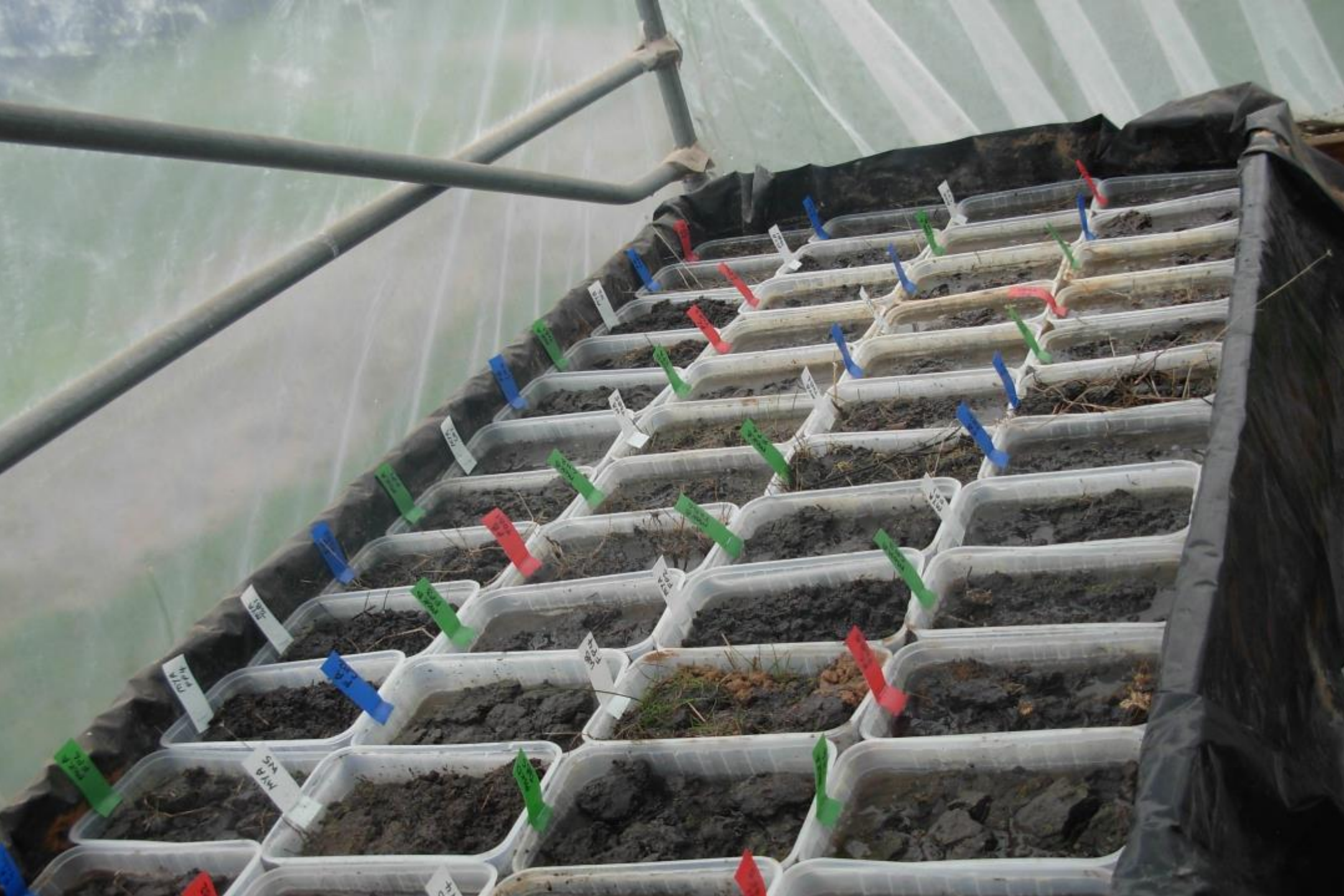
Predictor	Category	Exposure	Likelihood of cropping in wetland	Potential Impact	Vulnerability
Surrounding land use	Pasture	Medium (Sown forages)	Low	Medium	
	Cropping	High	High	High	
	Conservation	Low	Low	Low	
Water source	Rain-fed	High	High	High	
	Groundwater	High (West Wimmera)	Medium	High	
	Surface-flow	Low	Low	Medium	
Wetland water regime	Permanent	Medium (edges)	Medium (edges)	Low	
	Temporary (intermittent, ephemeral and seasonal)	High	High	High	
Wetland water quality	Saline	Medium (West Wimmera)	Medium	Low	
	Brackish	Medium	Medium	Medium	
	Freshwater	High	High	High	
Wetland modifications	Drainage	High	High	High	
	Dam	High	High	Low	
	No modification	High	High	Low	
Vegetation condition (IWC score)	High	High	High	High	
	Low	High	High	High	
Wetland size	<1 ha	High	High	High	
	<10 >1 ha	High	High	High	
	<100 >10 ha	High	High	High	
	<1000 >100 ha	Medium (partial)	Medium	Medium	
Land management	Conservation ethic	Low	Low	Low	
	No conservation ethic	High	High	High	

