Geographic Information Systems: How they can facilitate Environmental Accounting

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This session…

WAVES

- The importance of Geographic infrastructure
- Stable boundaries for reporting
- Use of remotely sensed data
- Solving the spatial challenge of integrating data:
  - Modify the method of data capture
  - Change the format
  - Model the data
  - Integrating different formats

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The importance of Geographic infrastructure

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- Successful data analysis with GIS relies upon well managed data and software
- Maintain meta data about each dataset you acquire and use
- Using the capabilities of other organisations is vital – one organisation cannot collect and manage all data!
  - Build networks with other GIS users
  - Share your skills

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Stable boundaries for reporting

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- Produce accounts for regions that are unlikely to change, but also relevant to policy makers
- Understanding which other data your account users will look at can help decide what geography to choose
  - producing Oil Palm data
- Ideally the account producer would maintain the output geography
  - This may not be practical for Ecosystem Accounting

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Use of remotely sensed data

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- Understand the quality and accuracy of data
  - Correction for atmospheric interference
  - Field validation to calibrate and test derived products
  - Maintaining consistency over time series
- Landsat series of satellites provides a 15 year time series
  - Raw data freely available from USGS

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Solving the spatial challenge of integrating data

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Modify the method of data capture

- Example from the ABS Agriculture survey program
- Agriculture is the biggest land user in Australia
- Our 5 yearly Agriculture Census is the second biggest collection by the ABS following the Census of Population and Housing
  - Provides a very rich data source for ecosystem accounts

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Modify the method of data capture

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ABS Agriculture business frame:

Current spatial representation using address latitude/longitude.

Spatial representation using a land parcel frame.

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Solving the spatial challenge of integrating data

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Change the format of the data

- Generally a simple process in GIS
- Some important considerations:
  - The raw format is always the most accurate
  - Converting to another format generally results in reduced accuracy
- Some GIS tools convert data for you behind the scenes
  - ArcGIS Tabulate Area tool does this

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Change the format of the data

Examples: Polygon to raster (grid)

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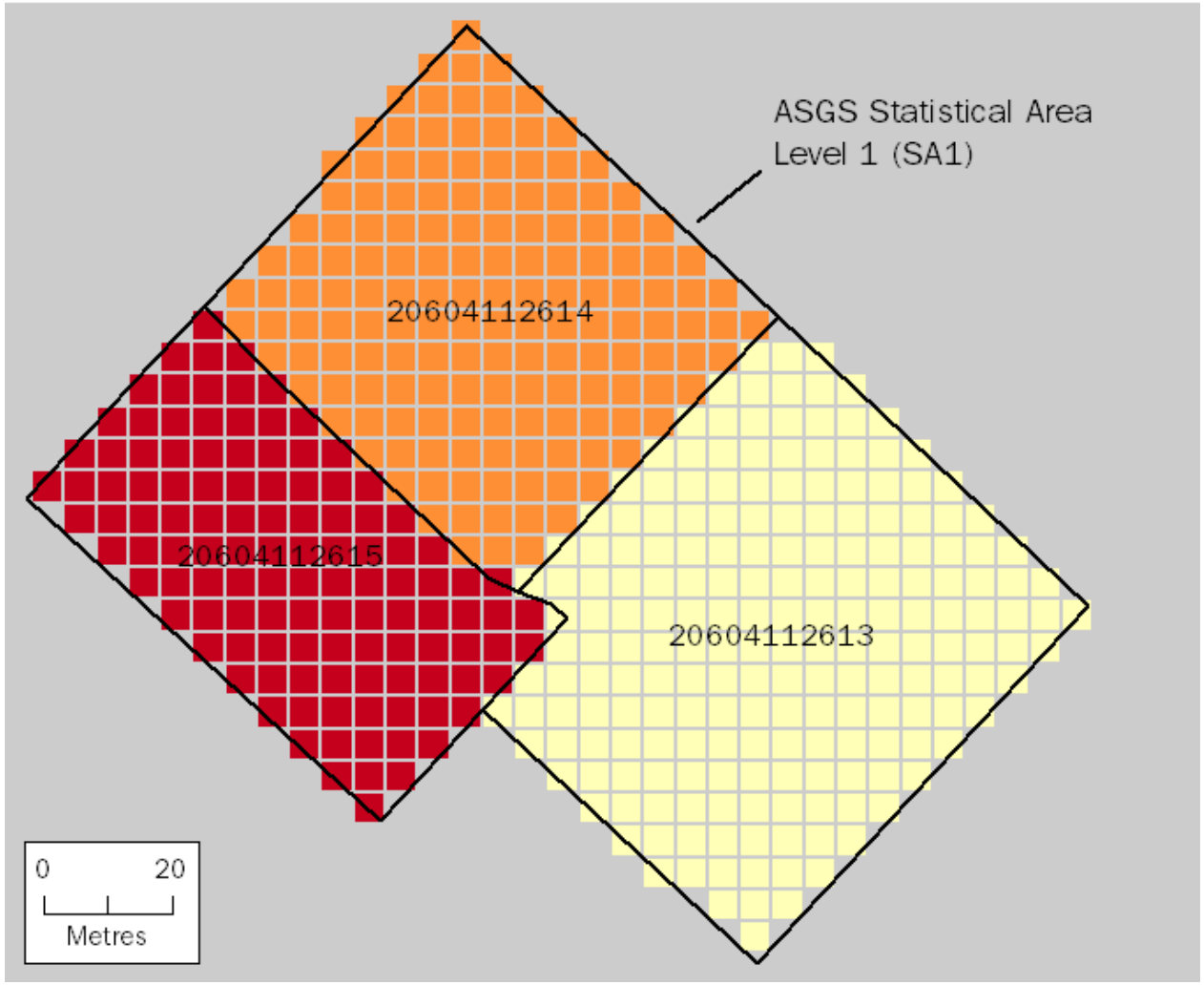

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Change the format of the data

Examples: Raster(grid) to polygon

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Solving the spatial challenge of integrating data

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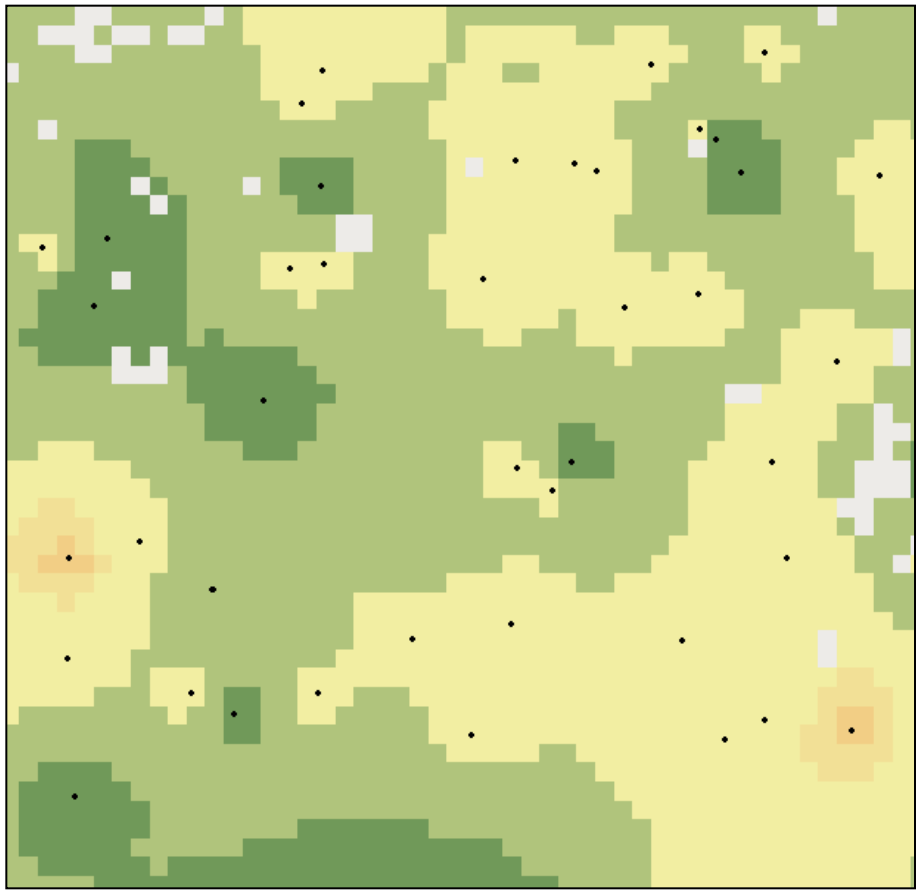
Model the data

