

Source: D. Perryman, DECCW, DECCW

Potential drought & fire habitat refuges and climate change refugia

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Flagship Collaboration Research Fund project

Indirect impact of climate change on biodiversity and implications for adaptation responses in conservation planning

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- **Refugia** can be defined as locations, sometimes functioning as networks, that provide suitable habitat for species when prevailing conditions change such that:
- (a) the necessary habitat resources needed for food, shelter and nesting become unavailable over the majority of the species range,
- (b) the environmental regimes (including climatic regimes) over the species range fall outside the conditions that match the species physiological niche, or

(c) a combination of the two

Refugia function as source habitats from which animals can disperse to repopulated the surrounding landscape once the threatening process has passed and suitable habitat conditions have returned

Drought and fire are two threatening processes which can result in a species suffering contraction to habitat refuges

Human forced, rapid- climate change is another threatening process, considered here in terms of enhanced drought conditions or changed fire regimes, from which animal may need refuge

There are various potential 'threatening processes' operating at a range of space/time scales...



Modified from Dickinson (Figure 9.9; 1986)

Theoretical basis is Southwood's dynamic 'habitat template'

...the distribution and availability of vegetation-based habitat resources in space and time is a selective force on animal life history strategies

(3) Minimum level of biomass production



The <u>three axes</u> of Southwood's habitat template can be approximated by tracking change in **vegetation primary productivity** (*f*PAR mean, minimum and C.o.V.) over a time series

Source data?

- NASA satellite data MODIS time series
 @250m & 16 day time-step
- Sensor data estimates solar energy intercepted by vegetation for photosynthesis
- Provides spatially distributed data to calibrate models of Gross Primary Productivity (GPP)
- Time series tracks GPP vegetation response between seasons and years in response to rain
- (NB. GPP is primary input into terrestrial ecosystem carbon models)





Great Eastern Ranges analysis boundary defined by IBRA Regions and the natural vegetation located within the boundary.



Averaged mean yearly fPAR value



Averaged Coefficient of Variation yearly fPAR value

Areas mapped as natural vegetation disturbed by fire between 2000 and 2009...



'Greenspots' – potential drought & fire refugia



Time series for *f*PAR at selection of sites

Wet sclerophyll forest



Date

Comparison of protected areas and greenspot area's designated as protected areas for various thresholds

Vegetation Type	Total Protected Area located within Vegetation Type	% of Protected Area within Vegetation Type	Ecosystem greenspots designated as a protected areas (ha) withir each Vegetation Type							Percentage of ecosystem greenspots designated as a protected areas (%) within each protected area of each Vegetation Type					
			10	25	50	75	90	95	10	25	50	75	90	95	
Rainforests	311428	63	245	665	7277	137428	282693	300757	0.1	0.2	2.3	44.1	90.8	96.6	
Wet Sclerophyll	1321380	32	280	2515	356451	656173	1000152	1133516	0.0	0.2	27.0	49.7	75.7	85.8	
Dry Sclerophyll - West	629436	14	8180	67423	215899	417248	544431	572967	1.3	10.7	34.3	66.3	86.5	91.0	
Heathlands	116916	55	372	4069	20619	50266	90890	100345	0.3	3.5	17.6	43.0	77.7	85.8	
Alpine Complex	209913	90	1898	6669	32924	65630	106021	132853	0.9	3.2	15.7	31.3	50.5	63.3	
Grassy <u>Woodlands</u>	691224	18	1417	52956	239830	436050	618988	658182	0.2	7.7	34.7	63.1	89.5	95.2	
Semi Arid Woodlands	17590	2	4729	7555	15400	16875	17187	17278	26.9	43.0	87.6	95.9	97.7	98.2	
Wetlands	79310	24	226	4055	33272	68144	73395	74429	0.3	5.1	42.0	85.9	92.5	93.8	
Coastal Complex	5985	89	0	18	2049	3051	3861	4194	0.0	0.3	34.2	51.0	64.5	70.1	
Grasslands	387	13	67	322	338	338	367	383	17.4	83.1	87.2	87.2	94.8	98.9	
Forested Wetlands	14376	16	1197	3662	6929	11467	13246	13915	8.3	25.5	48.2	79.8	92.1	96.8	
Mangroves	867	11	28	49	203	434	643	735	3.2	5.6	23.4	50.1	74.2	84.7	
Dry Schlerophyll - Coastal/Montane	3388628	38	13095	120967	827178	1903602	2765026	2975786	0.4	3.6	24.4	56.2	81.6	87.8	

Conclusions...

Potential drought and fire refugia are important for persistence of biodiversity per se

 As potential climate changes refuges, these sites warrant special consideration in landscape conservation planning as in they are poorly protected for many ecosystem types

 We should consider the species associated with other domains of Southwood's dynamic habit template

Next stage in analysis – the rest of the continent!