Land Accounts

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The environment and national accounts

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Content

1. **Emerging capability to create markets for environmental goods and services (EG&S)**
   - Mechanism design
   - Implications for the environment
2. **Implications for national accounts**
   - SNA and SEEA
     - Flow accounts
     - Stock accounts
3. **Information for national accounts**
   - Catchment Management Framework (CMF)
4. **Example accounts**

1. Emerging capability

Mechanism design to create markets

Mechanism design (see Roth 2002)

- Design new institutions that mimic the efficiency properties of markets
  - Game theory (**Von Neumann, Morgenstern, Nash, Vickrey**)
  - Theory of incentives (Laffont)
  - Information economics (**Akelof. Stiglitz, Spence**)
  - Experimental economics (**Smith, Kahneman** and Plott)
  - Mechanism design (**Myerson, Maskin, Hurwicz**)

Applications of the mechanism design approach

- Mobile phone spectrum
  - Adverse selection

1. Emerging capability

Design and create markets

Markets

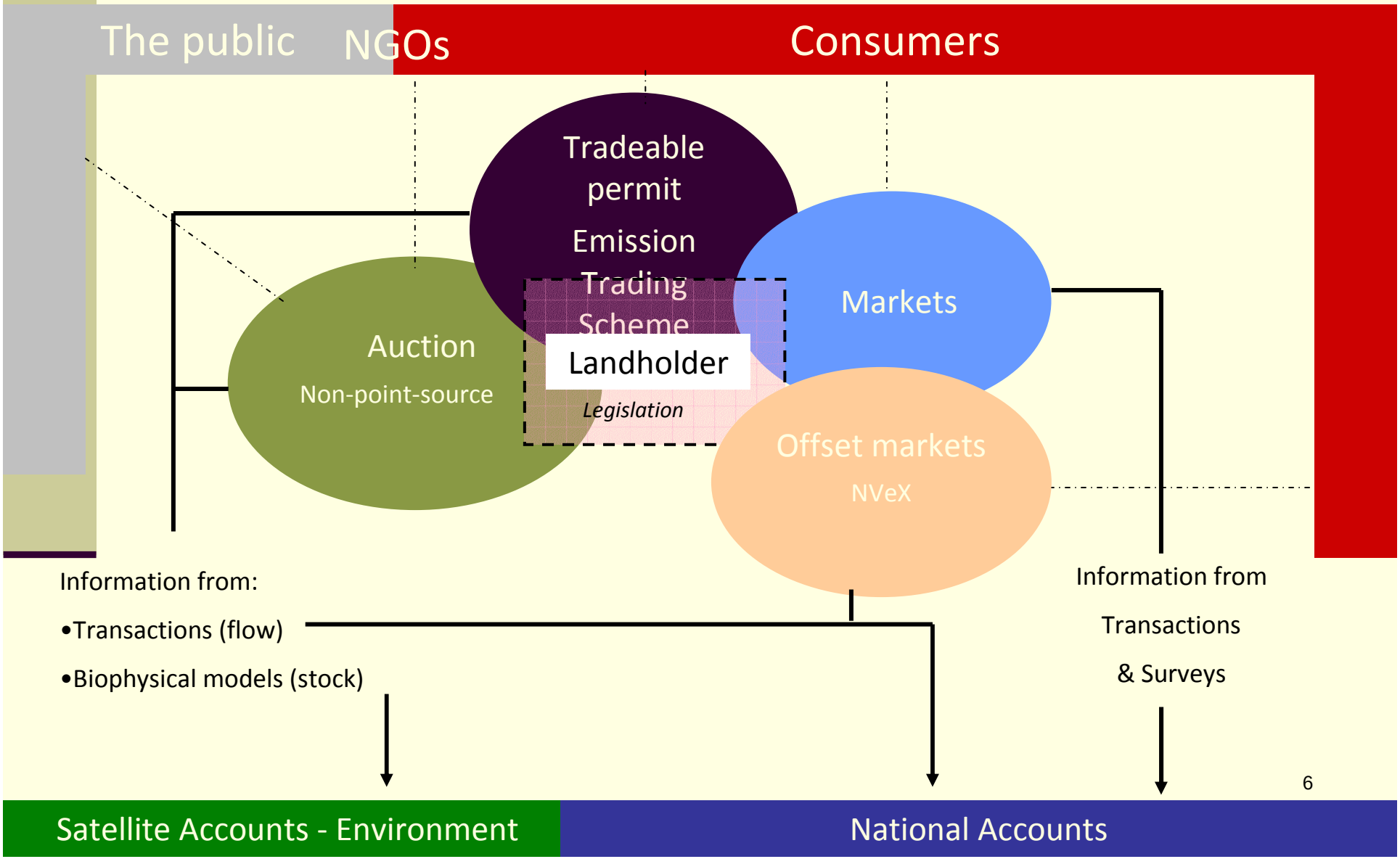
- Commodities
- Capital
- Inputs

Markets to create or not exist

- Mobile phone
- Legislation and regulation
- Airport landing slots
- Government programs
- Aquaculture sites
- Water
- Environment

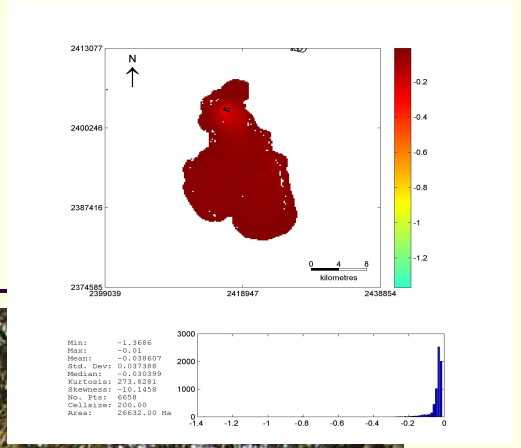
1. Emerging capability

Victoria's ESAS (*ecoMarkets*) program



1. Emerging capability

In the real world



Site visit – visual assessment of habitat

Contract - Payment to grow EG&S:

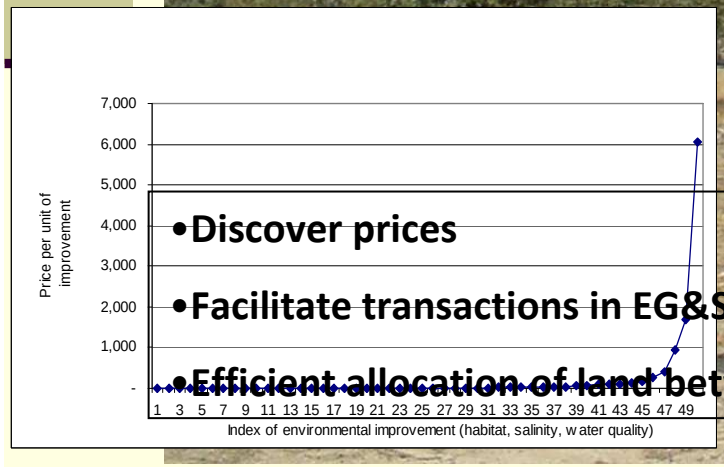
Model – salinity, water quality, carbon, stream flow

- construct fence
- exclude stock
- control weeds and pests
- plant more native species

How much will I receive when I sell the carbon in CPRS market?

What extra would I need to be paid to change land use?

