Water Account

(Levels 0, 1 and 2)

Project: Advancing the SEEA
Experimental Ecosystem Accounting

United Nations

UNEP

Convention on
Biological Diversity

NORWEGIAN MINISTRY
OF FOREIGN AFFAIRS

Overview: The Condition Account

1. Learning objectives
2. Review of Level 0 (5m)
- **What** is it?
- **Why** do we need it?
- **What** does it look like?
- **Expertise** & **data** required
- **Links** to related training materials

3. Level 1 (Compilers)
- Concepts (15m)
- Group exercise & Discussion (30m)

4. Level 2 (Data providers)
- Data options, examples & issues (15m)
- Group exercise & Discussion (15m)

5. Closing Discussion (10m)

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SEEA-EEA Training Levels 1 and 2

- **Learning objectives**
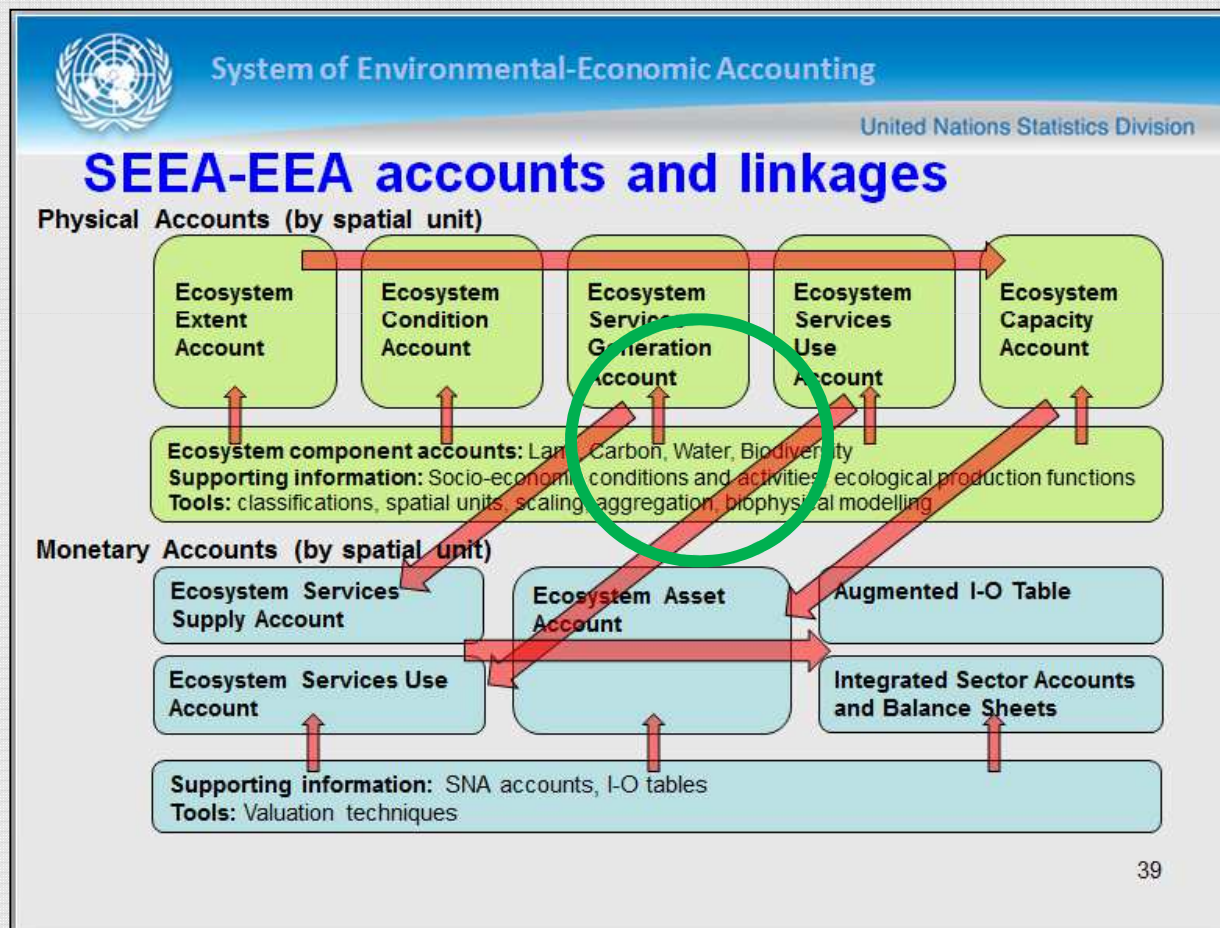 - Level 1:
    - Understand why Water Accounts are important and how they link to policy
    - Understand the basic concepts of Water Accounting
    - Understand how water is treated in the SEEA
    - Learn the steps of compiling a Water Account
  - Level 2
    - Understand the data options and sources
    - Understand the important conceptual issues
    - Be aware of how other countries have approached Water Accounting

Account 3: Water

Level 0: Account 3: Water

- **What?**
  - Spatially-detailed version of SEEA-CF water account to capture:
    - Inter-ecosystem flows of water (4.62),
    - Water quality and
   - Supply/use for ecosystems
- **Why?**
  - Policies on water security, water quality, impacts of water abstraction on ecosystems
  - Links to other accounts (Condition, Ecosystem Services Generation)
  - Links to SEEA-CF; SEEA-WATER
  - Indicators:
    - Local water supply/use, quality (use > supply?)
    - Variability in supply, trends (draughts, floods)
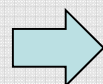
Level 0: Account 3: Water

- **What does a Water Account look like?**

Maps   Tables

Use

Rainfall

Hydrology
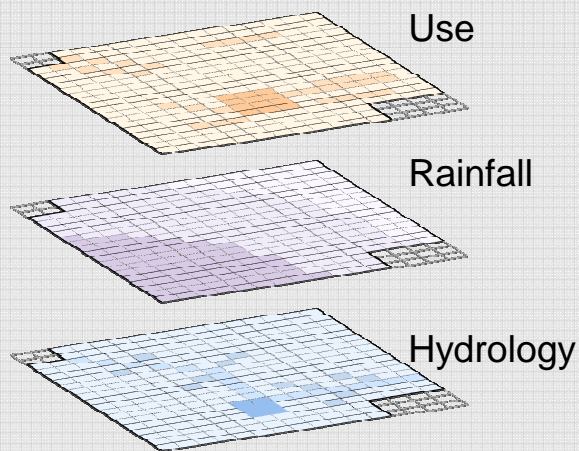
	Use of water							
	Agriculture, forestry and fishing	Mining & quarrying, manufacturing and construction	Electricity, gas, steam and air conditioning supply	Water collection, treatment and supply	Sewerage	Other industries	Households	**Total use**
	millions m^3							
Source of abstracted water								
Inland water resources								
Surface water								
Goundwater								
Soil water								
Total								
Other water sources								
Precipitation								
Sea water								
Total								
Total use of abstracted water								
Abstracted water								
Distributed water								
Own use								

Spatial units
Classifications
Biophysical modelling
Socio-economic data

6

Level 0: Account 3: Water

- ## What does a Water Account look like?