Consequences of cropping

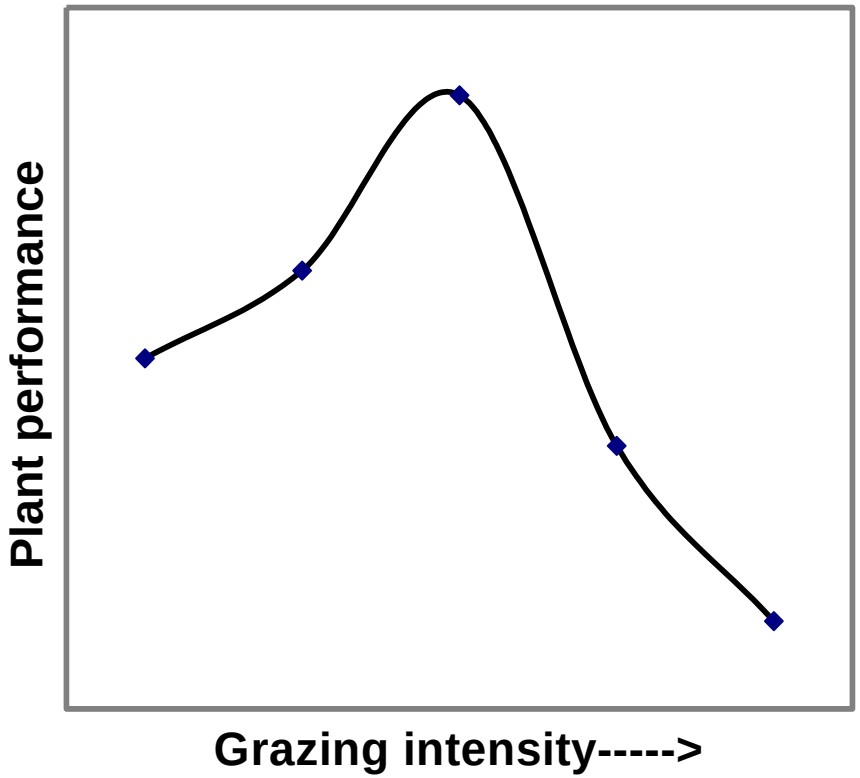


Mechanisms for Resilience

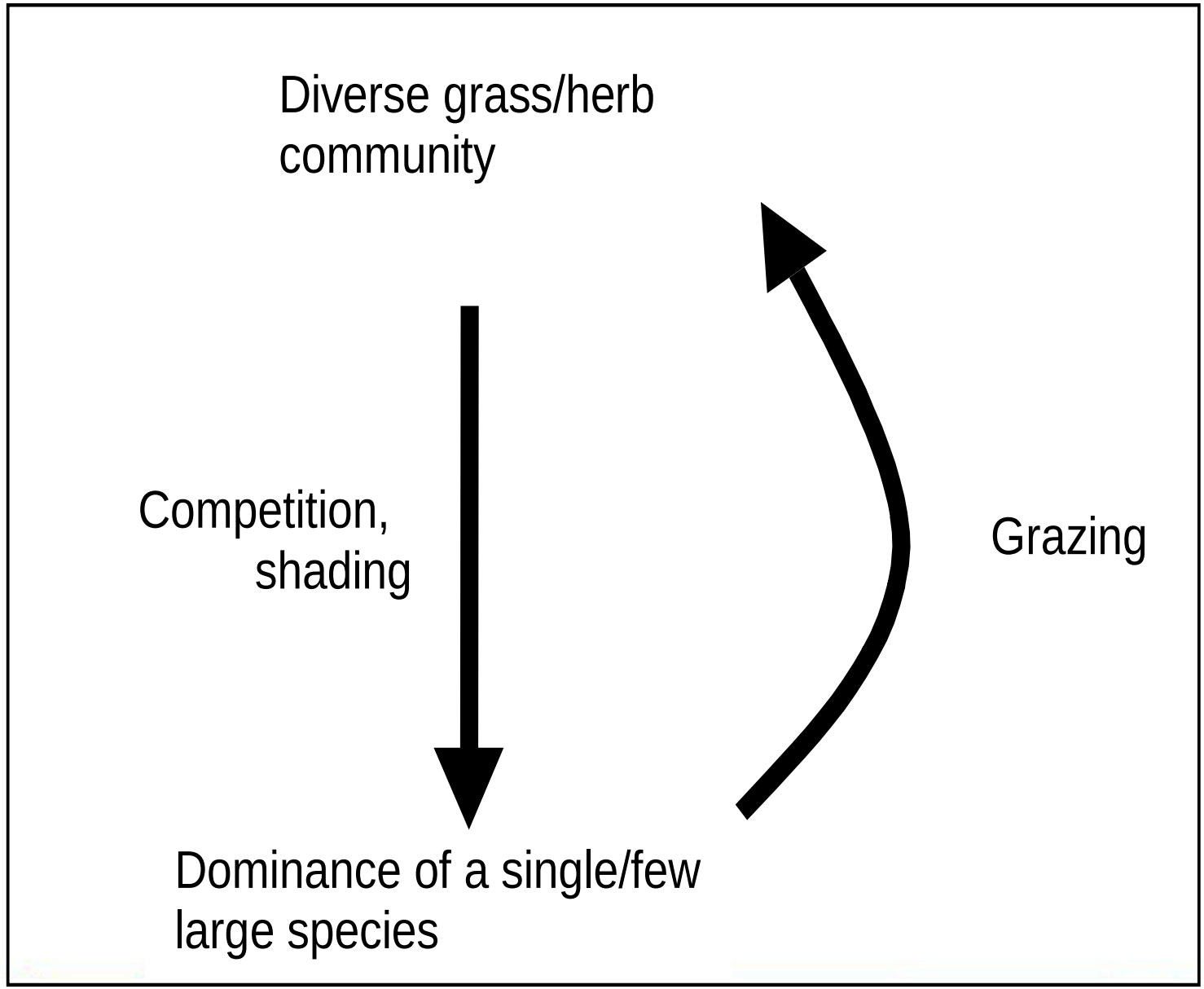
Seed bank (integrity)
Migration (connectivity)
Species adaptation to disturbance
Diversity of plants, algae, micro- and macroinvertebrates



