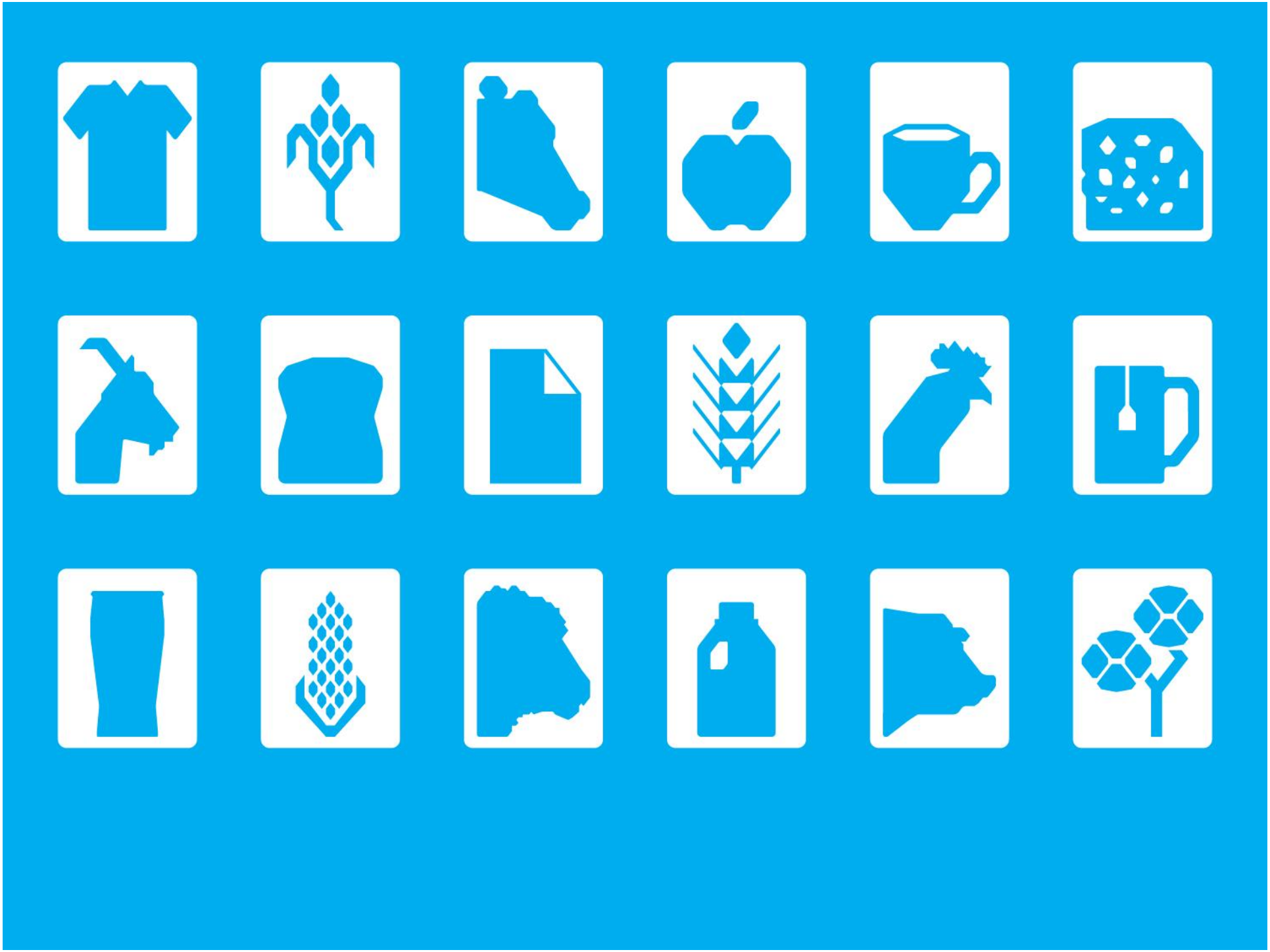
Water in Africa:
Hydro-Pessimism or Hydro-Optimism?

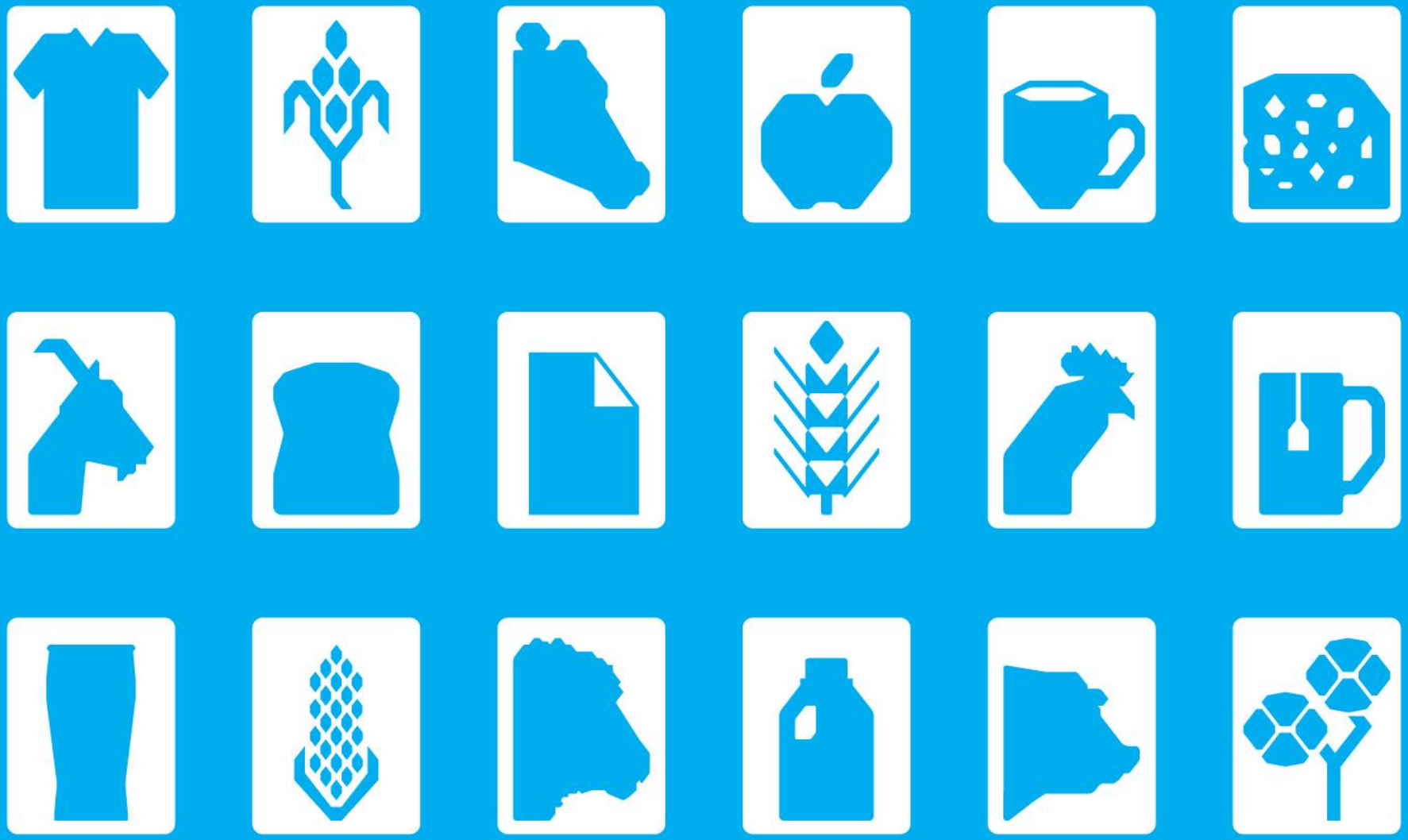
Água em África:
Hidro-pessimismo ou Hidro-optimismo