- Input data is point location of Wheat producing farms
- Data item is tonnes per hectare of wheat produced (Yield)
- Technique used was inverse distance weighting (others being investigated)
- Output constrained using land use mapping of “cereal cropping”



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Advantages of modelling data include:

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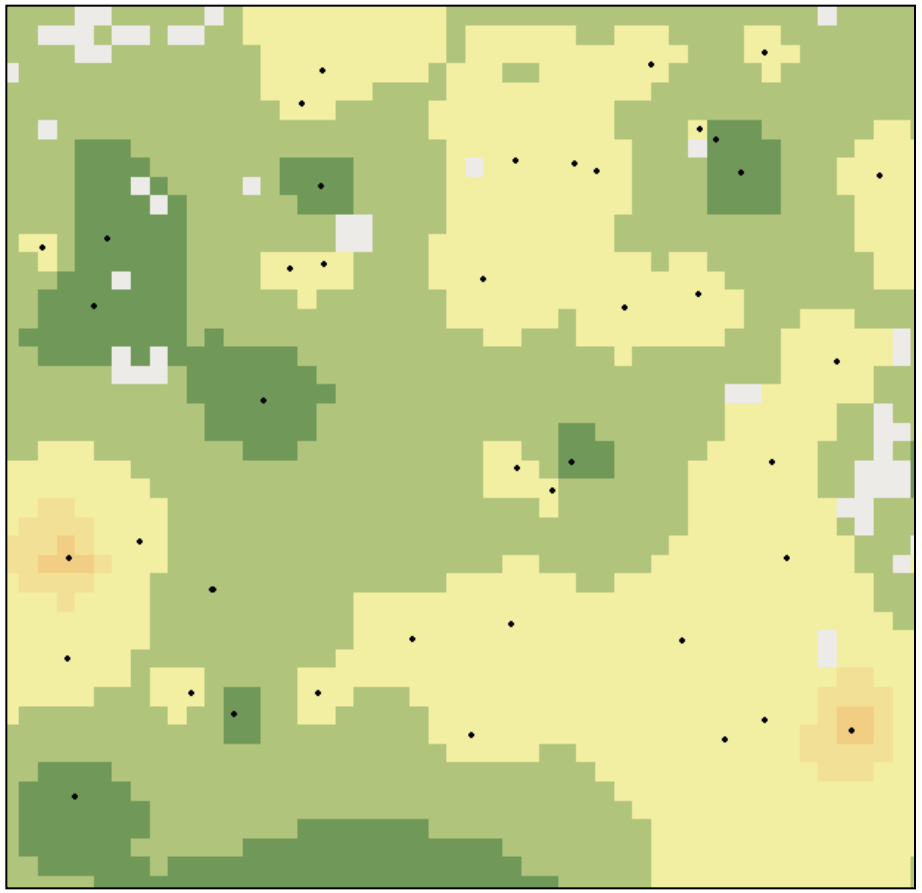
- More detailed spatial representation compared with traditional output geography
- Ability to generate estimates for locations where you had no data
- Provides built-in perturbation (uncertainty) which assists with disclosure control
- Facilitates integration with other gridded data for Ecosystem Accounts



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Solving the spatial challenge of integrating data

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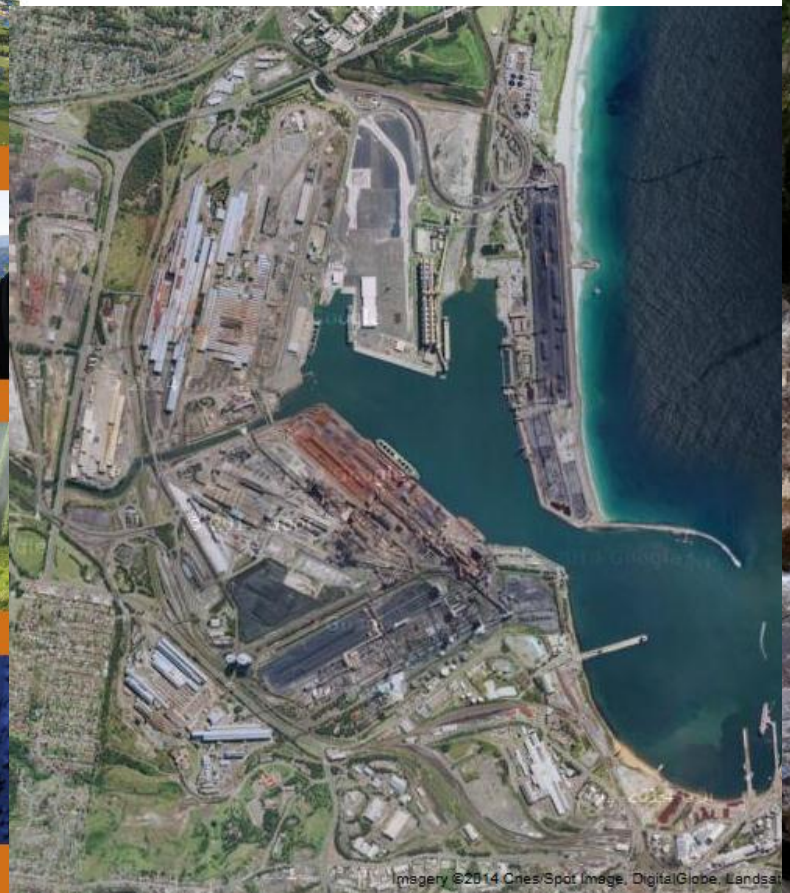
- Integrating different formats of spatial data



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Bringing the Economy to the Land

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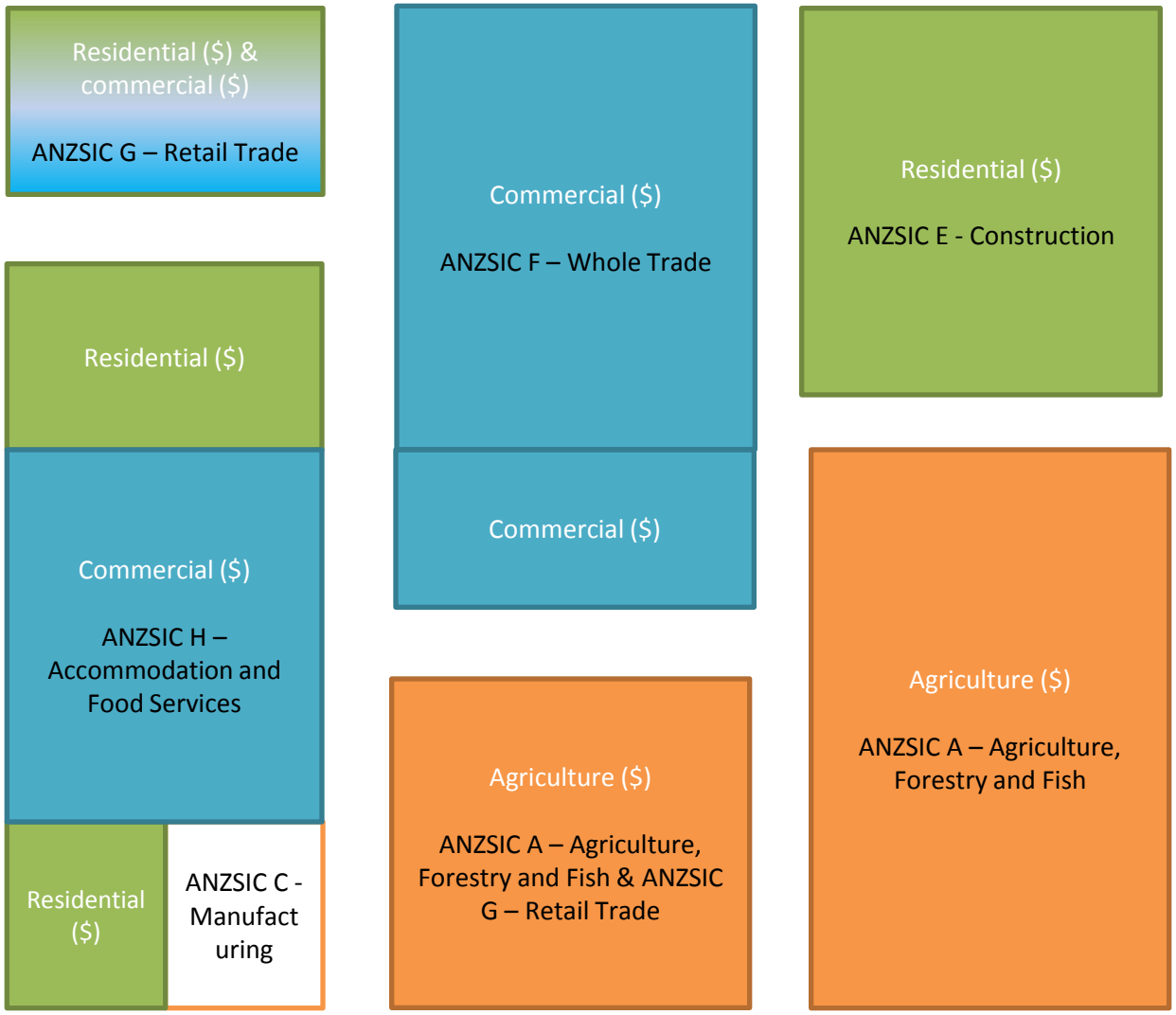
- Business locations were used to allocate industry type using the Australian and New Zealand Standard Industrial Classification (ANZSIC) 2006 codes to land parcels.
- The ABS Business Register holds an address for each business.
- Using Geocoding software and a National Address Index each address can be assigned a latitude and longitude.
- This point data can be integrated with polygons of Cadastral parcels