    - Spatially-detailed stock, supply and use including soil moisture & groundwater

    - Water quality measures (contribution to Condition Account)

Level 0: Account 3: Water

- **What do you need to compile a Water Account?**
  - Ecosystem Asset Account
  - Common spatial infrastructure (spatial units)
  - **Data:**
    - Spatially-detailed supply (rainfall)
    - Use (abstraction, inter-ecosystem transfers);
    - Water quality measures
  - **Expertise:**
    - Geographers (GIS and remote sensing)
    - Hydrologists
    - Ecologists
    - Climatologists

Why water and ecosystem accounts?

- Increasing human pressure on water and ecosystems from:
    - Extraction of water
    - Pollution of water
    - Degradation and depletion of ecosystems (e.g. conversion of forests to palm oil plantations)
- Having a comprehensive information on water and ecosystems will support assessing the impact of
    - Changes in vegetation cover and land use on water stocks and water provisioning and filtration services
    - Policy options for managing water and ecosystems on industries and sectors. For example, restricting human activity in catchments used for water supply or restrictions on the amount of water available for extraction by industry (e.g. agriculture).
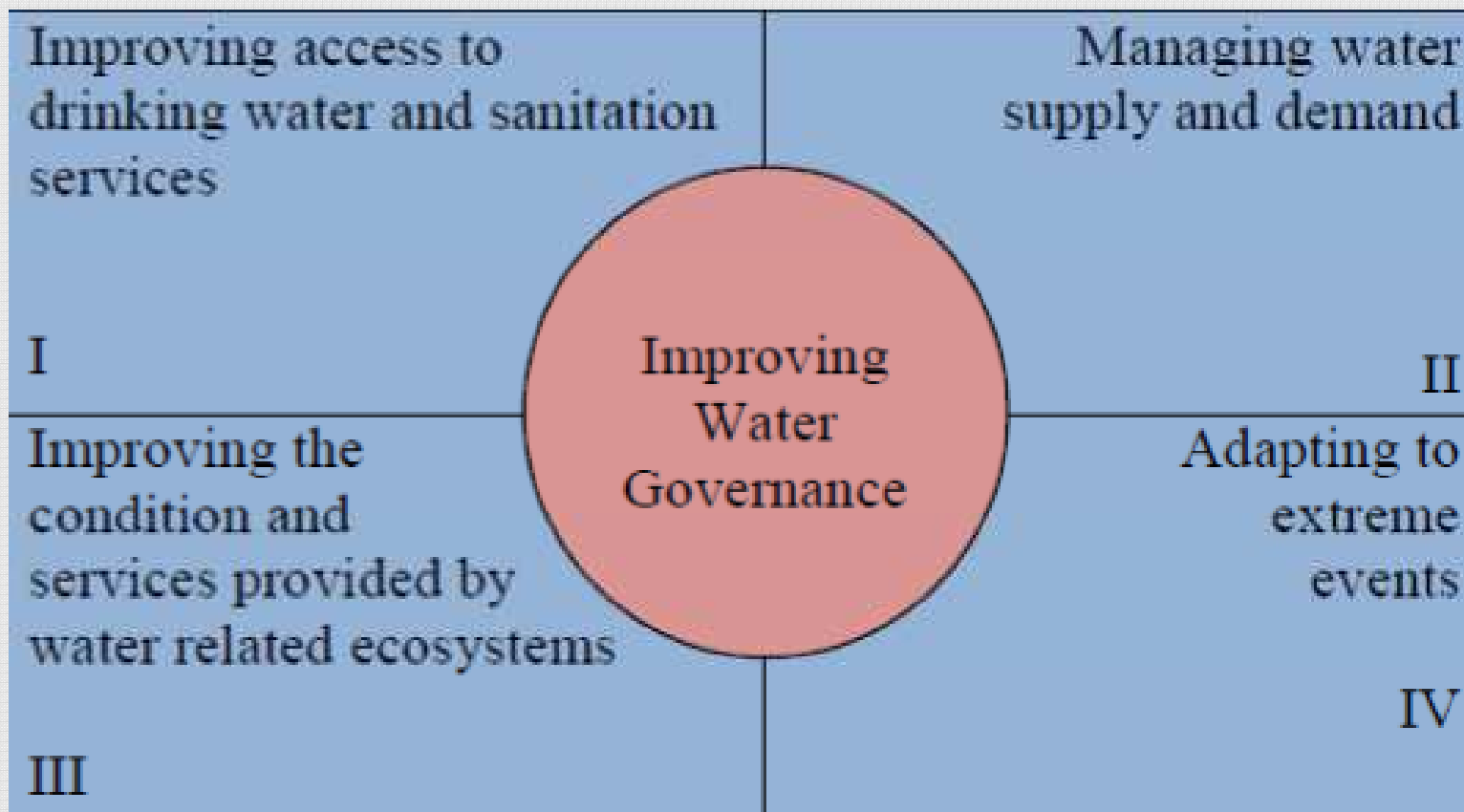
Accounts and data

"Lack of *integrated* water data is a systematic impediment to informed decision making related to the sustainable use of water resources. Data are needed to provide information not just about water quantity, both on the surface and underground, but also about its quality, social and economic relations as well as environmental dimensions."

Conclusion from Session 6.4 "Data for All" of the 5th World Water Forum

- Accounts provide a framework for arranging data. They enable data from different sources to be integrated. They also enable gaps and deficiencies in primary data sources to be identified and addressed.