Centro de Estudos Africanos da Universidade do Porto

Porto, Portugal, 2-3 October 2008



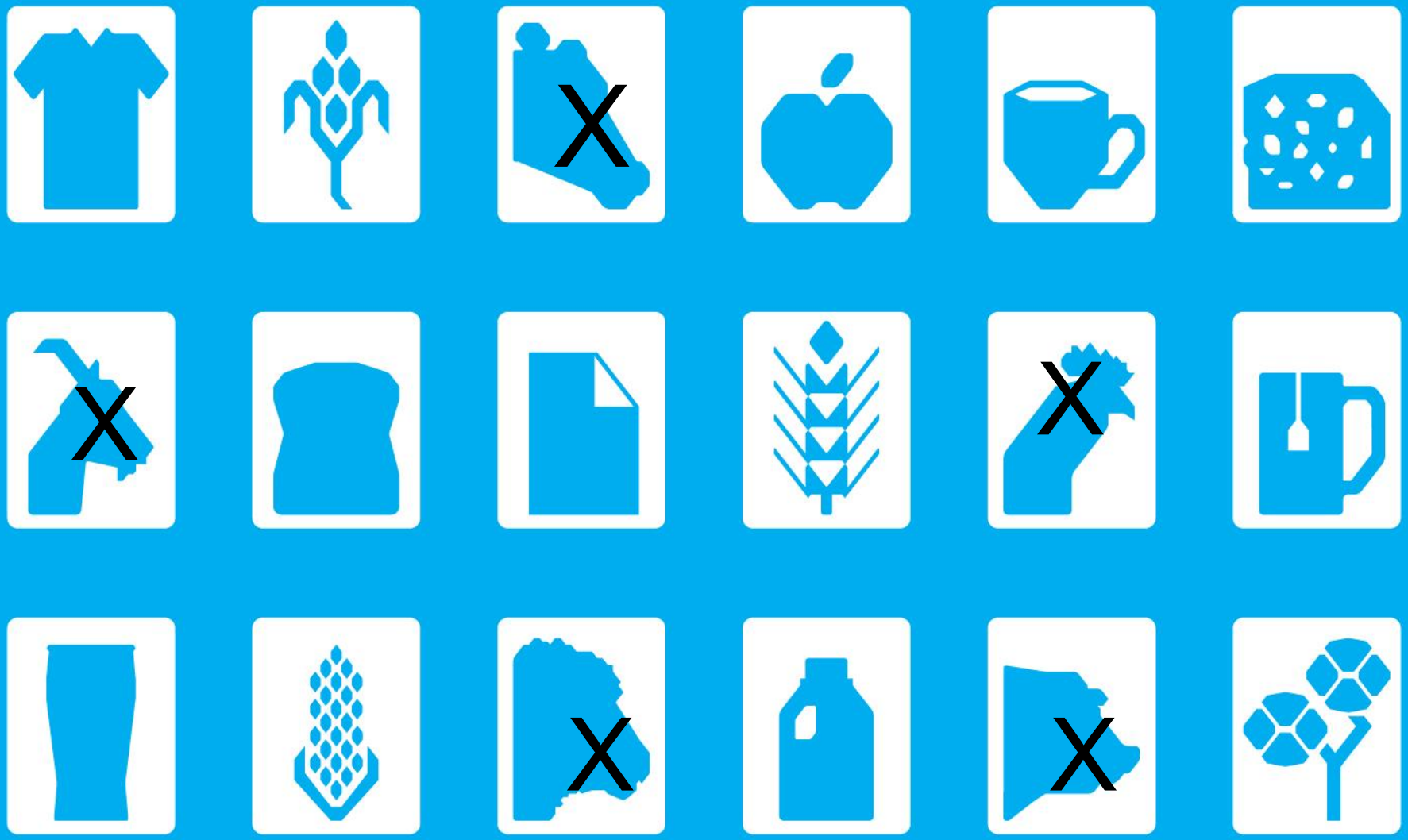
Virtual or embedded water



Moving the minds of consumers

Hoekstra/Morelli 2008

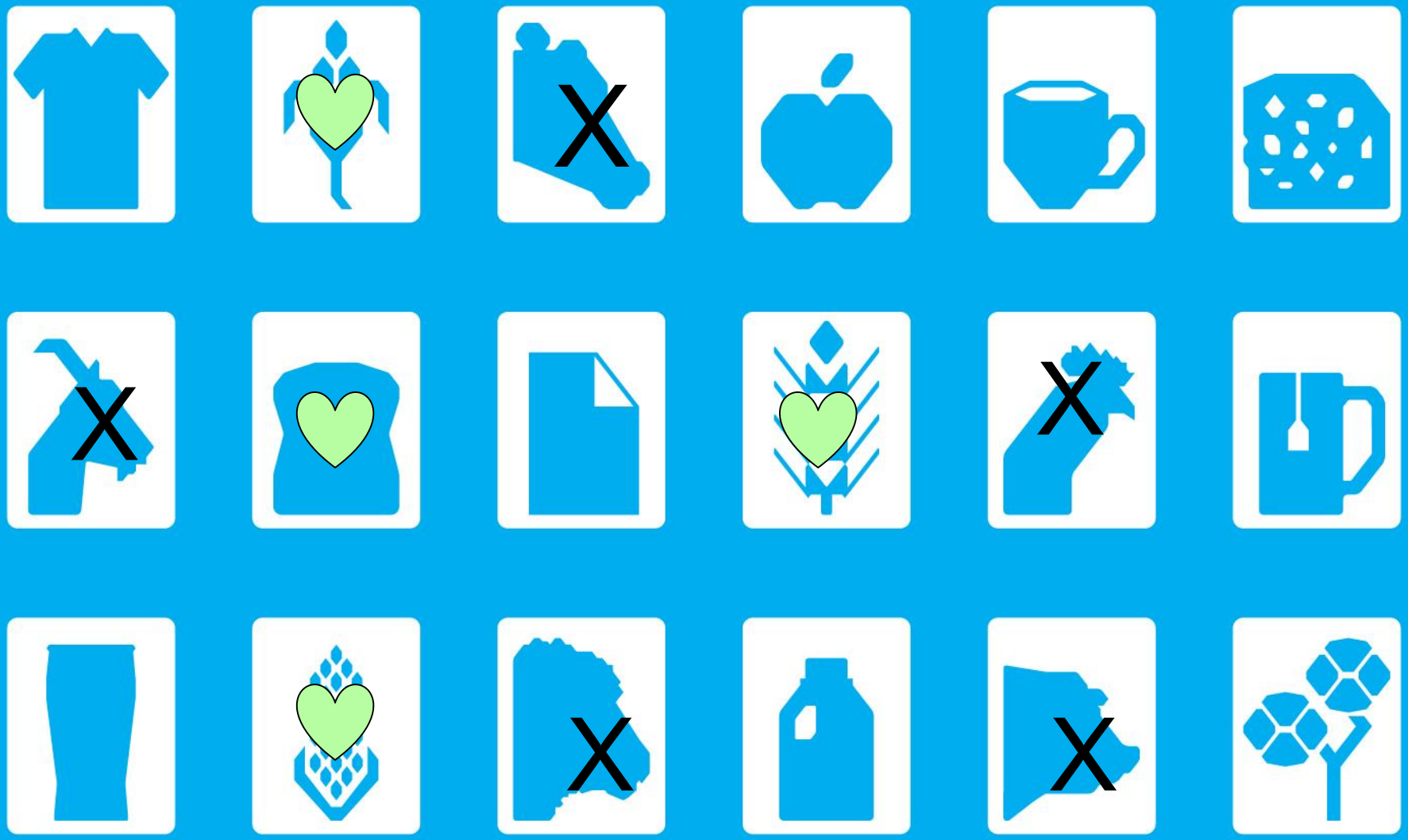
Virtual or embedded water



Moving the minds of consumers

Hoekstra/Morelli 2008

Virtual or embedded water



Moving the minds of consumers

Hoekstra/Angela 2008

Virtual water

Capturing the invisible
is easier
than communicating the invisible
to move the minds of consumers

Tony Allan
King's College & SOAS London

SIWI World Water Week 2008

Water in Africa - CEAUP - Porto
2008

Virtual water

Capturing the invisible
is easier
than COMMUNICATING the invisible
to move the minds of CONSUMERS

The importance of managing ourselves

Virtual Water

It can be foolish to export crops (Fishelson 1985)

Embedded water 'solution' (Allan 1990)

