System of Environmental Economic Accounting

Valuation – country experiences

United Nations

International experiences

Valuation experiences

- South Africa
- Netherlands
- United Kingdom
- EU – water purification

Valuation of ES – South Africa

- 10 individual services were modelled and valued
- Using a range of techniques, but always local/national data

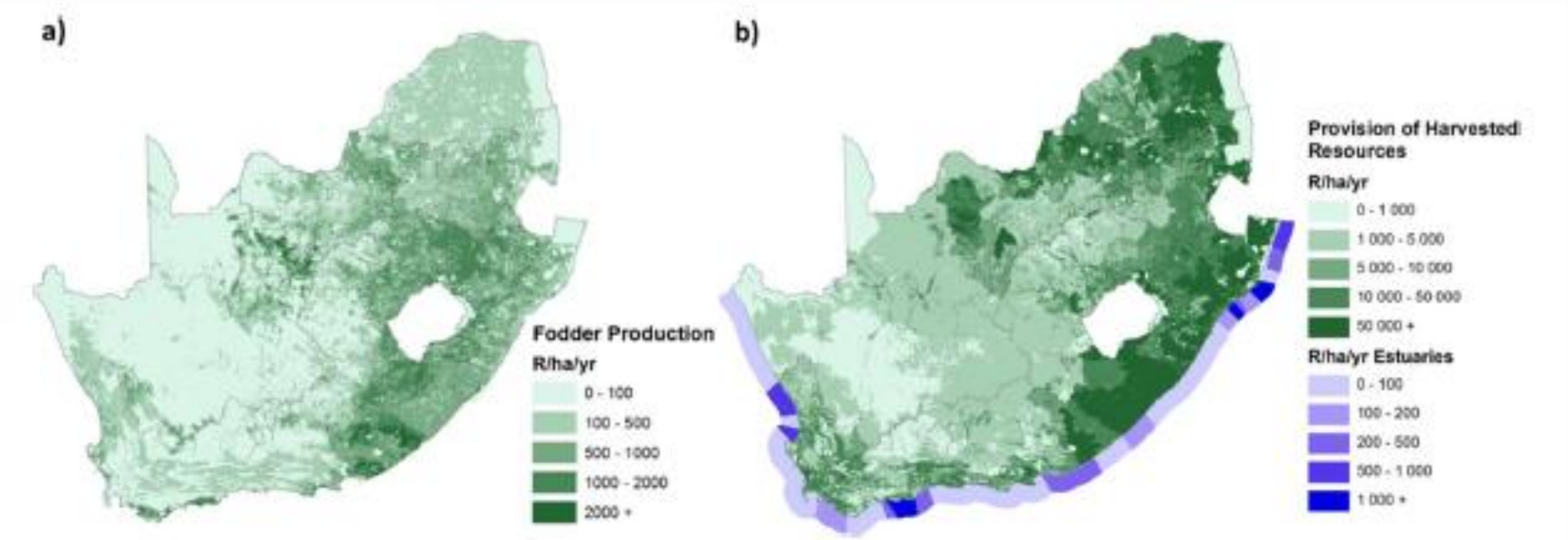
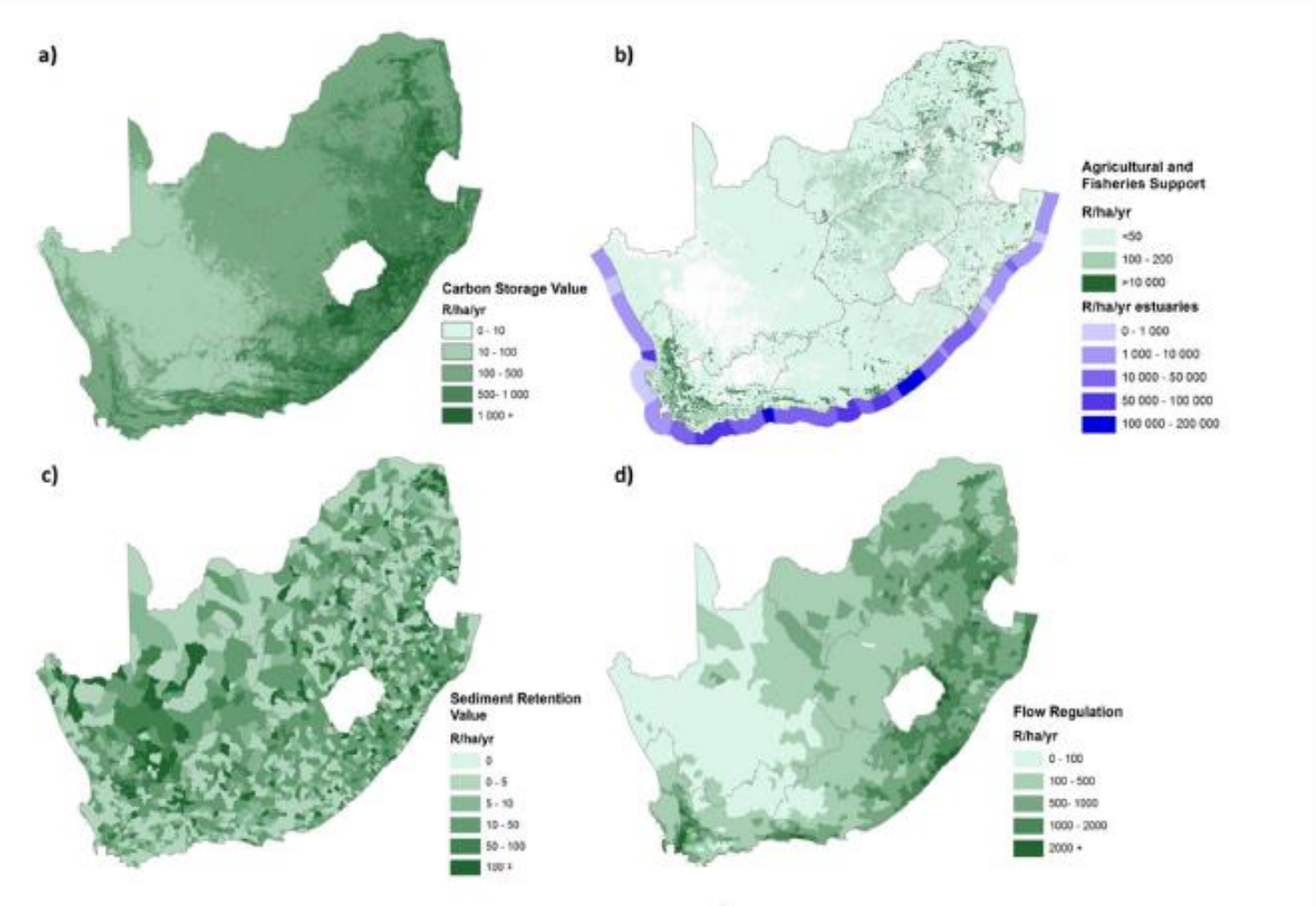


