Department of Sustainability and Environment

23 years in the "tunnel of love":

Habitat re-connectivity of the endangered Mountain Pygmy-possum

Presentation for EIA & NZ
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What to remember

Our story is about the tunnel of love for *Burramys*

"Canary in the coal mine" for Greenhouse in Australia - Tim Flannery

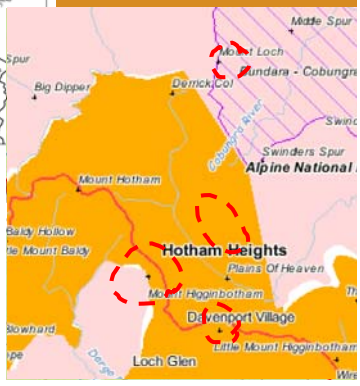
Key messages:

- Restoration of habitat continuity works – local extinction avoided
- Permanent, long-term solutions – allow population to self adjustment
- Knowledge of habitat and social organisation key elements
- Dispersal can be as important as breeding in population dynamics
- Under climate change habitat continuity, access to refugia and amelioration of stochastic events will be critical

Context of Mountain Pygmy-possum

- Endangered *Burramys parvus* - only Australian mammal restricted to the alpine - subalpine region -
- Genetically distinct populations – global population 1500- 2000
- "Sympatric" with alpine resorts (Mt Buller, Mt Hotham - Loch Higginbotham), Koscuiszko (Blue Cow, Perisher Charlettes Pass)
- > 60 % of world's population between Loch - Higginbotham, Mt Hotham
- Breeding biology and social organisation - gender separation
- Resort development has destroyed and fragmented habitat
- 1986 - tunnel corridor built to reconnect habitat and social organisation

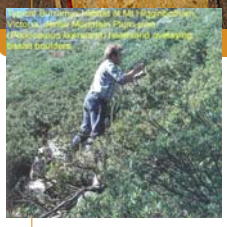
Distribution & abundance



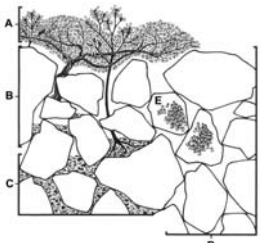
Global population
2000 – 1500

60% Mt Higginbotham
– Mt Loch

Habitat



Alpine boulder-field habitat – Bogong Moths



Cross-section of boulderfield showing the imprortant features of Burramys habitat: **A** shrub layer; **B** piles of boulders; **C** leaf litter and Bogong moth remains over soil and partially buried rocks. Usually permanent flowing springs. Plants establish in the soils where the boulders are shallow; **D** where the boulders are more than two metres deep, light levels are insuffiecient at the soil to allow plant growth; **E** congregations of Bogong moths.

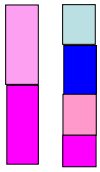
Annual cycle of Burramys at Mt Higginbotham

Sexes different hibernation sites.

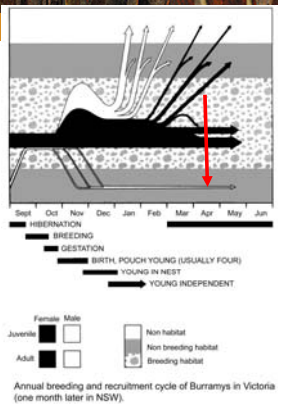
Tight single breeding p.a.

Sexes at Natal site in April

Natural Disturbed



Males Not disperse



Annual breeding and recruitment cycle of Burramys in Victoria (one month later in NSW).

