Distinguishing and valuing the water provisioning service, water as a natural resource and the product “natural water”

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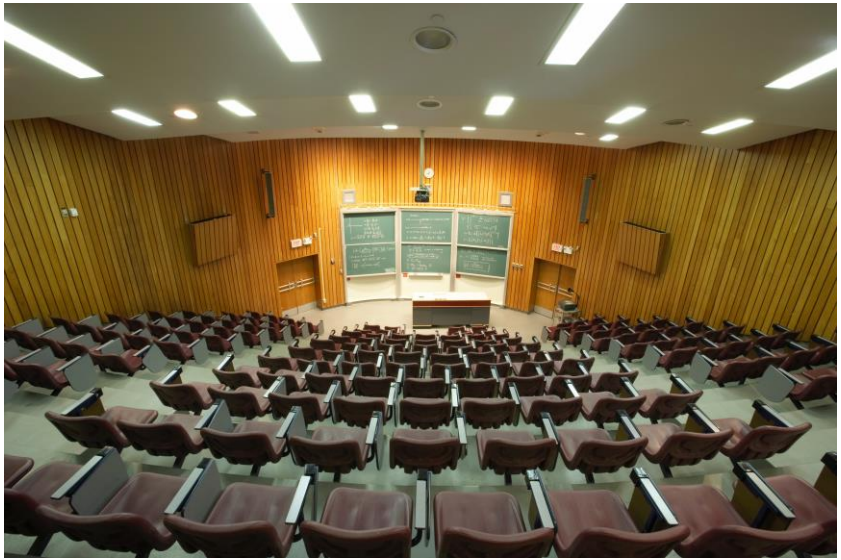
Outline of presentation

- Accounting, assets, flows
- Production boundary and own-account production
- Flows with example
- Recording of agricultural use of ecosystem services
- Water valuation
- Conclusion



INTRODUCTION

Water and accounting

System of National Accounts

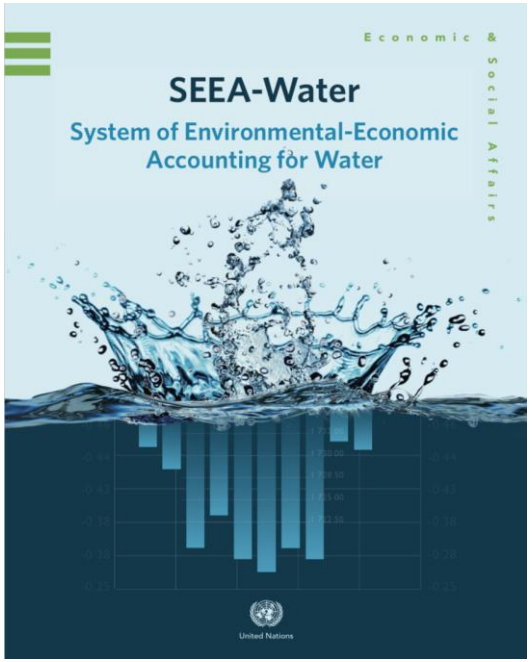
SEEA Water (original and best?)

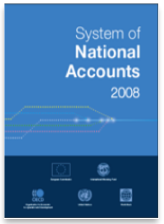
Central Framework

Ecosystem accounting

Different scope, coverage and classifications

- Assets
- Flows (SEEA Central Framework and SEEA Water explicitly included return flows, SEEA Water a more complete representation of hydrological system)
- When are they the same and when are they different?