Fig. 3. Value of provisioning services in the form of (a) fodder production and (b) harvested natural resources, including instream water and estuarine/coastal resources.

Source: Turpie et al., 2017

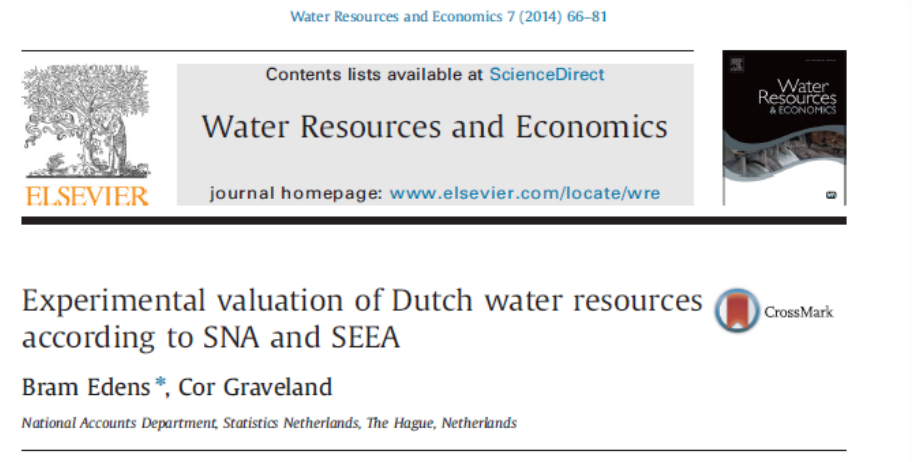
SA - continued



Source: Turpie et al., 2017

Netherlands

- Objective: investigate methods to value water resources consistent with national accounts principles
- Using the measurement boundary of the System of Environmental Economic Accounting(SEEA) Central Framework
- Restrict to extractive use / provisioning services of various types of water resources
- Approximately 26 billion euros, or 10 % of value of natural capital currently in Dutch balance sheet



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Experimental valuation of Dutch water resources according to SNA and SEEA

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Netherlands

Table 1
Abstraction of water by Dutch economy, 2010.
Source: [14–16] with minor adjustments.

Water resource	Unit	Economic activity						
		Agriculture, forestry and fishing	Mining and quarrying	Manufacturing	Electricity and gas supply	Watersupply and waste management	Other	Total water use
Ground	mln m^3	96	0	142	5	763	.	1006
Cooling	mln m^3	.	0	65	0	.	.	65
Other use	mln m^3	96	0	77	5	763	.	941
Surface	mln m^3	26	1	3350	9693	1006	.	14,076
Fresh	mln m^3	26	1	804	–	1006	.	1837
Fresh – cooling	mln m^3	.	.	2273	5699	.	.	7972
Salt and brackish	mln m^3	.	.	273	3994	.	.	4267
Soil water	mln m^3	7076	–	–	–	–	.	7076
Total	mln m^3	7198	1	3492	9699	1769	.	22,159

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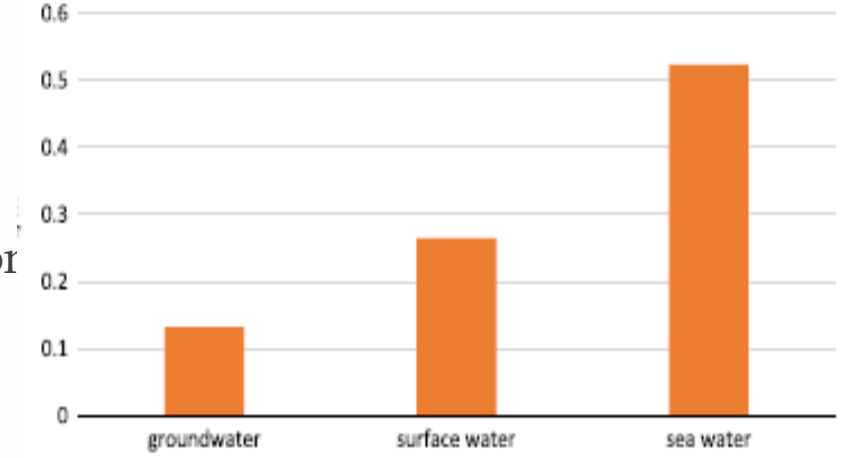
Netherlands

RR problematic due to market conditior

Replacement costs techniques:

- Valuation of provisioning service of groundwater: using additional cleaning costs when using surface water
- Assuming that surface water is indeed available under comparable conditions for abstraction and transport and not subject to depletion
- The least cost alternative for using surface water for making drinking water would be to use desalination.
- Etc.