Link of water policy issues and ecosystems

Improving access to drinking water and sanitation services

I

Managing water supply and demand

II

Improving Water Governance

Improving the condition and services provided by water related ecosystems

III

Adapting to extreme events
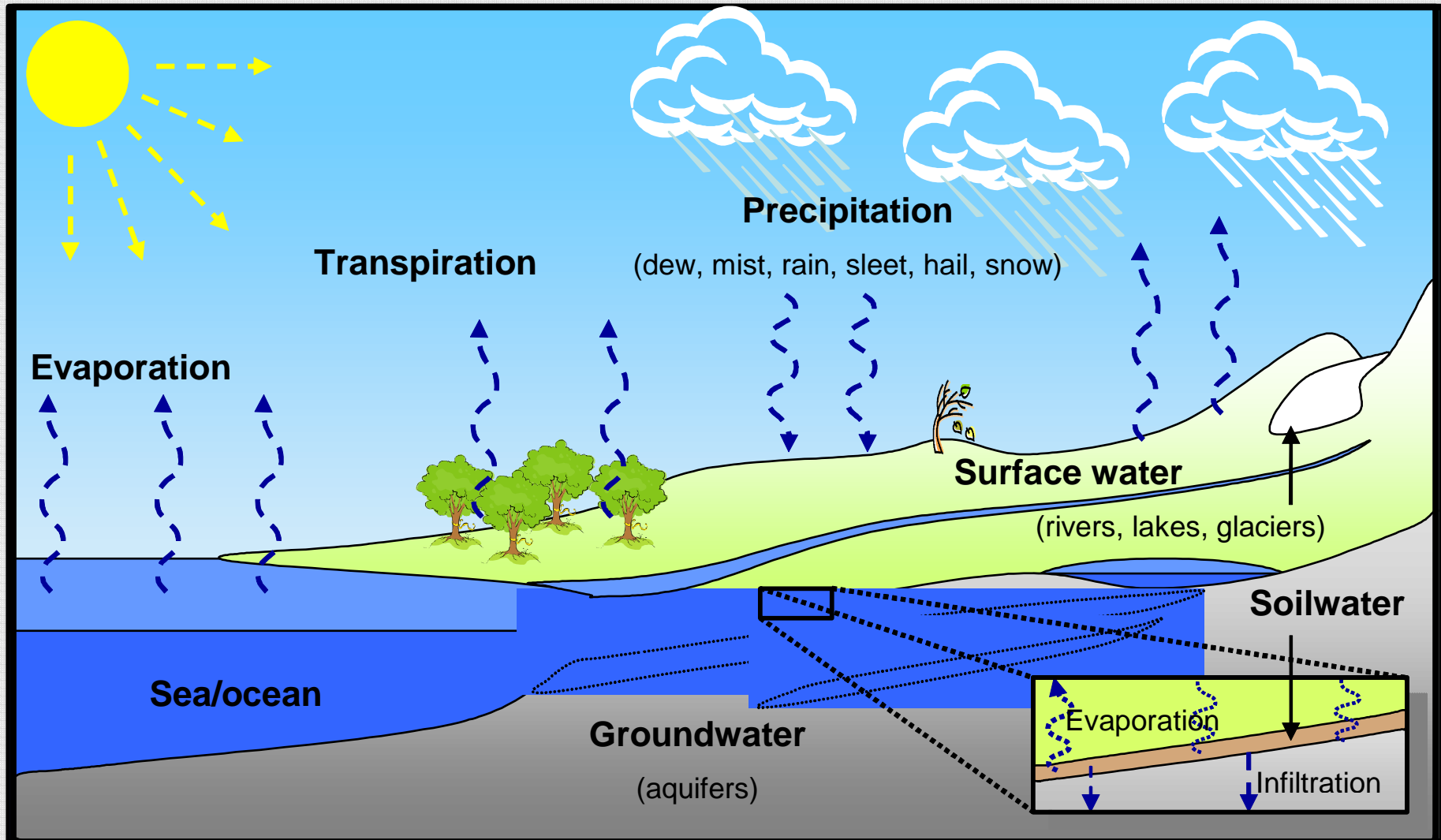
IV

http://unstats.un.org/unsd/envaccounting/WWAP_UNSD_WaterMF.pdf

Level 1: Account 3: Water

- Concepts
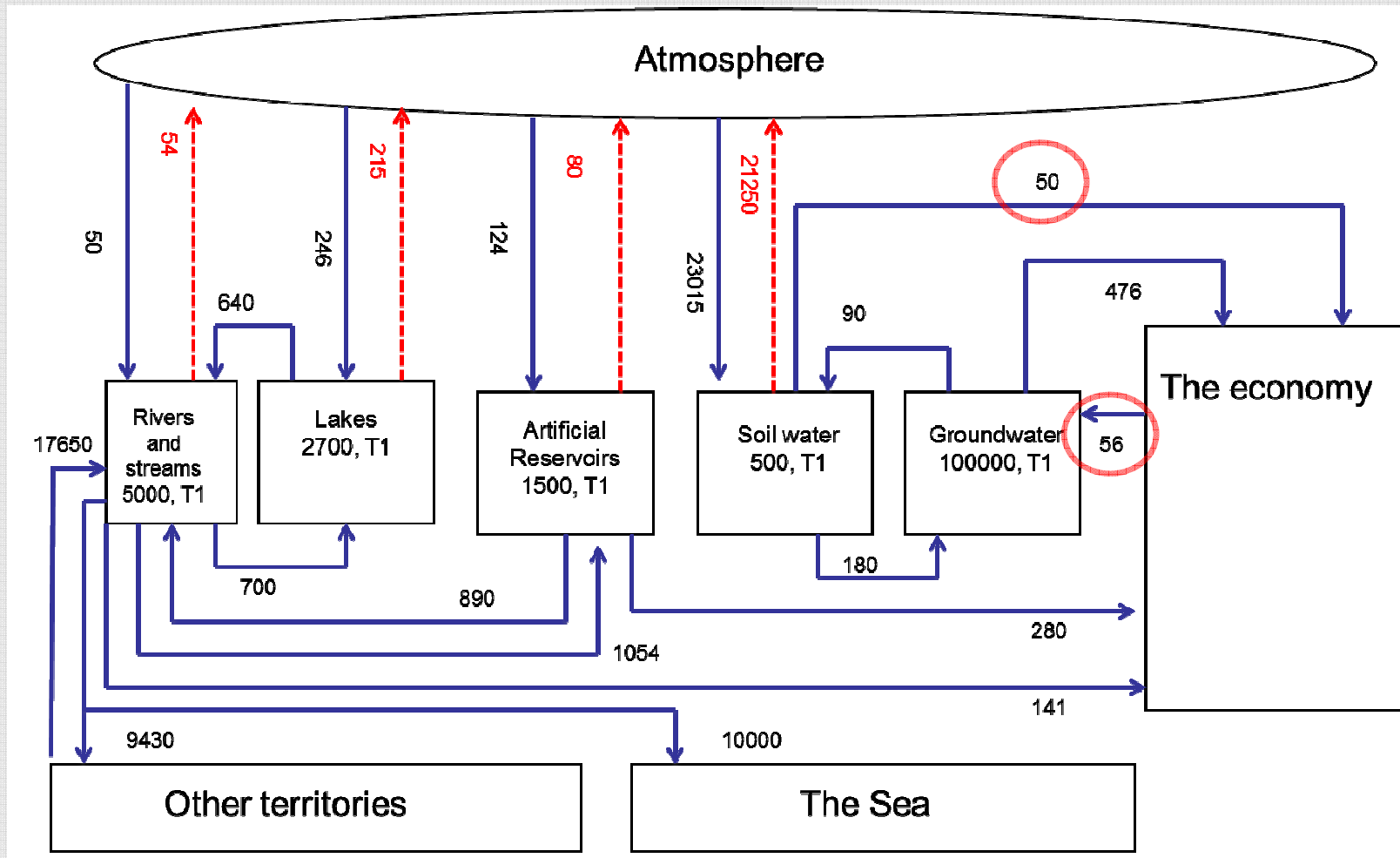 - The hydrological cycle
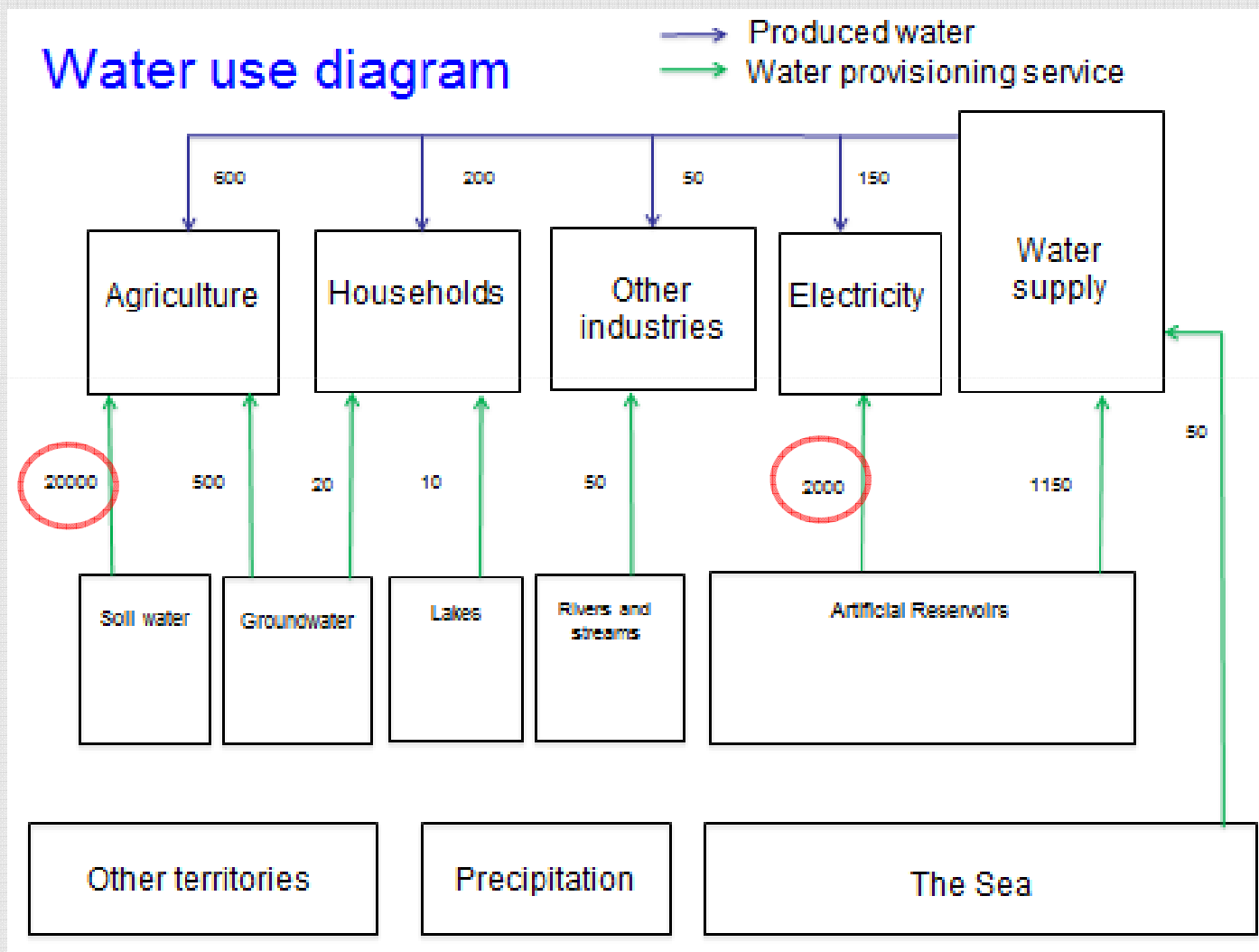 - Stocks, supply, abstraction and use

The Hydrological Cycle

Water stocks and flows diagram

Water asset account from diagram

		Type of water resource						Total
		Surface water				Groundwater	Soil water	
		Artificial reservoirs	Lakes	Rivers and streams	Glaciers, snow and ice			
Opening		1500	2700	5000	0	100000	500	109700
Additions								
	Returns					56		56
	Precipitation	124	246	50			23015	23435
	Inflows from other territories			17650				17650
	Inflows from other inland water resources	1054	700	640		180	90	2664
	Discoveries of water in aquifers							0
	Total additions to stock	*1178*	*946*	*18340*	*0*	*236*	*23105*	43805
Reductions								
	Abstraction	280		141		476	50	947
	for hydro power generation							0
	for cooling water							0
	Evaporation & actual evapotranspiration	80	215	54			21250	21599
	Outflows to other territores			9430				9430
	Outflows to the sea			10000				10000
	Outflows to other inland water resources	890	640	1754		90	180	3554
	Total reductions in stock	*1250*	*855*	*21379*	*0*	*566*	*21480*	45530
Closing		1428	2791	1961	0	99670	2125	107975

Level 1: Account 3: Water

Physical Water Use Table

	Use of water					Total use
	Agriculture, forestry and fishing	Electricity, gas, steam and air conditioning supply	Water collection, treatment and supply	Other industries	Households	
Sources of abstracted water						
Inland water resources						
Surface water		2000	1150	50	10	3210
Groundwater	500				20	520
Soil water	20000					
Total	*20500*	*2000*	*1150*	*50*	*30*	*3730*
Other water sources						
Precipitation						
Sea water			50			50
Total			*50*			*50*
Use abstracted water	20500	2000	1200	50	30	3780
Abstracted water						
Distributed water			1000			1000
Own use	20500	2000	200	50	40	22790
Use of water from other economic units						
	600	150	0	50	200	1000
Total use of water (abstracted and from other economic units)						
	21100	2150	1200	100	230	4780