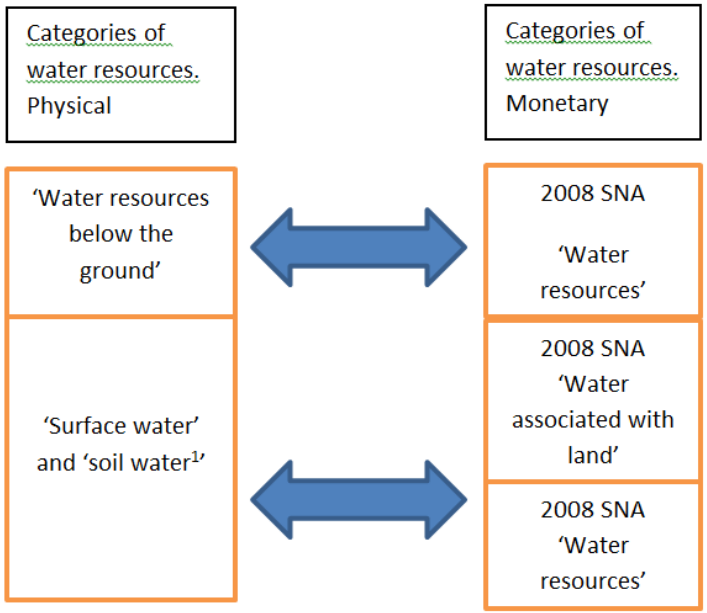




https://seea.un.org/

Water assets in the SNA and SEEA Central Framework

SEEA Central Framework to SNA asset items



[1]Soil water is assigned to the SNA category 'water associated with land'

The 2008 SNA assigns

- All groundwater to 'water resources'
- Water integrated with land ownership to 'water associated with land', which includes soil water
- Surface water subject to purchase, extraction and use in production as part of 'water resources' (along with groundwater).

SNA 'Water associated with land':

- "any inland waters (reservoirs, lakes, rivers, etc.) over which ownership rights can be exercised and that can, therefore, be the subject of transactions between institutional units". (2008 SNA, paragraph 10.175.)

SNA also has a 'permit to use a natural resource' which includes such things as tradable water rights. This is not the water, but may be used to value water

SEEA Central Framework

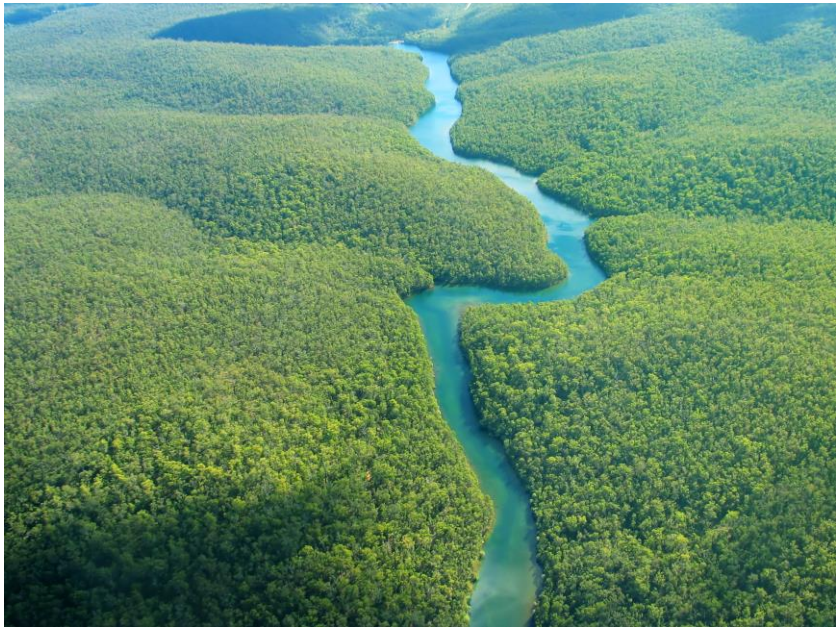
- Surface water, groundwater, soil water, seas and oceans (corresponds with GET classes)

Ecosystem assets related to water

SEEA Ecosystem Accounting Asset types (pp. 57)

- Freshwater
  - F1 Rivers and streams
  - F2 Lakes
  - F3 Artificial reservoirs
- Transitional
  - TF1Palustrine wetlands
  - FM1 Semi-confined transitional waters
  - MFT1 Brackish tidal systems
  - SF1 Subterranean freshwater
  - SF1 Anthropocentric subterranean freshwater

The classes aligns with the SEEA Central Framework



Ecosystem services related to water

SEEA Ecosystem Accounting services(pp. 131 to 133)

Provisioning services

- Water supply

Regulating and maintenance services

- Soil and sediment retention
- Water purification
- Water flow regulation
- Flood control
- Nursery and population habitat services

Cultural services

- Recreation
- Visual amenity
- Spiritual, artistic and symbolic services

PRODUCTION AND OWN-ACCOUNT PRODUCTION

Production boundary

The production boundary of the SNA includes the following activities:

a. The production of all goods or services that are supplied to units other than their producers, or intended to be so supplied, including the production of goods or services used up in the process of producing such goods or services;

b. b. The own-account production of all goods that are retained by their producers for their own final consumption or gross capital formation;

