MARKETS FOR ECOSYSTEM SERVICES – Concepts, Practise and Findings

JVAP | RIRDC | CSIRO | BBG | GBCMA | DIPNR NSW | LWA

Markets for Ecosystem Services

Markets for Ecosystem Services team at CSIRO:

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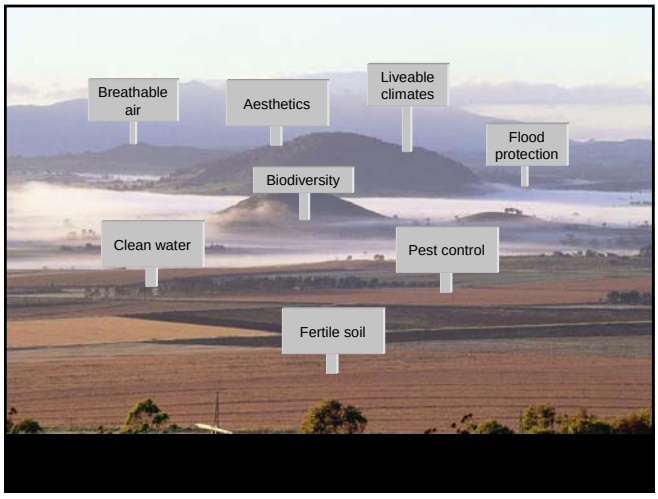
Funded by:

- **CSIRO, JVAP, RIRDC, LWA, GBCMA, Murrumbidgee CMA, Blackwood Basin Group.**
- **Additional joint research through NMBIPP, Wimmera CMA and others – included collaborations with John Ward, Jill Windle, John Rolfe and Bernie Dunn who are here today.**

Markets for Ecosystem Services

- **The Markets for Ecosystem Services Project**
  - What did we set out to achieve?
  - Overview of our approach
  - Case studies and locations
- **Findings to date …**
- **Some new horizons for MBI research**

- **Our ecosystems produce a number of valuable services that landowners and communities value.**
- **These include …**



What do we need for a market?

The idea of a market for ecosystem services seems simple – we need:

- **A buyer / beneficiary**
- **A seller / producer**
- **A way of bringing buyers and sellers together.**

What we already know:

- **Markets for ecosystem services are not so easy:**
- **ES often exhibit public good attributes**
  - non-excludable, non-rival
- **Challenges to investment are presented by multiple market failures**
  - Contested values and property rights, poor information, other market failures
  - But these challenges make government action difficult too!
  - So which option is better?

Research questions:

- **When and where are markets best for ecosystem services provision?**
- **How do we design and implement these markets?**
- **Focus at the regional/catchment scale:**
  - What is special at the regional scale?

Our approach

- **Four step approach as follows**
- **Some steps overlap to a greater or lesser degree or are repeated at different scales as MBI development proceeds.**
- **Remember – there are other options including doing nothing**
- **MBIs are not necessarily the best tool!**

Identifying and assessing markets …

1. What are the potential markets? ← Catchment targets for ecosystem services

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2. Are markets possible?
   - Understanding the issue
   - Identify market constraints

Identifying and assessing markets …

1. What are the potential markets? ← Catchment targets for ecosystem services

2. Are markets possible? ← •Understanding the issue •Identify market constraints

3. What would the market look like? ← •Identify MBI options •Design approach(es)

Identifying and assessing markets ...

1. What are the potential markets?
   - Catchment targets for ecosystem services
2. Are markets possible?
   - Understanding the issue
   - Identify market constraints
3. What would the market look like?
   - Identify MBI options
   - Design approach(es)
4. Test market performance
   - Confirm MBI approach
   - Test market design

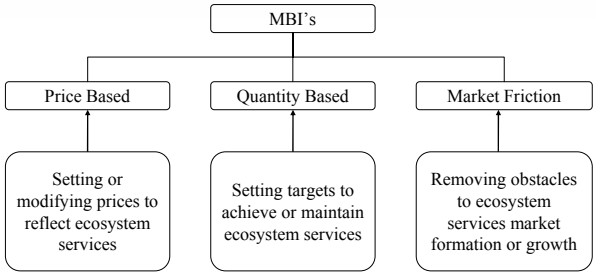
Our approach

We have applied this four step approach in identifying and exploring pilot markets with regional case study partners:

- **Goulburn Broken (Vic)**
- **Blackwood Basin (WA)**
- **Murrumbidgee (NSW)**
- **And have collaborated in similar approaches in Qld (Fitzroy and Desert Uplands), Victoria and Australia wide.**

Our Case Study Partners

Types of market-based instruments



Case study pilots

MBI type	Instrument	Application location	Natural Resource Management Issue
Quantity based	Cap and trade	Coleambally Irrigation Area (CIA), NSW	Improved management of salinity and waterlogging in irrigation areas.
Quantity based	Offsets	Murrindindi Shire, Victoria	Managing the ecosystem service impacts of peri-urban development.
Quantity based	Baseline and credit	Blackwood Basin, WA	Protecting road infrastructure from salinity and waterlogging.
Price based	Auction	Upper Wimmera Catchment, Victoria	Reducing instream salinity in the Wimmera River and tributaries.
Price based	Auction	Desert Uplands, Qld	Conservation of biodiversity with large synergies from achieving biodiversity corridors across the Desert Uplands.
Price based	Auction or similar	Muttama and Jugiong catchments in Murrumbidgee region	Pre-conditions for market-based instruments, especially auctions to outperform existing instruments for biodiversity, in-stream salinity, soil health and water quality.
Price / quantity based	Exploring instrument tradeoffs	Fitzroy Basin	Goal is to reduce nutrients in the Fitzroy and discharge to Great Barrier Reef (GBR) Lagoon.
Market friction	Certification Brokerage	Australia wide	Exploring market impediments in the native seed market in Australia.

Note: Table includes CSIRO lead projects as well as those undertaken jointly with collaborative partners.

SOME HIGHLIGHTS FROM OUR FINDINGS TO DATE

JVAP | RIRDC | CSIRO | BBG | GBCMA | DIPNR NSW | LWA

Markets for Ecosystem Services

Findings

1. **Importance of context / Understanding the issue**
2. **Identifying market constraints**
3. **Information to help identify what form of MBI is best**
4. **Critical market design parameters**
5. **Analysis identifying where MBIs are better**
6. **New ways to test market design**

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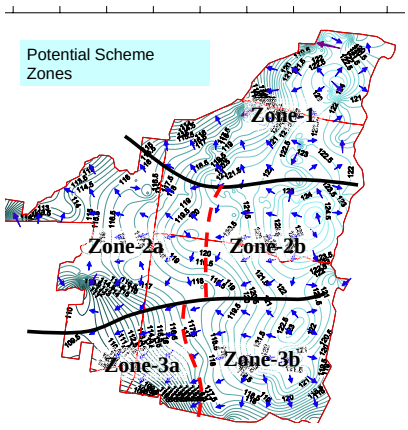
1. Importance of context

- **Biophysical context**
  - Importance of understanding the issue to market design = Coleambally zones
- **Market context**
  - Understanding the potential market = who are the players in the native seed market



Market context -Native seed markets

- **Supply quality and quantity issues**
- **Industry dominated by large scale buyers**
- **Local provenance issues dominate local markets**

Market context -Native seed markets

- Native seed markets have quality and quantity issues reducing their effectiveness in facilitating ecosystem services.
- Industry dominated by large scale buyers (mining, roads) who make up more than 90% of market.
- Local provenance issues dominate inefficiencies in the more numerous (but smaller scale) local and regional rehabilitation oriented markets.
- Why important?
  - support and active involvement of large scale buyers critical to success but could lead to market power issues.