Bringing the Economy to the Land



Bringing the Economy to the Land

- Integrating business locations with land parcels enabled the production of tables showing the value of land by Industry

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Land Account: Great Barrier Reef Regions, Experimental Estimates, 2011. (Cat no. 4609.0.55.001)

Released at 11.30am (Canberra time) 28 February 2011

Table 2.4 : Land Use Classified by DERM by Sector, Fitzroy NRM Region (rateable value), 2008-09

			DERM LAND USE CATEGORY						
	ANZSIC	Sector	Agriculture	Retail and Wholesale	Transport and Storage	Industrial	Sport, Recreation and Accommodation	Community Services	Other
								$'000	
		Industry							
	Division A	Agriculture, Forestry and Fishing							
		Nursery and Floriculture Production	5,806.1	np	600.0	np			
		Mushroom and Vegetable Growing	3,506.5						
		Fruit and Tree Nut Growing	11,955.7	np	np	np	1,141.0	np	np
		Sheep, Beef Cattle and Grain Growing	3,484,839.5	29,046.3	2,472.6	37,816.0	4,992.3	3,445.0	1,941.6
		Other Crop Growing	81,873.7	1,893.0	np	1,226.1	1,067.0		np
		Dairy Cattle Farming	27,660.4	np	np	np			np
		Poultry Farming	2,534.5						
		Deer Farming							
		Other Livestock Farming	64,738.2	np	np	2,213.7	np		
		Forestry and Fishing (d)	87,666.8	2,749.7	1,853.2	4,623.0	np	np	705.0
		Total Agriculture, Forestry and Fishing	**3,770,581.4**	**37,122.2**	**5,490.9**	**61,697.9**	**7,734.9**	**3,851.0**	**2,782.9**
	Division B	Mining	15,779.2	np	430.0	26,246.3			np
	Division C	Manufacturing	39,060.3	16,112.6	7,511.8	35,833.1	2,087.5	np	np
	Division D	Electricity, Gas, Water and Waste Services	3,462.0	np		np		np	np
	Division E	Construction	184,815.4	17,375.0	23,710.2	38,918.1	11,057.5	3,691.0	np
	Division F	Wholesale Trade	24,804.9	10,809.0	np	11,221.8	np		
	Division G	Retail Trade	40,094.1	np	9,856.5	22,541.5	np	1,418.0	np
	Division H	Accommodation and Food Services	40,293.2	20,679.1	np	5,055.0	np		np
	Division I	Transport, Postal and Warehousing	72,173.1	11,737.2	5,473.0	np	4,801.1	np	np
	Division J	Information, Media and Telecommunications	np	17,009.5		1,399.0	np		np
	Division K	Financial and Insurance Services	199,519.2	38,890.0	6,457.4	25,127.6	13,464.0	642.5	1,030.5
	Division L	Rental, Hiring and Real Estate Services	148,931.1	39,295.0	12,952.7	42,063.0	17,756.5	6,098.5	2,315.7
	Division M	Professional Scientific and Technical Services	82,590.1	19,424.5	4,083.0	13,946.5	8,671.4	np	np
	Division N	Administrative and Support Services	31,609.7	7,346.0	1,284.5	3,810.5	4,150.0	np	284.5
	Division O	Public Administration and Safety	np	1,400.0		np			np
	Division P	Education and Training	29,341.2	4,191.5	np	1,622.7	2,246.5	529.0	np

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Riparian vegetation example

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Integrating different formats of spatial data

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- Riparian vegetation example

57 **Do you have any rivers or creeks on your holding?**

Including
- Rivers or creeks that are currently dry
- Rivers or creeks that are part of your holding's boundary

No ☐ Go to Question **60**

Yes ☐

58 **Approximately what area of river or creek banks on your holding was protected for conservation purposes at 30 June 2010?**

None … … ☐ Go to Question **60**

Area … … ,,, . 0 ha

Don't know ☐

59 **Which of the following activities did you undertake to protect river or creek banks for conservation purposes on your holding between 1 July 2009 and 30 June 2010?**

	Please tick all that apply	Hectares
(a) Total livestock exclusion … … … … … … … … … … … …	☐ … …	,,, . 0
(b) Controlled livestock access … … … … … … … … … … … …	☐ … …	,,, . 0
(c) Planted and/or seeded native vegetation… … … … … … … …	☐ … …	,,, . 0
(d) Managed weeds … … … … … … … … … … … … … … … …	☐ … …	,,, . 0
(e) Managed pests and/or feral animals … … … … … … … … …	☐ … …	,,, . 0
(f) Retained existing native vegetation … … … … … … … … …	☐ … …	,,, . 0
(g) Other …	☐ … …	,,, . 0

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Integrating different formats of spatial data

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- Riparian vegetation example

Aim: "To calculate the length of streams and area of associated native vegetation on Agricultural properties from the ABS' Agriculture business frame using remotely sensed data"

Organisational goals:

- Increased data integration
- Reuse of existing data
- Data substitution/augmentation
- More efficient sampling
- Reduction in field costs
- Quality assurance and data confrontation