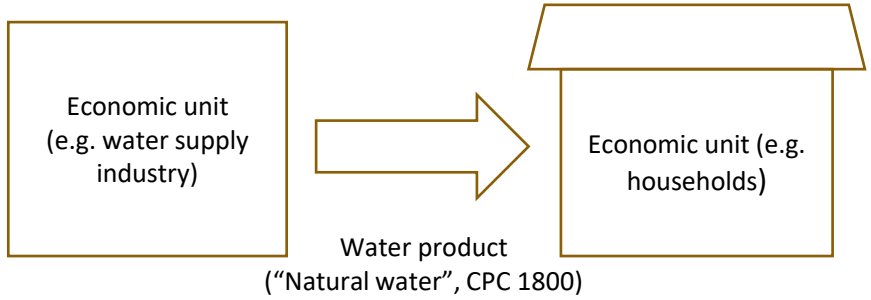
c. … (SNA para. 6.27)

Issue 16 Outcome Paper for Central Framework Development Recommendation 16.1:

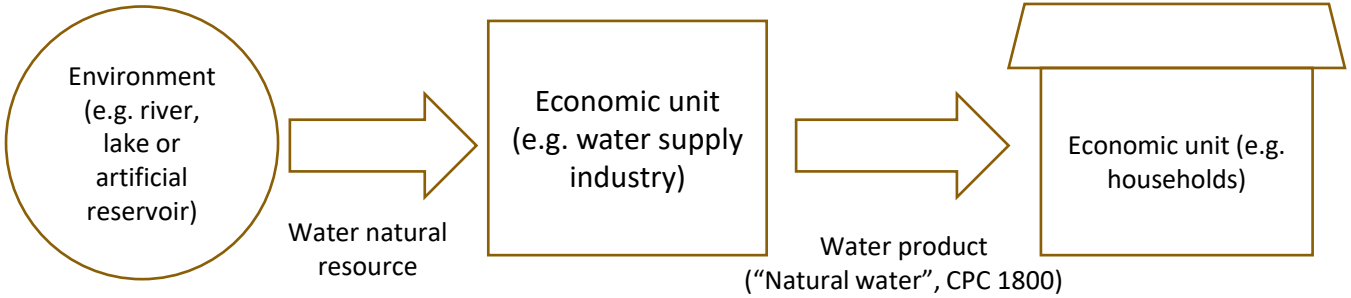
- "That in the revised SEEA, the production boundary of the SNA should be extended such that water in artificial reservoirs should be treated as entering the supply of the economy at the time it enters the artificial reservoir and the net recharge of water to artificial reservoirs should be recorded as a change in inventories."
- Degrees of management (regulation)