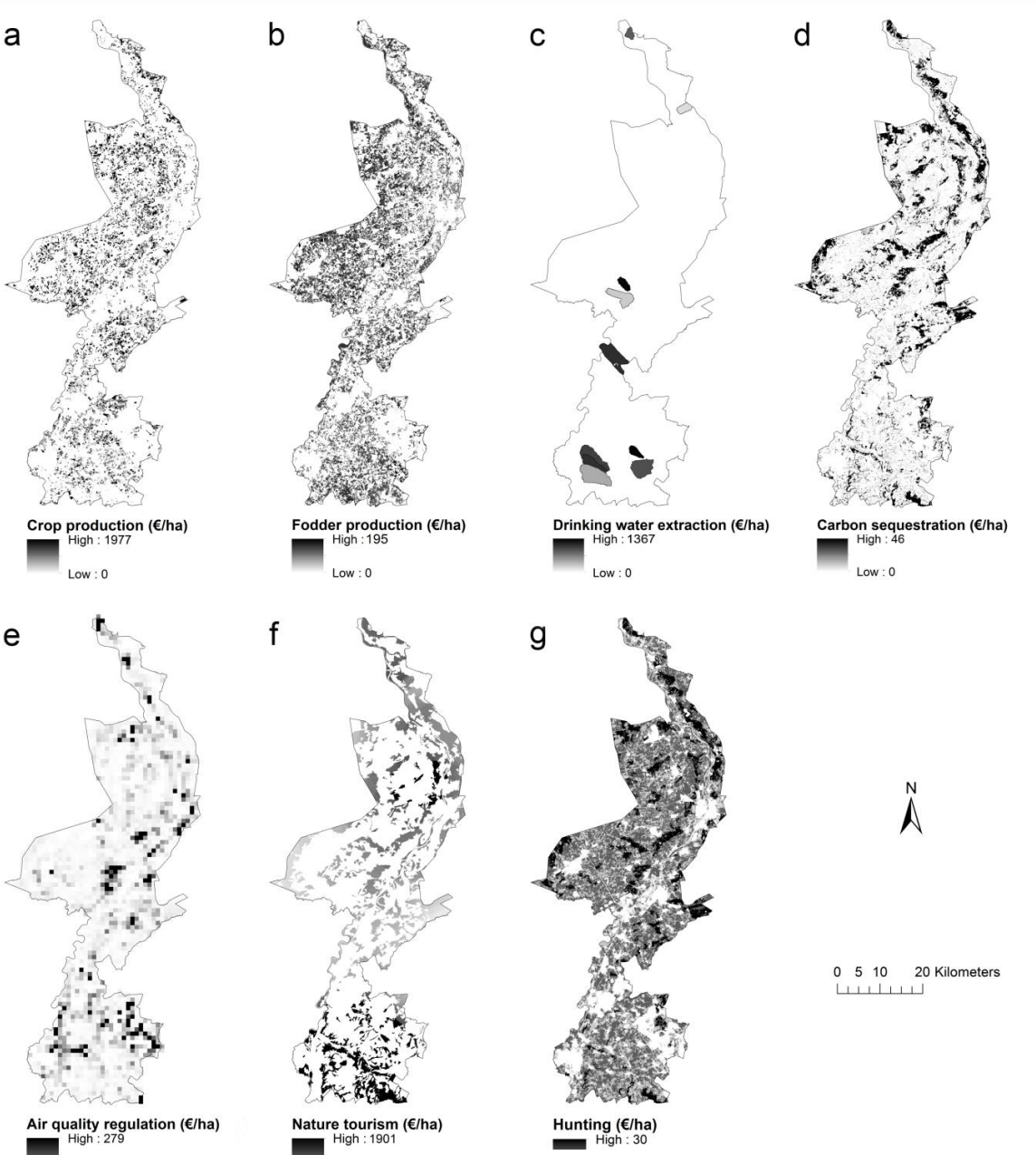
Operational costs of drinking water production for various water sources, 2010.

Source: PBL, RIVM, WUR, CICES 2014

Netherlands

- Limburg province:
- Biophysical model for 7 ecosystem services
- Spatially explicit!

(although resolution differs)



R.P. Remme et al. / Ecological Economics 112 (2015) 116–128

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Ecosystem services supply and use table

ECOSYSTEM SERVICES SUPPLY TABLE

	UNITS	Type of economic unit							Type of Ecosystem Unit															TOTAL SUPPLY
		Agriculture, forestry and fisheries	Electricity, gas supply	Water collection, treatment and supply	Other industries	Households	Accumulation	Rest of the world - Imports	Artificial surfaces	Herbaceous crops	Woody crops	Multiple or layered crops	Grassland	Tree-covered areas	Mangroves	Shrub-covered areas	Regularly flooded areas	Sparse natural vegetated areas	Terrestrial barren land	Permanent snow and glaciers	Inland water bodies	Coastal water and inter-tidal areas	Sea and marine areas	
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15								
Ecosystem services Provisioning services Regulating services Cultural services		A							B															
Products		C							D															

ECOSYSTEM SERVICES USE TABLE

	UNITS	Type of economic unit							Type of Ecosystem Unit															TOTAL USE
		Agriculture, forestry and fisheries	Electricity, gas supply	Water collection, treatment and supply	Other industries	Households	Accumulation	Rest of the world - Exports	Artificial surfaces	Herbaceous crops	Woody crops	Multiple or layered crops	Grassland	Tree-covered areas	Mangroves	Shrub-covered areas	Regularly flooded areas	Sparse natural vegetated areas	Terrestrial barren land	Permanent snow and glaciers	Inland water bodies	Coastal water and inter-tidal areas	Sea and marine areas	
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15								
Ecosystem services Provisioning services Regulating services Cultural services		E							F															
Products		G							H															

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Netherlands

Ecosystem monetary supply table

- Values per ha (per ET)

