



Maintaining production and meeting conservation goals on grazing properties in the rangelands

Neil MacLeod & John McIvor

CSIRO Agriculture Flagship, Brisbane Qld, Australia 4000.

CSIRO AGRICULTURE
www.csiro.au



Grassland Society of Southern Africa 51st Annual Congress, Wilderness 4th to 7th July 2016

Where are we going?

- Introduction.
- Principles & thresholds for landscape design.
- Application of the ecological principles.
- Exploring production-environmental trade-offs.
- Application - subtropical woodlands.
- Case study:
 - Example 1 - Tree clearing
 - Example 2 - Tree planting
- Concluding remarks.



Introduction

Key features of contemporary range management:

- Profitability is under constant challenge (cost-price squeeze, land prices).
- Intensification of management practices.
- Adverse changes in land condition (erosion, species loss, weeds)
- Simplification of landscape ecological structure.
- Community pressure for environmentally friendly land use(s).

Management intensification:

- Obvious economic benefits.
- Ecological downside.
 - Ecological processes have thresholds & limits.
 - Pushed too hard landscapes 'leak' resources.

Trade-offs are implied.

Assessment framework.

Case study (tree clearing & tree planting).

Management intensification

Rational (& necessary) response to cost-price squeeze:

- Raise productivity (per animal, per hectare etc).
- Cut labour & other costs etc.
- Exploit economies of scale.

Examples:

- Tree clearing & thinning.
- Pasture sowing & augmentation.
- Advanced breeding & nutrition.
- Grazing systems (esp. high intensity, short duration).
- Infrastructure - waters, subdivision etc.

Mandatory for viable pastoralism & process will not abate.

Landscape dysfunction

Well recognised (documented) & include:

- Declining productivity of native & sown pastures
- Reduced drought tolerance of pastures
- Soil structure decline & increased erosion
- Salination of land & water
- Tree decline at landscape scales
- Acidification of soils
- Plant & animal species extinctions (locally & regionally)
- Eutrophication of watercourses
- Encroachment of native & exotic weeds
- Loss of future land use options (e.g. eco-tourism, timber, bush foods)

Key to sustainable land management is to stay within ecological limits

Principles & thresholds

CSIRO grazing land management research mid-1990 to 2000s:

- Built on long history of grazing & pasture management trials.
- Integration of landscape ecology & conservation biology.
- Landscape cf. paddock focus.

Developed integrated set of landscape design principles.

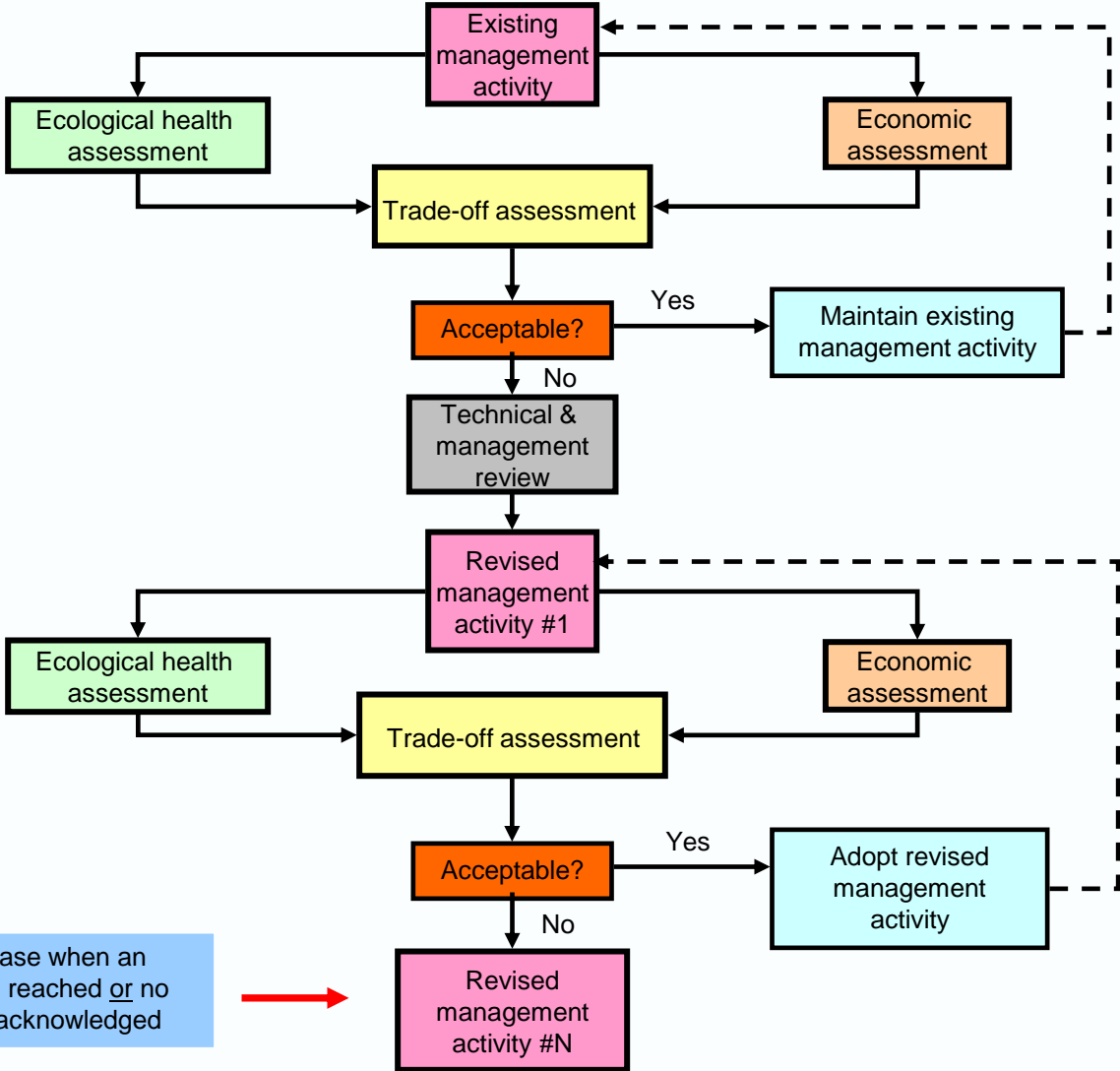
- Trees, pastures, soils, riparian lands, wildlife habitat etc.
- Included elements of both resource & nature conservation.
- Identified thresholds (empirical, judgement, precaution).

