



PBL Netherlands Environmental
Assessment Agency



Economic impacts of the land-water-energy nexus

Exploring its feedbacks on
the global economy

Eighth Annual Meeting of the IAMC, 16-
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Background

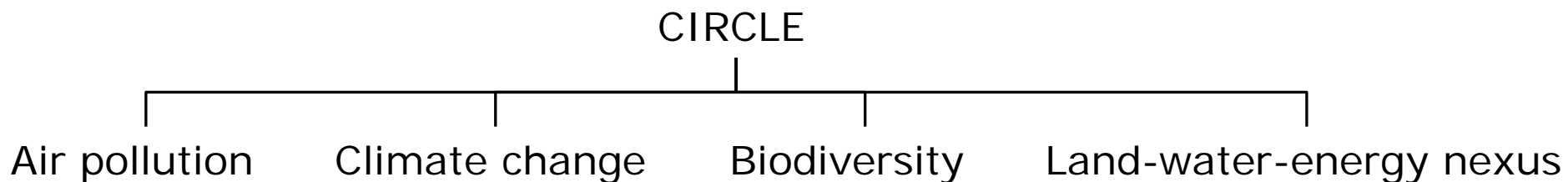
- Most global assessments:
 - One-way analysis: impacts of economic growth -> environment.
 - They do not assess: impacts of environmental degradation -> economic growth

- CIRCLE:
 - Two-way analysis:
 - › environmental and resource scarcity feedbacks into the economy.
 - Land-water-energy nexus is a focal point.



CIRCLE

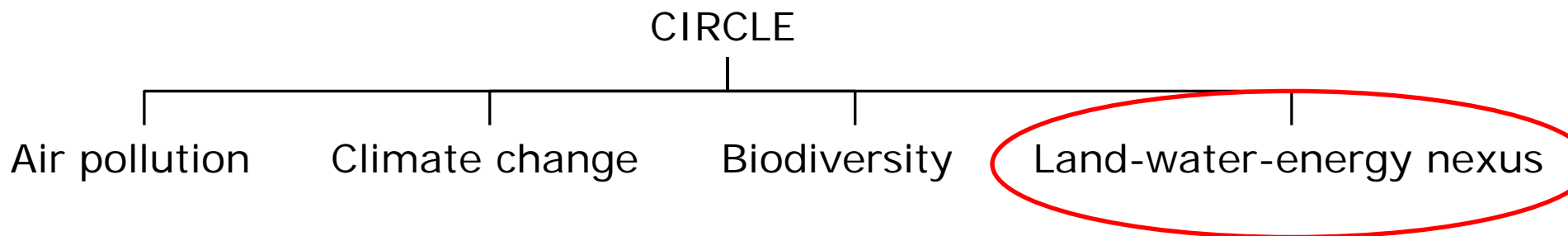
- CIRCLE is a big project; it encompasses several subprojects





CIRCLE

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What is the Land-Water-Energy nexus?

- Strong linkages between land, water and energy
 - Economic activity in 1 sector requires inputs from the others
 - Competition for the same resources
 - Many sectors affect each other through these resources

- In most cases resources are sufficient
 - Scarcity often regional
 - But more critical:
 - › when environment is considered
 - › when mega trends are considered