FLOWS WITH EXAMPLE

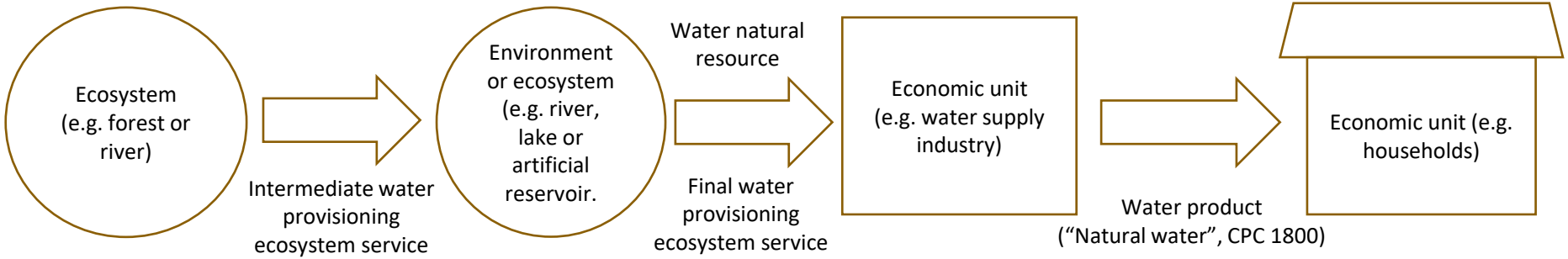
1 a. Water flows in SNA



1 b. Water flows in the SEEA Central Framework



1 c. Water flows in SEEA Ecosystem Accounting



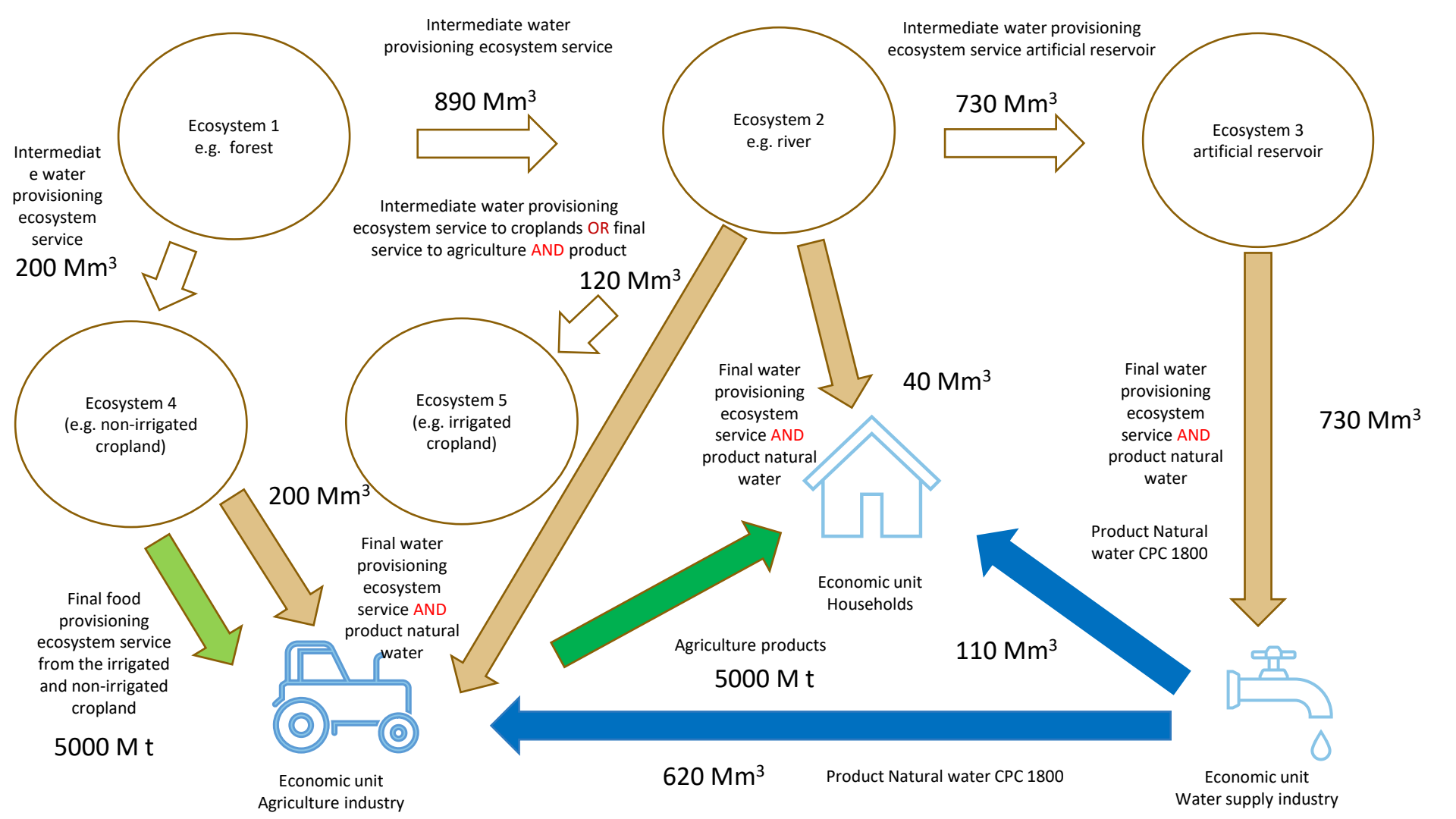

Intermediate water provisioning ecosystem service
890 Mm3
Intermediate water provisioning ecosystem service artificial reservoir
730 Mm3
Ecosystem 1
e.g. forest
Ecosystem 2
e.g. river
Ecosystem 3
artificial reservoir
Intermediate water provisioning ecosystem service
200 Mm3
Intermediate water provisioning ecosystem service to croplands OR final service to agriculture AND product
120 Mm3
Ecosystem 4
(e.g. non-irrigated cropland)
Ecosystem 5
(e.g. irrigated cropland)
Final water provisioning ecosystem service AND product natural water
40 Mm3
Final water provisioning ecosystem service AND product natural water
730 Mm3
200 Mm3
Final water provisioning ecosystem service AND product natural water
Product Natural water CPC 1800
Economic unit
Households
Final food provisioning ecosystem service from the irrigated and non-irrigated cropland
Agriculture products
5000 M t
110 Mm3
5000 M t
Economic unit
Agriculture industry
620 Mm3
Product Natural water CPC 1800
Economic unit
Water supply industry

Table 1a. River supplies agriculture and existing production boundary

	Economy				Ecosystem					