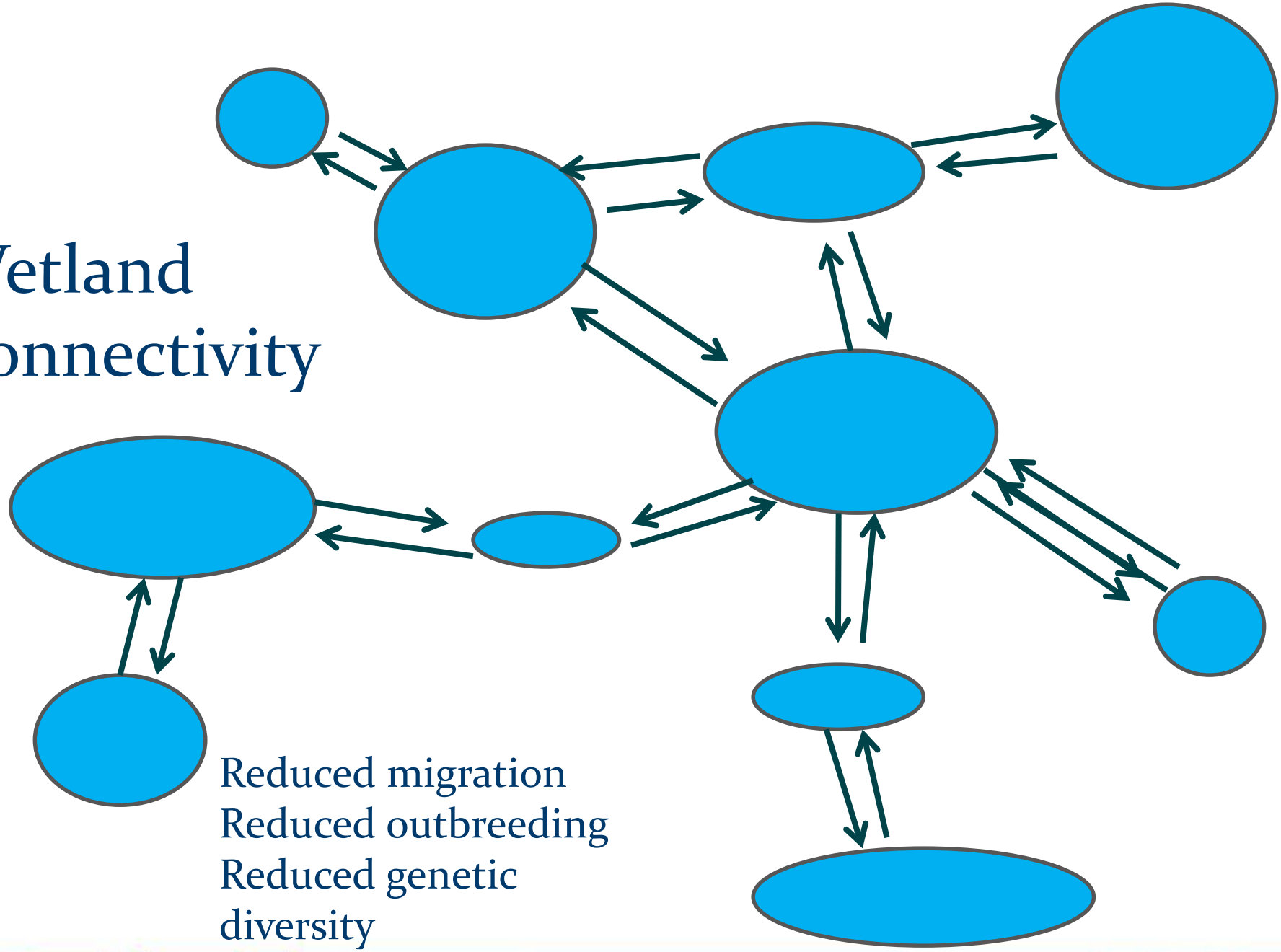
Effect of grazing on individual plants



Performance of individual plants under increasing grazing pressure. At low intensity grazing plant performance is enhanced, but as grazing pressure increases, plant performance is compromised (Osterheld and McNaughton 1991).