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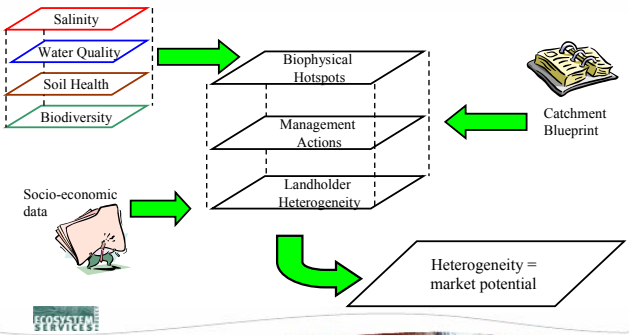
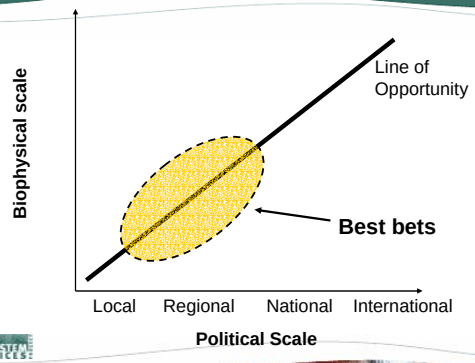
2. Identifying market constraints

- **Where are the potential gains from trade?**
  - Heterogeneity is a key pre-requisite
- **What are the constraints to markets?**
  - Spatial, technical, institutional?

Where are the gains from trade? A rapid assessment tool



Spatial / political constraints



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3. What form of MBI is best?

- One market or many?
- Price or quantity?

One market or many?

		Management Actions Overlapping	
		Yes	No
Biophysical Hotspots Overlapping	Yes	**1.** Multiple outcome market – site and management actions reasonably specific	**2.** Programs/Markets with biophysical sites specified, but greater flexibility in management actions
	No	**3.** Programs/Markets with management actions specified, but greater freedom in location	**4.** Separate single outcome markets – relatively greater freedom in sites and management actions.

Prices or quantities?

Prices	Quantities
• Fixed budget	• Physical targets
• Production cost uncertainty and potential thresholds (steep or kinked marginal cost curve);	• Thresholds (steep or kinked marginal benefit curve)
• Beneficiary pays (rights to damage ecosystem services)	• Impactor pays (no rights to further damage ecosystem services)
• Cost-sharing to achieve change (may be mixed with quantity)	• Time lag between action and outcome (under budget uncertainty)
	• Protection of existing outcomes

Others:

- Limits to jurisdictional powers
- Transaction costs under alternative options

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4. Critical market design parameters?

- The importance of a robust market failure analysis
  - Principles for metric design
- Designing markets that 'fit'
  - Nesting within existing mechanisms and institutions

Why no market already? Market failures

Rights and responsibilities	No clear definition or allocation
Rights and responsibilities	Desired ecosystem services are non-excludable
Asymmetric information	Unknown landholder net costs
Asymmetric information	Landholders don't know benefits
Information failure	Landholders may not be familiar with tools and techniques to change management
Information failure	Scientific uncertainty about the relative and absolute impacts of landuse change
Principle agent issues	Success of landuse change only known later but costs incurred upfront. Difficult to monitor implementation of landuse change.

Taking just one market failure – a lack of a clear definition of rights and responsibilities …

Rights to underpin markets …

- **What: unique commodity (e.g. Carbon)**
- **Quantified: measurable at reasonable cost**
- **Ownership: clear and enforceable**
- **Valuable: worthwhile to define and enforce**
- **Transferable: feasible and low cost**
- **Risk: good science (link to ecosystem service) and secure from government intervention**

Rights to underpin markets …

- What: unique commodity (e.g. Carbon)
- **Quantified: measurable at reasonable cost**
  - Ownership: clear and enforceable
  - Valuable: willing buyers for commodity
  - Transferable: feasible and low cost
  - Risk: good science (link to ecosystem service) and secure from government intervention

What are we trading?