Tested with whole of enterprise case studies & modelling

- Full application of the principles uneconomic for private landholders.
- Partial application (trade-offs) warranted exploration.

Full application probably socially warranted (some empirical support).

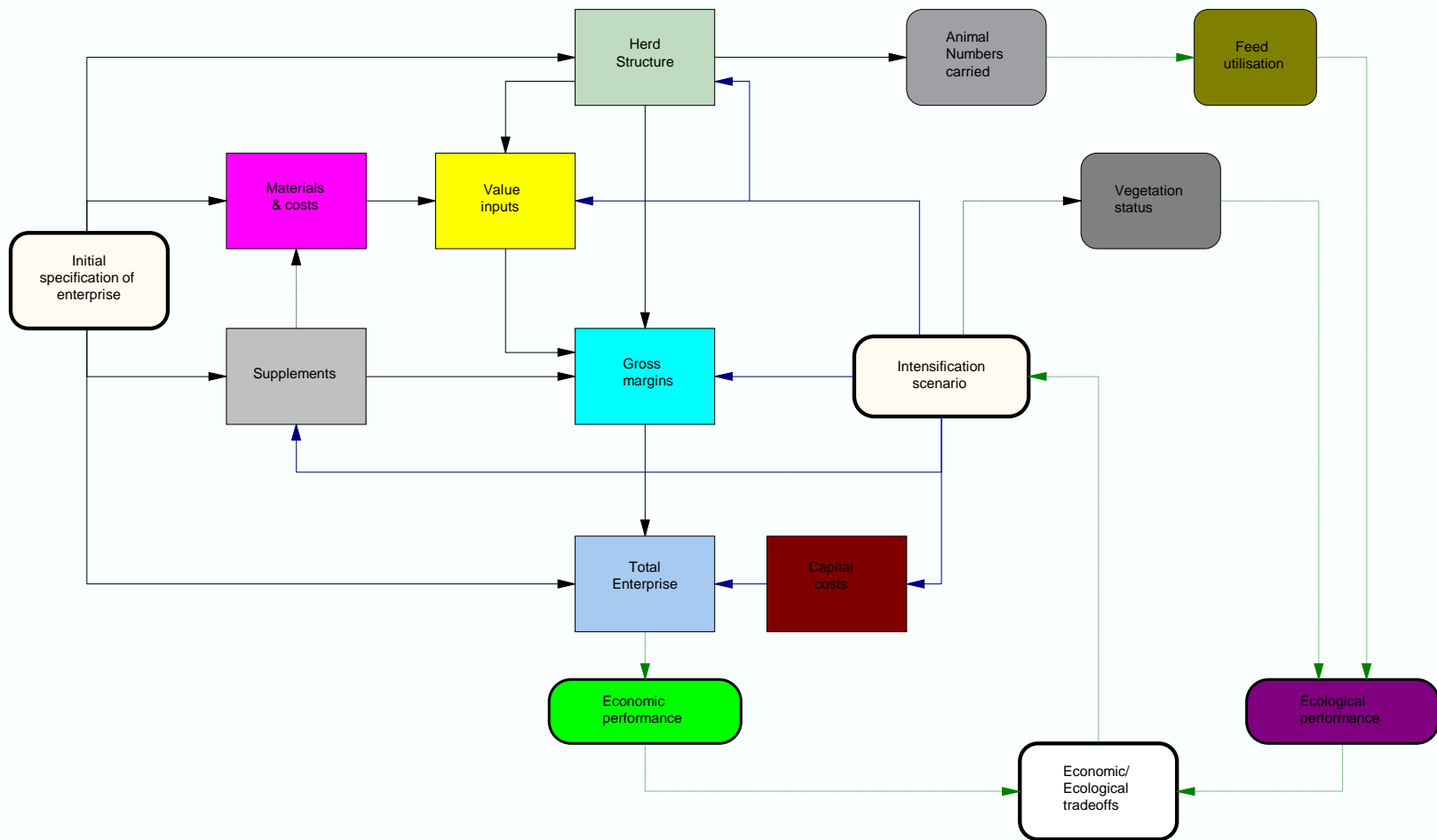
Assessment framework



Review iterations (N) cease when an acceptable compromise is reached or no feasible improvement is acknowledged



Economic assessment



Ecological assessment

- **Component A. Maintenance of ecosystem function & stability**

Attribute 1. Soils & hydrology (6 dimensions)

Attribute 2. Pastures (cover & composition, perennial grasses)

Attribute 3. Weeds (species, density/cover)

Attribute 4. Feral animals (species, density)

Attribute 5. Riparian areas (water quality, stream health)

Attribute 6. Atmosphere (greenhouse gas emissions)

- **Component B. Conservation of biodiversity**

Attribute 7. Native vegetation & habitat (5 dimensions)

Attribute 8. Native animal populations (size & viability)

Case study - 7,000ha Burnett beef property

- 3 Land classes:
 - Silver leaved ironbark (70%)
 - Narrow leaved ironbark (20%)
 - Blue Gum (10%)
- Cleared area 3,900ha
- + Regrowth 1,000ha
- Sown pasture 800ha
- 600 breeders
- Carrying capacity:
 - (SLIB) 8 ha/AE
 - (NLIB) 10 ha/AE
 - (BG) 5 ha/AE
- Liveweight gain:
 - (SLIB) 140kg/hd/yr
 - (NLIB) 100kg/hd/yr
 - (BG) 150 kg/hd/yr
- WIWO AU\$5.6 million

Two management options:

- Tree clearing 1,000ha (SLIB)



- Tree planting 100ha (SLIB)



Results #1 - Tree regrowth control (1,000ha)

Economic Attributes:	Existing	Revised	Change
Total number of stock carried (AE)	1,530	1,658	+128
Total number of stock sold (Head)	492	532	+40
Total gross margin (AU\$'000)	427	461	+34
Net profit (AU\$'000)	297	326	+29
Return to capital (%)	4.5	4.8	+0.3
Capital value (AU\$'000)	5,585	5,832	+247