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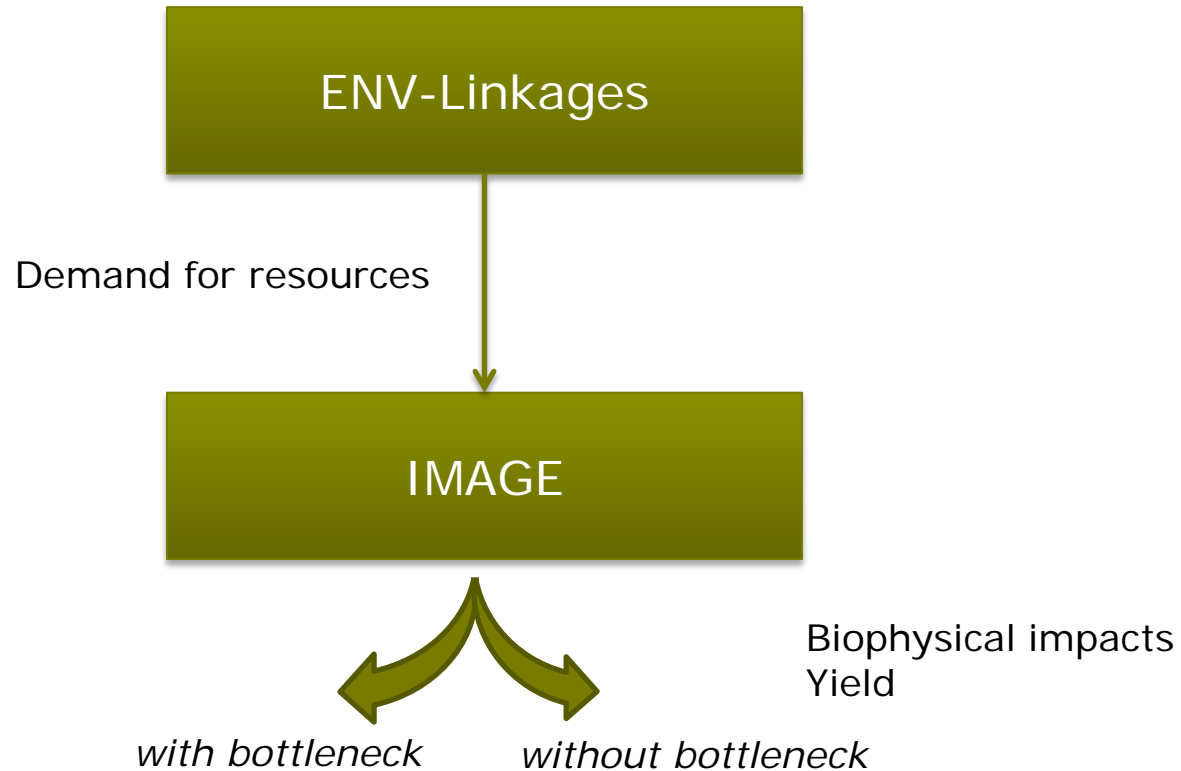
- Resource scarcity (= bottleneck in land, water or energy supply) thus more prominent in future!



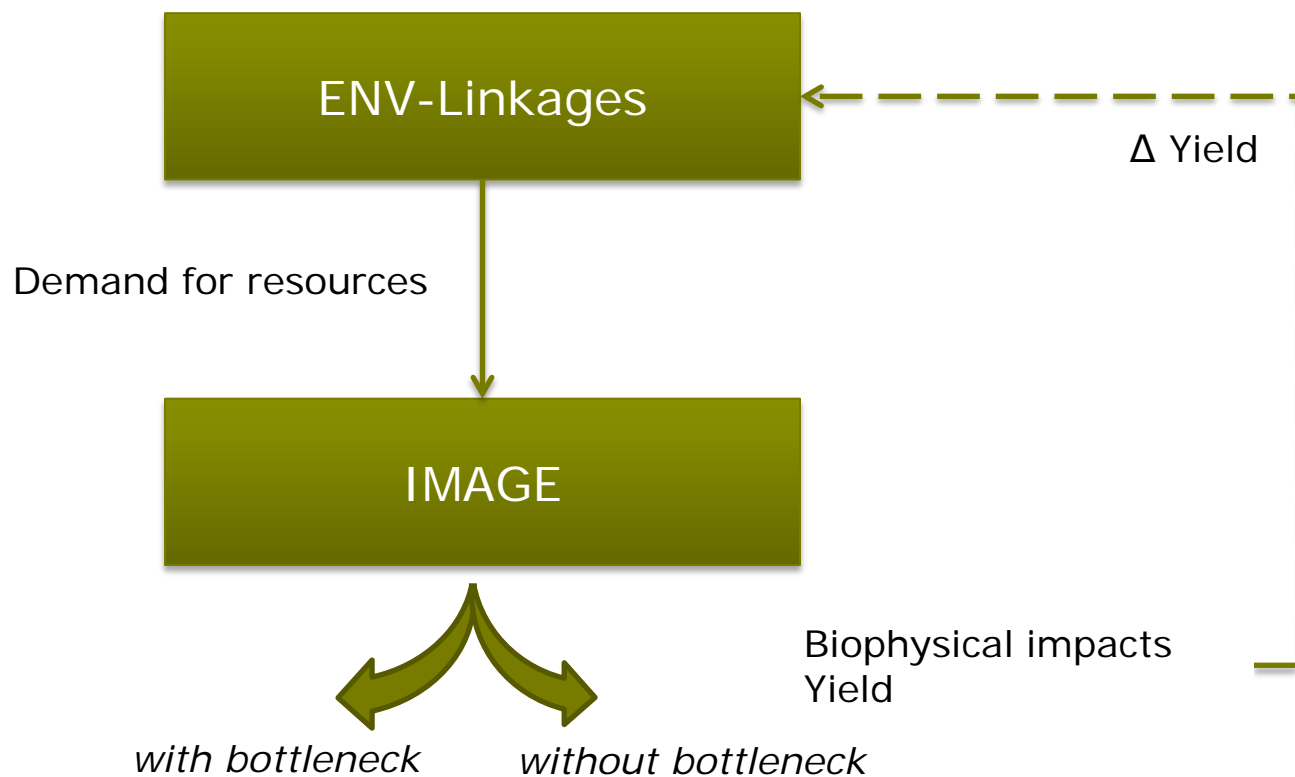
How to assess impact of nexus bottlenecks on economic growth?