- **We need a metric that reflects the ecosystem service goal (sometimes termed fungibility).**
- **The metric is the measure of what is being bought and sold in the market.**
- **It is THE critical element in evaluating alternative actions / purchases.**
- **Often there a many potential measures that each send a different signal to landholders and thus generate subtly different outcomes.**
- **Therefore it reflects a subtle and complex bundle of tradeoffs in selection and use.**

Metric design principles …

Quantity / quality	**Change to ecosystem service quality and quantity**
Relative change	**Measured change from BAU value?** **Is there a DOC requirement?**
Location	**Are there distance functions, path impacts, thresholds, synergies to different bundles?**
Timing	**Change now preferred over future change**
Risk / certainty	**Probability of success of actions** **Success and permanence of landuse change**
Irreversibility	**Thresholds, extinctions, other?**
Spillover impacts	**Adverse impacts of land use change?**

Designing markets that fit … Nesting in the Murrindindi Case

- **Existing institutions introduce boundaries and potential tradeoffs around how we design MBIs.**
  - Realistically we have to design the MBI within the boundaries
  - Particularly the case for small MBIs
  - So we need to nest MBIs within current institutions and frameworks
- **Nesting is beneficial for some parts of MBI design but not so useful for others (tradeoffs)**
  - Eg metric for native vegetation offset but not much for residual impacts
  - What are these benefits and costs and what do they mean for instrument design?

Nesting in the Murrindindi Case

NATIONAL
- National Strategy for Ecological Sustainable Development
- National Objectives and Targets for Biodiversity Conservation
- National Framework for Management and Monitoring of Australia's Native Vegetation
- National Strategy for Conservation of Australia's Biological Diversity
- National Principles for the Provision of Water for Ecosystems
- National Action Plan for Salinity and Water Quality
- EPBC Act

Nesting in the Murrindindi Case

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STATE OF VICTORIA
- Catchment and Land Protection Act 1994
- Flora and Fauna Guarantee Act 1988
- Planning and Environment Act 1987
- Wildlife Act 1975
- Environment Protection Act 1970
- Victorian River Health Strategy
- Victoria's Biodiversity Strategy
- Victoria's Vegetation Framework
- Native Vegetation Retention Controls
- Victoria's Salinity management Framework
- Victorian Pert Management – A Framework for Action

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GOULBURN BROKEN CATCHMENT (REGIONAL)
- Goulburn Broken Catchment – Regional Catchment Strategy
- Goulburn Broken RCS Achievements Report 1996 . 2001 Draft 2002
- Goulburn Broken CMA Business Plan . 1998, 1998, 1999, 2000, 2001, 2002
- GBCMA Annual and Financial Reports
- Goulburn Broken Dryland Salinity Management Plan 1995-2001 Review Second Generation Salinity Management Plan
- Goulburn Broken Native Vegetation Plan Volume 1 & 2
- Native Vegetation Retention Controls Riverine Health Strategy 2002
- Goulburn Broken Catchment Water Quality Strategy . 1997 & 2002
- Floodplain Management Strategy 2002
- Goulburn Broken Recreation Strategy 2002
- Rabbit Management Action Plan 2001
- Weed Action Plan 2001
- Economic Profile of Goulburn Broken Catchment 2002
- Riparian and Instream Native Flora and Fauna of the Goulburn Broken 2002
- Threatened Flora and Fauna Species and Non-threatened Vertebrate Fauna in the Goulburn Broken Catchments: Status, Trends and Management 2002

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- Threatened Flora and F

Fauna in the Goulburn B
Management 2002

MURRINDINDI (LOCAL)
- Local Planning Policy Framework in compliance with SPPF frameworks and guidelines
- Zoning, overlays and permitting
- Rural Living development guidelines
- Whole farm plans with subdivision application – demonstrate location and type of vegetation and required offsets
- Council specification of required offset and bank contribution using Framework

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5. Where are MBIs better?

- **Modelling the costs and benefits of MBIs over other instruments**
  - Policy options for reducing net recharge in Coleambally Irrigation Area

Where are MBIs better?

