



Collaborators

ALCOA | Murdoch UNIVERSITY

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Projects: CALM, FPC, CRC Greenhouse Accounting, WA Greenhouse Strategy, RIRDC

Preamble

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- Land and water degradation (salinity, erosion eutrophication) are major ongoing issues
- Various approaches (regulation, voluntary programs) tried, problems persist
- Need for large catchment-scale treatments – where will the money come from? Who pays?
- Market based approach reversed salinity trends in the Denmark River
- Can this approach be expanded with payment for other environmental services such as water, carbon?

Overview

- Carbon investment offers opportunity for reforestation and thus NRM benefits
- Suggest that we can extend this to consider payment for water; implications of this
- Concern that agricultural land use will be displaced by carbon plantations (“food vs fuel”)
- Several additional opportunities for carbon mitigation on farms

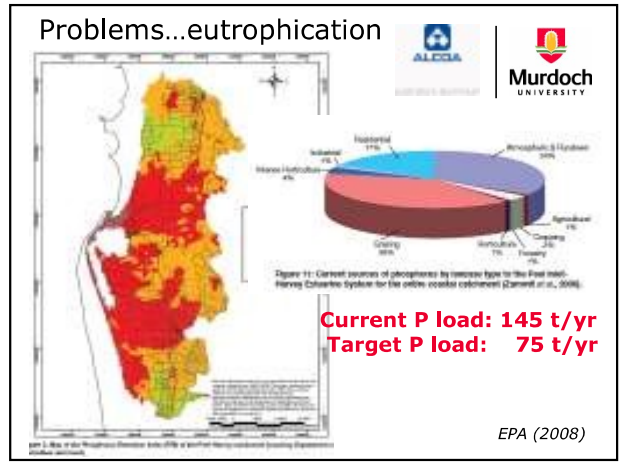


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- Saline 1988
- Saline 1998

Salinity assessment via satellite: the Land Monitor project

Furby et al. 2010. *J. Environ. Quality* 39: 16-25.



Some features of these and other natural resource management problems...

- Widespread, big impacts
- Causes and treatments are generally known
- Various programs tried (regulation, Landcare), but problems mostly persist or recur
- Need for large catchment-scale treatments
- Where will the money come from? Who pays?

Soil Erosion: The Problem Persists Despite the Billions Spent on It

The data shows that have swept part of the Great Plains in recent months have been for many people a warning in the 1990s, when much attention was given to soil conservation. And, in fact, millions of the land that produced the "Great Plains" in the early 1990s are now in various stages of erosion. The erosion is not only a problem for the land itself, but also a problem for the people who live on it. The erosion is not only a problem for the land itself, but also a problem for the people who live on it.

Foster's Remarks:

Soil specialists generally agree that erosion can be reduced to a manageable level by using a combination of biological methods and practices. These include contour plowing, strip-cropping, and other soil conservation practices. However, the erosion is not only a problem for the land itself, but also a problem for the people who live on it.

Carter (1977) Science 196: 409

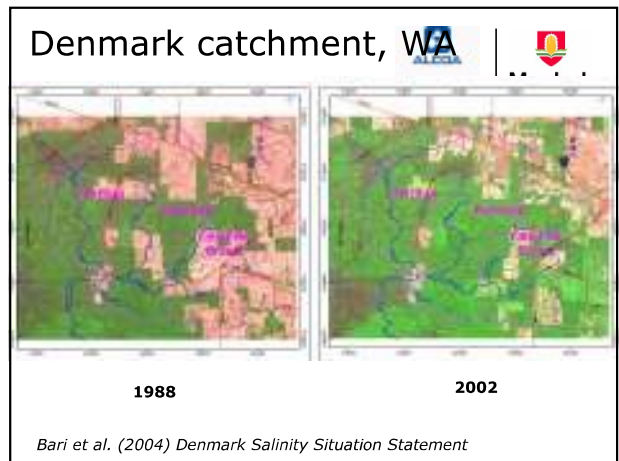
Western Australia's environment report card