- Baseline scenario **with** bottleneck
- Counterfactual scenario **without** bottleneck
- Difference in economic performance = cost of bottleneck

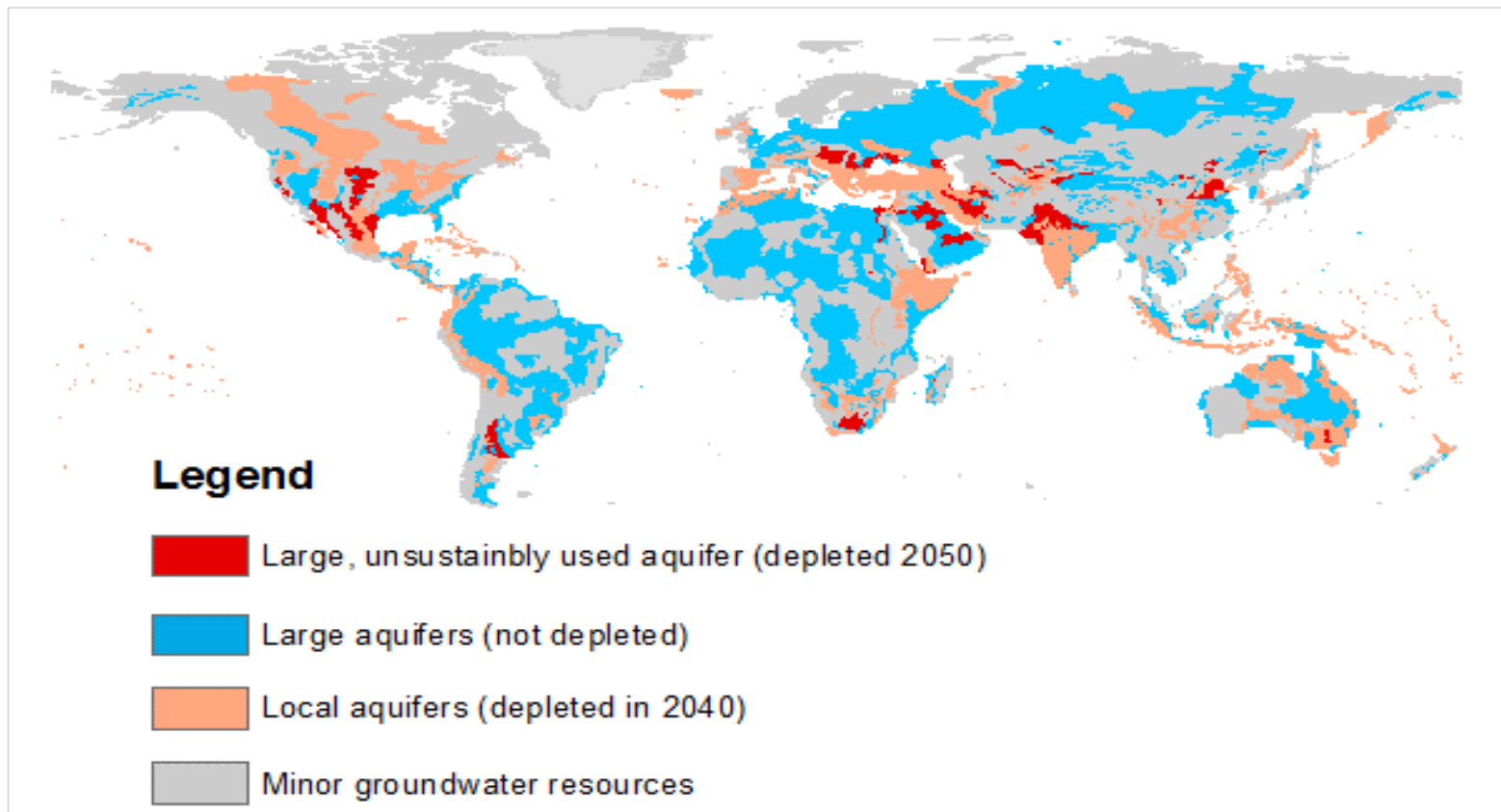
Which models do we use?