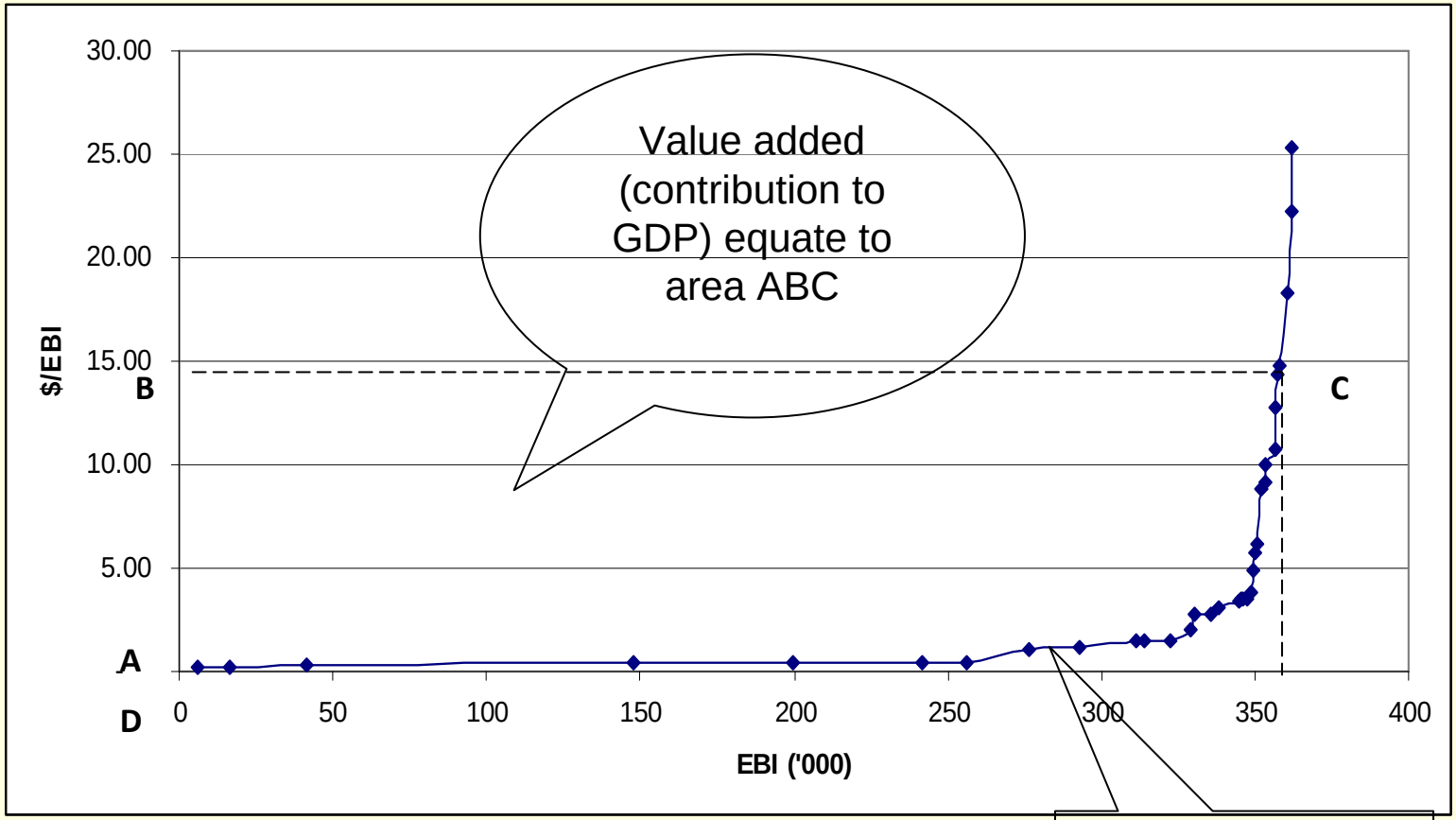
What will other landholders ask for and do I have a good site?



- Discover prices
- Facilitate transactions in EG&S
- Efficient allocation of land between commodities, carbon, EG&S

Submit bid

Contribution to GDP (SNA)