		Non-perennial plants	Meadows (for grazing)	Hedgerows	Deciduous forest	Coniferous forest	Mixed forest	Heath land	Fresh water wetlands	Natural grassland	Public green space	Other unpaved terrain	River flood basin	Totals
extent	ha	53.629	27.066	2.940	11.414	7.091	10.437	2.149	936	3.121	4.761	22.591	14.126	220.922
Crops	€	35.303.100	-	-	-	-	-	-	-	-	-	-	-	37.908.400
Fodder	€	1.960.900	4.587.100	-	-	-	-	-	-	-	-	-	942.300	7.556.200
Meat (from game)	€	817.700	223.400	-	186.800	192.700	261.100	35.600	12.700	32.900	14.700	211.200	136.000	2.249.400
Ground water	€	3.861.200	1.802.300	193.900	824.200	63.500	218.700	57.300	11.200	295.700	192.600	1.041.100	545.700	11.602.800
Capture of PM10	€	301.200	173.700	30.400	200.200	185.700	200.700	27.200	2.400	46.700	78.100	258.200	85.900	2.275.900
Carbon sequestration	€	300	165.700	18.000	562.500	350.300	515.000	13.200	6.400	19.300	40.500	139.000	95.600	2.006.100
Nature tourism	€	4.410.000	6.349.100	2.357.700	6.930.100	3.162.500	5.443.100	917.000	392.800	2.488.900	625.900	2.870.600	3.162.100	41.816.200
Recreation (cycling)	€	NA												NA
	€	46.654.400	13.301.400	2.600.000	8.703.800	3.954.700	6.638.800	1.050.400	425.400	2.883.500	951.700	4.520.200	4.967.500	105.415.000
value per ha (excl. Amenity)	€/ha	870	491	884	763	558	636	489	454	924	200	200	352	477
value per ha (incl. Amenity)*	€/ha	870	491	884	1.193	988	1.066	489	454	924	688	220	352	553

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Example: valuing woodland timber provisioning service (annual)

Physical service flow

- Volume of timber removed

→ 13.7 million cubic metres of wood standing (overbark)

Valuing the flow

- Use market prices such as stumpage prices:
- £16.58 per cubic metre of overbark standing in 2015

The stumpage price represents the value of the timber standing in the forest (i.e. before extraction). It may be necessary to net off some management overheads

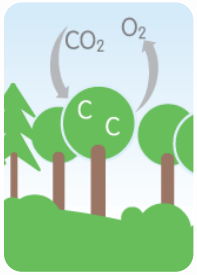
P x Q: Value of ecosystem provision of timber

= 16.58 x 13.7

= £227 million p.a.

NB This treatment assumes that cultivated timber in plantations is not included in the accounting framework in the form of incremental growth

Example: valuing woodland's carbon sequestration service (annual)



Physical service flow

- UK woodland area
- Data on age, species, etc
- Apply sequestration rate / ha

→ 17 million tonnes of CO_2 equiv. removed

Valuing the flow

- Use appropriate carbon price e.g. non-traded price of carbon (consistent with meeting UK targets)
- The extent to which this is an exchange value depends upon assumptions about the nature of the market that would have to be in place in order to obtain such prices
- £61/tonne in 2015

P x Q: Value of ecosystem contribution to the sequestration of carbon

= £61 x 17

= £1,046 million p.a.

Example - valuing woodland recreation

Physical service flow

- Numbers of visitors to woodland (based on survey data)

→ 557 million visits in 2015

296 million hours spent

Valuing the flow

- Travel cost method: using combination of costs of travel and admission to sites
- Average cost per visit £0.52

Excludes value of time, so free trips are not given a value
Requires assumptions about primary and secondary destinations/purposes

P x Q: value of recreational services provided by woodland

= £0.52 x 557

= £291 million p.a.

Example: valuing air pollutant removal

Physical service flow

- Uses sophisticated atmospheric chemistry model
- This accounts for transport and deposition of pollutants, variations in meteorology and summer/winter leaf cover, and interactions within the atmosphere and between different pollutants
- The role of vegetation (natural capital) is assessed by modelling two scenarios for pollutant concentrations: one with and one without vegetation
- For $PM_{2.5}$, the average population weighted concentration (for an English municipal area) was

  - 4.85 ug/m3 with vegetation
  - 5.75 ug/m3 without vegetation

Valuing the flow

- This service provides a health benefit through the reduced exposure of the receiving population
- Can use official air quality impact pathway guidance – e.g. for $PM_{2.5}$, an established health-response function of 0.0011 ug/m3
- Value can be based on reduced respiratory hospital admissions from an established baseline

Baseline hospital admissions (for an English municipal area)	1,551
Health-response function	0.0011
Value per hospital admission	£6,650

Value of air pollutants removed by vegetation (for English municipal area) = (6,550 x 0.0011 x 1,551) x (5.75-4.85) = £10,211

NB vegetation outside the area is responsible for reducing concentrations within the area