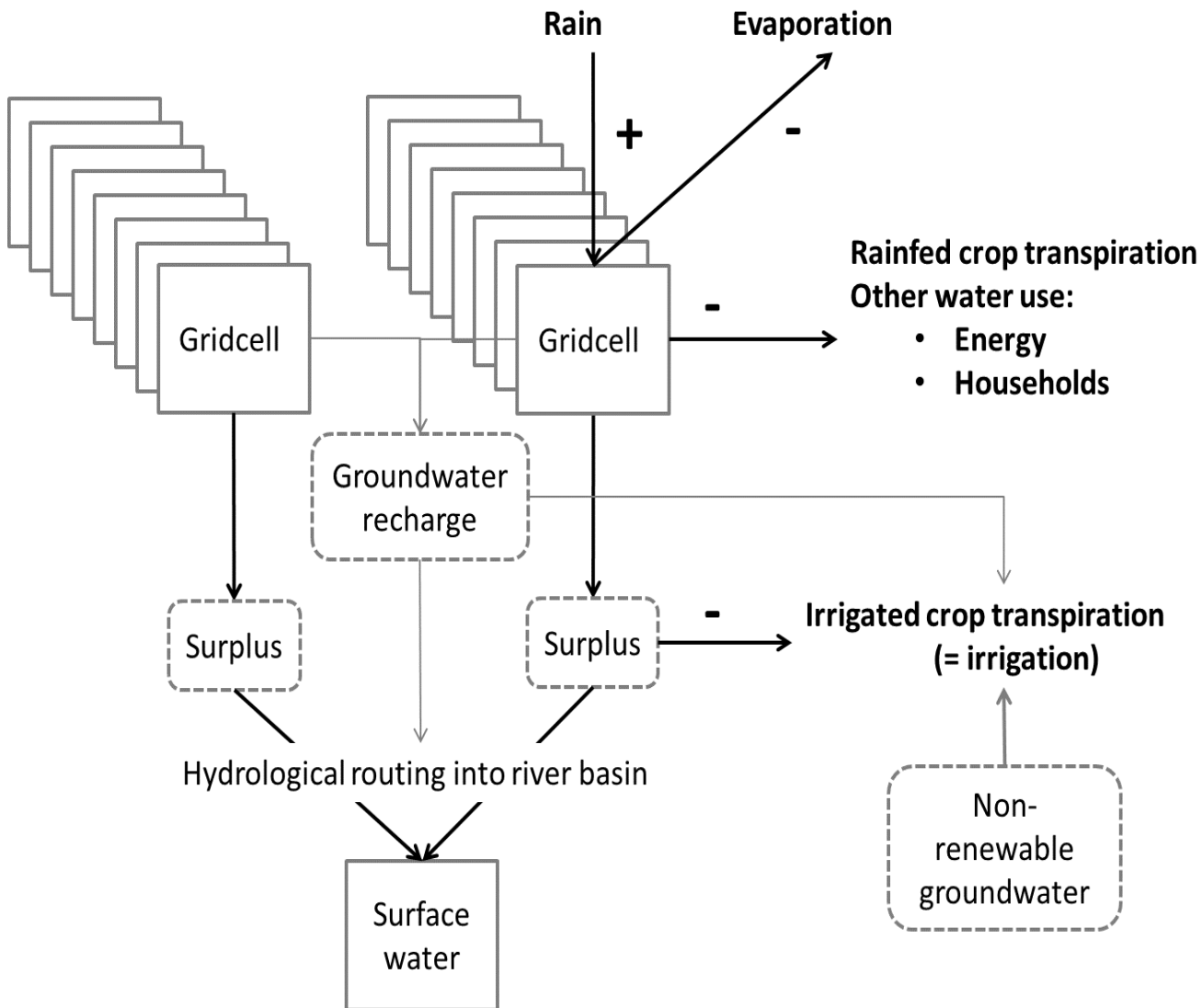