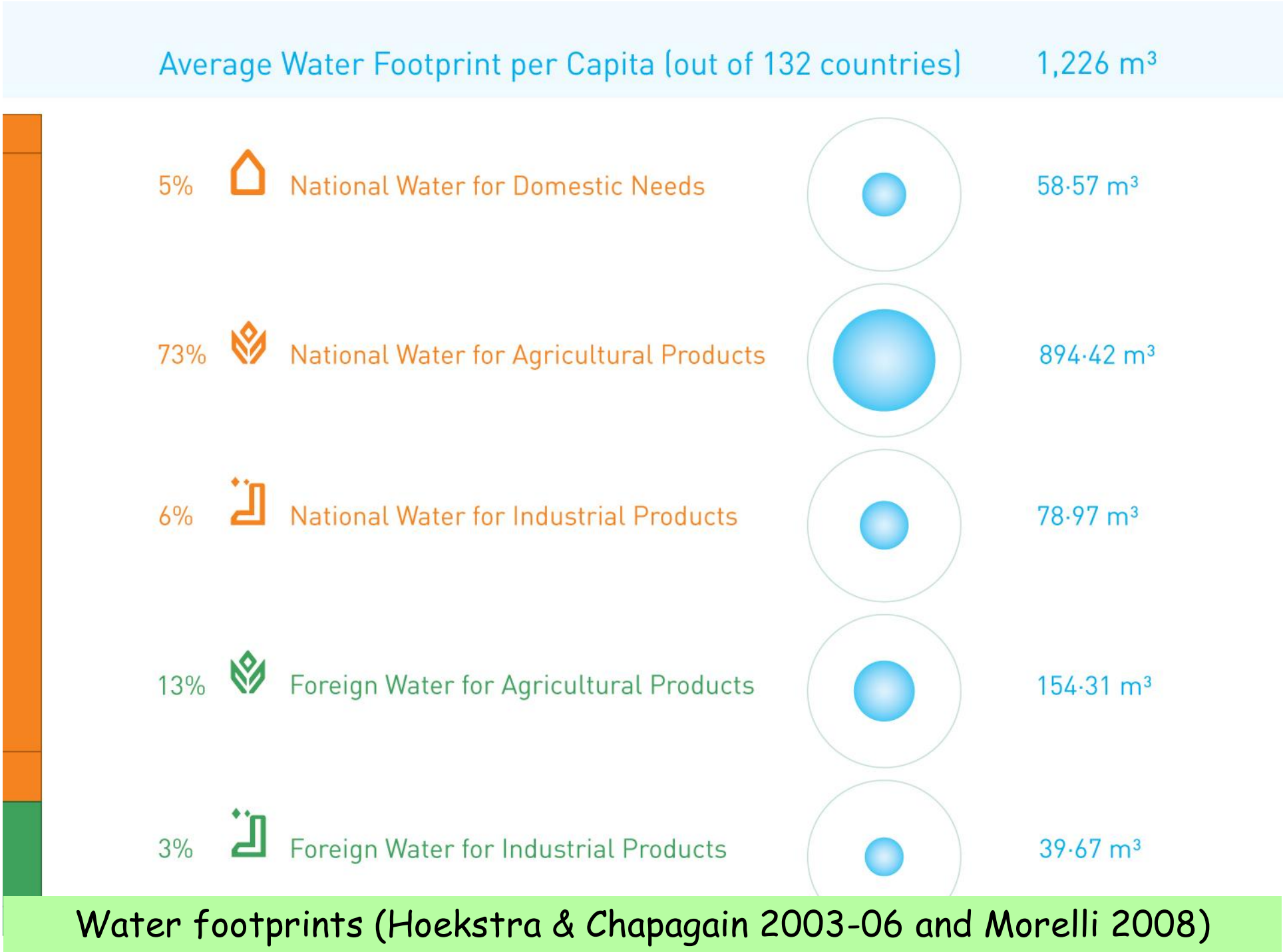
Virtual water 'trade' (Allan 1993, '94, '96 etc)

Modeling crop trade (Hoekstra & Hung 2001)

Modeling livestock trade (Hoekstra & Chapagain 2003)

Soil water in 'trade' (Aldaya, Hoekstra & Allan 2008)

VW and migration (Allan 2008)



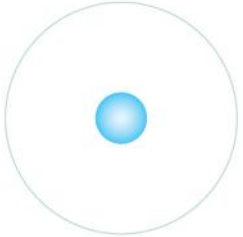
Water footprints (Hoekstra & Chapagain 2003-06 and Morelli 2008)

TANZANIA: 1,127 m^3/cap

3 m^3/cap

1,093 m^3/cap

1 m^3/cap



27 m^3/cap

3 m^3/cap

INDIA: 980 m^3/cap

38 m^3/cap

907 m^3/cap

19 m^3/cap

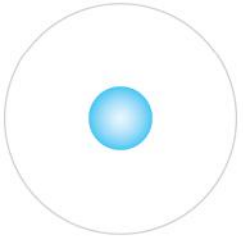
14 m^3/cap

2 m^3/cap

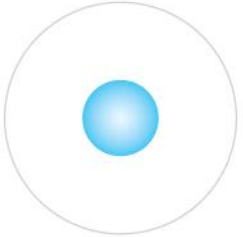
BRAZIL: 1,381 m^3/cap

70 m^3/cap

1,155 m^3/cap



51 m^3/cap



87 m^3/cap

18 m^3/cap

USA: 2,483 m^3/cap

217 m^3/cap

1,192 m^3/cap

609 m^3/cap

267 m^3/cap

197 m^3/cap

Virtual water 'flows' - crops & livestock (Chapagain & Hoekstra 2004)