Level 1: Account 3: Water

- Compilation Group Exercise (30m)
  - Situation:
    1. Have a simplified Stock and Flow Diagram
    2. Have a simplified Physical Supply and Use Diagram
  - Objective (Groups of 3-5):
    1. Transcribe diagram (1) into a Water Asset Account
    2. Transcribe diagram (2) into a Physical Supply and Use Table
    3. Report results

Level 1: Account 3: Water

Group Exercise: Step 1 – Transcribe stock and flow data
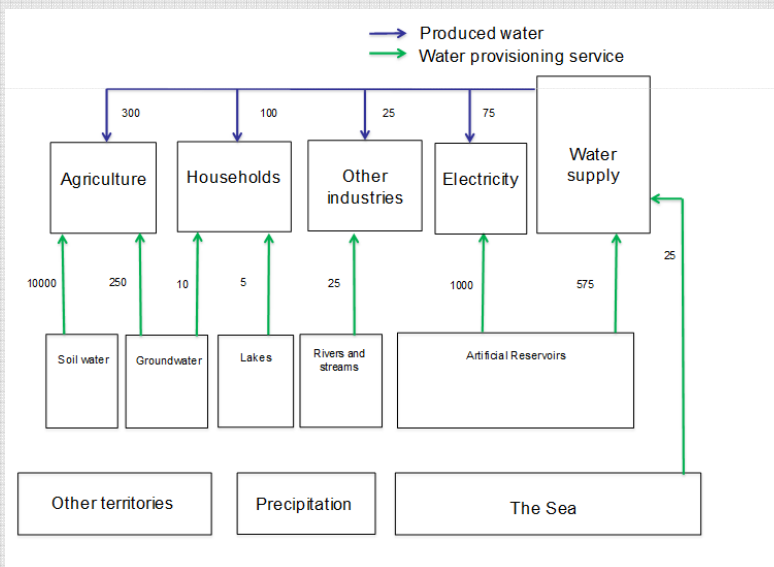
Stock and Flow Diagram

Water Asset Account

Level 1: Account 3: Water

Group Exercise: Step 2 – Transcribe supply and use data

Physical Supply and Use Diagram

Physical Supply and Use Table

Level 1: Account 3: Water

- Is everyone clear on the objectives?
- 30 minutes group work
- Please ask questions!
- Results:
  - Each group report:
    1. Opening and closing stock
    2. Total use of water
  - Bonus questions:
    1. What was the largest source of reductions in stock?
    2. What is the main use of water

21

Water asset account answers

| | Type of water resource | | | | | | |
| | Surface water | | | | | | |
	Artificial reservoirs	Lakes	Rivers and streams	Glaciers, snow and ice	Groundwater	Soil water	Total
Opening stock of	**1500**	**-**	**5000**	**0**	**5000**	**200**	**11700**
Additions to stock							
Returns		-	-	-	20		20
Precipitation	50	-	20	-		10000	10070
Inflows from other territories	-	-	1000	-			1000
Inflows from other inland water	1000	-	500	-	100		1600
Discoveries of water in aquifers	-	-	-	-	-	-	0
Total additions to stock	*1050*	*-*	*1520*	*-*	*120*	*10000*	*12690*
Reductions in							
Abstraction	200	-	100	-	100	20	420
for hydro power generation	-	-	-	-	-	-	-
for cooling water	-	-	-	-	-	-	-
Evaporation & actual evapotranspiration	40	-	20	-		9000	9060
Outflows to other territores		-		-			-
Outflows to the sea		-	900	-			900
Outflows to other inland water resources	500	-	1000	-			1500
Total reductions in stock	*740*	*-*	*2020*		*100*	*9020*	*11880*
Closing stock of	**1810**	**-**	**4500**	**-**	**5020**	**1180**	**12510**

Physical Supply and Use Table Answers

	Use of water					Total use
	Agriculture, forestry and fishing	Electricity, gas, steam and air conditioning supply	Water collection, treatment and supply	Other industries	Households	
Sources of abstracted water						
Inland water resources						
Surface water		1000	575	25	5	1605
Groundwater	250				10	260
Soil water	10000					
Total	*10250*	*1000*	*575*	*25*	*15*	*1865*
Other water sources						
Precipitation						
Sea water			25			25
Total			*25*			*25*
Use abstracted water	10250	1000	600	25	15	1890
Abstracted water						
Distributed water			1000			1000
Own use	10250	1000	100	25	20	11395
Use of water from other economic units						
	300	75	0	25	100	500
Total use of water (abstracted and from other economic units)						
	10550	1075	600	50	115	2390

23

Level 2: Account 3: Water

- **Learning objectives (Level 2)**

  - Understand the data options, sources and methods used

  - Understand the important conceptual issues

  - Be aware of how other countries have approached Water Accounting

Level 2: Account 3: Water

- Data Options
  - Types of water data
    - Stock, supply, use,
    - Water quality
  - Sources of national and global water data

Level 2: Account 3: Water

Data sources by type

▪ The main data sources used for producing water accounts and water related ecosystem services are:

- Survey data (e.g. agricultural survey)
- Administrative data (e.g., water consumption)
- Hydrological/meteorological data (e.g., rainfall)
- Research data (e.g., case studies)
- Land cover data
- Water quality data

Level 2: Account 3: Water

- Data sources by agency
  - Government agencies responsible for:
    - Water, meteorology, hydrology, statistics, agriculture, environment, energy (especially hydro-power), planning, finance, geology
    - National, state/provincial or local government
  - Water suppliers and wastewater treatment
  - Water research organisations
    (e.g. government agencies, universities)
  - Non-government organisations
    (e.g. water industry associations, farmer associations, conservation groups, etc.)

