

Using carbon and water ecosystem services to restore catchment function

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DISCOVERIES WELCOME

Major environmental issues that confront the world

Climate change and the 5 Gt C/year "emission gap"

Biodiversity loss via deforestation

Desertification

Maintaining environmental values while producing food

Water – ensuring quality and supply; flood protection



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UNEP Year Book 2011; UNFCCC, FAO various reports

Some features of these and other environmental management problems...

Widespread, big impacts

Causes and treatments are generally known

Various programs tried (regulation, government grants), but problems often 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

Carter (1977) Science 196: 409

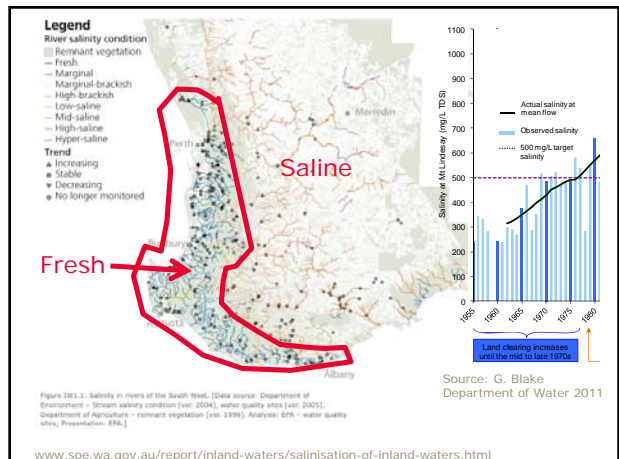
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Problems...salinity

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Evolving possibilities...

Carbon mitigation via reforestation – in Kyoto Protocol (CDM) and national schemes (CFI)

Offer opportunity to achieve large scale restoration

May provide other environmental benefits (water, biodiversity). Need to avoid dis-benefits (competition for land, water)

Payments for environmental services (PES) provides a framework for decision making



Today's talk


Briefly describe reforestation as a component of climate mitigation

Using this reforestation to improve water quality

Case study: Use an environmental services framework to value water, carbon and other products

Explore where this may lead

Summary and conclusions



Possible extent of carbon farming

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EXAMPLE SCENARIO:

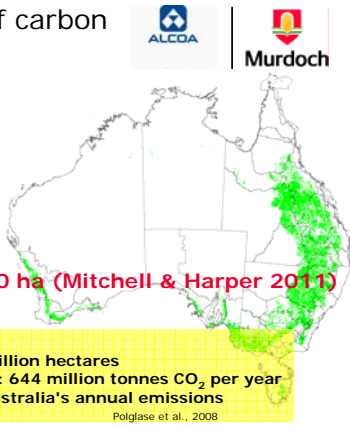
- All areas where forest carbon farming is more profitable than the preceding agricultural enterprise
- Rainfall is <800 mm/year

Current area: 65 000 ha (Mitchell & Harper 2011)

RESULT:

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

Polglase et al., 2008



Potential mitigation from Art. 3.3. reforestation

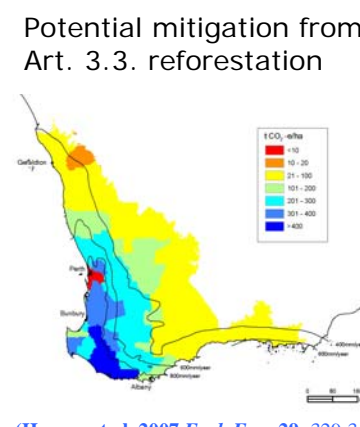
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16.7 Mha of cleared farmland

2,100 Mt CO₂-e if all reforested

Australia's emissions: ~600 Mt CO₂-e/year

(Harper et al. 2007 Ecol. Eng. 29: 329-341)



Positive and negative consequences of using land for carbon mitigation


Positive

Catchment restoration, soil erosion control, biodiversity restoration

Allow broad scale treatments over large areas

Negative


Competition for land and water resources ("food vs fuel", water flows and recharge)