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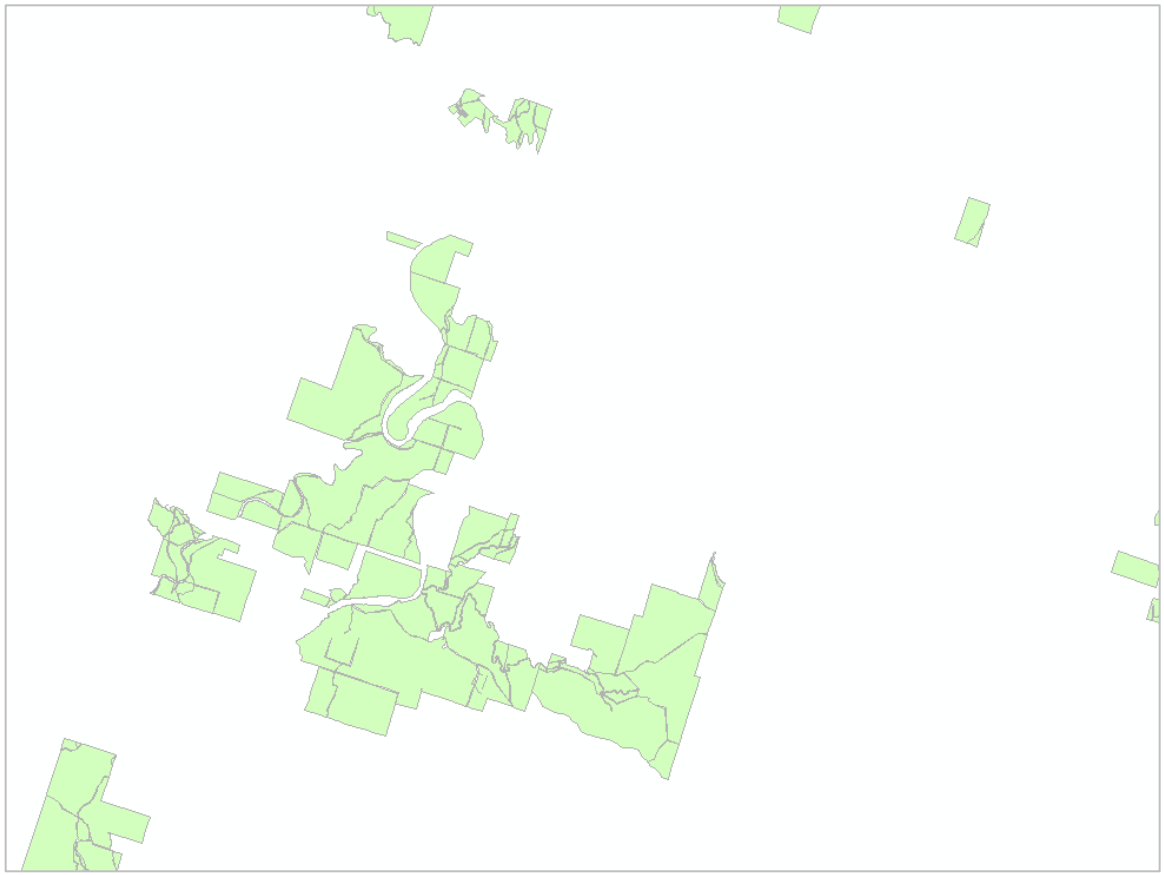

Partial parcel frame for 2010/11 Ag Census

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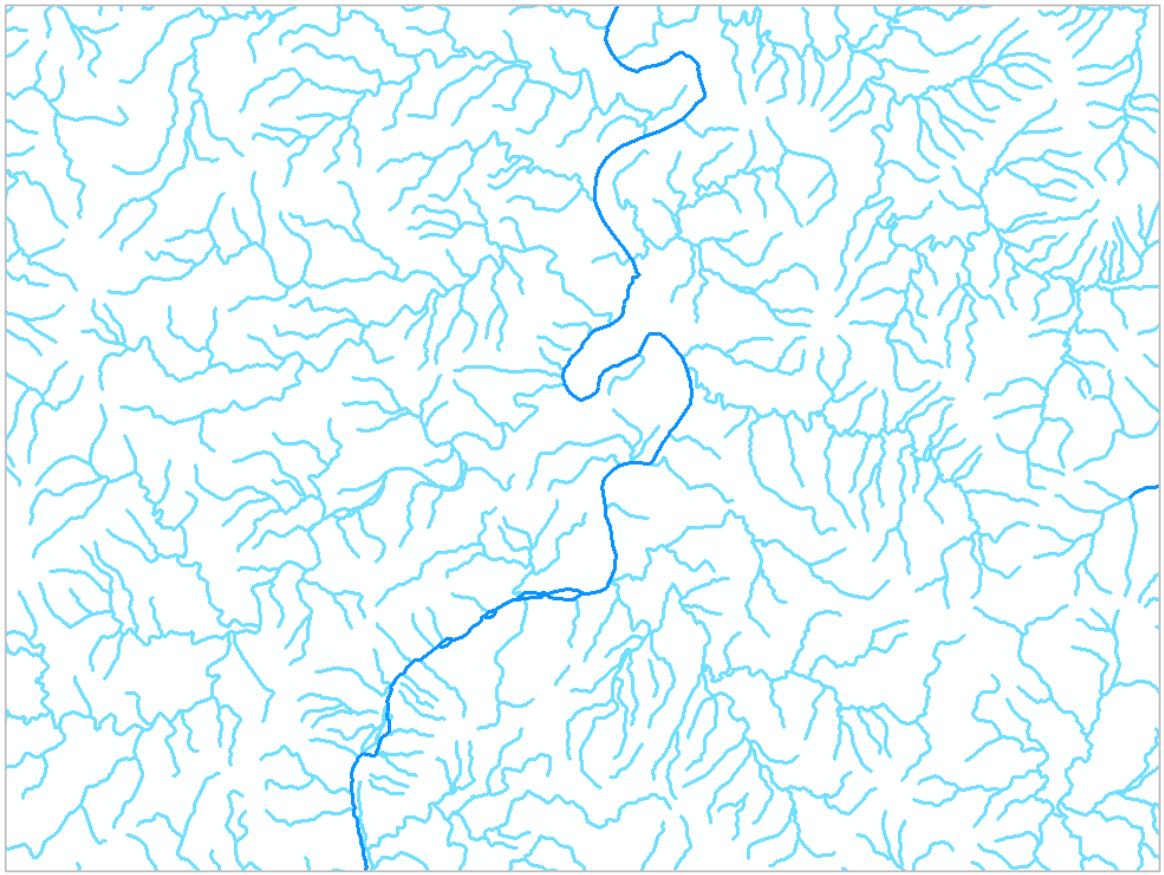

Australian Hydrological Geospatial Fabric (Geofabric)

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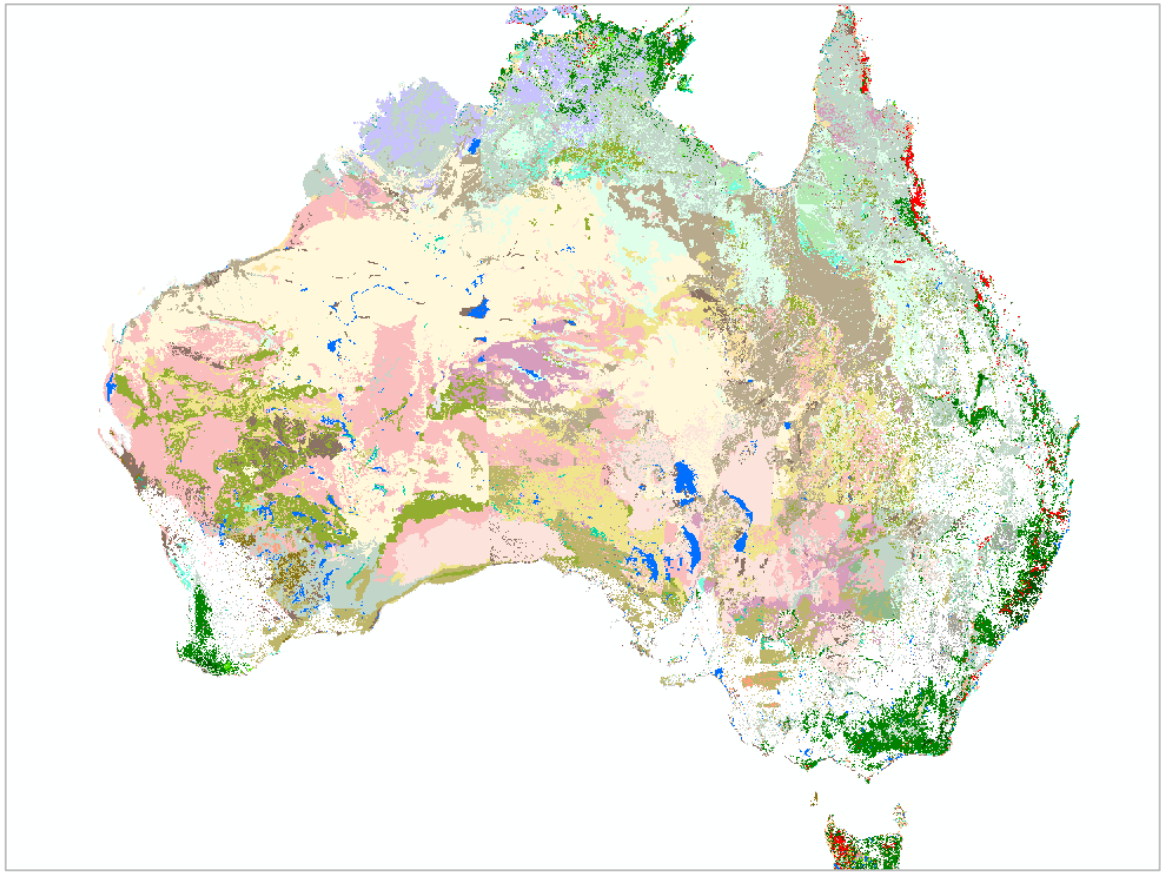