Level 2: Account 3: Water

Global data sources

A range of data on water and land cover are available from international agencies or research organisations. These include:

- FAO Aquastat http://www.fao.org/nr/water/aquastat/main/index.stm
- WHO World Climate Data and Monitoring Program (WCDMP) http://www.wmo.int/pages/prog/wcp/wcdmp/index_en.php
- WMO World Hydrological Cycle Observing System (WHYCOS) http://www.whycos.org/whycos/

Level 2: Account 3: Water

- Types of water quality indicators (examples)

Indicator	Notes	Water quality	Ecosystem condition
Nutrient levels and pollution loads	E.g. N,P,K levels, heavy metals and pesticides	Higher levels mean lower water quality and limits the possible uses of the water	Can lead to a change in the composition of aquatic species (e.g. fish kills)
Sediment load	e.g. small particles in the water resulting from soil erosion	Higher loads mean lower water quality and limits possible uses of water	Can lead to a change nature of downstream ecosystems (e.g. siltation of rivers and impact on marine ecosystems)
Species richness and abundance	This is a measure of the number, type (e.g. vascular plants, invertebrates, fish) of species occurring in the water.	Particular species or groups of species are sensitive to changes in the levels of nutrients or sediments loads and hence species richness and abundance is a proxy for water quality	Biodiversity is an indication of ecosystem condition.

29

Level 2: Account 3: Water

Guidelines on methods:

Many guidelines, standards and classifications relevant to water and ecosystem accounting
- International Recommendations for Water Statistics (IRWS)
- Guide to Meteorological Instruments and Methods of Observation
- Guidelines on the Role, Operation and Management of National Hydrological Services
- International Benchmarking Network for Water and Sanitation Utilities
- A System of Integrated Agricultural Censuses and Surveys
- ISO (e.g. ISO 19115 for geographic information)
- Statistical Data and Metadata Exchange (or SDMX)
- World Meteorological Organisation Core Metadata Standard
- Infrastructure for Spatial Information in the European Community (INSPIRE)
- Global Annual Assessment of Sanitation and Drinking Water
- MDG reporting standards (for water supply and sanitation)

Level 2: Account 3: Water

- Some common problems in compilation of water accounts:

    - Classification of units to industry especially those engaged in multiple activities (e.g. water supply, sewerage and hydro-electricity generation)

    - In most countries national accounts do not separate the water supply and sewerage industries

    - Recording of losses in distribution and the flows for use of water in hydro-electricity and water for cooling

    - Boundary between environment and the economy, especially artificial reservoirs

    - Spatial referencing – economic data refers to administrative boundaries while hydrological data refers to river basins

Level 2: Account 3: Water

- Other conceptual issues
  - Inter-ecosystem flows (ecosystem as supplier and beneficiary)
  - Treatment of rivers, coasts, marine (SA example)
  - Large stock – difficult to measure (e.g., Canada)
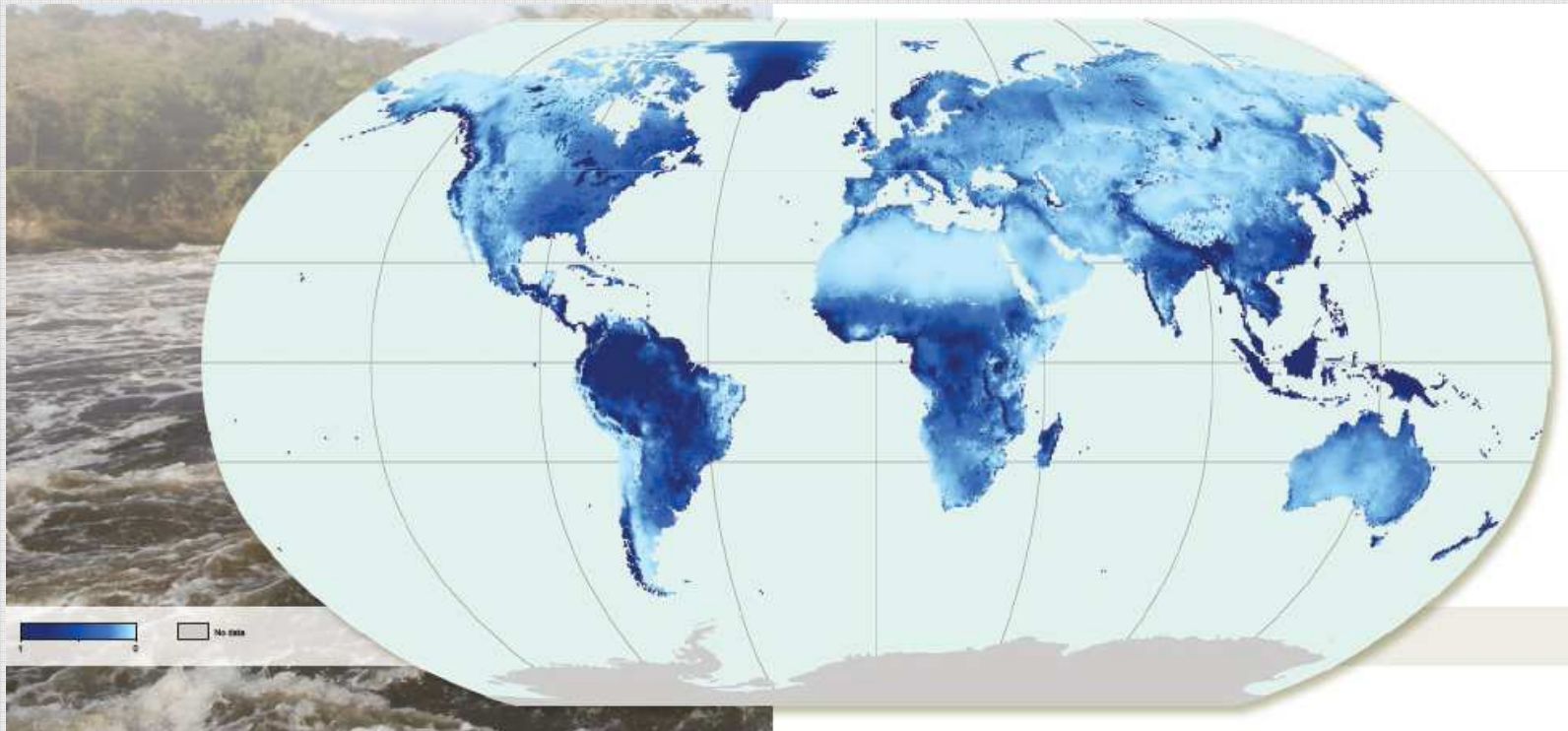 - Variability (e.g., Canada drought/flood cycles)

Level 2: Account 3: Water

- Some examples:
  - UNEP-WCMC Composite map of global ecosystem assets (Freshwater component)
  - Australia Water Accounts
  - Canada Freshwater Supply and Demand