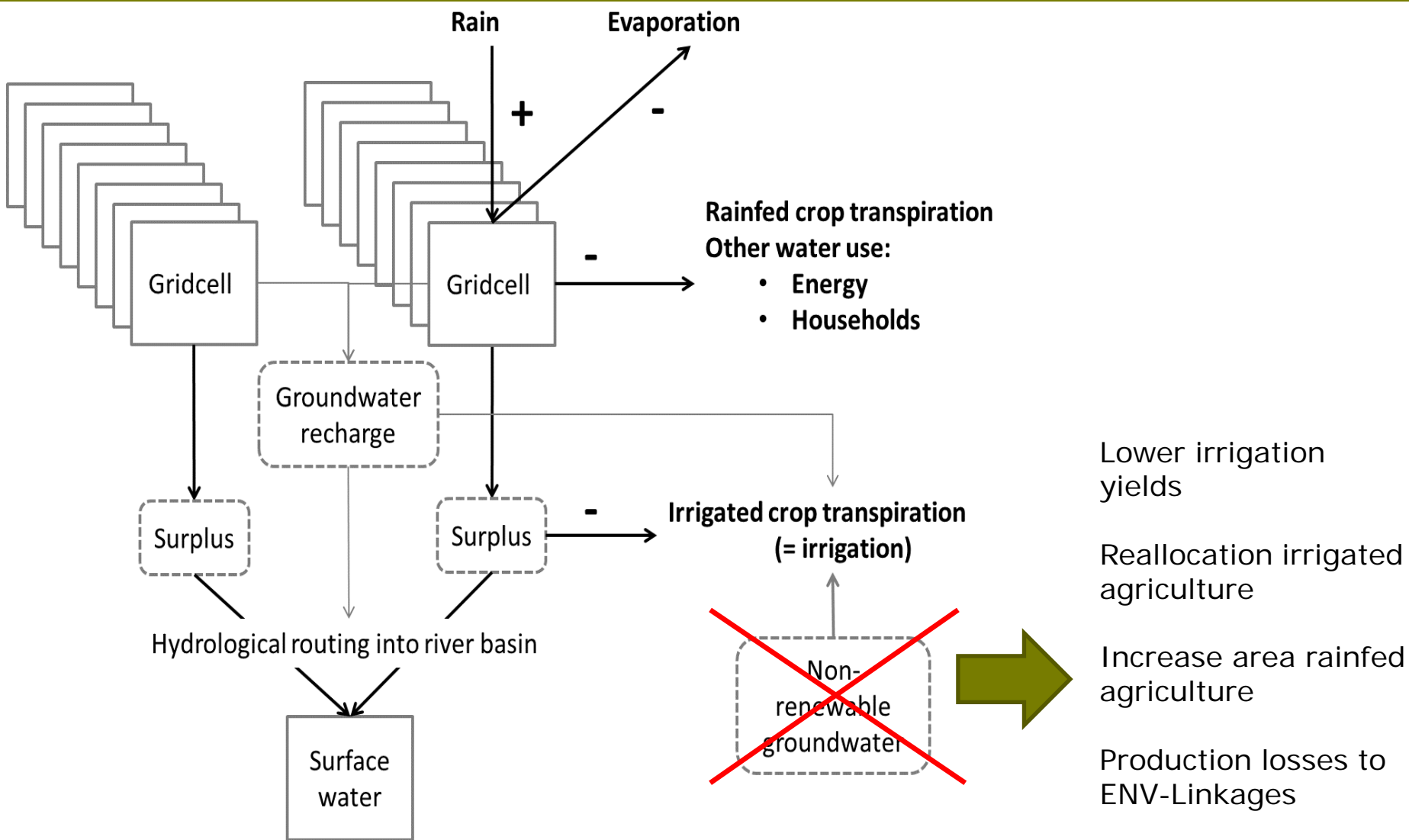
Which models do we use?