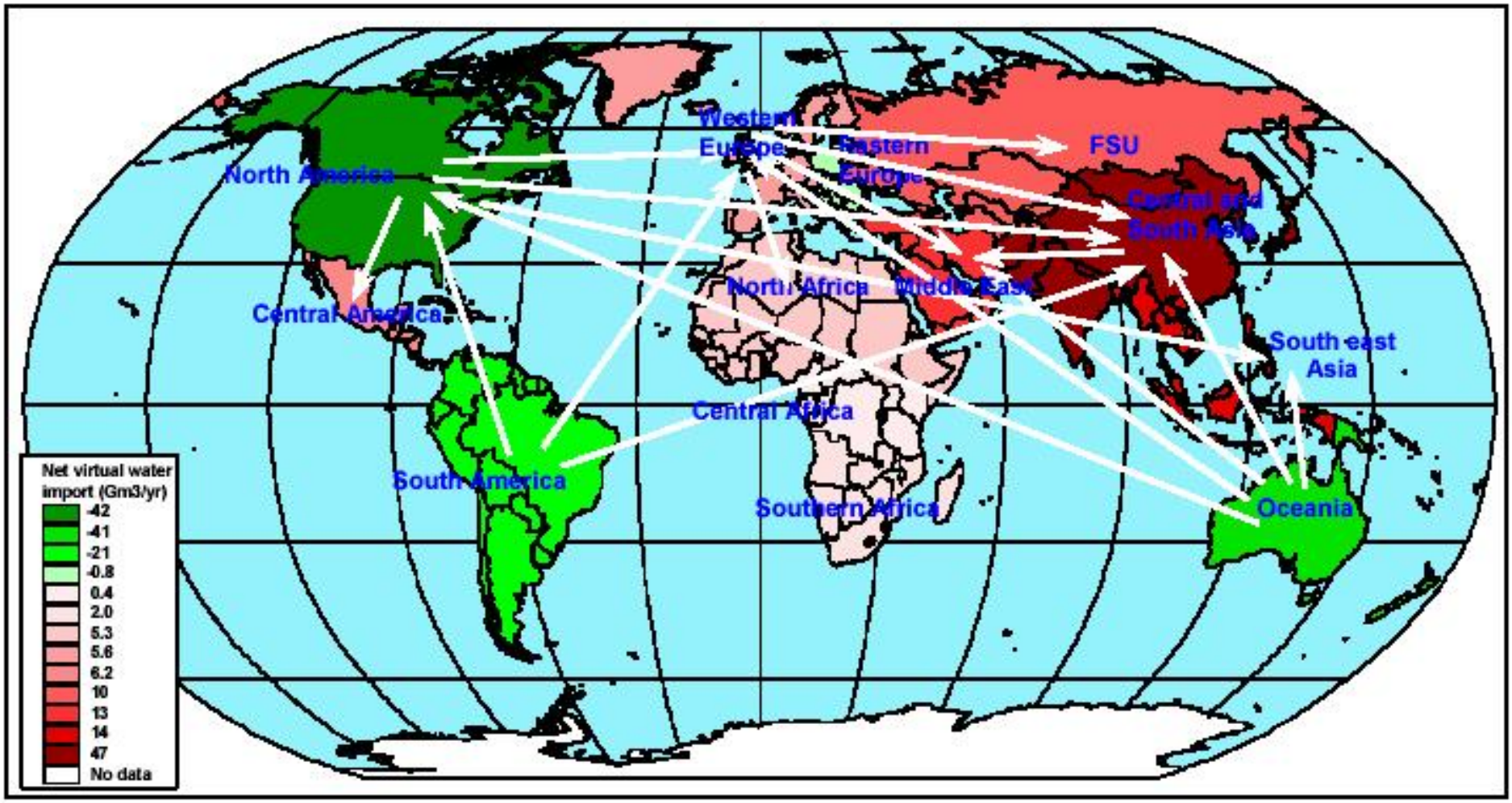
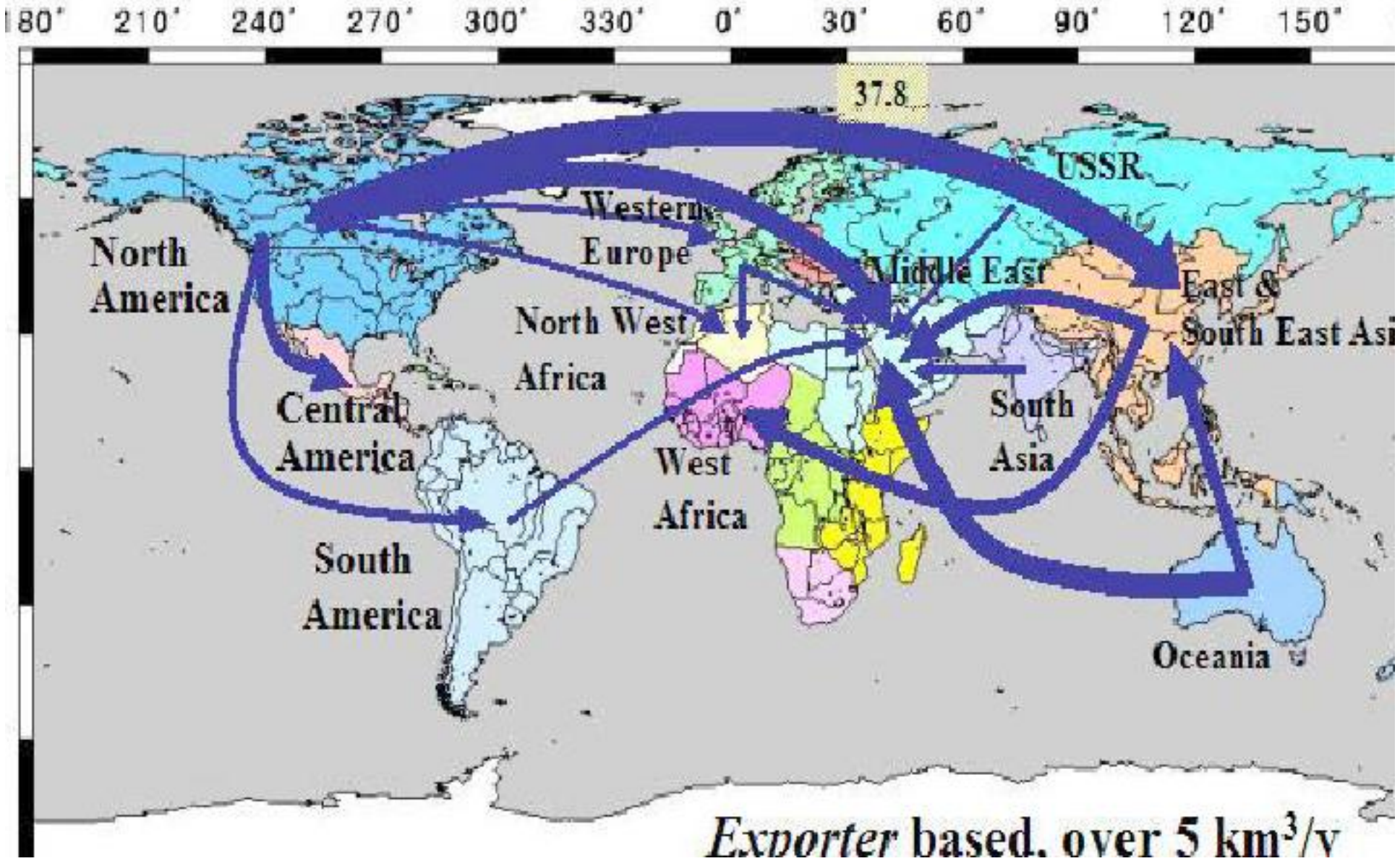


Figure 5.3. Virtual water balances related to the trade in livestock and livestock products of thirteen world regions. Period: 1995-99. Green coloured regions have net virtual water export; red coloured ones net virtual water import. The arrows show the net virtual water flows of more than 2 Gm^3 per year between regions.

