From Moonlight Jewels to Common Browns

Butterfly Accounts for the Australian Capital Territory

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Key questions for biodiversity accounting

- What are the units of account? (Genes, species, ecosystems?)
- Can indices of biodiversity be used as an input to ecosystem accounts?
- In what types of accounts would biodiversity by included?
 - Environmental (ecosystem) asset
 - Input to economic production
 - Input into ecosystem which generates ecosystem services
 - Indicator of ecosystem condition
 - Ecosystem service
- When assessing ecosystem condition, what reference points can be used?

Development of biodiversity accounting for the ACT using butterfly data



ACT Nature Conservation Act Endangered and Vulnerable Listed Species, 2001-2016



From Environmental-Economic Accounting for ACT State of the Environment Reporting Proof of Concept

http://www.environmentcommissioner.act.gov.au/publications/environmental-economic-accounts

Butterflies as indicators of biodiversity condition

- Useful indicator group of species:
 - Short lifespans
 - Generally limited dispersal ability
 - Larval food plant specialisation
 - Close reliance on weather and climate
 - Relatively well-documented for insects
 - Taxonomy relatively well-understood
 - Easy to recognise species
 - Information available on their ecology and life history



ACT Butterfly Research Project

- Materials and methods
 - Australian National Insect Collection (ANIC)
 - Published papers and books
 - Personal and citizen science observations
 - Field work
 - Modified Pollard (1977) walk
 - Fixed time and space
 - Transect surveys
 - Spring to autumn
 - Grassland, lowland woodland, dry forest, montane forest, wet forest, montane and subalpine woodland, wetlands, urban gardens, riparian habitat



ACT Butterfly Research Project

- Ongoing monitoring project since 2014 which collects reliable data on adult butterfly presence and abundance
- 176 survey sites in the ACT across a range of habitats.





Butterflies of the World



Wallacea (between Wallace's Line and Lydekker's Line) important biogeographical transition zone separating Australian fauna from the rest of the world

	Number of species	Endemic to Australia	Introduced to Australia
Global	~18 000	NA	NA
Australia	408*	200 (49%)	3
ACT	87	61 (70%)	2

* Represents continental Australia only (e.g. excluding Christmas, Norfolk and Lord Howe Islands

Snapshot of ACT butterfly species, endemic and introduced species, 2018

	Native species				Introduced species	
	Endemic	Endemic	Non-endemic	Listed as	Introduced	
	ACT	Australia	Australia	threatened	Australia	Total species
Papilionidae	0	1	5	0	0	6
Hesperiidae	0	17	0	0	0	17
Pieridae	0	4	6	0	1	11
Nymphalidae	0	15	8	0	1	24
Lycaenidae	0	25	4	0*	0	29
Total	0	62	23	0	2	87

- No threatened endemic species in ACT
- Anticipated that the Small Ant-blue (Lycaenidae family) will be listed as threatened in ACT
- Two introduced species Cabbage White from the Pieridae and the Monarch from the Nymphalidae

Snapshot of ACT butterfly species, breeding status and specialisation, 2018

	Breedi	Special			
	Breeding species*	Non-breeding species^	Generalists	Specialists	Total species
Papilionidae	3	3	3	0	6
Hesperiidae	17	0	7	10	17
Pieridae	3	8	3	0	11
Nymphalidae	18	6	9	9	24
Lycaenidae	26	3	9	17	29
Total	67	20	31	36	87

* Resident and regular migrant species

^ Migrants and vagrants; not included in classification of generalist/specialist breakdown

Specialists are species which rely on a particular habitat and hence can be linked to condition of these habitats (i.e. ecosystems)



- Common Brown (Heteronympha merope)
- Widespread and abundant in every ACT ecosystem
- Cosmopolitan food plant preference (native and introduced plants)
- Adults live for several months
- Flexible strategies for surviving heat and drought



- Alpine Sedge-skipper (Oreisplanus munionga)
- Restricted to swampy subalpine eucalypt woodland and grassland
- Food plant preference is one plant species
- Adults live for a few weeks
- Vulnerable to introduced herbivores, drought and heat

Butterfly species account for the ACT, 1978 - 2018

		Native species			Introduced					
					species	species Specialisation				
		Endemic	Endemic	Non-endemic	Listed as	Introduced				
		ACT	Australia	Australia	threatened	Australia	Generalists~	Specialists~	Total species	
Opening stock 1978		0	56	19	0	2	NA	NA	78	1
Additions										
	Discovery of									
	new species	0	0	0	0	0	NA	NA	0	ł
	Rediscovery of									
	extinct species	0	0	0	0	0	NA	NA	0	1
	Addition of									
	species	0	5	3	0	0	NA	NA	8	1
	Taxonomic									
1	reclassification	0	1	0	0	0	NA	NA	1	
	Total	0	6	3	0	0	NA	NA	9	
Reductions										
	Extinction of									
	species (Aust)	0	0	0	0	0	NA	NA	0)
	Loss of species									
	(distribution)	0	0	0	0	0	NA	NA	0	J
	Taxonomic									
	reclassification	0	0	0	0	0	NA	NA	0)
	Re-evaluation									
	of records	0	0	0	0	0	NA	NA	0)
	Total	0	0	0	0	0	NA	NA	0)
Closing stock 2018		0	62	23	0	2	31	36	87	,
Net change		0	6	4	0	0	NA	NA	9	,

Range extensions

- 3 vagrants or migrants
- 5 residents

Taxonomic

 Golden Ant-blue was split from Copper Ant-blue (Lycaenidae)

Unexpected findings

- Complex taxonomic revisions over time
 - One new species,
 - Many scientific name changes
- Two points in time 40 years apart can miss significant disturbance events
 - 2003 bushfires
 - Reduced diversity at formerly productive sites
 - Two species lost for 14 years
 - Two species severely impacted and nearly lost



Final thoughts

- Systematic collection and assembly of species data a barrier to regular production of accounts
- Classification of species
 - Conservation status important but other classifications useful for understanding management needs of species
 - Generalists and specialists
 - Breeding and non-breeding
 - Which definitions should we use?
- Integration of species accounts with ecosystem accounts
 - Condition accounts
 - Cultural and recreation services (Bogong Moth example)



Questions for discussion

- What do you think of our table presentation? Is there a way to improve or change data presentation for greater clarity or impact?
- Have there been similar species accounts constructed for biodiversity?
- How could we best approach the future integration of this style of biodiversity species accounts with ecosystem accounts?