Table 1a River supplies agriculture and exisiting productions boundary	Agriculture	Water supply	Inventories	Households	Forest	Non-irrigated cropland cropland	Irrigated cropland	River	Artificial reservoir	Total
SUPPLY	M m3	M m3	M m3	M m3	M m3	M m3	M m3	M m3	M m3	M m3
Ecosystem service										
Water provisioning										
Intermediate					1090			730		1820
Final						200		160	730	1090
Products										
Natural water	~~320~~	730		~~40~~						1090
USE										
Ecosystem service										
Water provisioning										
Intermediate						200		890	730	1820
Final	320	730		40						1090
Products										
Natural water	940			150						1090

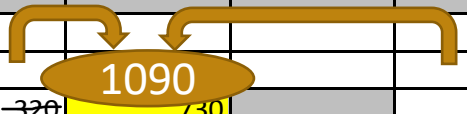


Table 1b. River supplies irrigated crops and irrigated crops supply agriculture and existing production boundary

	Economy				Ecosystem					
Table 1b River supplies irrigated crop, irrigated crops supply agricultre and exisiting productions boundary	Agriculture	Water supply	Inventores	Households	Forest	Non-irrigated cropland cropland	Irrigated cropland	River	Artificial reservoir	Total
SUPPLY	M m3	M m3	M m3	M m3	M m3	M m3	M m3	M m3	M m3	M m3
Ecosystem service										
Water provisioning										
Intermediate					1090			850		1940
Final						200	120	40	730	1090
Products										
Natural water	320	730		40						1090
USE										
Ecosystem service										
Water provisioning										
Intermediate						200	120	890	730	1940
Final	320	730		40						1090
Products										
Natural water	940			150						1090