And now a worked-out example.. non-renewable groundwater limitation









Non-renewable groundwater: Biophysical impacts

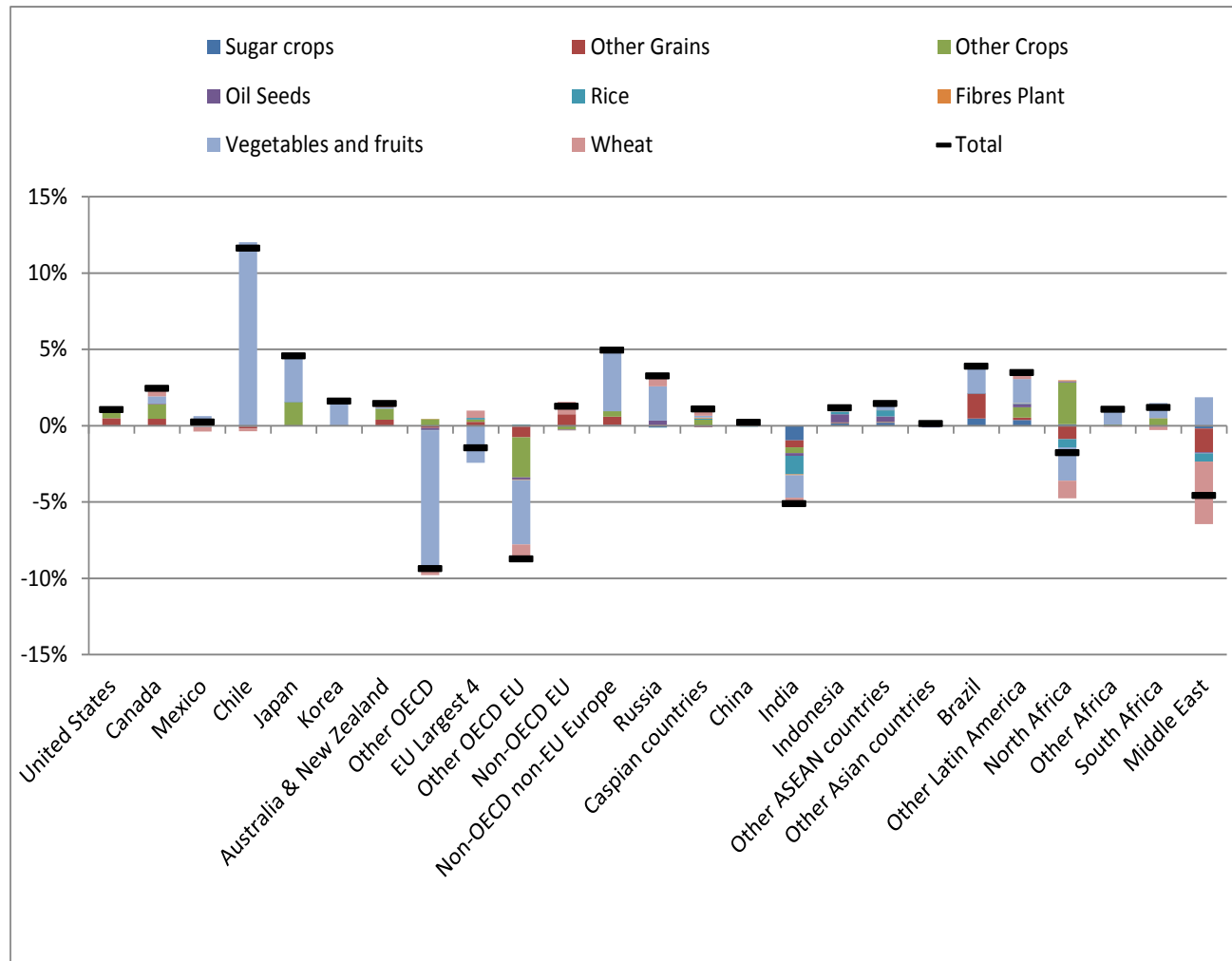
- Some highlights:

Region	Yield impacts	Remarks
Canada, Brazil, Africa, Latin America, Oceania, Russia	No	No irrigated areas
Japan, Korea, Indonesia	No	Renewable groundwater
USA	Small	Reservoirs
Mexico, S Africa	Moderate	Increasing land competition
India	Severe	
China	Small	
N Africa, Middle East	Severe impacts	Severe land competition
Europe	Seems dramatic	Only OE5 really affected