Level 2: Account 3: Water
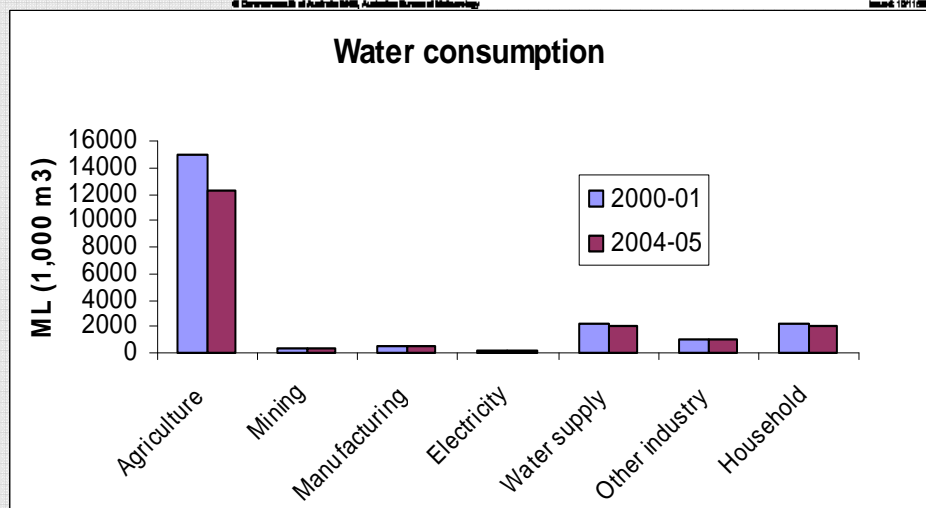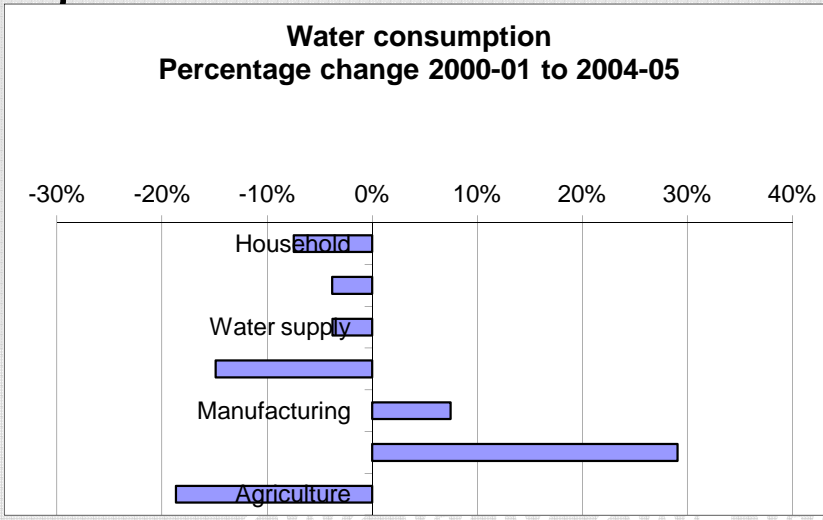
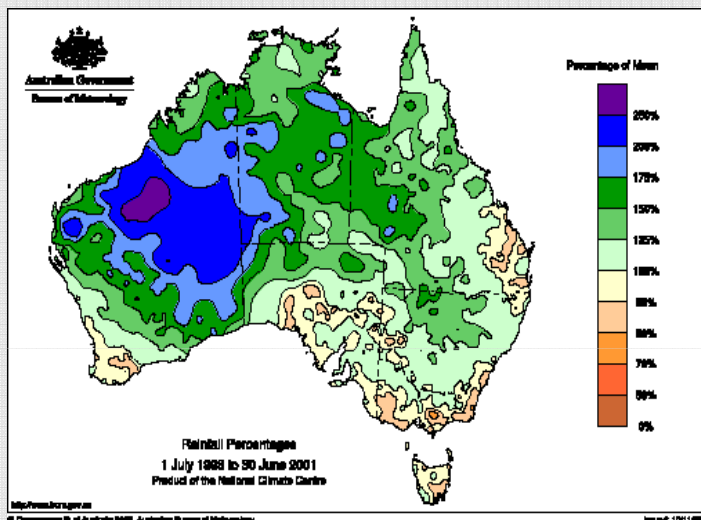- UNEP-WCMC Composite map of global freshwater resources

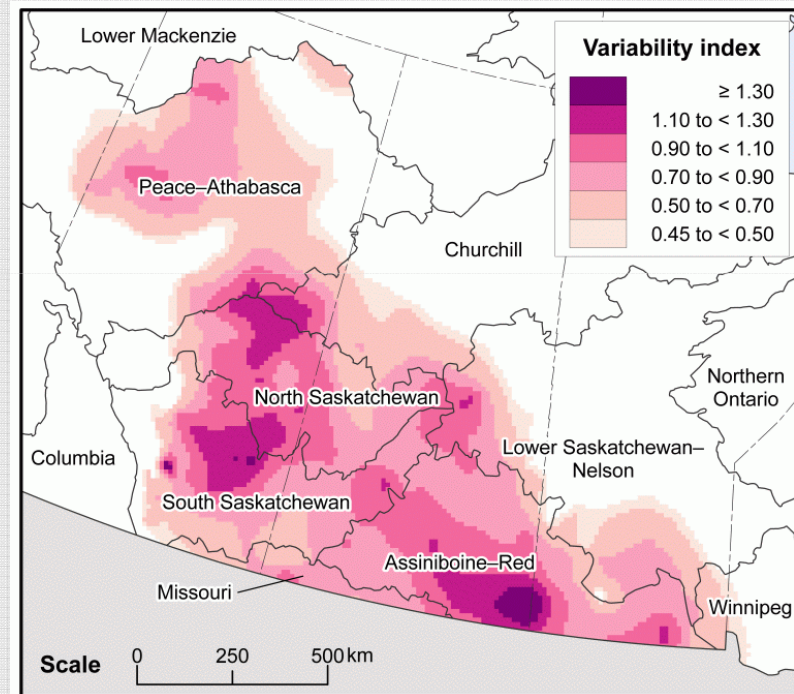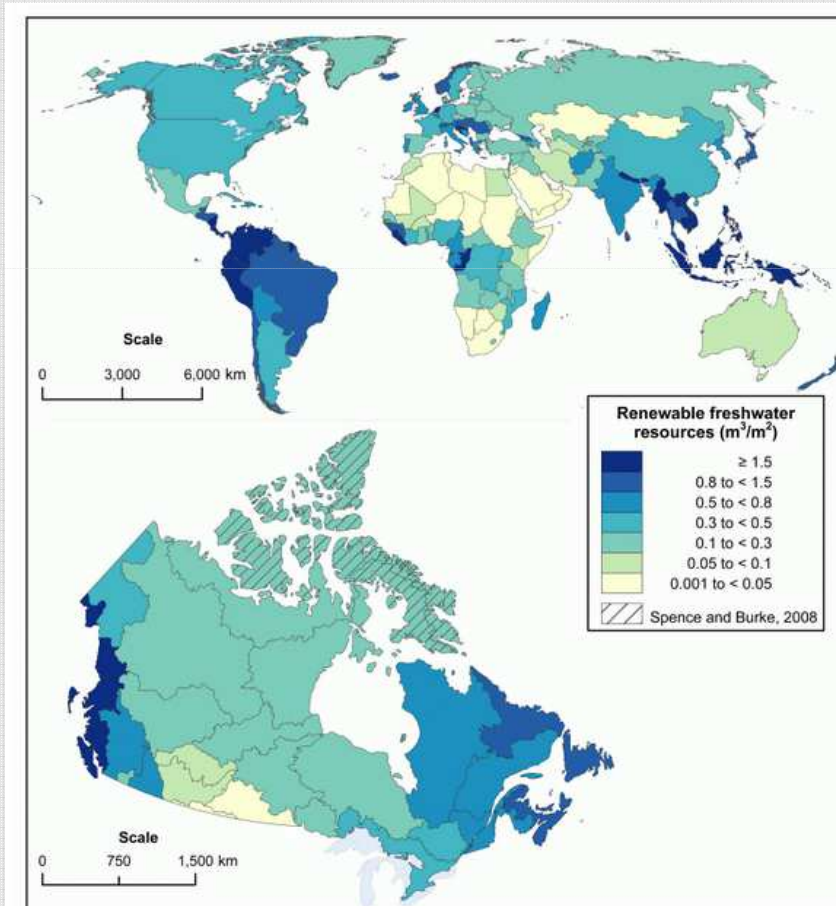Source: Dickson, Blaney et al. (2014)   34