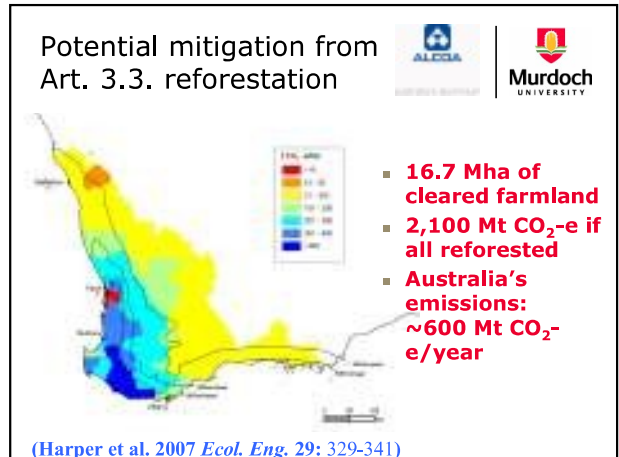
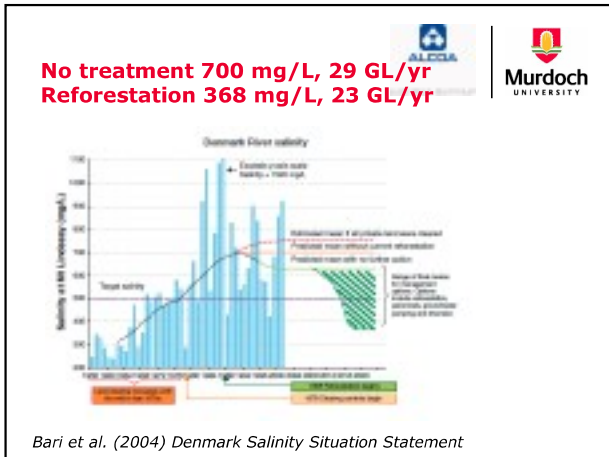
The following report card presents the Environmental Protection Authority's (EPA) progress for WA's environment in 2007. The EPA has considered a number of indicators relating to the condition of the natural resources or assets, the protection of these present and the adequacy of current responses. 'Status' refers to the current overall condition of the natural resources or assets, while 'trend' refers to the likely change in natural resources or asset condition over the past decade.

Issue	Status & Trend	Comments
Fundamental Pressures	Downward trend	Continuing pressure on the environment from WA's economic boom, consumption of natural resources, and climate change require more attention to environmental management.
Atmosphere	Stable	Atmospheric pollution levels across WA are generally within regulatory limits and appear to be under control. Some issues require further attention.
Land	Downward trend	Many land problems in the South West are getting worse. There are fewer problems in other parts of WA.
Island States	Downward trend	Many island states and territories in WA are degrading, especially in the South West. Better management and protection of island waters is required.
Biodiversity	Stable	There is insufficient knowledge about biodiversity in WA. More biodiversity issues are serious and appear to be getting worse.
Human Settlements	Stable	A few human issues in WA have improved problems. Improved knowledge of the marine environment is required.
Heritage	Stable	Some WA settlements are growing at an unsustainable pace with increasing demand for land, water and energy and increasing waste generation.

WA SoE (2007)

Term	n
Salinity	2
Erosion	6
Acidity	1
Carbon	7
Climate change	13
Water quality	30
Biodiversity	96





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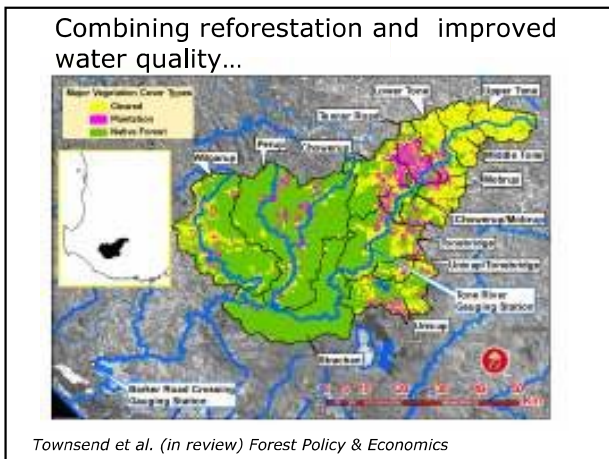
Payments for environmental services

Two broad concepts:

1. Payments for various goods and services produced by reforestation. Traditional (wood) and new (carbon mitigation, water, biodiversity, eco-tourism)
2. Bundling – consider several products at the same time

Success will depend on knowing how the ecosystem responds to change, being able to measure the change and also having a market for the products

Products are at different stages of development; some may not eventuate



Water and carbon as a product...Warren-Tone catchment

Area

- 408,000 ha total, 105,000 ha cleared
- 25,000 ha existing plantations

Water

- Current: 260 GL/year @ 1000 mg/L
- 2035: 245 GL/year @ 700 mg/L

To reach target of 500 mg/L will need another 28,000 ha, and will produce 237 GL/year