Exporter volumes of virtual water in food trade (Oki, 2003)



Virtual water 'flows' - crops & livestock (Chapagain & Hoekstra 2004)

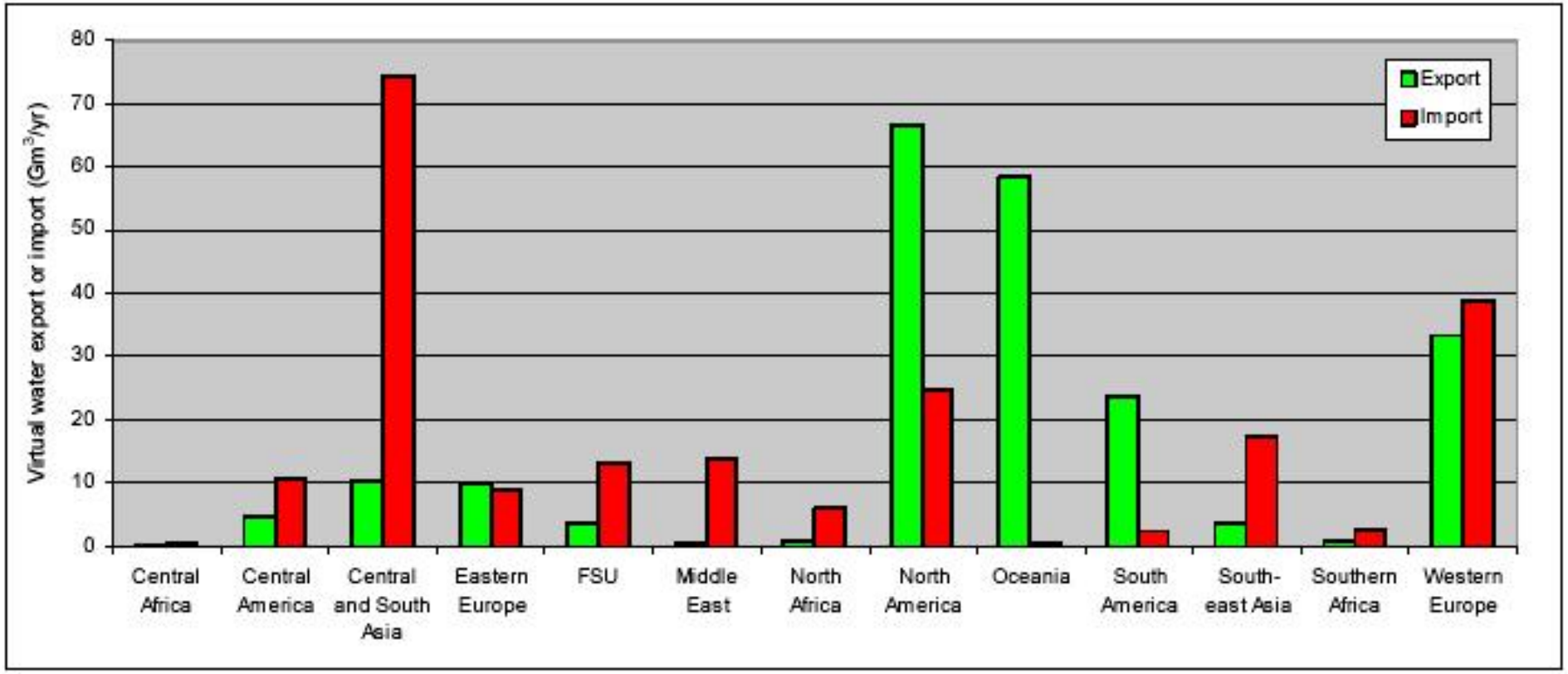
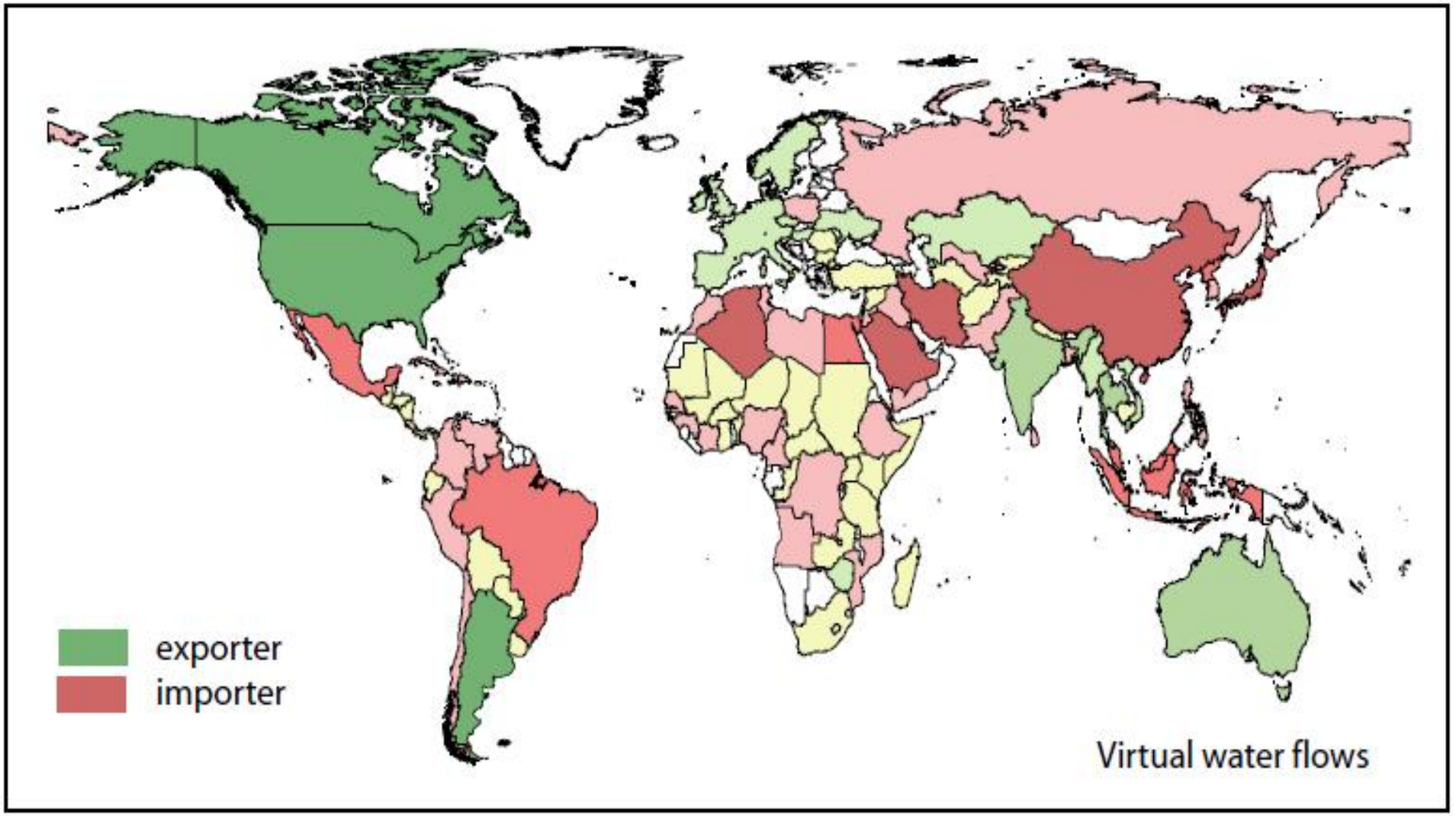
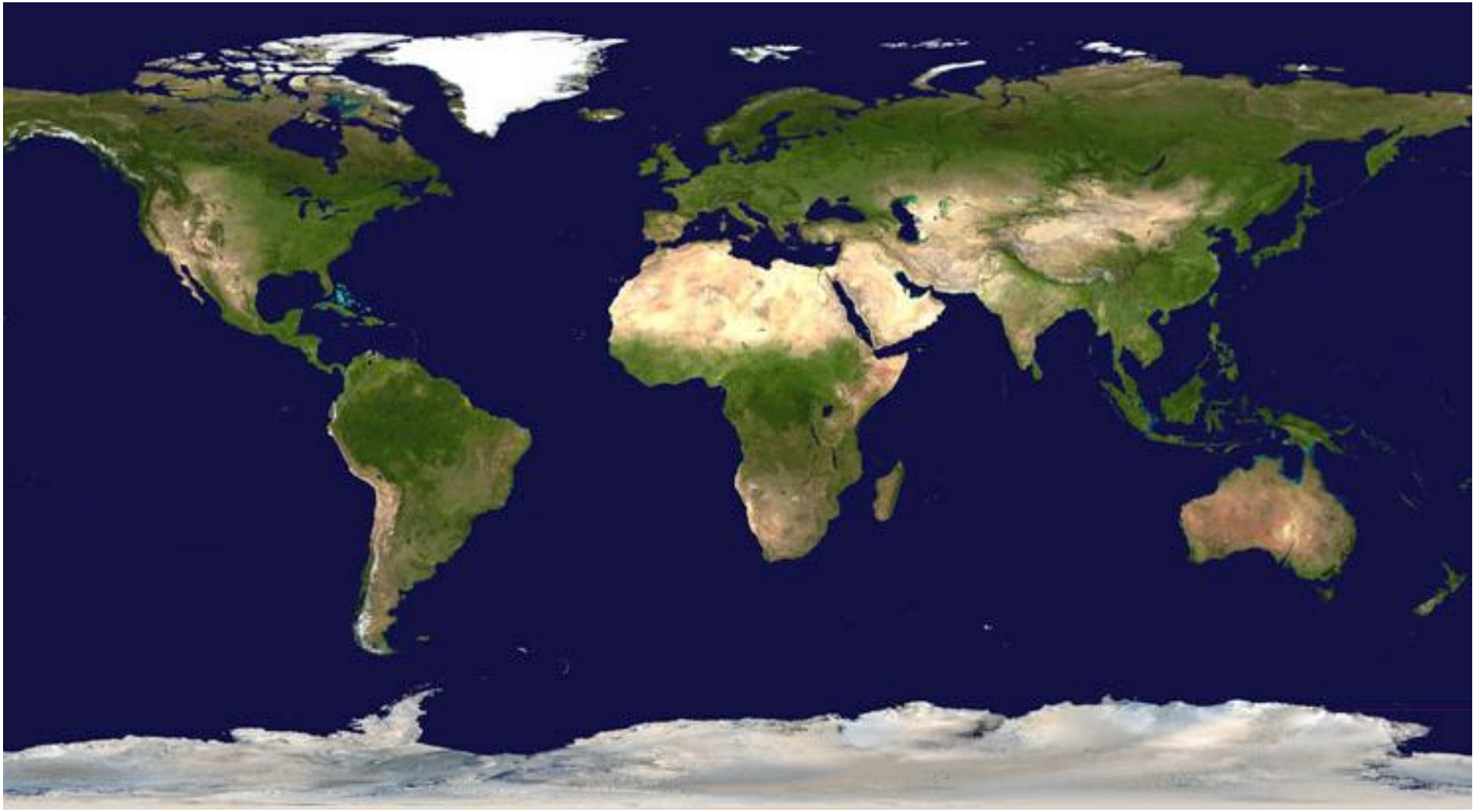