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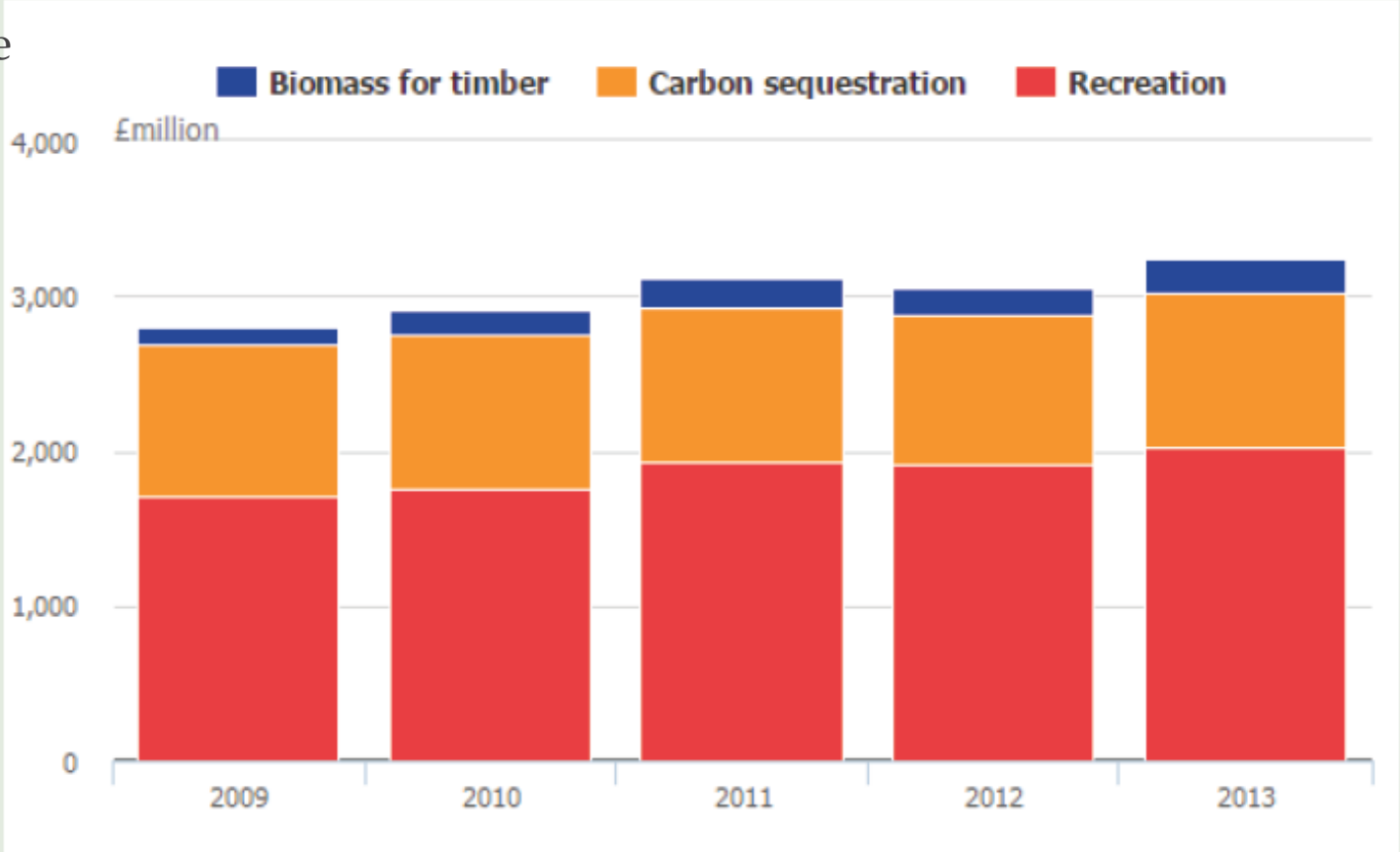
UK

- ET approach
- Also balance sheet values

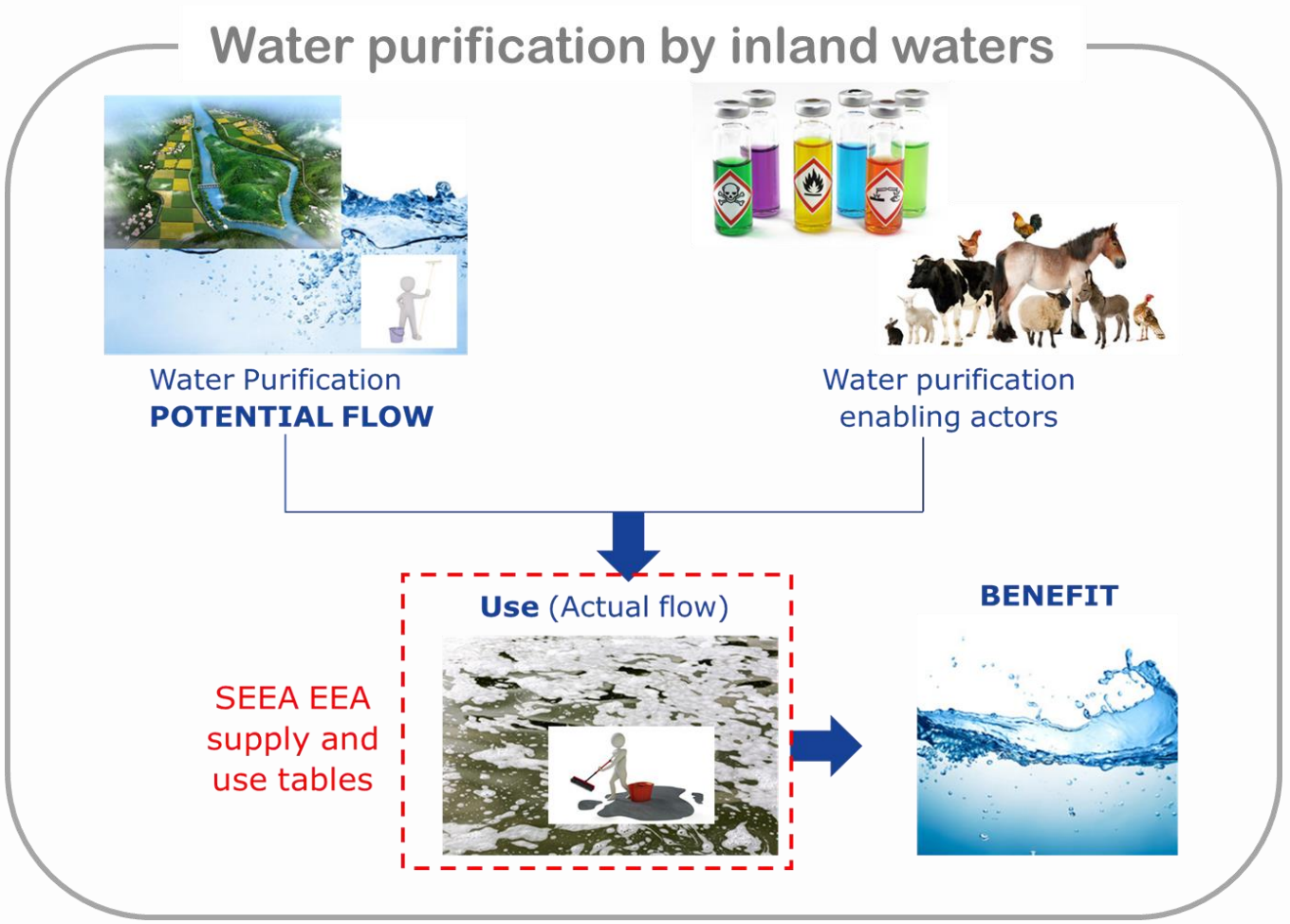
Box 23.3 The value of a tree: ecosystem services in UK woodland