Townsend et al. (in review) Forest Policy & Economics

Water and carbon as a product...Warren-Tone catchment



Water value

- 100 GL water @\$150,000/GL
- Net water value of \$285/ha/year

Carbon + timber value

- \$154-\$244/ha/year

Agricultural returns

- \$100-\$160/ha/year

Townsend et al. (in review) Forest Policy & Economics

Implications of having a price for water and carbon following catchment restoration



1. Restoration of dammed catchments – e.g. Mundaring, Collie
2. Are there other catchments that can be restored? Salinity Action Plan only had five water resource recovery catchments
3. Payment for retaining plantations to protect water quality? e.g. Denmark River
4. Is this a mechanism to pay for the thinning of native forest and mine-site rehab?

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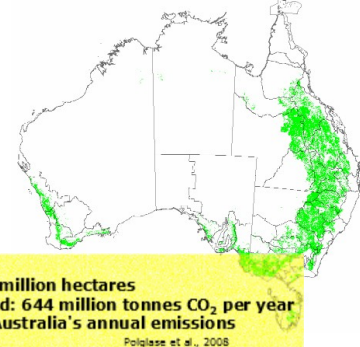


Possible extent of carbon farming



EXAMPLE SCENARIO:

- All areas where forest carbon farming is more profitable than the preceding agricultural enterprise
- Rainfall is <800 mm/year



RESULT:

- Area of opportunity: 69 million hectares
- Total carbon sequestered: 644 million tonnes CO₂ per year
- Which equals 111% of Australia's annual emissions

Polglase et al., 2008

Other analyses...



Garnaut (2008)

9.1 million ha of land where returns would be more than \$100/ha more than current land-use, water interception less than 150 mm/year and permit price of \$20/t

ABARE (Lawson et al. 2008)

CPRS-5 carbon price scenario assuming \$20.88

3.0 million ha – Timber plantations

2.7 million ha – Environmental plantings

Area planted to carbon sinks - Australia



Number of entities	Type of entity	Planting type	Area (Ha)
3	For profit company	Mallee	24,413
2	For profit company	Biodiverse	5,500
2	Government BE	Maritime pine / Mallee/hardwood <i>P. radiata</i>	14,600
5	Not-for-profit	Biodiverse, mallee	8,840
4	Individuals	Oil mallee	11,775
			65,130

Sources: Annual reports, published reports, web-data, commercial-in-confidence data

Mitchell & Harper (2010) ABARES Outlook

Explaining the gap between potential and realisable

- Lack of a carbon compliance scheme
- Low carbon prices where compliance schemes exist
- Investment characteristics
 - Initial capital investment is significant compared with running costs
 - Returns over decades
- Technical risk
 - Lack of solid data in new areas
- Lack of landholder interest



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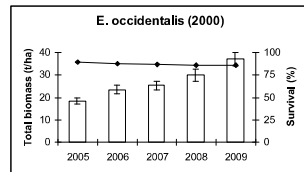
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Using salt-land as a carbon sink

- Large areas of salinized and low productivity land
- Various species on non-productive farmland
- Potential products
 - Biodiversity protection and enhancement
 - C sequestration
 - Hydrological control, land repair



68 tCO₂-e/ha at 8 years

Harper et al. (2009) RIRDC Report 09-059
Sochacki et al. (2007) Biomass and Bioenergy 31: 608-16

Can we increase soil carbon storage?

- "Evaluation of soil carbon in the Peel Region..."
- New Royalties for Regions project via the Peel Development Commission
- Partners – Murdoch, Alcoa, DAFWA, UWA, NDU, ChemCentre
- Evaluation of:
 - prospects for increasing soil carbon storage including amendments (clay, biochar, Alkaloam)
 - benefits in terms of water quality, farm profitability



What about wind erosion?



12-32t CO₂-e/ha following erosion



(Harper & Gilkes 2010 Aeolian Res. 1: 129-41)

Concluding remarks

- Potential of environmental markets (carbon, water) to drive reforestation and achieve water and NRM benefits
- Carbon forestry is part of mix of approaches to meet climate challenge
- Care needed to avoid perverse outcomes: manage through system design, planning and regulations, valuing all costs and benefits
- But also care we don't lose the opportunity to capture carbon investment to tackle NRM problems