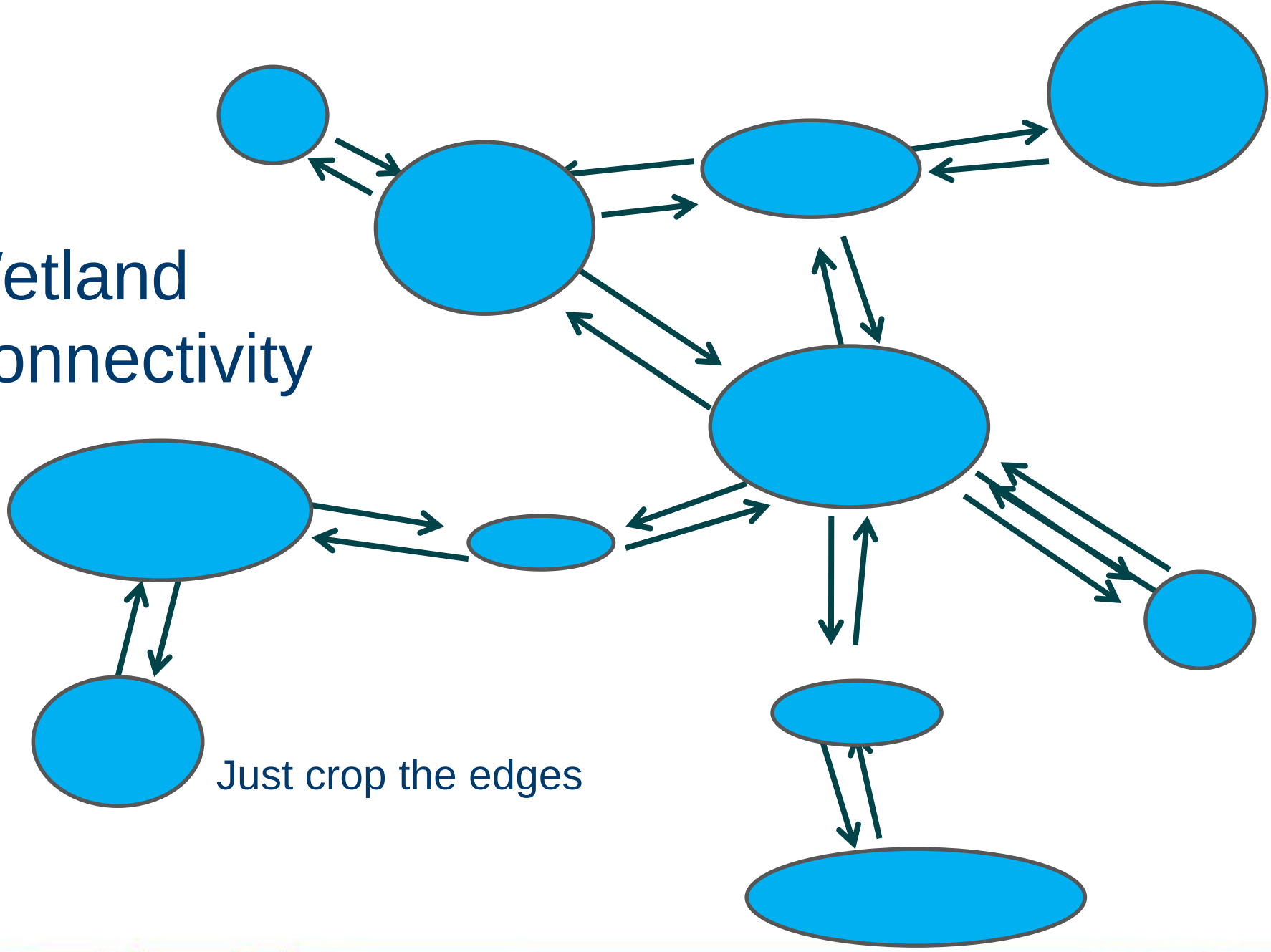

Diverse grass/herb community
Competition, shading
Grazing
Dominance of a single/few large species