The UK Office for National Statistics (ONS Woodlands, 2015) studied the values of UK woodland ecosystems. The study considered three ecosystem services (timber production, carbon sequestration and recreation), calculating monetary flows for them. The results are presented in the graph below.

Similar work carried out in Germany, Spain and by EU-funded research projects indicate similar orders of magnitude.



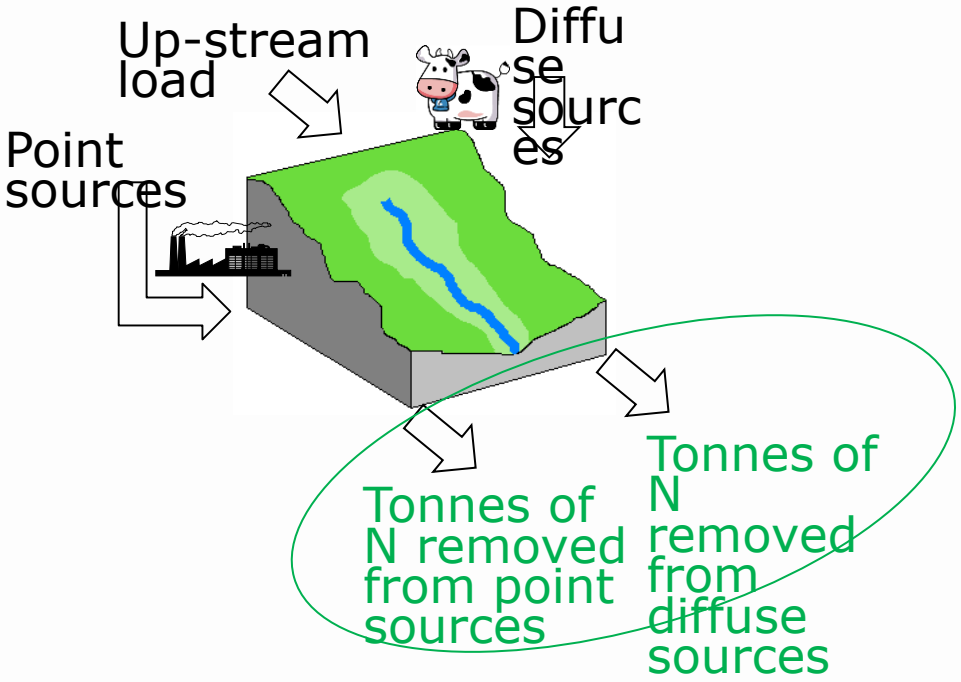
Water Purification accounting

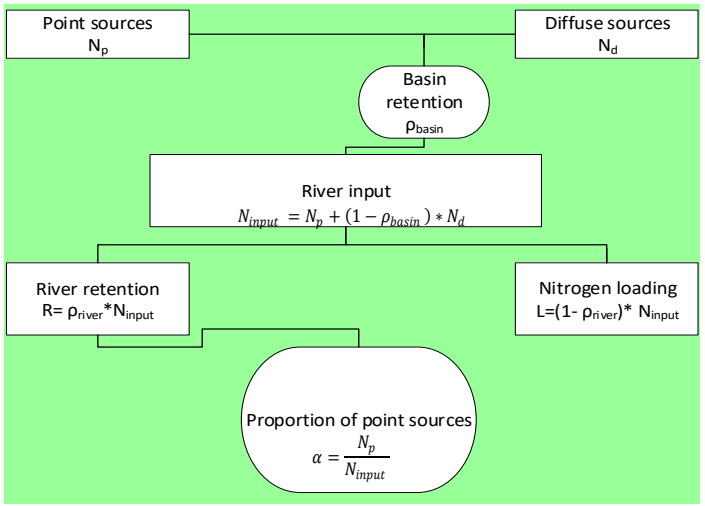


La Notte, Maes, Dalmazzone, Crossman, Grizzetti, Bidoglio (2017) 'Physical and monetary ecosystem service accounts for Europe: A case study for in-stream nitrogen retention', Ecosystem Services, 23, pp 18–29

La Notte, Dalmazzone (2018) 'Sustainability assessment and causality nexus through ecosystem service accounting: The case of water purification in Europe', Journal of Environmental Management, 223, 964-974

