Quantifying water policy related trade-offs

A catchment-scale approach to environmental flows in the Great Barrier Reef

Alex Smajgl

10th International River*symposium* & Environmental Flows Conference
03-06 Sept 2006, Brisbane

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1 Square one

- Why do we have to talk about **environmental flows**?
- **Competitiveness** between anthropogenic and environmental uses
- Often **decision makers** reduce resources like water available for environment
  - Population growth, food security, profit
- Water **quality** as relevant as **quantity**

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2 GBR

- **GBR** Reef Water Quality Protection Plan: Action and impact by 2013
- Policy makers:
  Which interventions?
  What impact?

➢ Policy
impact assessment

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3 Methods

- Main problems: **Sediment** & **nutrients**
- Policy decisions have **trade-offs**?
- Methodological challenge: **Integration**
- Test of various methods for different scales of decision making
  - Computable General Equilibrium modelling
  - Agent-based modelling

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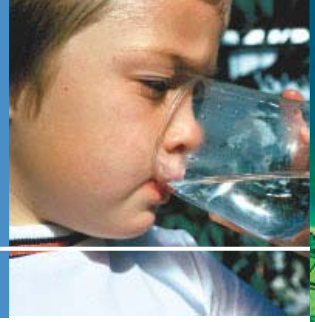
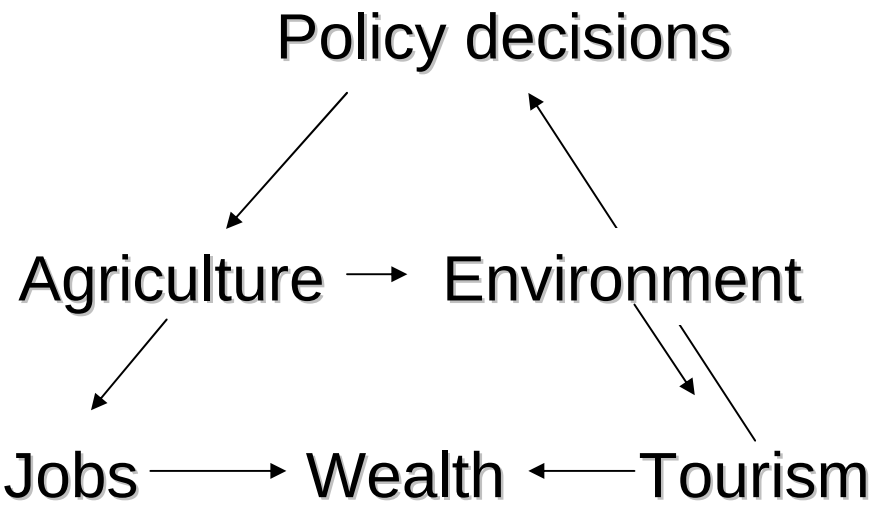
4 Catchment scale