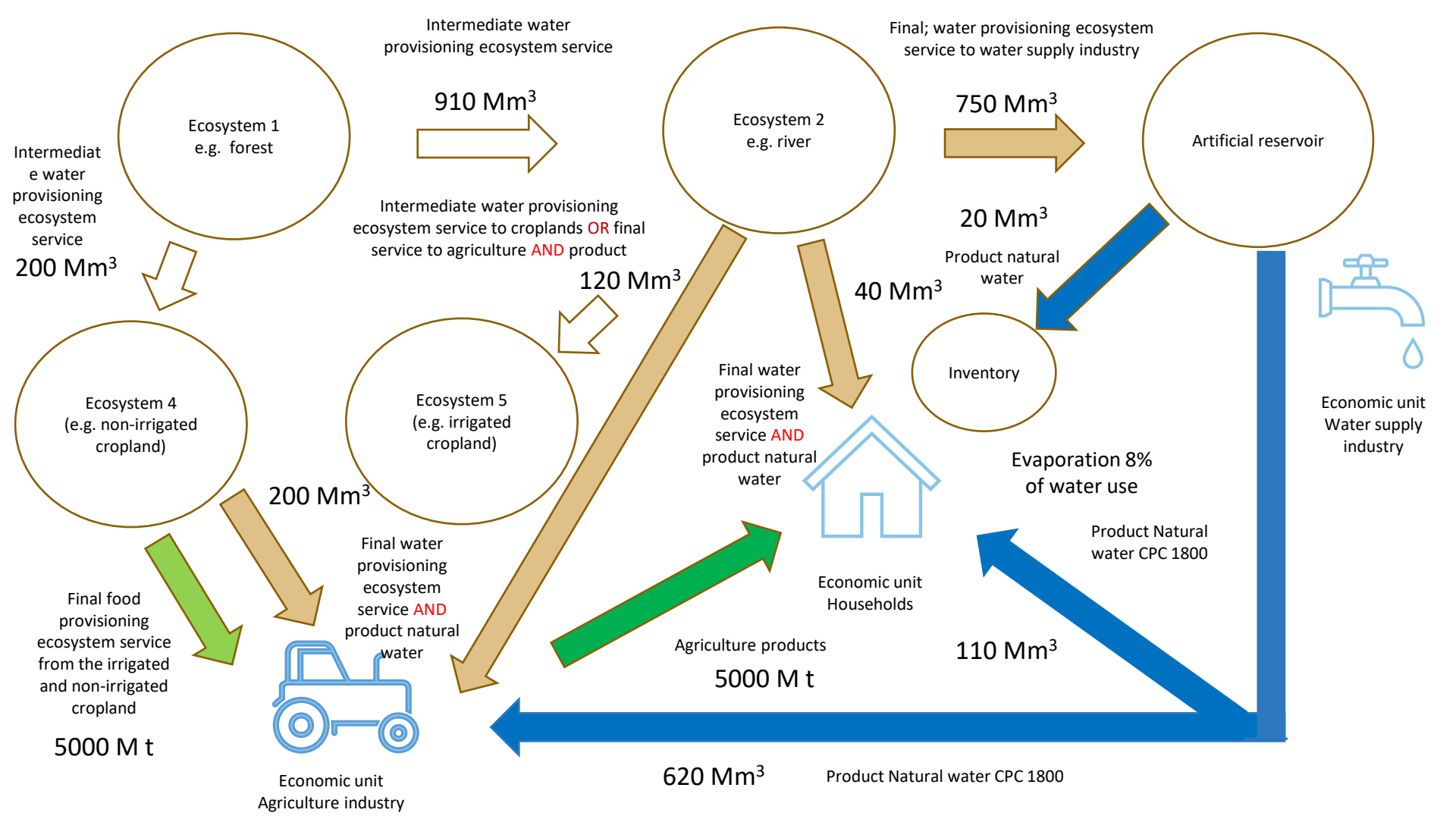

Intermediate water provisioning ecosystem service
910 Mm3
Final; water provisioning ecosystem service to water supply industry
750 Mm3
Ecosystem 1 e.g. forest
Ecosystem 2 e.g. river
Artificial reservoir
Intermediate water provisioning ecosystem service
200 Mm3
Intermediate water provisioning ecosystem service to croplands OR final service to agriculture AND product
120 Mm3
20 Mm3
Product natural water
40 Mm3
Ecosystem 4 (e.g. non-irrigated cropland)
Ecosystem 5 (e.g. irrigated cropland)
Inventory
Final water provisioning ecosystem service AND product natural water
Economic unit Water supply industry
Evaporation 8% of water use
200 Mm3
Final water provisioning ecosystem service AND product natural water
Product Natural water CPC 1800
Economic unit Households
Final food provisioning ecosystem service from the irrigated and non-irrigated cropland
Agriculture products
5000 M t
110 Mm3
5000 M t
Economic unit Agriculture industry
620 Mm3
Product Natural water CPC 1800

Table 2a. River supplies agriculture and expanded production boundary

	Economy				Ecosystem					
Table 2b River supplies agricullture and expanded productions boundary	Agriculture	Water supply	Inventores	Households	Forest	Non-irrigated cropland cropland	Irrigated cropland	River	Artificial reservoir	Total
SUPPLY	M m3	M m3	M m3	M m3	M m3	M m3	M m3	M m3	M m3	M m3
Ecosystem service										
Water provisioning										
Intermediate					1110			750		1860
Final						200		160	750	1110
Products										
Natural water	320	750		40						1110
USE										
Ecosystem service										
Water provisioning										
Intermediate						200		910	750	1860
Final	320	750		40						1110
Products										
Natural water	940		20	150						1110

Table 2b. River supplies irrigated crops and irrigated crops supply agriculture and expanded production boundary