Level 2: Account 3: Water

Australia`s water accounts are not just tables
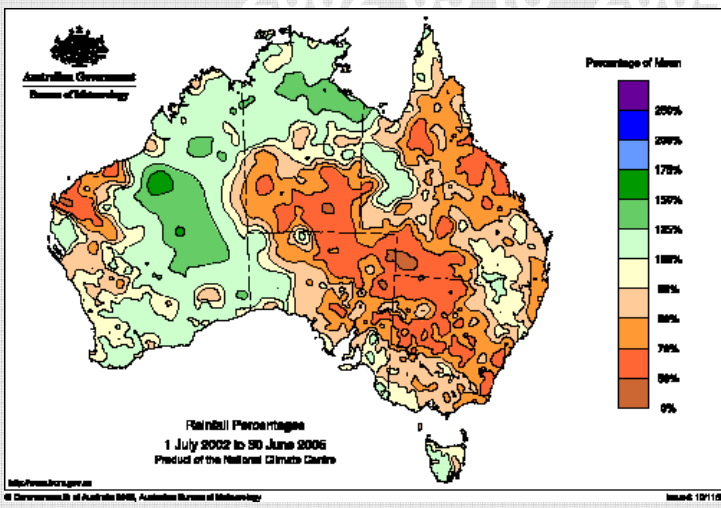
Level 2: Account 3: Water

- Canada's Freshwater Supply and Demand

Source: Statistics Canada, 2010

36

Level 2: Account 3: Water

- Group exercise (15m) (Groups of 3-5)

1. What is the main water issue in your country?
2. Suggest **three** measures that could be used to address it?
3. Report:
   - The water issue you selected
   - The three measures you selected
   - Are **national** data available in your country for these measures?

Level 2: Account 3: Water

- Concepts Group exercise (15m)

- Group reports
  - Water issue you selected
  - The three measures you selected
  - Are national data available in your country for these measures?

- Discussion
  - What other measures could you suggest?
  - What other data sources could you suggest?

Level 2: Account 3: Water

- **Discussion and questions**
- **Take home points**
  - Water accounting can address a range of policies related to:
    - Improving access to drinking water and sanitation services
    - Managing water supply and demand
    - Improving the condition and services provided by water-related ecosystems
    - Adaptation to extreme events (flooding and drought)
  - It is not necessary to compile complete water accounts
    - Address national policy priorities with available data
  - National and global data and guidance are available to get started

39

Level 2: Account 3: Water

- ▪ References
- ▪ Australian Bureau of Statistics (2014). Water Account, Australia, 2012-13.
  http://www.abs.gov.au/ausstats/abs@.nsf/mf/4610.0
- ▪ Dickson, B., Blaney, R., Miles, L., Regan, E., van Soesbergen, A., Väänänen, E., . . . van Bochove, J. (2014). *Towards a global map of natural capital: Key ecosystem assets.* (No. DEW/1824/NA). Nairobi, Kenya: UNEP.
- ▪ Statistics Canada. (2010). Human activity and the environment: Freshwater supply and demand in Canada (2010). (No. 16-201-XWE). Ottawa: Government of Canada.
- ▪ UNSD (2009) 5th World Water Forum Istanbul: Topic 6.4 Data for All, Turkey,
  http://unstats.un.org/unsd/envaccounting/workshops/wwf2009/topicOutline.pdf
- ▪ Vardon, M., Lenzen, M., Peevor, S., & Creaser, M. (2007). Water accounting in Australia. Ecological Economics, 61(4), 650-659.

- ▪ Further Information
  - SEEA Experimental Ecosystem Accounting (2012)
  - SEEA-EEA Technical Guidance (forthcoming)
    - ▫ Detailed supporting document on "Water and ecosystem accounting" by Michael Vardon
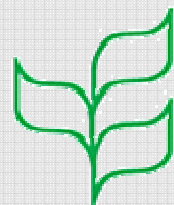
40

Evaluation of the training module

- Please complete the evaluation form for this module
- For this module
    - What did you learn that you could apply in your work?
    - Was the presentation clear and informative?
    - Was it too simple? Too complex?
    - Was there anything you did not understand?
    - What additions or deletions would you suggest (recognizing that the unit is intended for a general audience)?
    - Do you have any suggestions as to how the SEEA-EEA may be improved (concepts, principles) in this area?

Acknowledgements

- This project is a collaboration of The United Nations Statistics Division, United Nations Environment Programme and the Secretariat of the Convention on Biological Diversity and is supported by the Government of Norway.