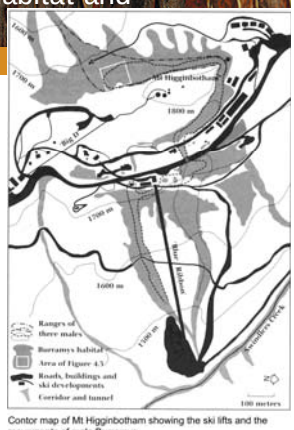
Spatial distribution of habitat and conservation

Female: --->
Resource rich high altitude, adults sedentary, long lived (12 yrs)

Male: ----->
Lower altitude, Bogong moth poor, movement, life span (4 yrs)

Different hibernation sites & requirements

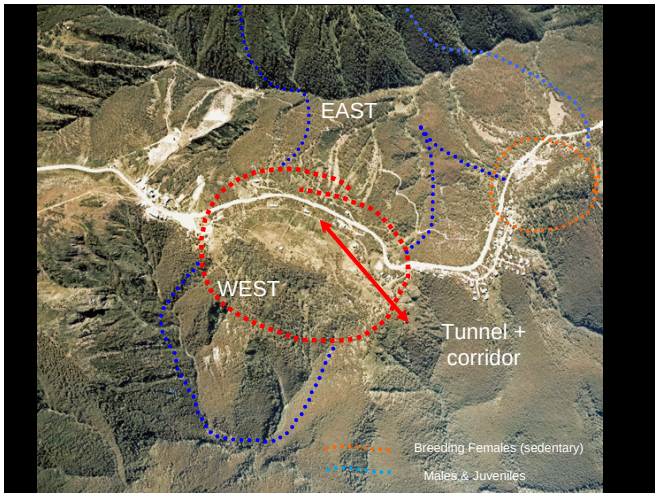
Resort infrastructure and roads concentrated uphill



Contor map of Mt Higginbotham showing the ski lifts and the movements of male Burramys.

1972

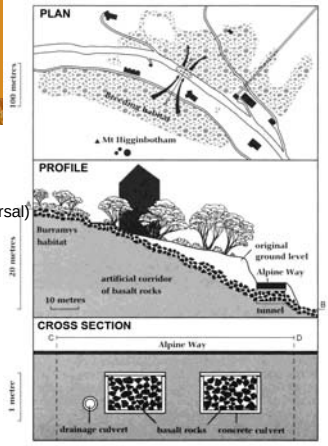
1987



"Tunnel of Love"

Tunnel and corridor used immediately

Seasonal up (ad. males) – down (dispersal) usage as predicted



The tunnel and corridor that restored the social organisation of Burramys on Mt Higginbotham.

Tunnel in Hotham resort

Disturbed (resort) compared to natural (park).

- adult males and juveniles did not disperse from natal areas
- non-dispersal = c. 50 % reduction in survivorship of ad.females.

Christened the "Tunnel of love" by the press on world environment day 1986.

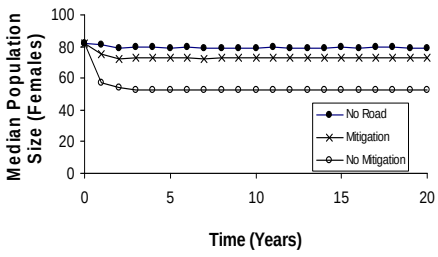
In the first two years after the tunnel it was shown to have successful restored.

- Fecundity
- social organisation (movement of males, and dispersal of juveniles)
- survivorship of breeding females

(Mansergh & Scotts, 1989).

How's it going 23 years on ?

Mt Hotham population – modelling (in 2005)

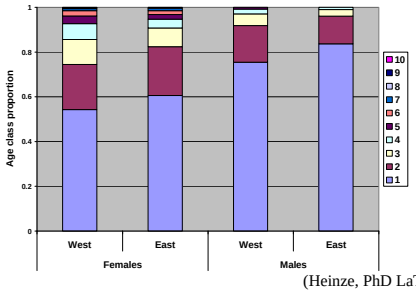


- An unmitigated road reduced population size by ~ 40%
- The tunnel has mitigated the barrier effect of the road, with a 15% reduction in population size.