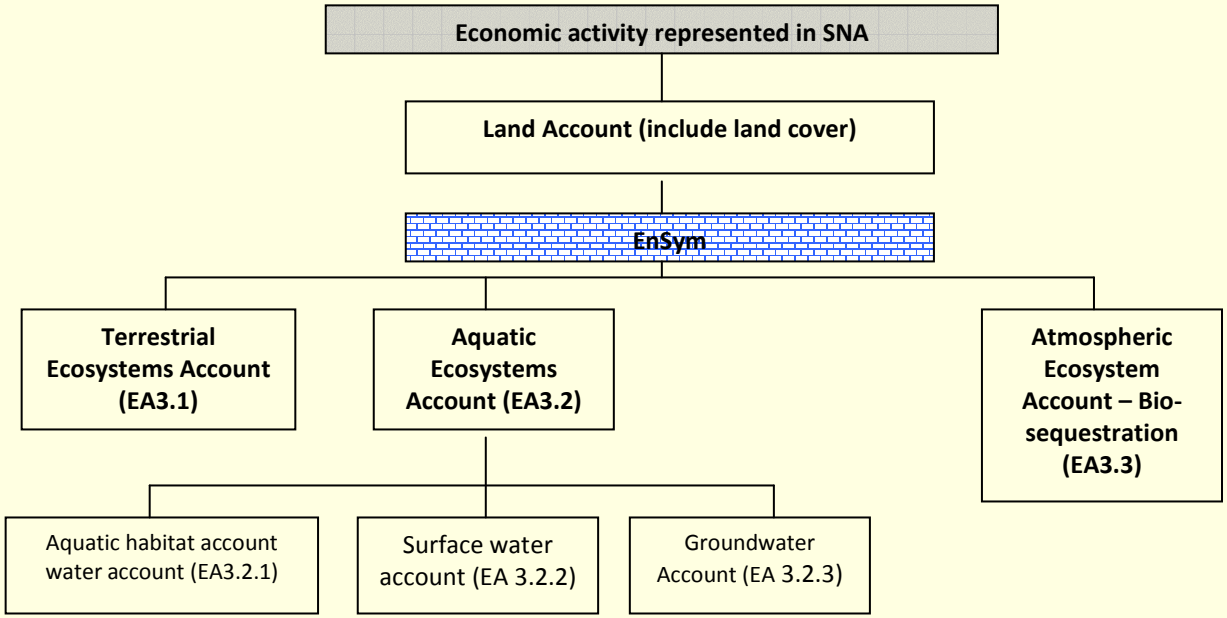


Contribution to GDP (SNA)

- **Production of EG&S**
  - Creates value (Revenue > Costs)
  - Adds to GDP
- **Environment production included in GDP estimates**
  - Revenue available from farm records
  - Costs included in farm records (materials etc.)
- **Markets for EG&S give a small increase in aggregate GDP**
  - Participation constraint
- **Attribution of GDP**
  - Able to attribute a component of GDP to environmental production
  - Able to estimate gross investment in environmental production

3. Implementation for environmental accounts - SEEA

Environmental asset accounts – satellite accounts



Asset accounts – general format

- **Opening stock level – 1750… or now**
  - **Increases in stock**
    - Due to economic activity
    - Due to regular natural processes
  - **Decreases in stock**
    - Due to economic activity
    - Due to regular natural processes
    - Due to natural disasters (net increase)
  - **Changes due to economic reclassification**
  - **Closing stock levels (current)**
  - **Changes in environmental quality**
    - Due to natural processes
    - Due to economic activity

Australian Land Use and Management (ALUM) Classification

- Class 1 – Conservation and Natural Environments

  Land is used primarily for conservation purposes, based on the maintenance of essentially natural ecosystems already present.

- Class 2 – Production from Relatively Natural Environments

  Land is used mainly for primary production, based on limited change to the native vegetation.

- Class 3 – Production from Dryland Agriculture and Plantations

  Land is used mainly for primary production, based on dryland farming systems.

- Class 4 – Production from Irrigated Agriculture and Plantations

  Land is used mainly for primary production, based on irrigated farming.

- Class 5 – Intensive Uses

  Land is subject to substantial modification, generally in association with closer residential settlement, commercial or industrial uses.