Figure 5.4. Gross virtual water import and export per region in the period 1995-99 (Gm^3/yr).



Source: International Water Management Institute, *Comprehensive Assessment of Water Management in Agriculture Research Report 4*

The consequences of asymmnetric rainfall Source Nasa



The patterns of water use / water footprint vary globally and will change in future

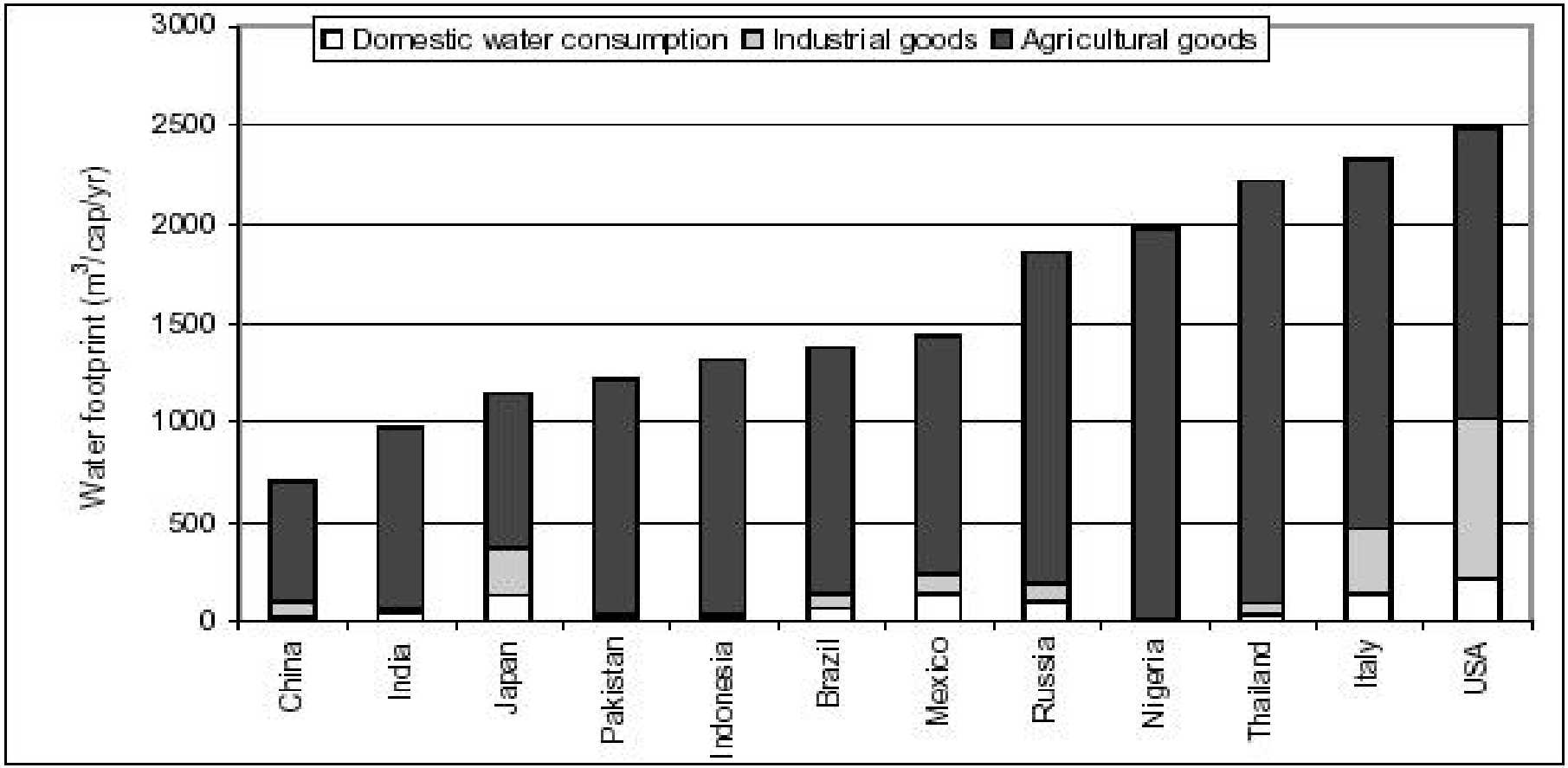


Figure 4.12. The national water footprint per capita and the contribution of different consumption categories for some selected countries.