Graphical simplification of the procedure





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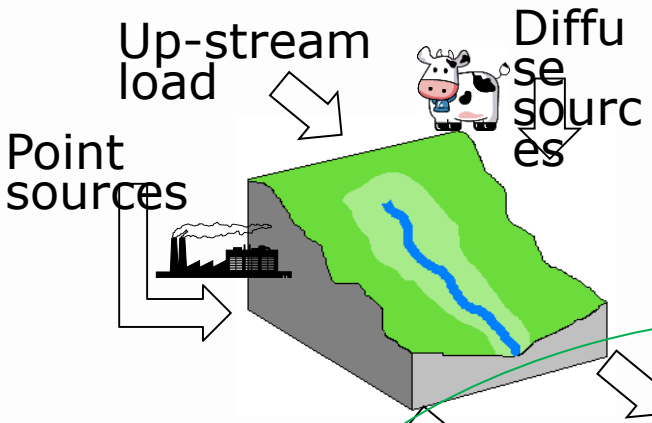
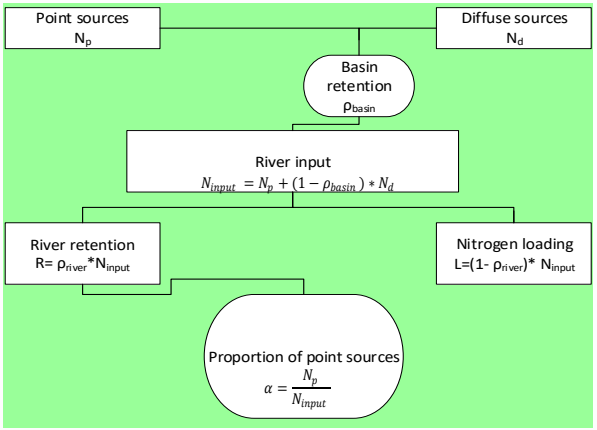


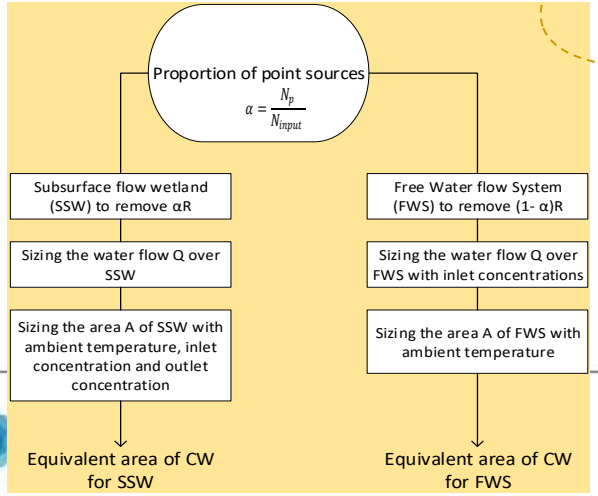


Tonnes of N removed from point sources

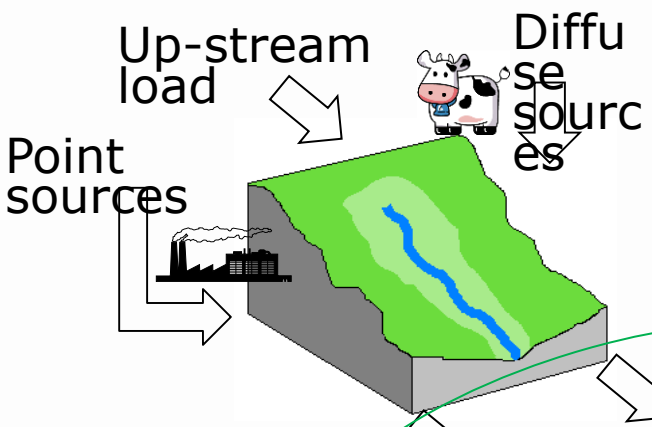
Tonnes of N removed from diffuse sources