- Catchment scale integration



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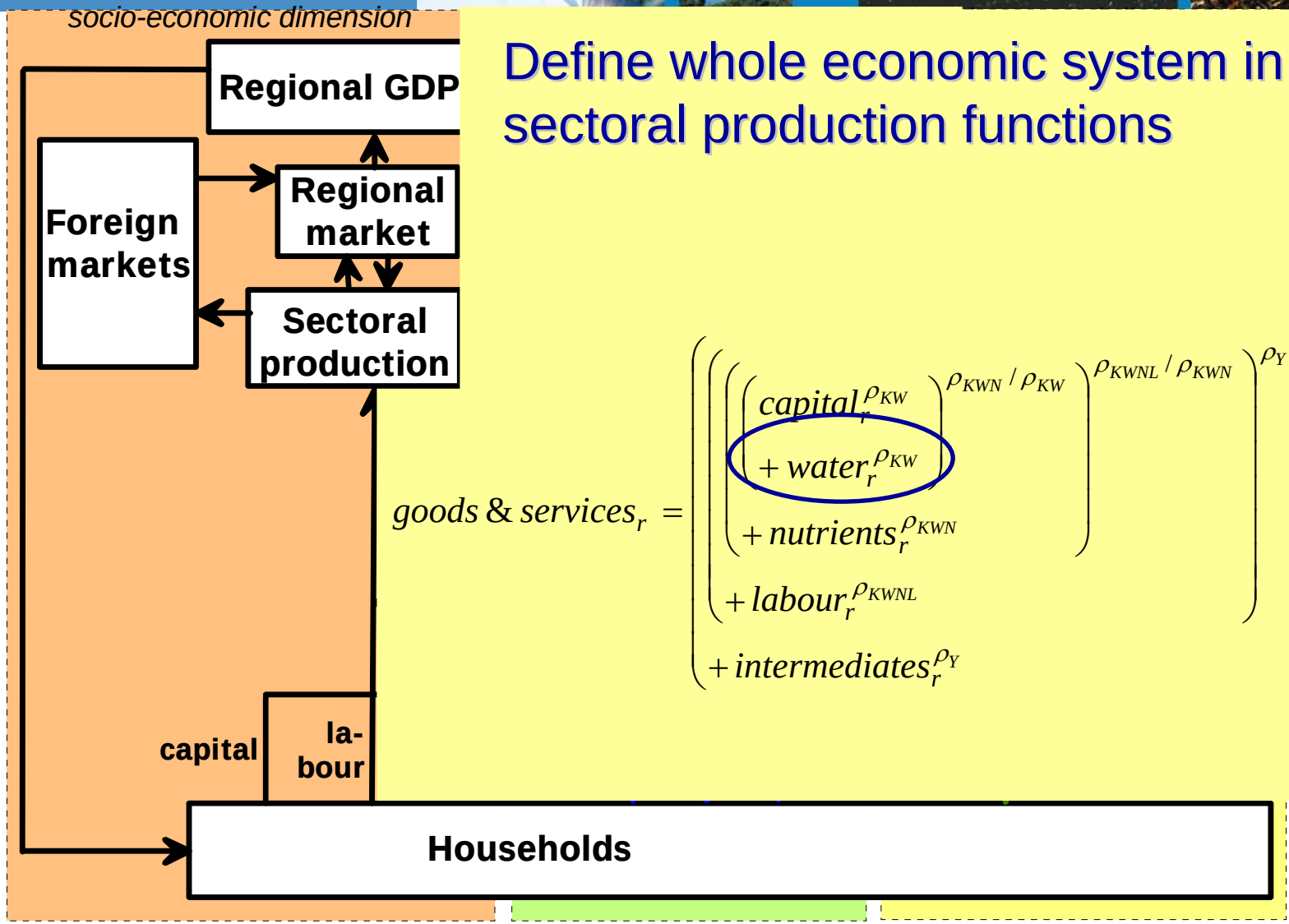
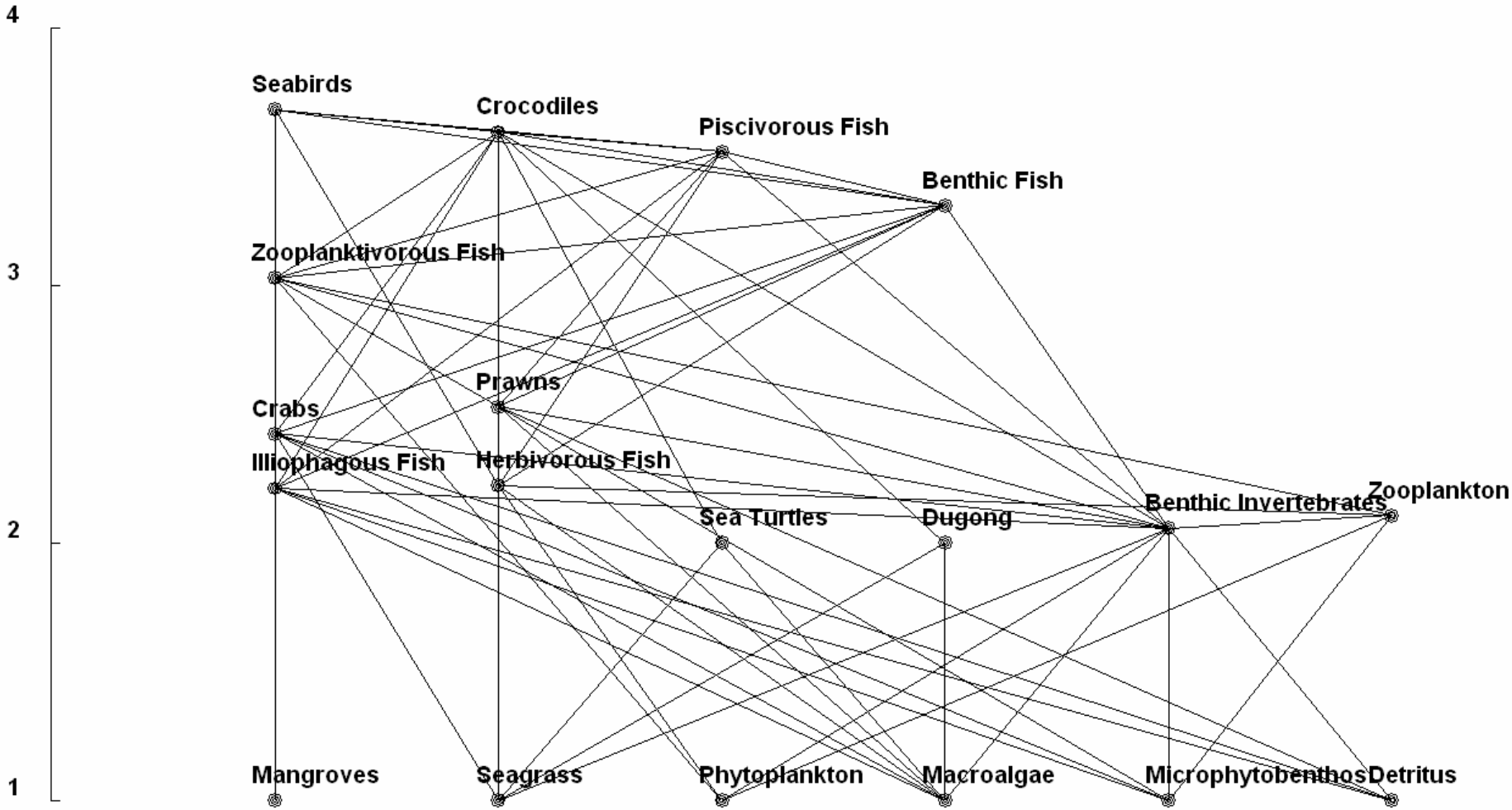
5 The PIA model