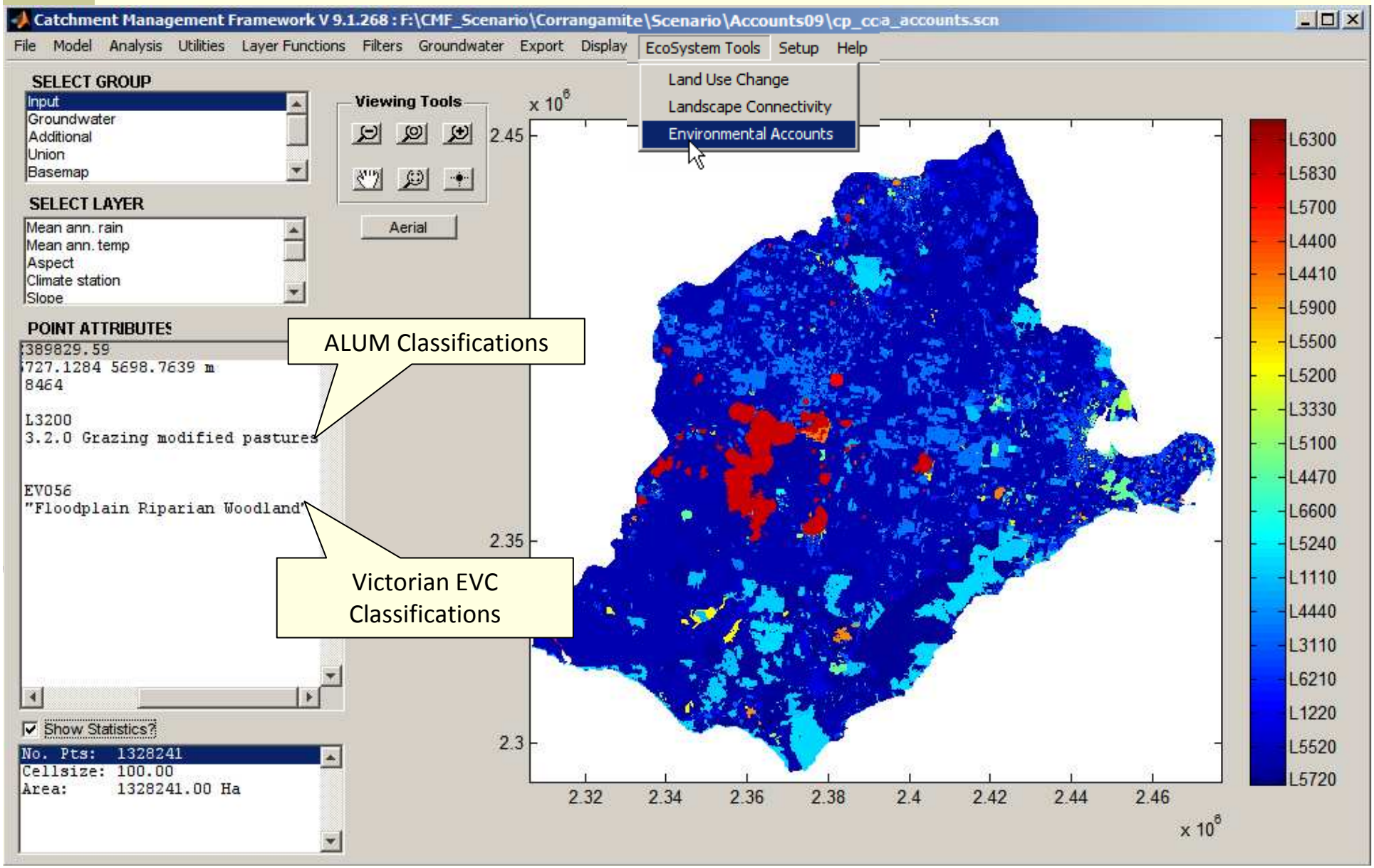
- Class 6 – Water

  Although primarily land cover types, water features are regarded as essential to the classification system.