National Vegetation Information System (NVIS 4.1)

Department of Sustainability, Environment, Water, Population and Communities

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How information was integrated

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- starting with streams

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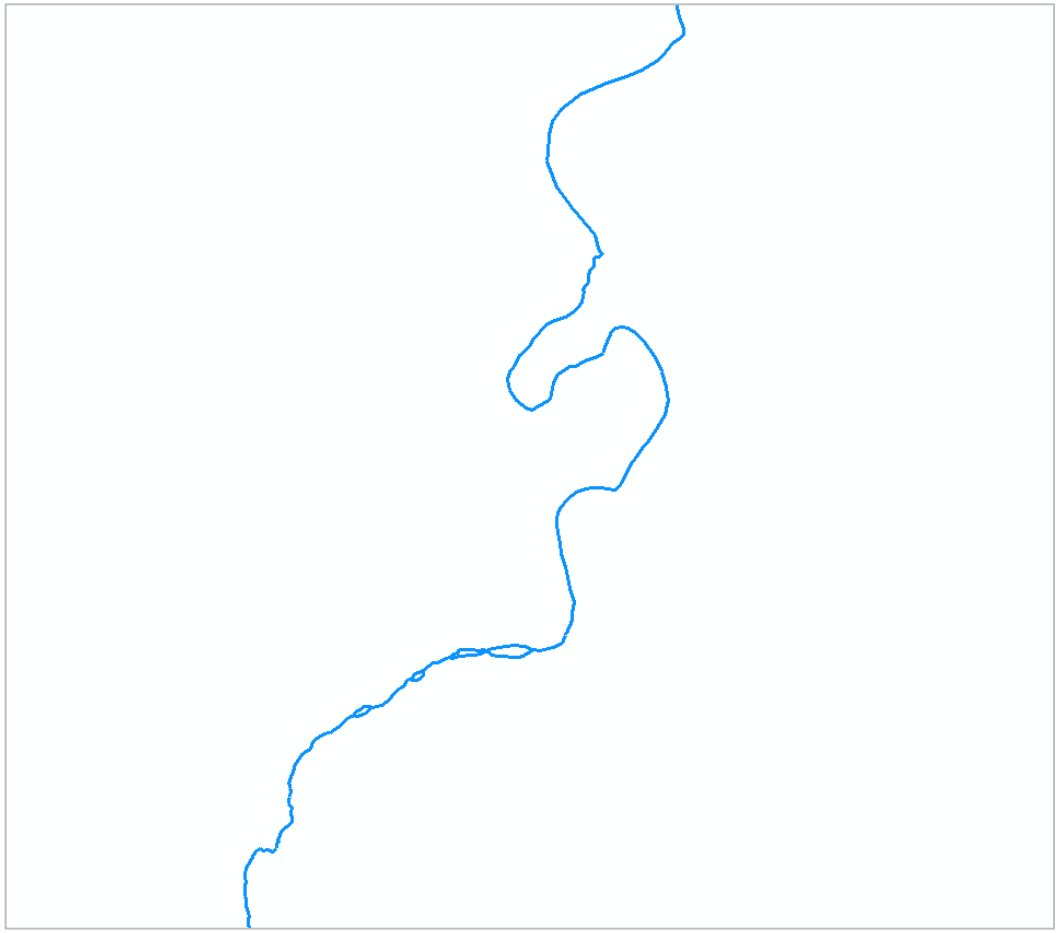
How information was integrated

WAVES

- starting with streams
- filter on perenniality



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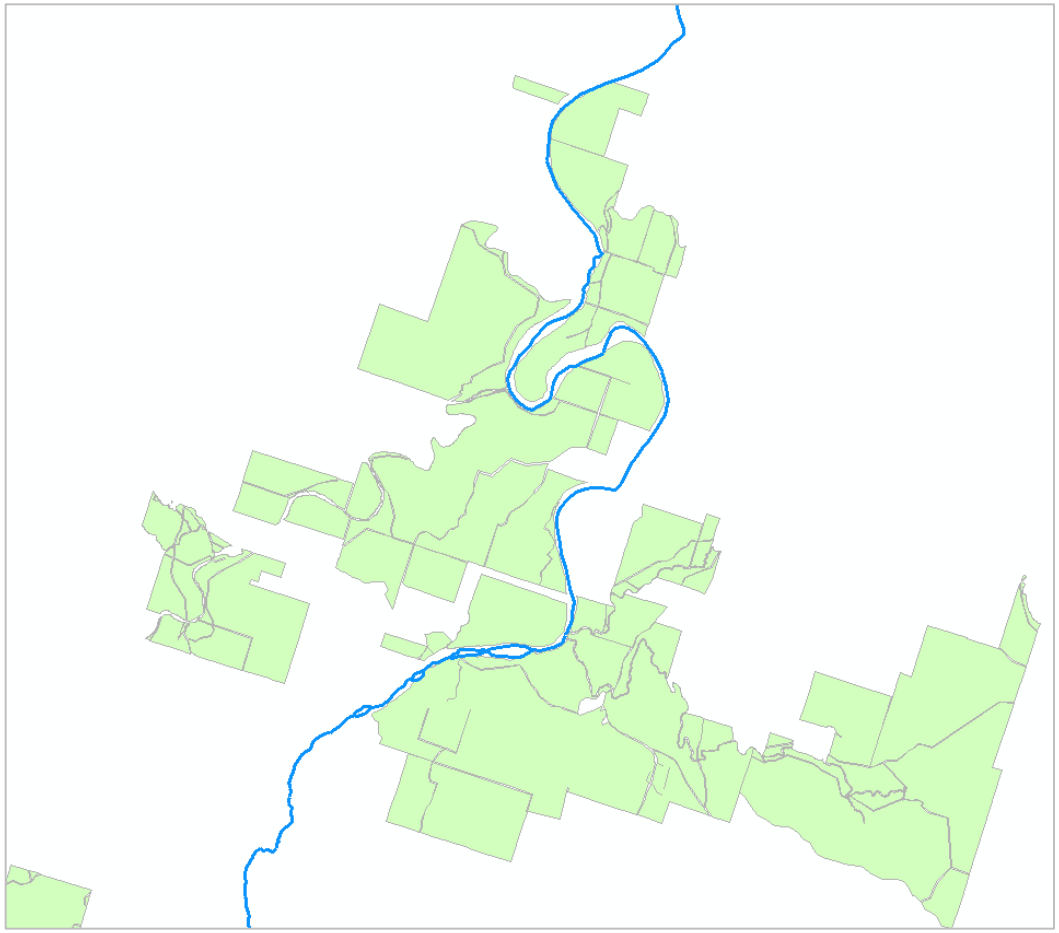
How information was integrated

WAVES

- starting with streams
- filter on perenniality
- compare to property boundaries