	Economy				Ecosystem					
Table 2b River supplies irrigated crops irrigated crops supply agricultre iand expanded productions boundary	Agriculture	Water supply	Inventores	Households	Forest	Non-irrigated cropland cropland	Irrigated cropland	River	Artificial reservoir	Total
SUPPLY	M m3	M m3	M m3	M m3	M m3	M m3	M m3	M m3	M m3	M m3
Ecosystem service										
Water provisioning										
Intermediate					1110			870		1980
Final						200	120	40	750	1110
Products										
Natural water	320	750		40						1110
USE										
Ecosystem service										
Water provisioning										
Intermediate						200	120	910	750	1980
Final	320	750		40						1110
Products										
Natural water	940		20	150						1110

Treatment of water use by agricultural land

SEEA Central Framework	SEEA Ecosystem Accounting
Non-irrigated cropland • **Uses soil moisture** - **Source of source moisture is direct precipitation plus run-off** • **Use of soil moisture by agriculture**	Non-irrigated cropland • Uses intermediate water provisioning service from other ecosystems - Runoff from other ecosystems transpired by crops - Precipitation onto the non-irrigated cropland (atmosphere as an ecosystem) transpired by crops • Use of all water by agriculture
Irrigated cropland • **Use surface and groundwater from water suppliers (including own-account production), and soil moisture** - **Source of source moisture is direct precipitation plus run-off** • **Use of all water by agriculture**	Irrigated cropland – options 1 • Water ecosystems (e.g. rivers, artificial reservoirs) supply the final water provisioning ecosystem services to agriculture Irrigated cropland – options 2 • Irrigated croplands use of intermediate water provisioning ecosystem services from water ecosystems (e.g. rivers, artificial reservoirs) by irrigated cropland • Irrigated croplands supply the final water provisioning ecosystem service to agriculture

Implications of treatment of water flows and agriculture for valuation

To what ecosystem asset is the value of water being attributed?

- Croplands
  - The value of water provisioning service embedded in the food provisioning service
- Water ecosystems
- Direct attribution of water provisioning service

Need to identify possible double counting

- Possible to alternative, non-additive presentations (like industry and sector in SNA

Water and renewable energy

Is this a use of an ecosystem service of water provisioning?

- Certainly, a use of water in the SEEA Central Framework (both natural resource and product and return flows
- Could be the use of the ecosystem service of gravity!

For the value of hydroelectricity simplest to record the value under renewable energy

VALUATION

Academic studies of water valuation

Massive literature

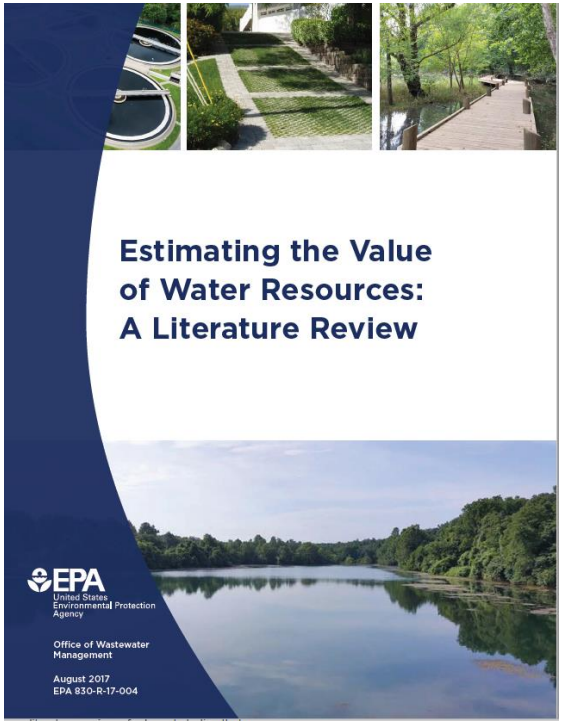
- 2657 articles identified via Scopus search

Several reviews of water valuation (Kind et al 2020, Siikamaki et al. 2021)

Need to identify approaches consistent with exchange values

Determine the data available to support valuation

- Price x quantity = value
- Quality of water
- Price a function of many things (e.g. relative scarcity and demand)



https://www.epa.gov/sites/default/files/2018-10/documents/estimating_value_of_water_lit_review.pdf

SEEA – valuation concepts and methods

Methods suitable for estimating exchange values as listed in the SEEA Ecosystem Accounting in order of preference (p. 193):

i. Methods where the price for the ecosystem service is directly observable;