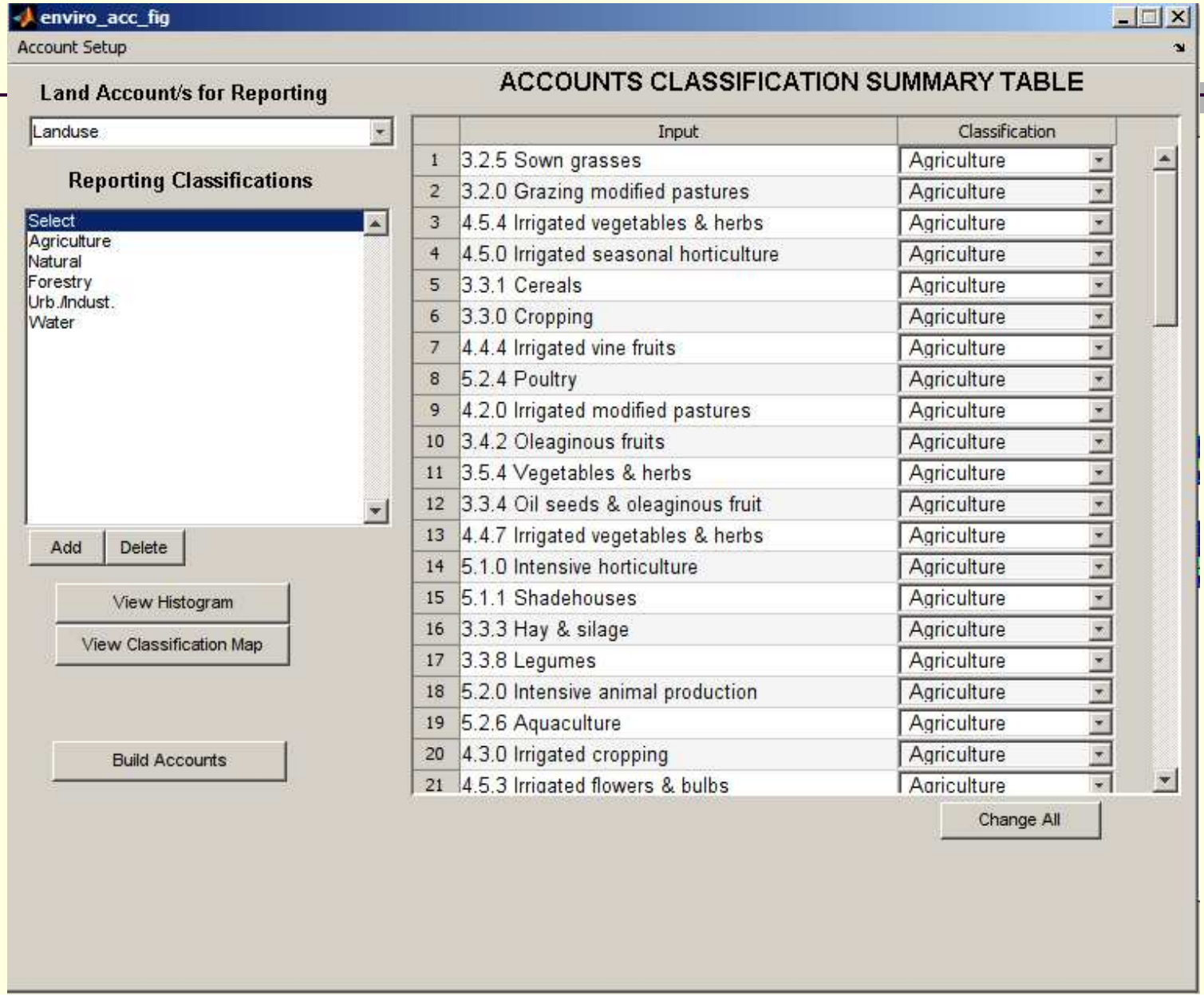
Victorian Application of ALUM

- Class 1
  - 1.1.0 Nature conservation
    - 1.1.1 Strict Nature Conservation
  - 1.2.0 Managed recourse protection
    - 1.2.1 Biodiversity
    - Ecological Vegetation Classes
    - EVC (1 – 999)
- Additional classifications have been added to:
  - represent the value (preferences) within a class
  - estimate the ecological services provided
    - e.g. Rare and threatened, biodiversity conservation status, RAMSAR, National Significance (CFOC)

Catchment Management Framework



CMF – Accounts Interface



Summary Land Account (ha)

	Agriculture	Natural	Forestry	Urban Industrial	Water	TOTAL
Pre-1750		1,328,241				
2008	835,149	219,367	167,159	101,221	5,345	1,328,241
% Change		-83				

- Corangamite – total area = 1.3m ha
  - 17% of the land remains “natural”
  - Predominant change is towards agriculture, making up 75%
    - Still contains some “natural” features
  - Forestry – 15%

Current Biophysical Environmental Services

	Agriculture	Natural	Forestry	Urban Industrial	Water	TOTAL
Carbon Stored	183,794	6,060,573	1,153,741	2,974	24,593	7,425,675
Carbon Sequestration	1,157	692	339	22	3	2,212
Drainage	132	63	33	19	1	248
Dry Matter	266,532	13,162,256	2,489,527	5,457	53,417	15,977,189
Pan Evaporation	925	237	174	112	6	1,454
Transpiration	255	90	127	9	2	483
Surf. Runoff	6	1	2	4	0	14
Erosion (t/h)	0	0	0	0	0	0
Rainfall (mm)	580	182	174	71	4	1,011
Subsurface Lat.	40	25	14	6	0	86
Recharge	92	38	19	13	1	162
Evaporation	187	27	11	38	1	264

Carbon Stored (t/m) - Biosequestered

	Agriculture	Natural	Forestry	Urban / Industrial	Water	TOTAL
Pre-1750	-	69,079,663	-	-	-	69,079,663
2008	183,794	6,060,573	1,153,741	2,974	24,593	7,425,675
% Change		-91				**-89**

- 89% of the carbon that was stored in the landscape has been released since European settlement
  - to the atmosphere
  - stored in buildings etc
- The largest store is still in the natural systems (81%)

Runoff (ML/yr)

	Agriculture	Natural	Forestry	Urban / Industrial	Water	TOTAL
Pre-1750		5,209,596				5,209,596
2008	6,413,089	1,280,301	1,805,200	4,028,518	37,836	13,564,944
% Change		-75				**160**