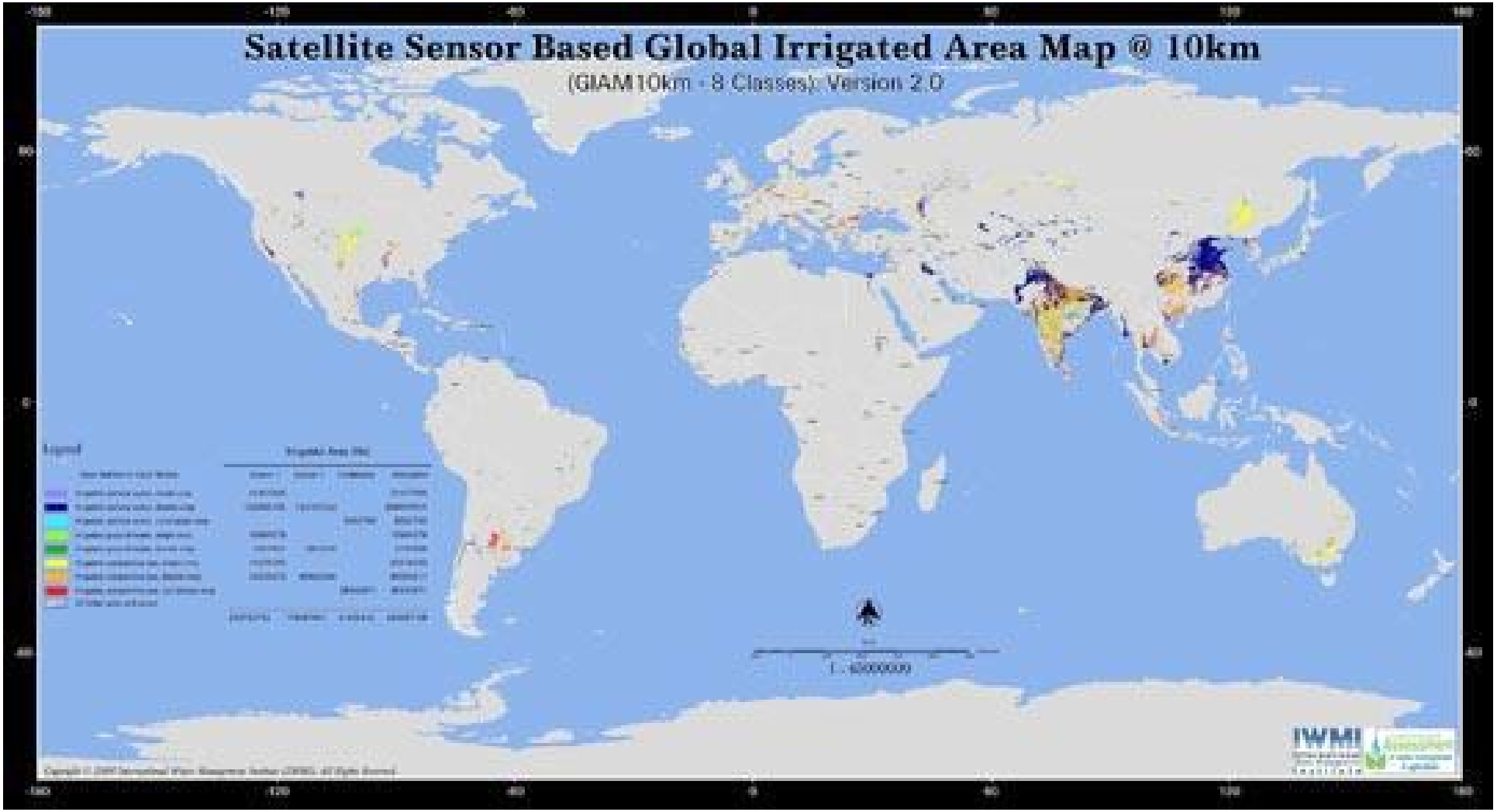
Source: Hoekstra & Chapagain

The consequences of asymmnetric rainfall

Source Nasa

RESPONSE Global Irrigated Area Map Source IWMI.org

Look at the International Water Management Institute [IWMI] website



Global Irrigated Area Map Source IWMI.org

Look at the International Water Management Institute [IWMI] website

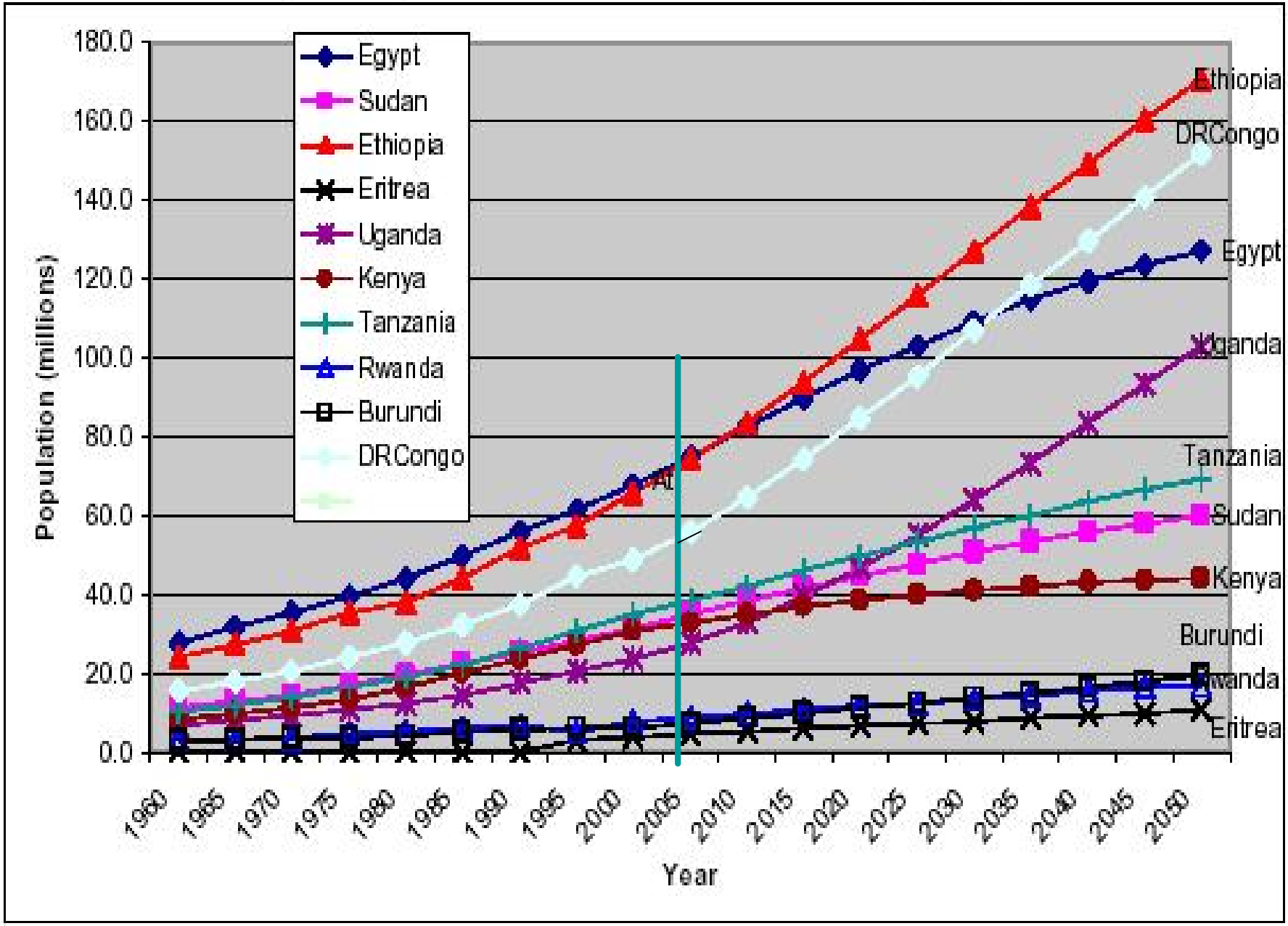
Important contexts & issues in Africa

Southern economies:

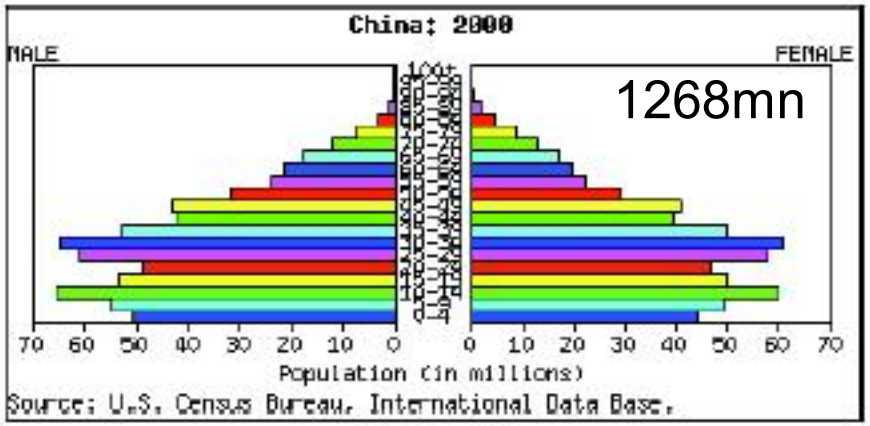