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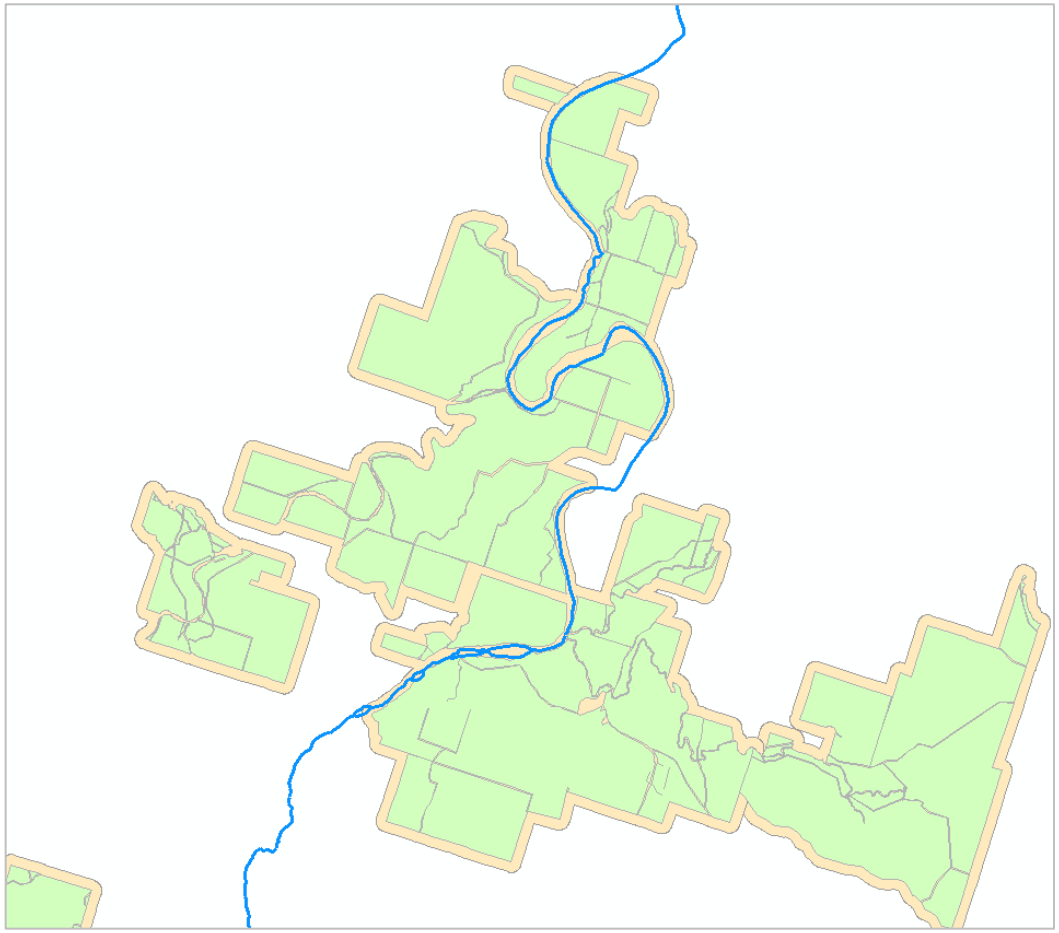
How information was integrated

WAVES

- starting with streams
- filter on perenniality
- compare to property boundaries
- within a distance



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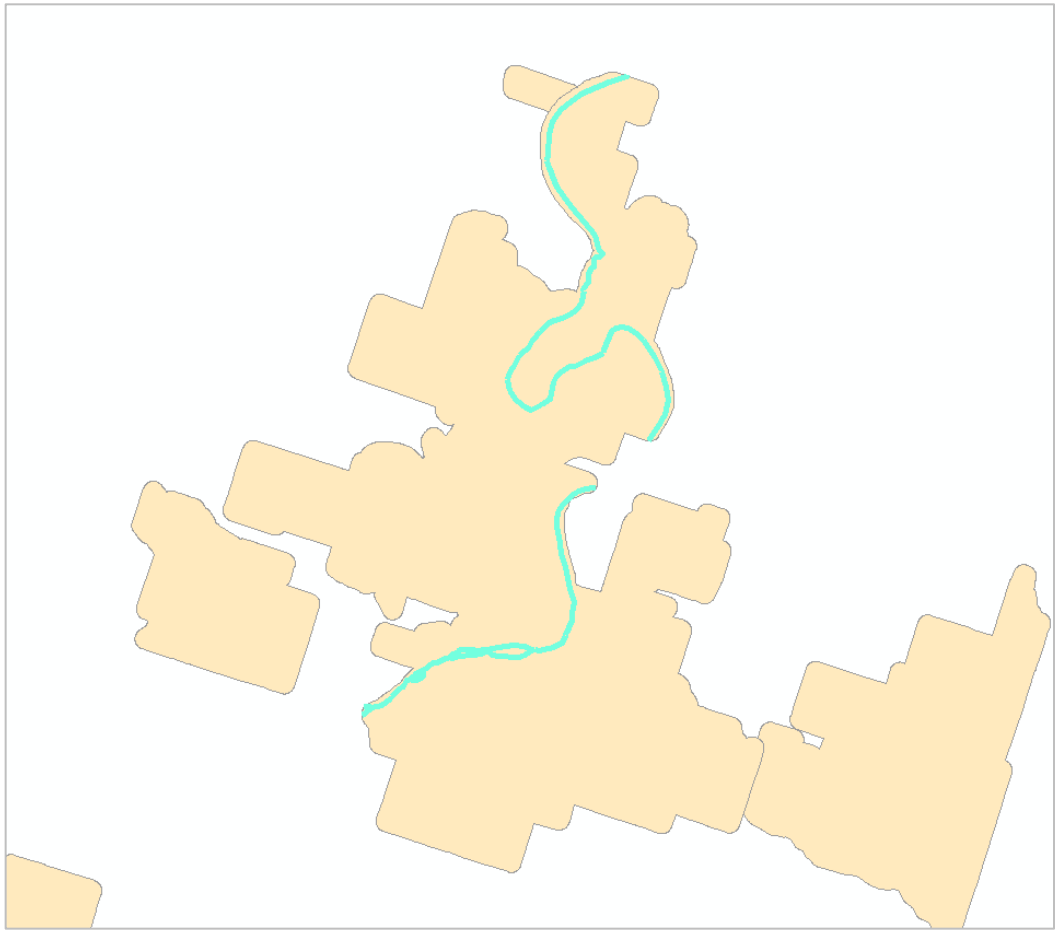
How information was integrated

WAVES

- starting with streams
- filter on perenniality
- compare to property boundaries
- within a distance
- isolate segments of interest



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How information was integrated

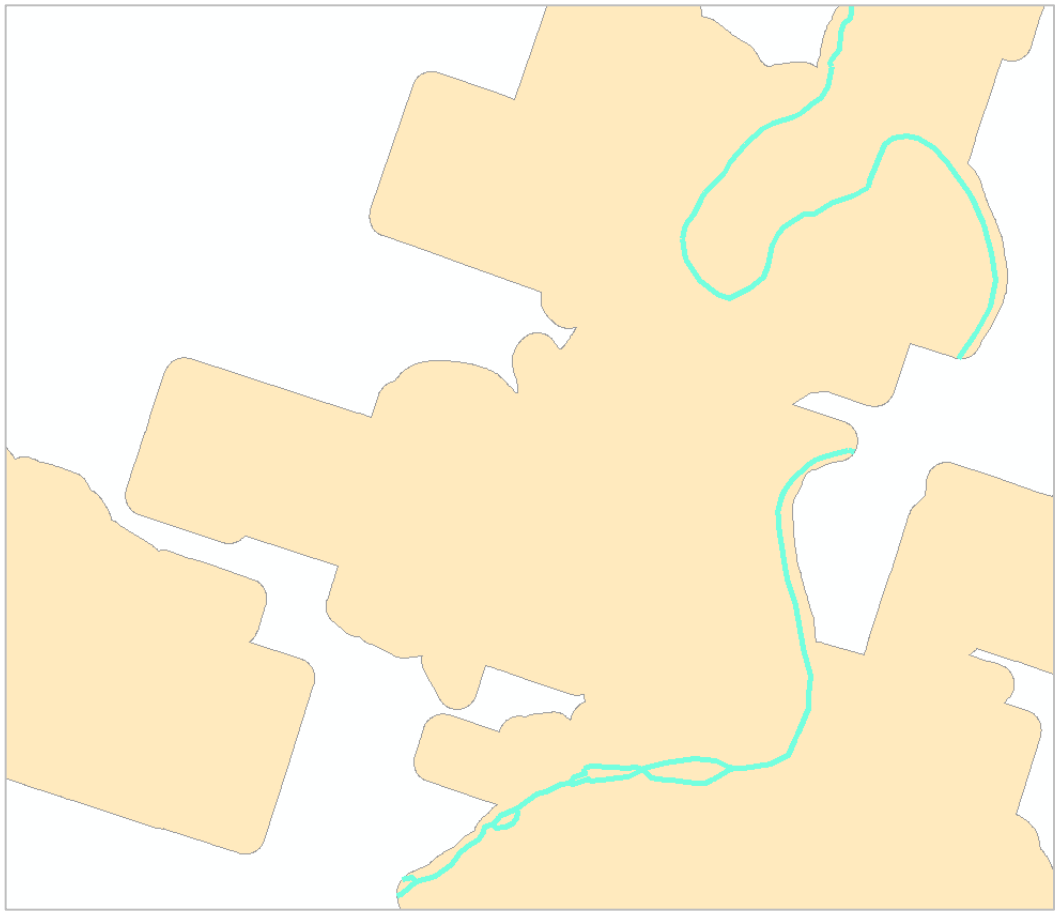
WAVES

- starting with streams
- filter on perenniality
- compare to property boundaries
- within a distance
- isolate segments of interest
- calculate total length