- 160% increase in runoff to streams
  - A significant movement away from natural flow regimes
- Re-establishing the landscape in key areas can contribute to returning flows to “natural” regimes (EcoTender in Victoria)
- Flood and asset risks can also benefit from strategic land use change

Recharge (ML/y)

	Agriculture	Natural	Forestry	Urban / Industrial	Water	TOTAL
Pre-1750		173,061,320				173,061,320
2008	91,550,860	37,554,013	19,333,963	12,754,149	906,292	162,099,277
% Change		-78				**-6**

- 6% decrease in recharge (to groundwater)
  - A small overall change
  - A substantial change in the area it is occurring
  - Saline land increases a result of increasing recharge in specific areas!
  - Agriculture is located in high (relatively) rainfall areas and thus increasing net recharge to groundwater – more saline land area

Habitat Hectare

(Terrestrial biodiversity metric)

	Agriculture	Natural	Forestry	Urban/ Industrial	Water	TOTAL
Pre-1750		1,328,241				1,328,241
2008	134,173	116,922	96,451	26,144	2,265	375,954
% Change		-91				**-72**

- 72% decrease habitat hectare
  - Significant loss in habitat services for flora and fauna
- NOTE: agriculture and forestry still provide some services
  - Victorian EcoTender pays landholders to manage natural systems on their land and thus increase habitats services for flora and fauna

Summary Land Account (ha)
(Annual reporting of transactions)

	Agriculture	Natural	Forestry	Urban / Industrial	Water	TOTAL
2008	835,149	219,367	167,159	101,221	5,345	1,328,241
Changes due to transactions	-330	330	-	-	-	
Additions to stock levels	-	-	-	-	-	
Deductions from stock levels	-	-	-	-	-	
Others changes to stock levels	-	-	-	-	-	
2009	834,819	219,697	167,159	101,221	5,345	1,328,241
% Change	-0.04	0.15	0.00	0.00	0.00	

- $1.2m EcoTender in Corangamite
  - 330 ha of land is now defined as “natural”
  - Remains in private ownership and under private management
  - *EcoTender transactions between the Victorian government and landholders add value to the agricultural sector by producing EG&S*

Habitat Hectare – biodiversity

(Annual reporting of transactions)

Area (ha)	Agriculture	Natural	Forestry	Urban / Industrial	Water	TOTAL
2008	134,173	116,922	96,451	26,144	2,265	375,954
Changes due to transactions	4,950	-	-	-	-	
Additions to stock levels	-	-	-	-	-	
Deductions from stock levels	-	-	-	-	-	
Others changes to stock levels	-	-	-	-	-	
2009	139,123	116,922	96,451	26,144	2,265	380,904
% Change	3.69	0.00	0.00	0.00	0.00	**1.32**

- 1.3% increase in habitat services for flora and fauna
  - *All these services are being sourced from "agricultural" land*

Status of Victorian Accounts project (Next twelve months)

- Ten catchment management areas covering all of Victoria
- Can geographically report for any zones / areas
  - local council, sub catchments, river basins etc
- Can geo-reference all transactions involving the environment
  - Can spatially present locations of all transactions
- Develop alignment between ALUM classification system and Victorian land use mapping
  - Process for inclusion of Ecological Vegetation Classes
- Provide the Environmental Accounts Reporting System (EARS) to NRM investors for reporting to the commonwealth and state government

National application

- Catchment Management Framework (CMF)
  - Is applicable nationally
  - Landuse data sets
  - Base data sets – status
    - Soil mapping, DEM
    - Native vegetation classifications
- Potential to report nationally consistent set of environmental accounts and geo-referenced transactions

5. Some conclusions

Summary points

1. **Can now create markets where missing**
   - Mechanism design
   - Significant investment in quantitative tools that connect science with points in space

2. **Markets for EG&S will eventually be attractive to government**
   - Superior economic efficiency properties (+30%)
   - Design to mimic markets

3. **Increasing use of markets for EG&S**
   - Water markets
   - Emission Trading
   - Procurement auctions (Victoria)
   - Offset markets (eBX)

4. **Transactions in EG&S reveal price and define value attributes**

5. **Implications for national accounts:**
   - Environmental production recognised in Flow accounts (transactions occur) in SNA
   - Environmental stocks included in Asset accounts (models developed) using SEEA

Thank you