Wetland Connectivity



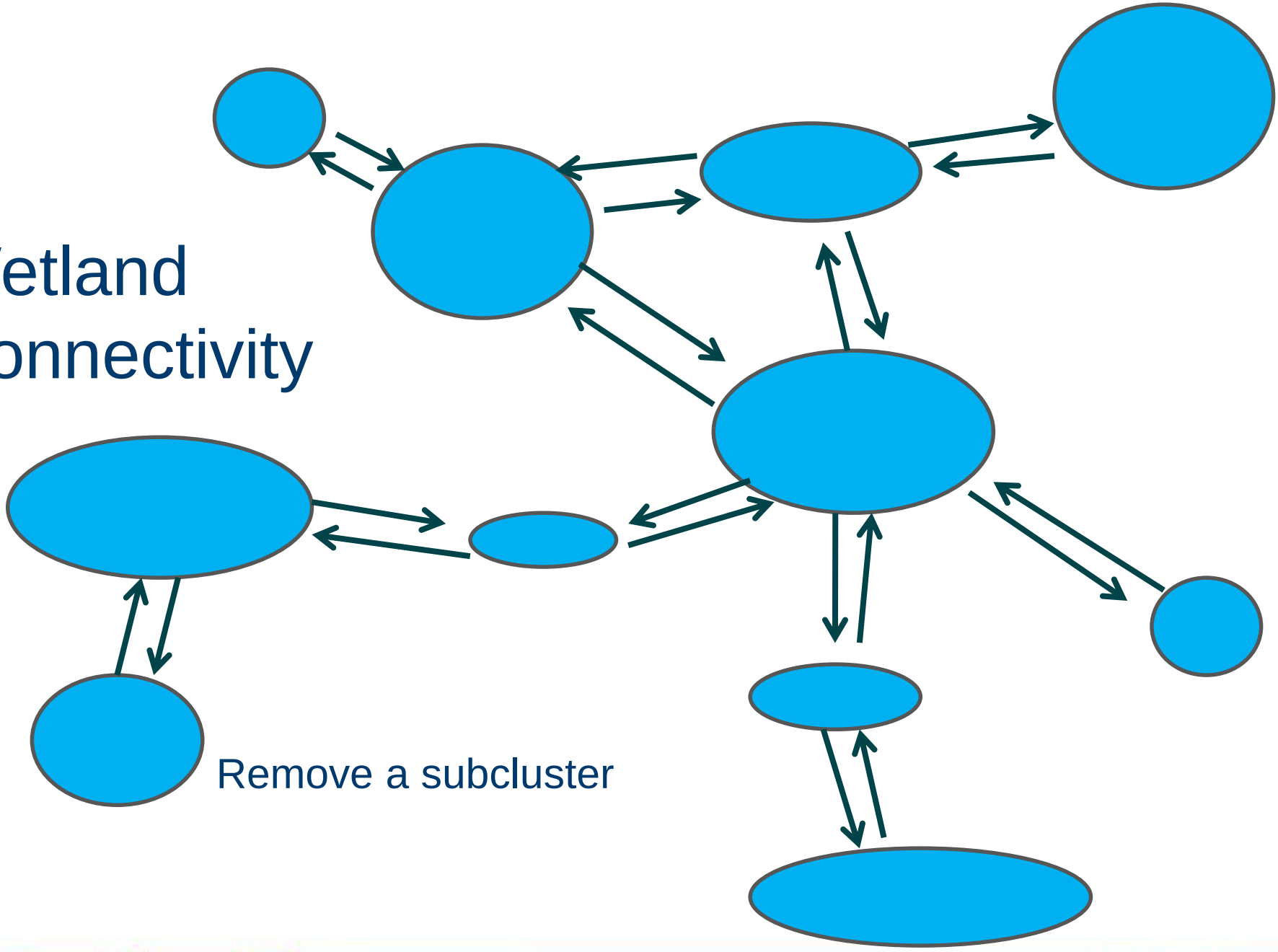
Reduced migration
Reduced outbreeding
Reduced genetic diversity
(e.g. Tasmanian Devils)