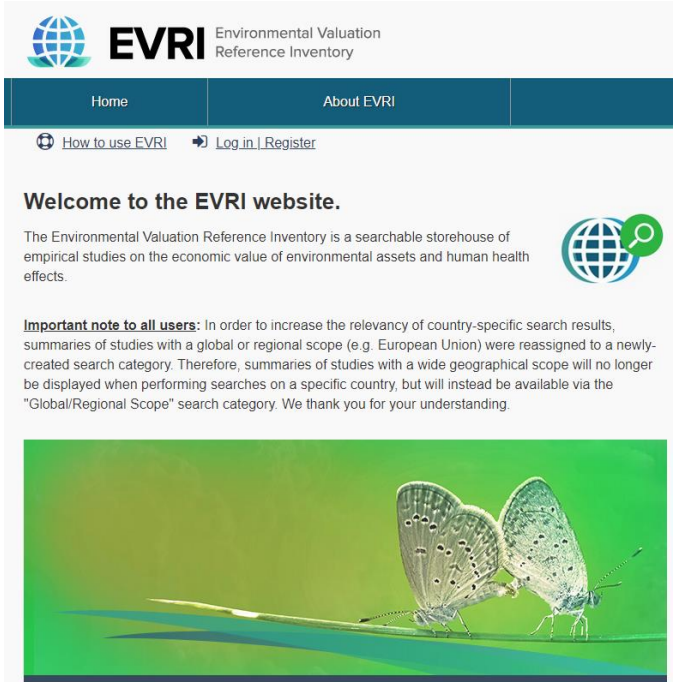
ii. Methods where the price for the ecosystem service is obtained from markets for similar goods and services;

iii. Methods where the price for the ecosystem service is embodied in a market transaction;

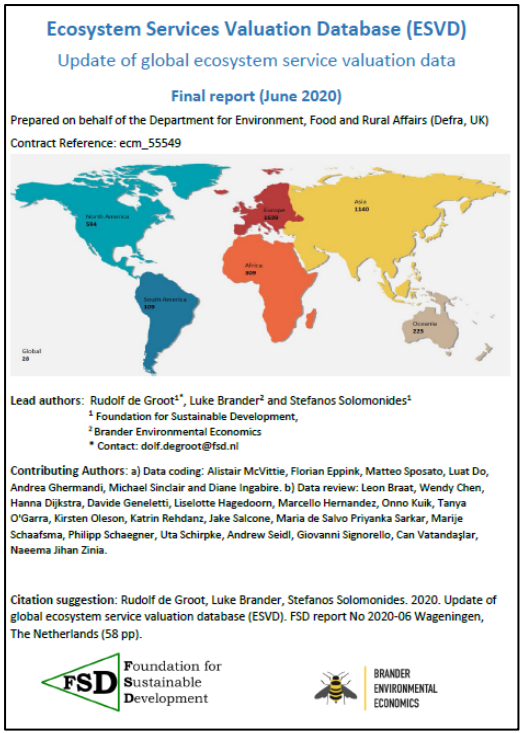
iv. Methods where the price for the ecosystem services is based on revealed expenditures (costs) for related goods and services;

v. Methods where the price for the ecosystem service is based on expected expenditures or markets.

Data bases for environmental valuation



https://www.evri.ca/



https://www.es-partnership.org/wp-content/uploads/2020/08/ESVD_Global-Update-FINAL-Report-June-2020.pdf

CONCLUSION

Conclusions

- The supply of the natural resource water from natural resource water (non-produced) assets to the supply of water provisioning ecosystem service from water ecosystems assets (rivers, lakes, artificial reservoirs, subterranean) **is equivalent**
- In the case of supply of water from water natural resources and water ecosystem assets these flows **are equivalent to the product flow CPC 1800 "Natural Water"** (with the point is becoming a product changing with the production boundary)
- The supply and use of the water provisioning ecosystem services from non-water ecosystem assets to industry is open interpretation and conventions need to be established – at least two options
- Valuation remains an issue
  - Distinguishing the different types of physical water flows and the assets producing and using water provisioning ecosystem services is a useful step. Doing this can help identify actual or potential double counting of ecosystem service flows in asset values
  - Value of some water flows (or assets) will be embedded in assets (e.g. land)

THANK YOU

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Questions and discussion