	"Object ID" *	unitid	FREQUENCY	SUM_stream_length_m
▶	1	AT00002230	2	1765.418566
	2	AT00002644	5	3462.145276
	3	AT00005460	2	4940.045482
	4	AT00005579	3	805.296509
	5	AT00007528	5	7227.483022
	6	AT00010259	3	1925.780788
	7	AT00010755	1	827.405177
	8	AT00012078	4	2495.310721
	9	AT00012140	1	985.478321
	10	AT00012554	4	2738.947345
	11	AT00015265	2	3847.145545
	12	AT00015274	2	543.718749
	13	AT00015792	2	686.520334
	14	AT00016942	1	537.560326
	15	AT00019390	1	643.658446

How information was integrated

- starting with isolated segments



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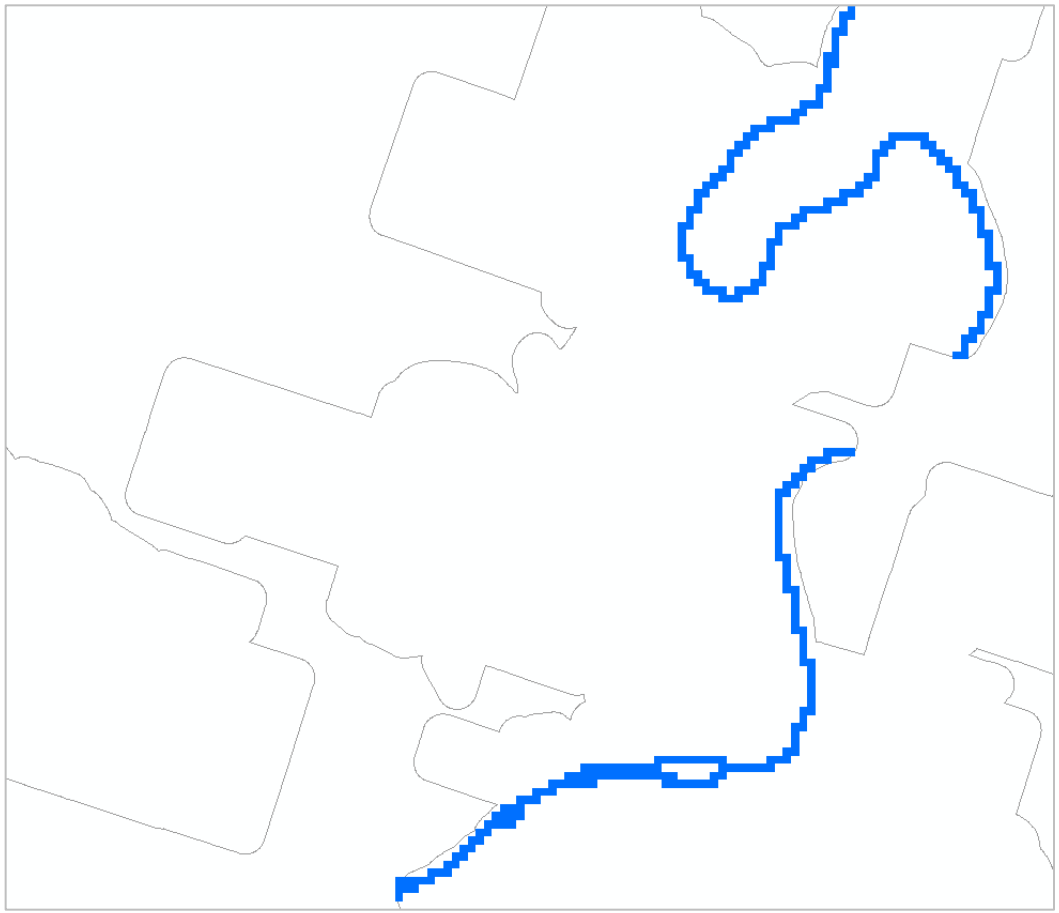
How information was integrated

WAVES

- starting with isolated segments
- convert to grid (raster)



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How information was integrated

WAVES

- starting with isolated segments
- convert to grid (raster)
- area of interest

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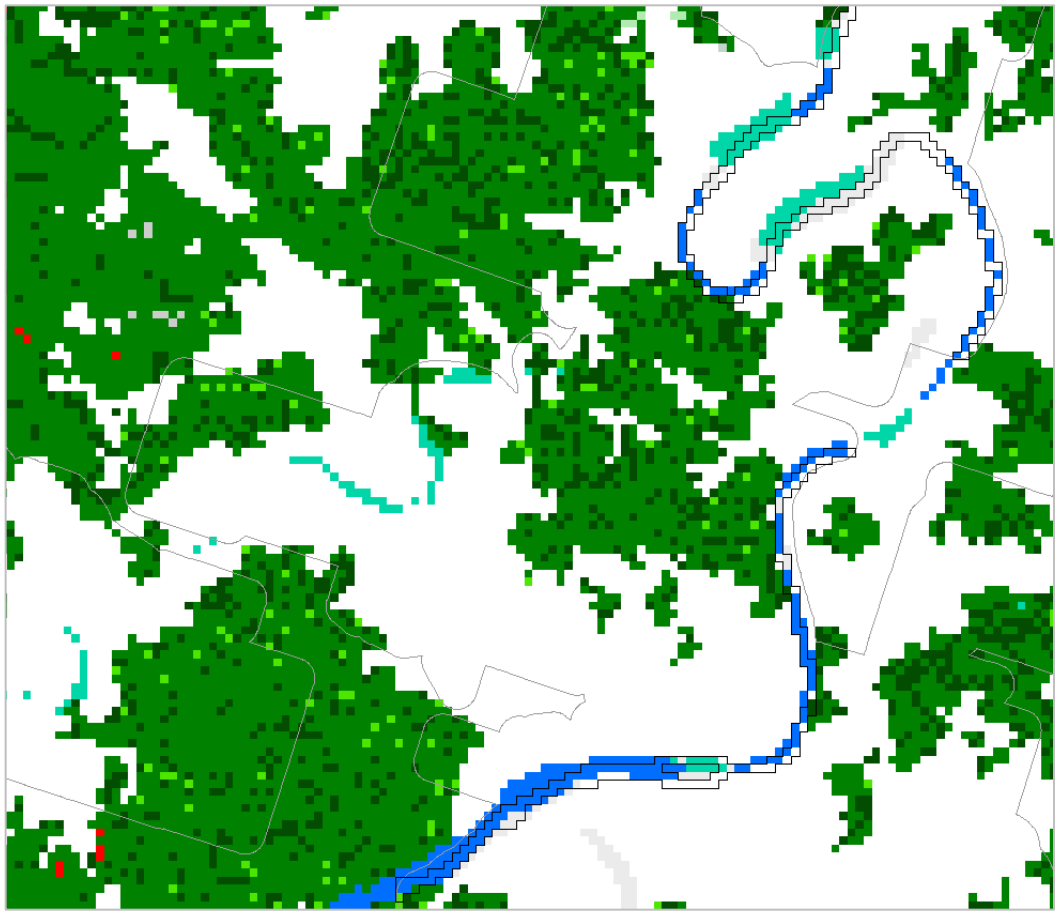
How information was integrated

WAVES

- starting with isolated segments
- convert to grid (raster)
- area of interest
- compare to NVIS Vegetation layer



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How information was integrated

WAVES

- starting with isolated segments
- convert to grid (raster)
- area of interest
- compare to NVIS layer
- tally the area for each vegetation category

	OBJECTID *	unitid	VALUE_1	VALUE_2	VALUE_3
▶	1	AT01005855	0	0	0
	2	AT00311916	0	0	0
	3	LC02174592	0	0	0
	4	AT06090763	0	0	0
	5	AT04970102	0	0	0
	6	AT02149454	0	0	0
	7				
	8				
	9				
	10				
	11				
	12				
	13				
	14				
	15				

...