Wetland Connectivity



Just crop the edges

Wetland Connectivity



Remove a subcluster

Recommendation

Retain water regime

Conserve seed bank

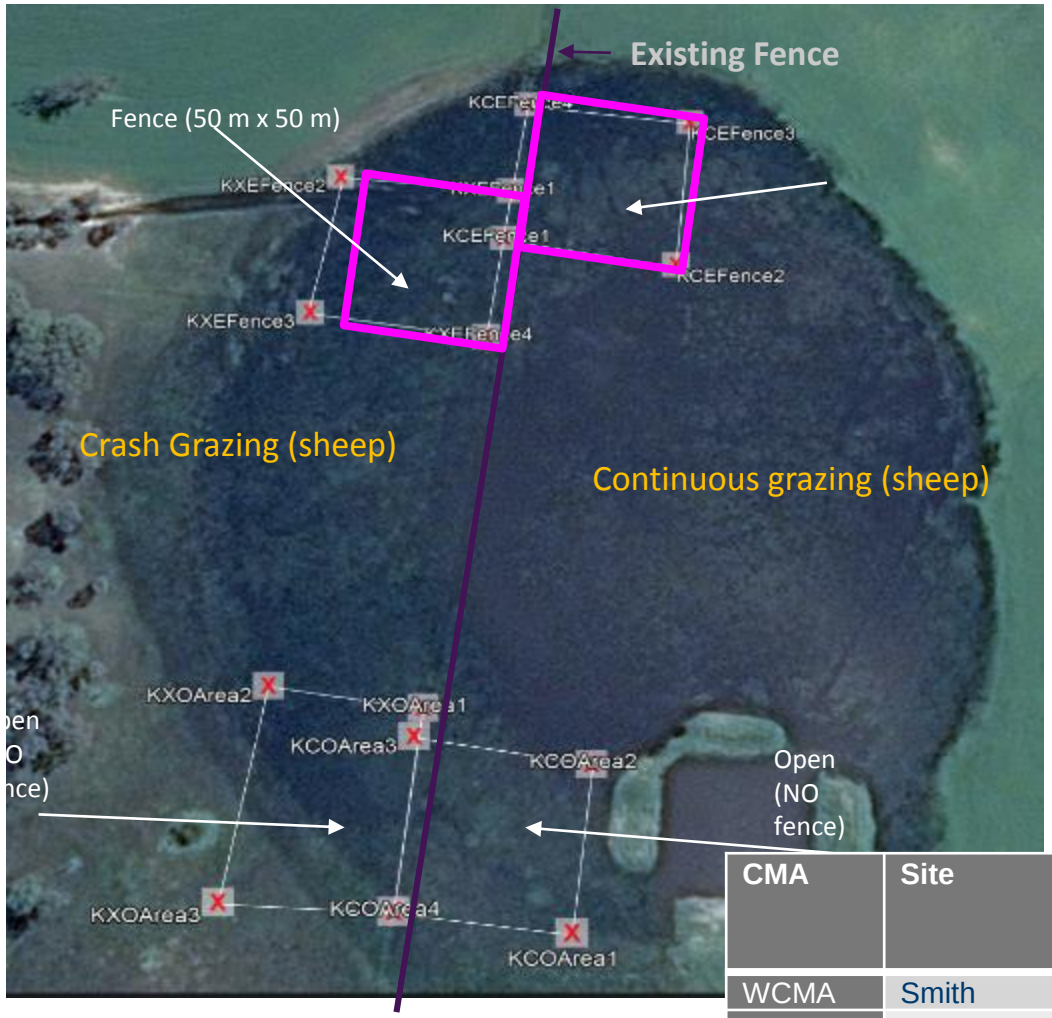
Control exotic species (weed plants and feral animals)

Best management of wetlands in western Victorian agricultural systems is grazing?