Scenario		Economic theory / policy	Estimation methodology	Impact salinity and damage path
1.	Business as usual	Open access (current rice area quota continues)	Estimate a farm model for 10 representative farms in each zone. Aggregate and extrapolate to total.	Yield declines to ? level Linear damage path
2.	Rice cap	Input cap on most damaging process – rice production	As for 1. but reduce rice area proportionately until target recharge achieved. Water can be shifted to alternative crops or sold out of area.	No further yield decline.
3.	Water cap	Input cap on most damaging input – irrigation water inputs	As for 1. but water inputs proportionately reduced until target recharge achieved. No compensation for lost water.	No further yield decline.
4.	Cap and no trade	Cap on net recharge at the farm scale but no trading allowed – optimal regulation.	As for 1. but regional targets proportionately applied to recharge at the farm scale. Water can be sold out of area at average historic prices (no water purchases).	No further yield decline.
5.	Cap and trade	Cap on net recharge with trade allowed.	Model treats the 10 representative farms as one farm and optimises. Water can be sold as per 4.	No further yield decline.

Results - NPV

	Rice quota	Allocation water cap	Recharge cap - no trade	Recharge cap - with trade
TGM/year	$33,484,357	$24,795,853	$33,427,573	$33,973,879
NPV (20 year)	-$2,845,326	-$114,241,969	-$3,573,369	$3,430,911

Policy transaction costs ≤ $268,000 p.a. for 'recharge cap with trade' policy to breakeven

Note:- Analysis did not include

- Waterlogging costs
- Non-farm benefits (eg environmental, infrastructure)
- Banking and borrowing benefits associated with variations in annual climate
- Transaction costs of policy implementation
- Farm fixed costs associated with changing management eg livestock purchases

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6. New ways to test markets

- **Experimental economics to test and aid MBI design**
  - Market failures in Coleambally recharge trading
- **New workshop based tools taking experimental techniques to stakeholders**
  - Desert Uplands auction design workshops and others

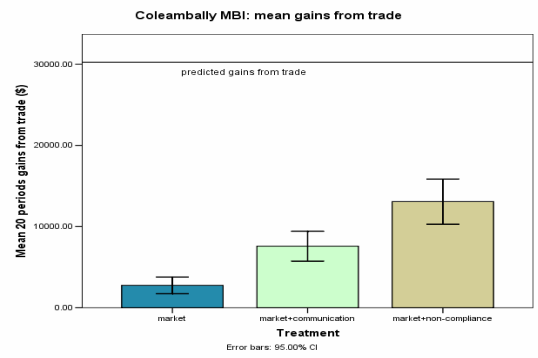
Examining market failures in an experimental context

Experimental Round	Individual recharge information	Institution		Penalty			Replicates
		Communication	Market	Socialised	Individual	Timing	
Control	×	×	×	✓	×	End of session	2
Recharge info	✓	×	×	✓	×	End of session	2
Info + crop loss	✓	×	×	✓	×	Each round	2
Communication	✓	×	✓	✓	×	Each round	2
Market	✓	✓	×	✓	×	Each round	2
Market + comm	✓	✓	✓	✓	×	Each round	2
Market + non-compliance	✓	×	✓	×	✓	Each round	2

Some outcomes from experiments …

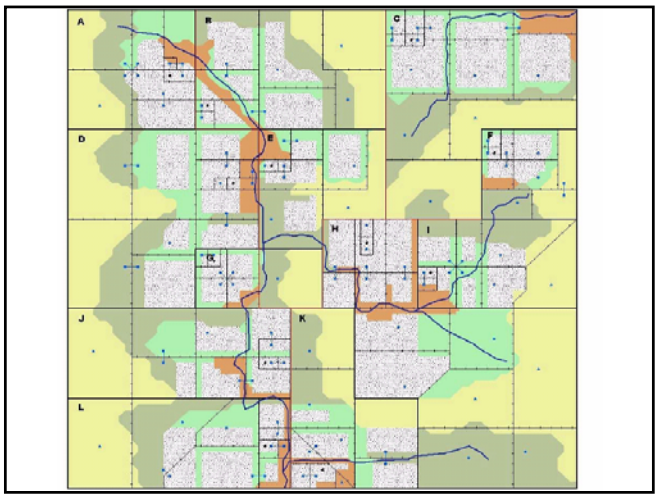
- **Experiments aid in determining the implications of some elements of market failure**
- **Allow pre-tests of market structures**
  - For example experimental tests of potential MBIs in Coleambally reinforced the conclusion that the gains from trade within the irrigator community were unlikely to be sufficient to support a cap and trade based framework.