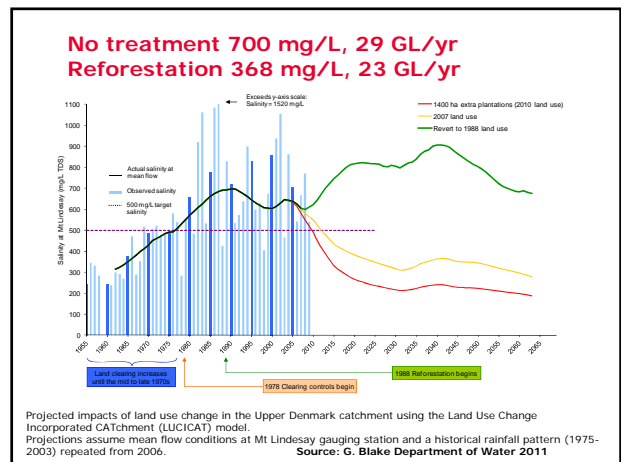
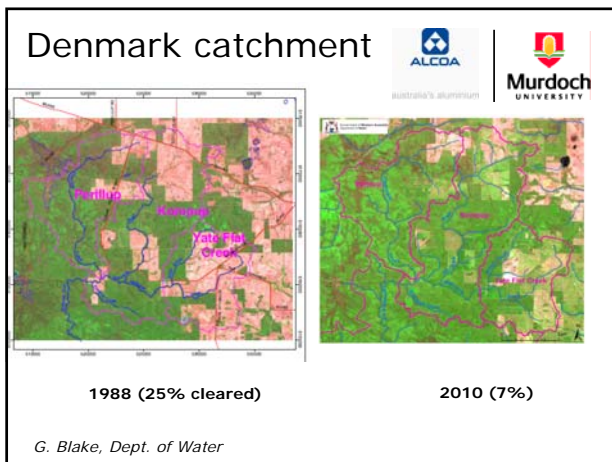
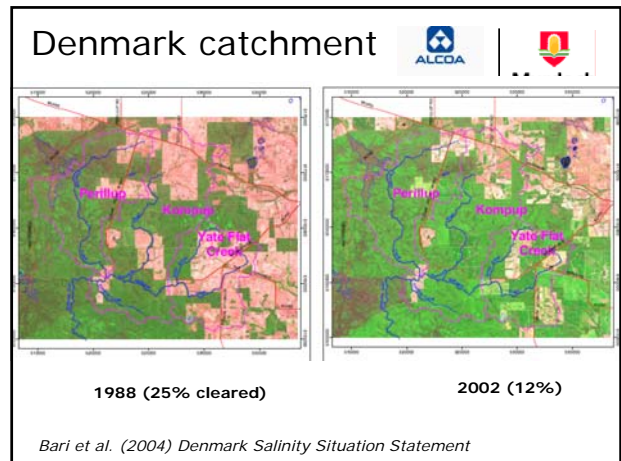
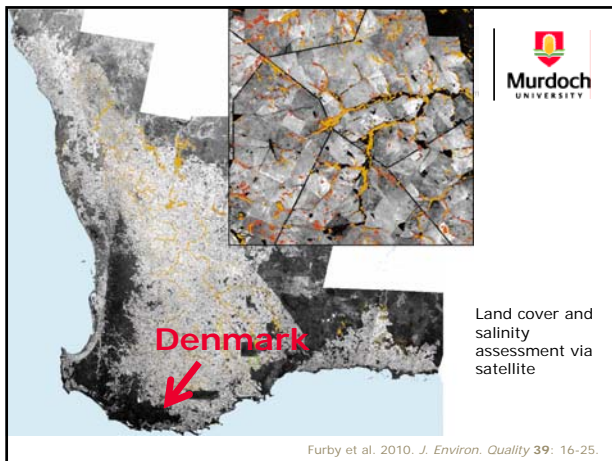


Avoiding the negative consequences of using land for carbon mitigation

Three broad approaches:

- 1) Regulation
- 2) Avoid broad land conversion
 - Integrate biosequestration into farming systems
 - Use abandoned lands
- 3) Value the different costs and returns (payment for environmental services)





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

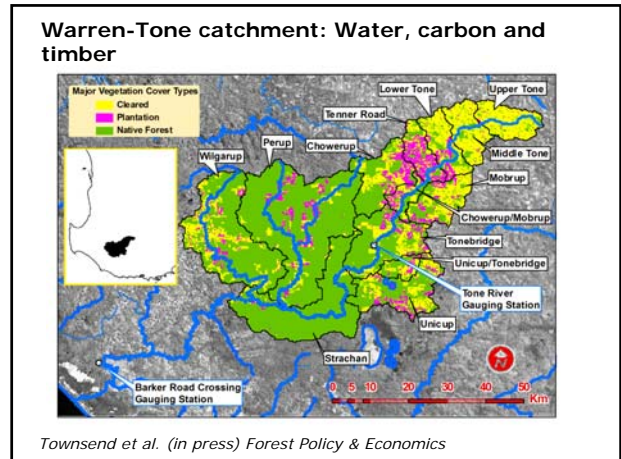
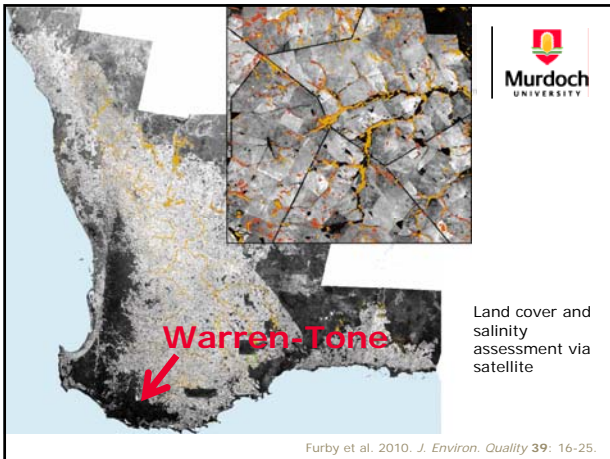
Payments for environmental services

Success will depend on:

- knowing how the ecosystem responds to change
- being able to measure the change
- having a market for the products

Products are at different stages of development

- Well developed (timber)
- Developing (carbon, water, biodiversity)
- May not eventuate (ecotourism)



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

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Area

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

Water

Use existing watershed model (LUCICAT)

- 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; will produce 237 GL/year

Townsend et al. (in press) *Forest Policy & Economics*

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

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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 press) *Forest Policy & Economics*

Already salinized land may provide carbon mitigation

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Large areas of salinized and low productivity land
 Wickiepin: various species on salinized farmland
 Potential products

- C sequestration
- Biodiversity protection and enhancement
- Hydrological control, land repair

How do we value the biodiversity and salinity benefits?

E. occidentalis (2000)

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
 Sochacki et al. (in press) *GCB Bioenergy*

Implications of having a price for water

1. Restoration of existing dammed catchments – e.g. Mundaring, Colлие
2. Are there other catchments that can be restored? WA 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?
5. How would this be implemented?

Concluding remarks

- Reforestation is one of several approaches to mitigate climate change
- Potential of this reforestation to achieve water, land and biodiversity conservation benefits
- CFI rules at present don't allow production forests
- Water responses to land-use change can be predicted; markets exist or are developing. Problem of valuing all benefits (e.g. biodiversity)
- What is needed to develop a water market?