Wetland Intervention Monitoring Program

- DELWP funded, ARI managed
- Collaboration with CMAs and farmers
- What are the consequences of different grazing management strategies?
- Set stock: seasonal: crash: exclusion……intensity
- CCMA, GHCMA, WCMA, EGCMA, NCCMA

Assessments 2017



CMA	Site	Animal	Wetland Type	Setting	Crash vs Excl.	Cont Vs Excl.
WCMA	Smith	Sheep	Meadow	LGP	Y	Y
WCMA	Kealy	Sheep	Meadow	LGP	Y	Y
GHCMA	Pines Nth	Sheep	Meadow	LGP	Y	N
GHCMA	Pines Sth	Sheep	Meadow	LGP	N	Y
TOTAL	4	3	1	2	3	3

Time lapse cameras

- Photos of assessment area taken every 6 hours
- Visual assessment of changes in vegetation cover with grazing

Glenelg Hopkins Catchment Management Authority

Charophyte Services

Arthur Rylah Institute

DELWP


Questions?

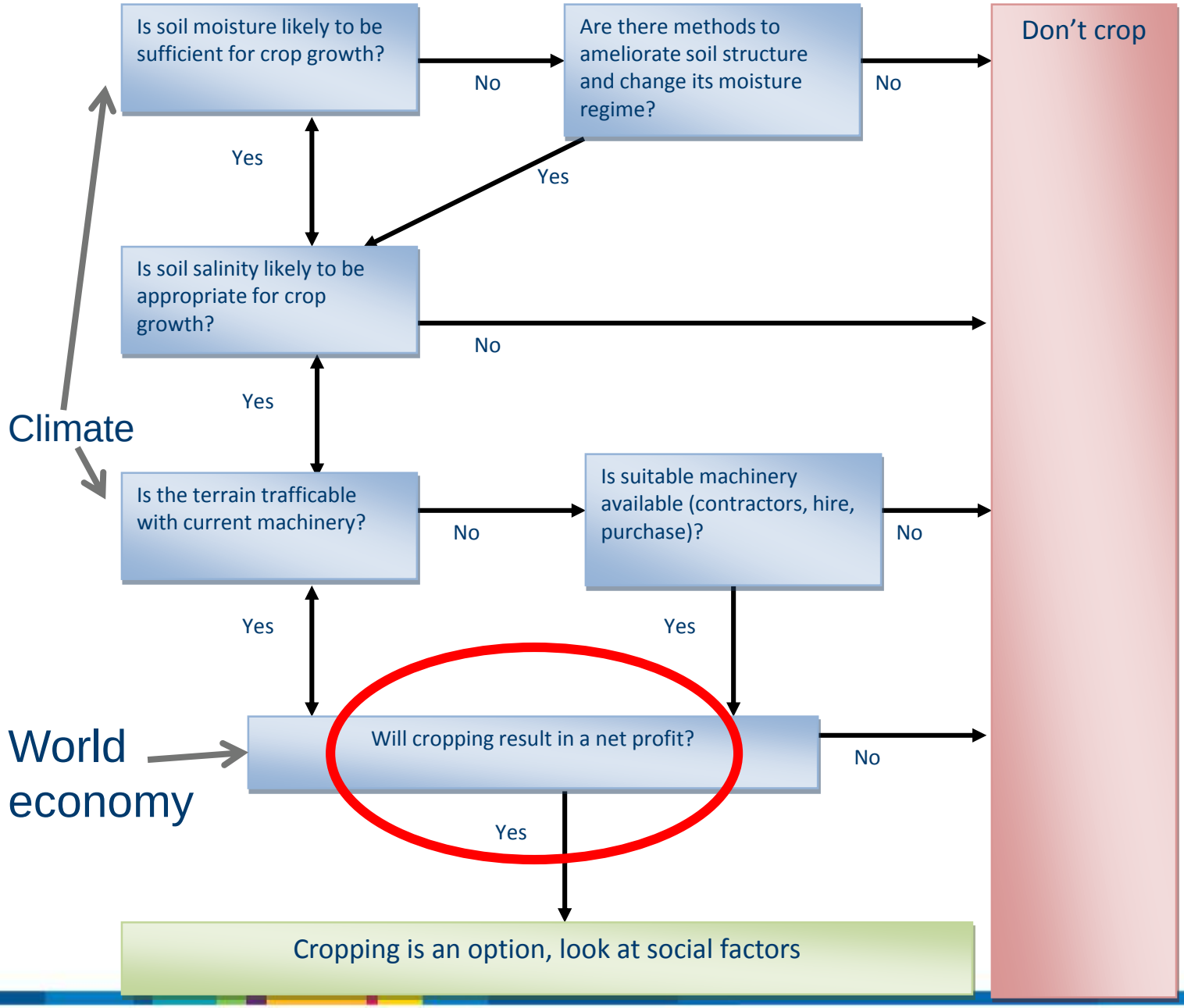


Figure . Physical and economic factors that influence a farmer's decision to crop a wetland.