VALUE_99	TOTAL_AREA	NATIVE_VEG	PERCENT_NATIVE
0	100000	100000	100
0	110000	30000	27
10000	50000	0	0
0	250000	210000	84
0	180000	0	0
0	80000	30000	38
50000	250000	0	0
30000	90000	10000	11
0	40000	30000	75
0	100000	20000	20
0	20000	20000	100
0	250000	240000	96
0	80000	0	0
0	190000	70000	37
0	150000	0	0

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Known issues with the process

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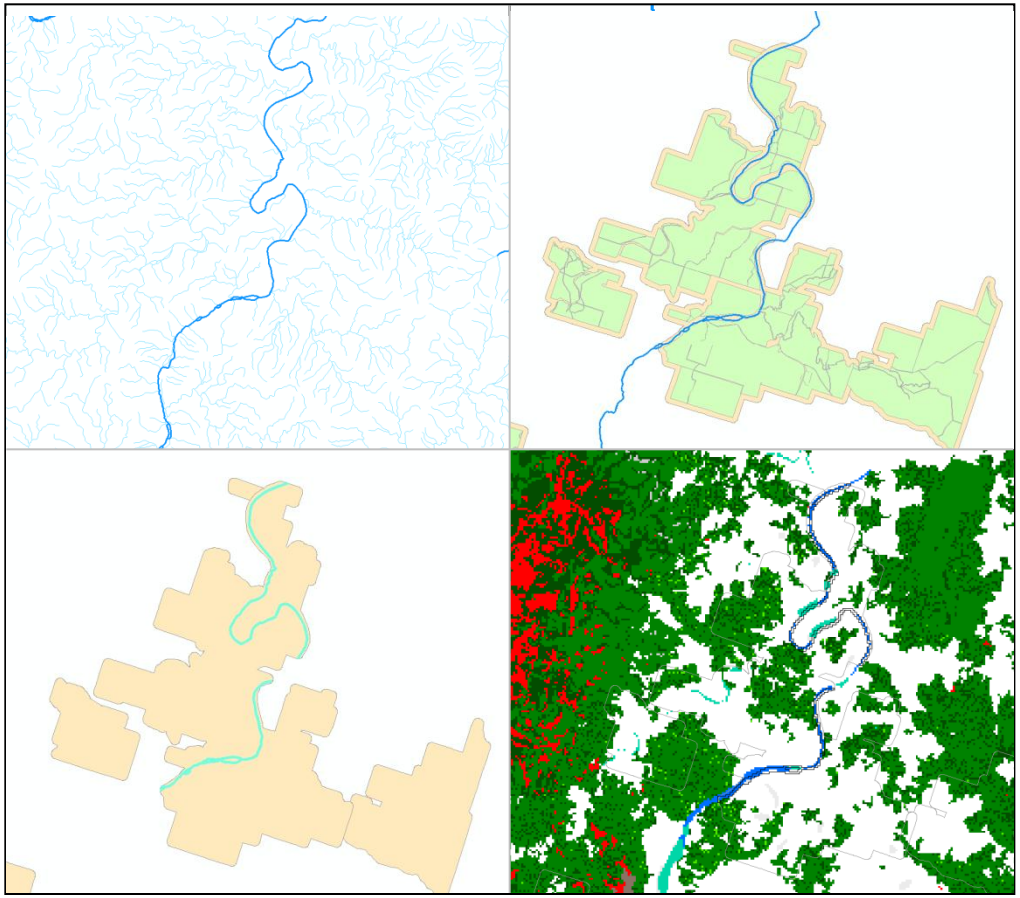
- resolution
- representation
- Registration

- false positives?
- false negatives?



Ecosystem Service view in SEEA EEA

Inputs to pastures e.g. fire control, seeds for improved pastures

Inputs to animal holding e.g. herding, veterinary care

Ecosystem asset (Rangeland)

ES: Grass and other animal feed

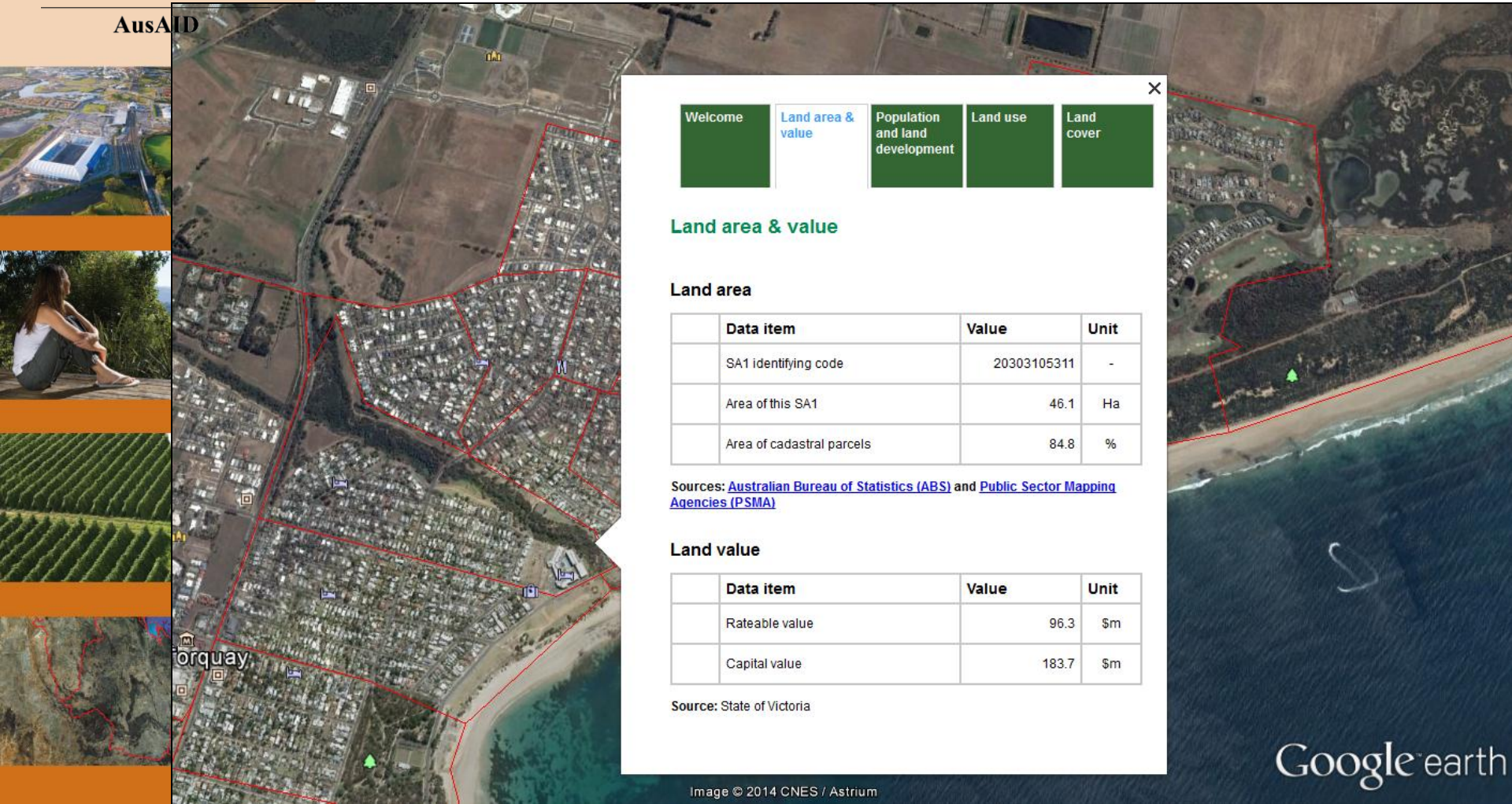
Grazing by domestic animals

BENEFITS: Animals, milk, meat, hides

Manure

Simple summary data for a common geography is a good starting point to help those are not familiar with Environmental Accounting tables.

- Integration without analysis
- Encourages people to find their own relationships between data



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Summary

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- Geographic infrastructure underpins successful data analysis
- Stable boundaries promote consistent, comparable time series
- Remotely sensed data is amazing, but needs to be used appropriately
- Geographic Information Systems are powerful and can provide a solution to integrate most types of data
- Understanding the data is key to successful analysis

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Questions?

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WAVES

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