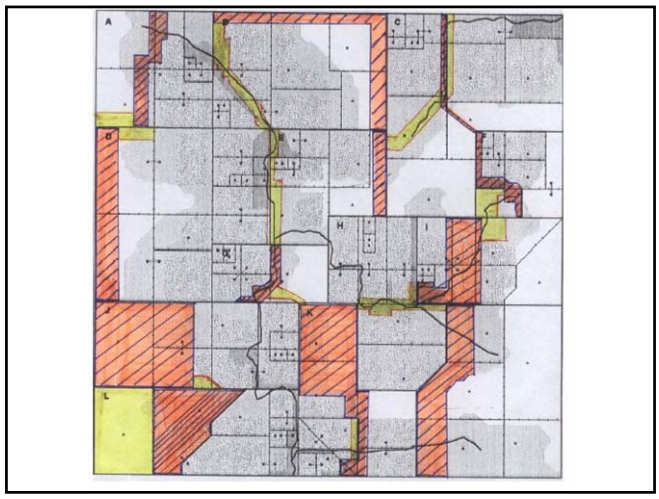
Experimental economics – gains from trade



New workshop tools …

- **Aid in communicating more unfamiliar instruments that may be more complex than existing options.**
- **Can gather specific contextual information to aid in instrument design and implementation.**

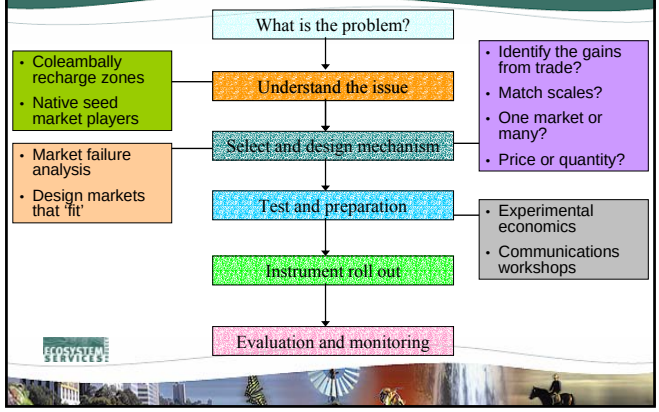




Some conclusions

- **Market based instruments are both possible and may be better than other available options - BUT**
  - Important to ensure the issue is well understood at the start
  - Clearly identify the constraints and opportunities
  - Assess what form of MBI is best
  - Design the MBI to overcome market failures and focus on the desired outcomes
  - Ensure that MBIs are the better policy option
  - Where possible pre-test market design before implementation

MBI design plan



OUR NEW HORIZONS IN MARKET-BASED INSRUMENTS

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Markets for Ecosystem Services: Future Research

Includes role of MBIs in NRM and enhancing MBI effectiveness:

1. **Mixing instruments for maximum effectiveness:**
   - ✓ Bundling instruments to achieve single outcomes
   - ✓ Multiple constituencies or locations
2. **Designing instruments that encourage cooperative behaviour to achieve landscape outcomes.**
3. **Designing effective instruments in environments with biophysical thresholds and discontinuities.**

Markets for Ecosystem Services: Future Research

4. **Understanding the evolution to effective markets.**
5. **Challenge to "nest" MBI with current institutions and instruments.**
6. **Role and possibilities of financial instruments in emerging markets.**
7. **Information requirements for effective markets:**
   a. Trade off between cost and effectiveness
   b. Impact of new information on markets
8. **Improved understanding of reactions to MBIs**

For more details:

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