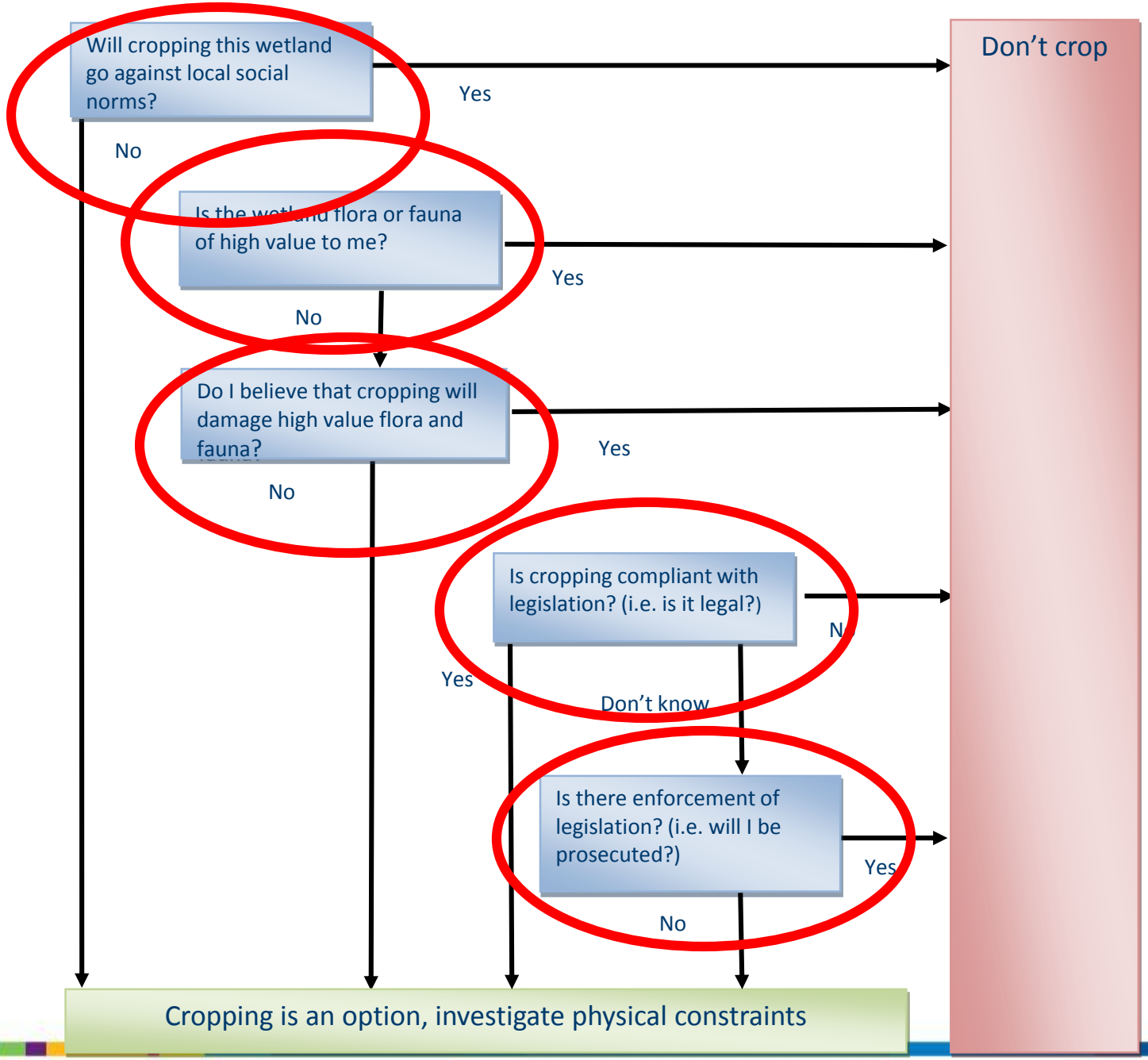


Figure 8 Social factors considered in the assessment of a wetland for cropping.

Seasonal Herbaceous Wetlands