Median population size for female Mountain Pygmy Possums for 20 years post construction, based on mean parameter estimates.
(From van der Ree and McCarthy)

Mt Hotham - age classes 20 years on

Proportion of age classes 1985-2005 (mean values)



(Heinze, PhD LaTatrobe)

Burramys body weight and fecundity over 20 years

***Burramys* Mean body weight**

		Mt Higginbotham	
Age class	**Sex**	**West (control)**	**East (disturbed)**
Adult	**F**	45.11	44.33
	M	42.46	41.95
First year Adult	**F**	42.28	41.21
	M	40.76	41.64

Differences not statistically significant

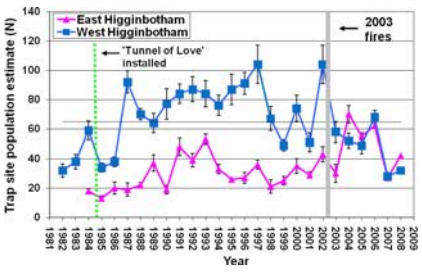
Fecundity (pouch young / female

3.61 s.e. 0.04 (N = 1022)	3.16 s.e. 0.08 (N = 446)

Highly significant statistical difference
Independent samples t-test
t (643) = 5.30, p<0.001 **

Some of the assumptions of the t-tests may not be met.

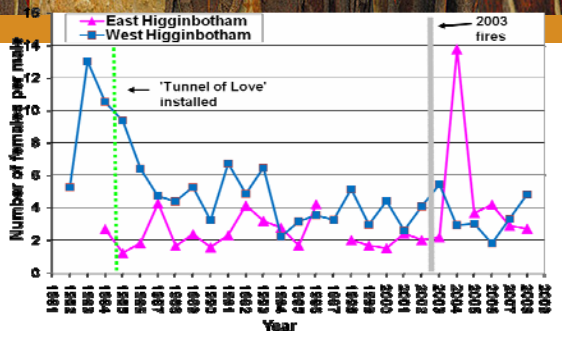
Mt Higginbotham *Burramys* population



2003 Fires
Tunnel and corridor
Dispersal to refugia ??

Ad. Female population estimate (N) ± 1 s.e. for trapping sites on the Western and Eastern slopes of Mt Higginbotham, 1984 – 2005.

Mt Hotham - sex ratios



Sex ratios of *Burramys* recorded from trapping sites on Mt Higginbotham, 1981 – 2008

Summary of results at Hotham after 23 years

- Tunnel successful in restoring movement (breeding migration and dispersal of young)
- Consequently age structure, survivability and health (weights) restored.
- Abundance at site appears 15- 20% less and fecundity less (- 0.5 py).
- added population insurance in stochastic events (fire)
- Dispersal may be as significant as breeding in long term
- Connectivity allows access to refugia
- Congratulatory letter from Minister to VicRoads (engineer)

Overall, successfully avoid observed declines (to extinction?)

- world-wide review of road corridors (VanRees and Mccarthy 2003) 23 experiments examined - Hotham tunnel only one to show effects at population level (ie Mansergh and Scotts, 1989)

Burramys tunnels and corridors elsewhere

Mt Buller - Genetically viable population (1996) - estimate 350

- habitat destruction of ski industry
- population has declined to imminent genetic and census extinction (Heinze 2006, Mitrovski and Hoffman 2006)
- Corridors and tunnels and recreation of habitat critical to replenishment of population (regrettably captivity breeding has been required)

NSW

- Corridors and tunnels have been used with success at Blue Cow resort and elsewhere.

Tunnels and corridors

Logical extension of habitat reconnection success is ..... habitat restoration

Mt Buller

Corridors and tunnels and re-creation of habitat is critical to survival of population
(too little too late, now require captive breeding and out breeding)

Mt Kosciuszko NP NSW

Other ripples of the “tunnel of love”

For current management:

- Proven viable method to restore fragmentation and recreate habitat - consolidate population
- population declines and extinctions due to habitat degradation of the roads & ski industry are clearly avoidable outcomes

for the future generations

- Adds to “sense of place”
- Two page spreads in world geography texts (year 10)
  - 8 different books - total print run > 120000
  - a positive conservation “story”