Capital cost of management change (AU\$'000)	N/A	150	
Ecological Attributes:	Existing	Revised	Change
1. Soils and hydrology	+2	+3	+1
2. Pastures	+1	+3	+2
3. Weeds	-1	-2	-1
4. Feral animals	0	0	0
5. Riparian areas	-2	-3	-1
6. Atmospheric emissions	-1	-3	-2
7. Native vegetation & habitat	-2	-3	-1
8. Native animal populations	-1	-2	-1
Total score	-4	-7	-3

AU\$1 ≈ ZAR10

Results #2 - Tree planting (100ha)

Economic Attributes:	Existing	Revised	Change
Total number of stock carried (AE)	1,530	1,510	-20
Total number of stock sold (Head)	492	488	-4
Total gross margin (AU\$'000)	427	423	-4
Net profit (AU\$'000)	297	292	-5
Return to capital (%)	4.5	4.3	-0.2
Capital value (AU\$'000)	5,585	5,675	+90
Capital cost of management change (AU\$'000)	N/A	100	

Ecological Attributes:	Existing	Revised	Change
1. Soils and hydrology	+2	+3	+1
2. Pastures	+1	0	-1
3. Weeds	-1	-1	0
4. Feral animals	0	0	0
5. Riparian areas	-2	-1	+1
6. Atmospheric emissions	-1	+2	+3
7. Native vegetation & habitat	-2	-1	+1
8. Native animal populations	-1	0	+1
Total score	-4	+2	+6

AU\$1 ≈ ZAR10

Concluding remarks - issues

- Present framework is rudimentary & still being developed.
- Heuristic - empirical support for economic-ecological linkages required.
- Can handle a wide range of management options (11 at present).
- Framework places options in consistent & transparent context.
- Advantages over 'valuation' methods that lump economic & ecological values into a common metric (\$).
 - Meant to enhance decision-process
 - Masks specific nature of what is being traded.
 - Avoids placing arbitrary values on intangible environmental services.
- Trade-offs are inevitable - few 'win-wins' in real world (esp. private).



Thank You

Contact Us

Phone: +61 41 9715234 (cell), +61 7 32142237
Email: neil.macleod@csiro.au Web: www.csiro.au

CSIRO AGRICULTURE
www.csiro.au