Non-renewable groundwater: Economic impacts

Agricultural value added in 2060 (in % change from baseline):

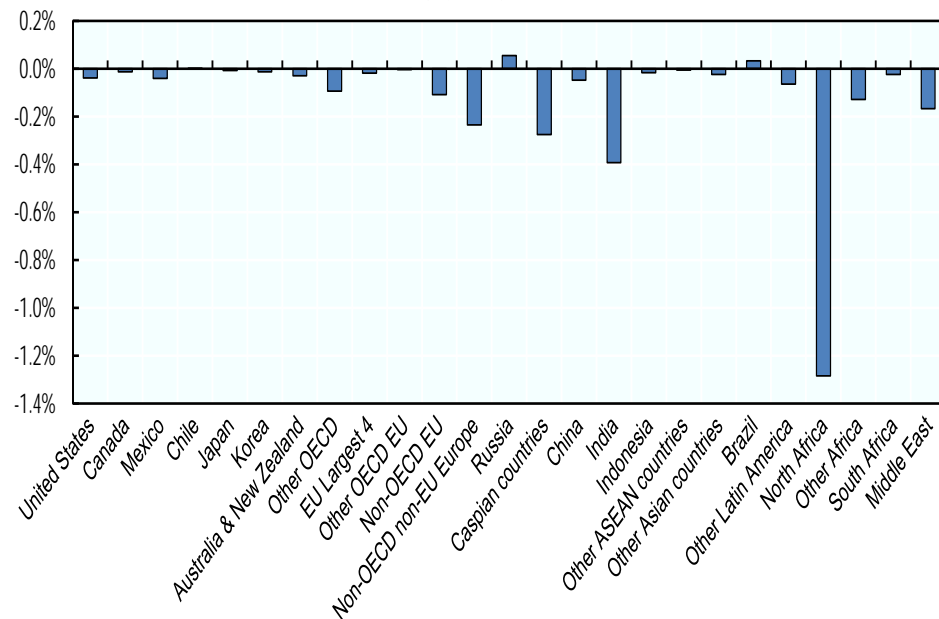
- Substantial loss: EU, India, Middle East and North Africa



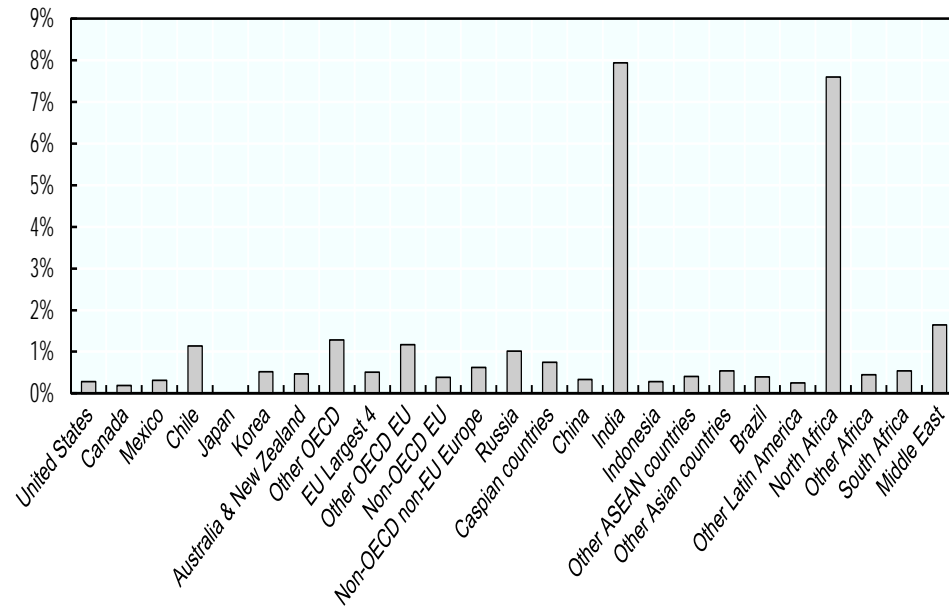
Non-renewable groundwater: Economic impacts

- GDP impacts are quite small, except for Mediterranean, North Africa and India.
- Food prices increase everywhere, but more dramatic in India and North Africa

Real GDP



Food Prices





Thank you

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