Define whole economic system in sectoral production functions

$$goods\ \&\ services_r = \left(\left(\left(\left(capital_r^{\rho_{KW}} + water_r^{\rho_{KW}} \right)^{\rho_{KWN}/\rho_{KW}} + nutrients_r^{\rho_{KWN}} \right)^{\rho_{KWNL}/\rho_{KWN}} + labour_r^{\rho_{KWNL}} \right)^{\rho_Y/\rho_{KWNL}} + intermediates_r^{\rho_Y} \right)^{1/\rho_Y}$$


4
3
2
1
Seabirds
Crocodiles
Piscivorous Fish
Benthic Fish
Zooplanktivorous Fish
Prawns
Crabs
Herbivorous Fish
Illiophagous Fish
Zooplankton
Benthic Invertebrates
Sea Turtles
Dugong
Mangroves
Seagrass
Phytoplankton
Macroalgae
Microphytobenthos
Detritus

5 PIA

Mass balance approach: Translates into Leontieff Production functions

	Prey Groups	Predator Groups: 8
1	Seabirds	
2	Crocodiles	
3	Piscivorous Fish	
4	Benthic Fish	
5	Zooplanktivorous Fish	
6	Illiophagous Fish	
7	Herbivorous Fish	
8	Sea Turtles	
9	Dugong	
10	Crabs	
11	Prawns	
12	Benthic Invertebrates	
13	Zooplankton	
14	Mangroves	
15	Seagrass	0.550
16	Phytoplankton	
17	Macroalgae	0.450
18	Microphytobenthos	
19	Detritus	
	Import	
	Sum	**1.000**

$$turtle\ biomass_r = \left(seagrass_r^{\rho_{turtle}} + macroalgae_r^{\rho_{turtle}}\right)^{1/\rho_{turtle}}$$

$$tourism\ services_r = \begin{pmatrix} \left(capital_r^{\rho_{KL}} + labour_r^{\rho_{KL}}\right)^{\rho_Y/\rho_{KL}} \\ + intermediates_r^{\rho_Y} + species_r^{\rho_Y} \end{pmatrix}^{1/\rho_Y}$$

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Scenario assumptions

Years	Gross regional product	Sugarcane	Horticulture	Beef production	Tourism	Turtle biomass	Average fish populations	Dugong population
1. Rainfall in GBR region: -5% compared to 2001-2005 average								
2. In Burdekin catchment protection of environmental flows: Restriction of surface water use by 10% + water trade								
3. Burdekin catchment restricts fertiliser use by 10%								

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Thanks

Questions?

Alex Smajgl
CSIRO Sustainable Ecosystems
Townsville, Australia
alex.smajgl@csiro.au

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