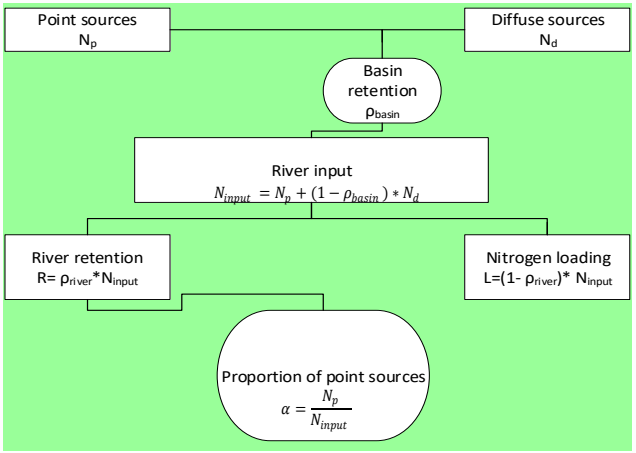
FWS CW ha

HF CW ha



Graphical simplification of the procedure





Tonnes of N removed from point sources

Tonnes of N removed from diffuse sources

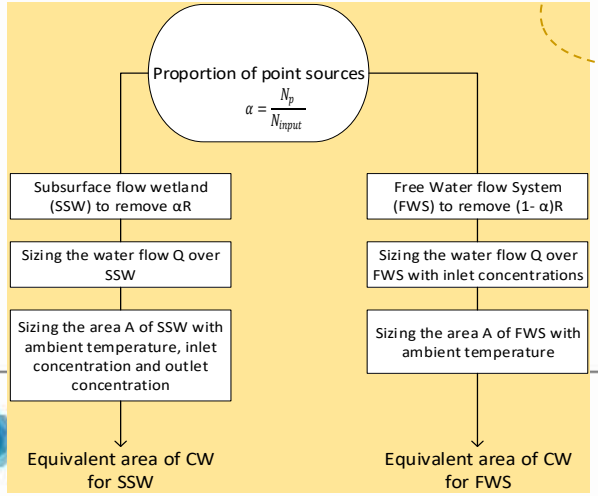
FWS CW ha

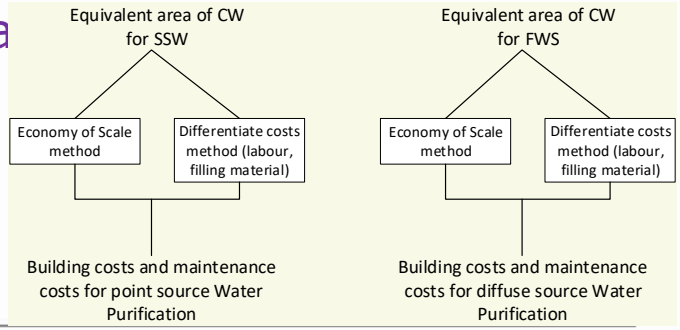
HF CW ha

€*ha

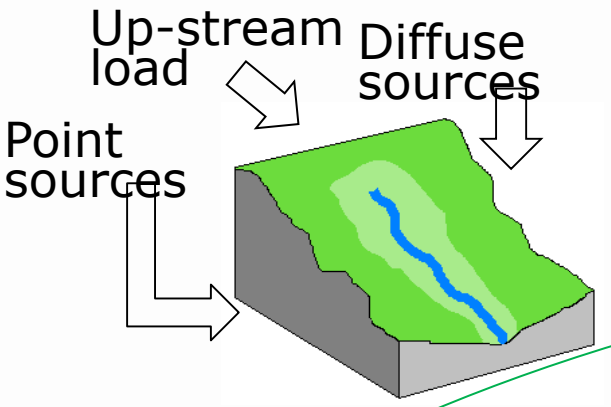
€*ha

Translation in monetary terms





Water purification potential and actual flows



Introduction of a threshold concentration

Tonnes of N removed from diffuse sources

Tonnes of N removed from point sources

FWS CW ha

HF CW ha

Actual flow

Potential flow

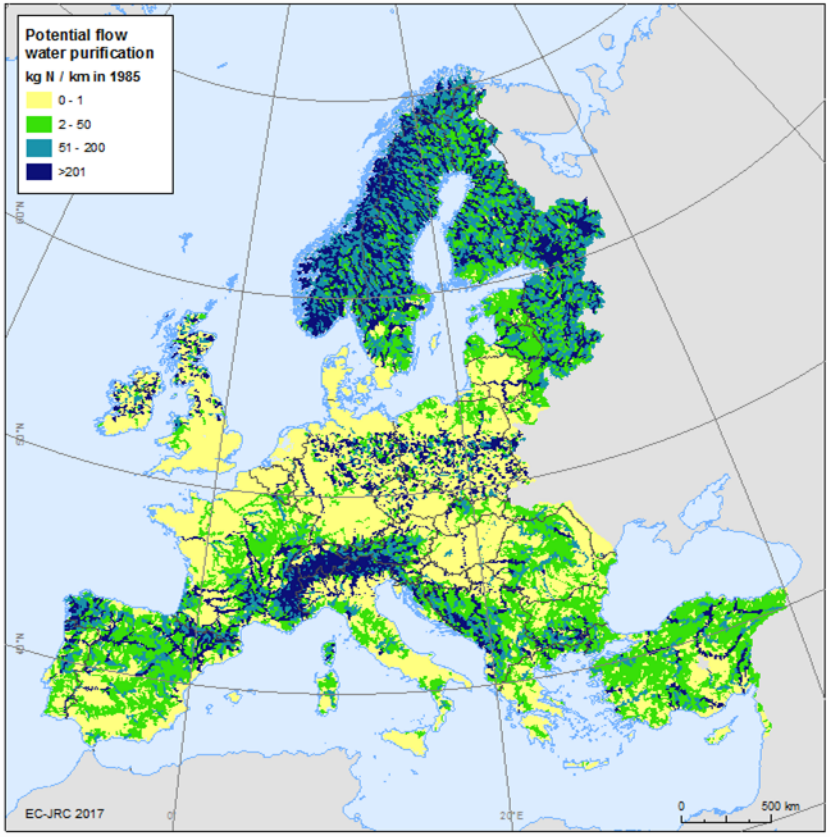
€*ha

€*ha

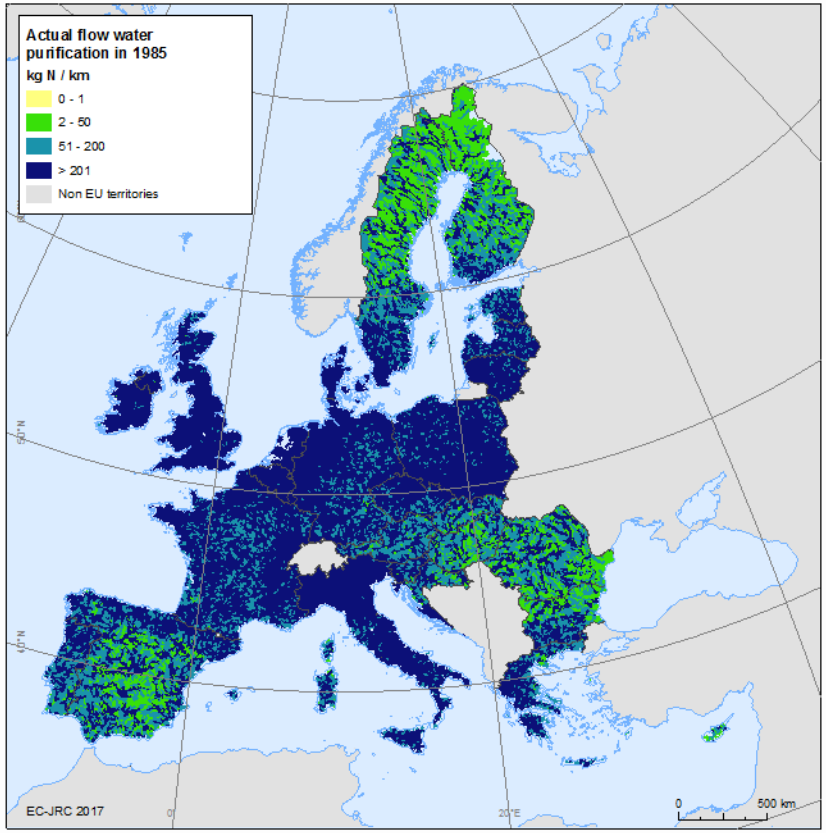
Translation in monetary terms

ES potential and actual flows for water purification

Potential flow



Actual flow



Considering a threshold of 1mg/l

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Acknowledgements

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United Nations UNEP Convention on Biological Diversity NORWEGIAN MINISTRY OF FOREIGN AFFAIRS