- are in an early stage of the demographic transition with rising populations that need more food and jobs
- some of the poorest - in Africa - face very challenging demographic scenarios

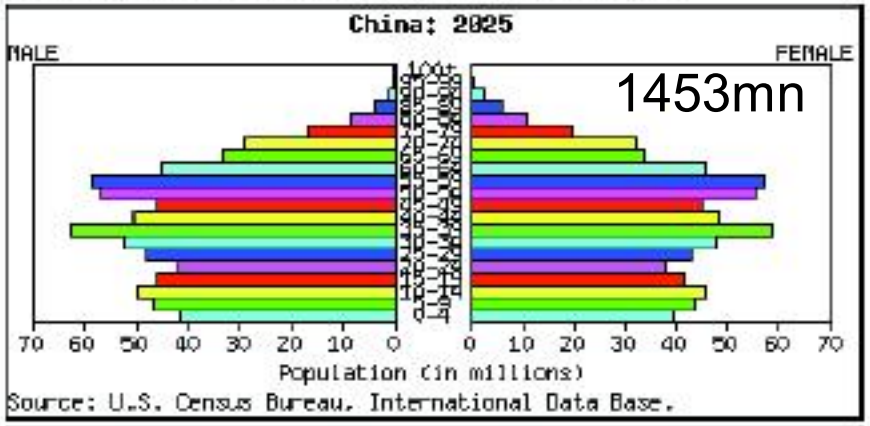
Globally the demographic challenges of the past 50 years will NOT be repeated. Population is levelling off.

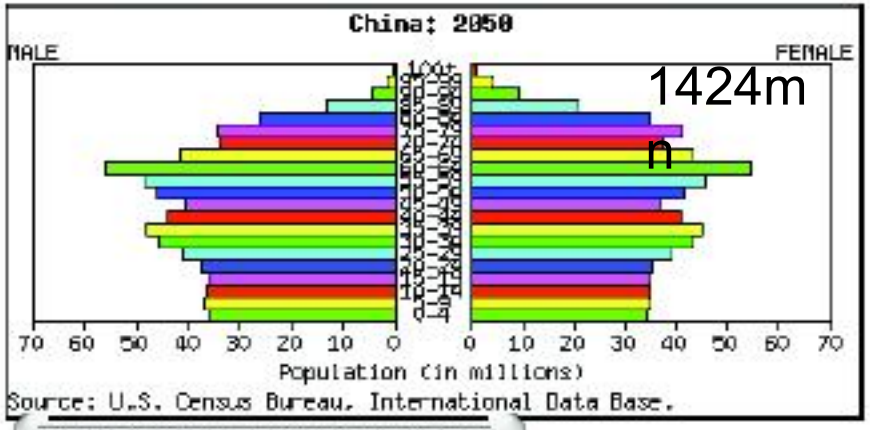
Figure 2.6 Past and Projected Populations of Nile Basin States, 1960 – 2050. (Millions)

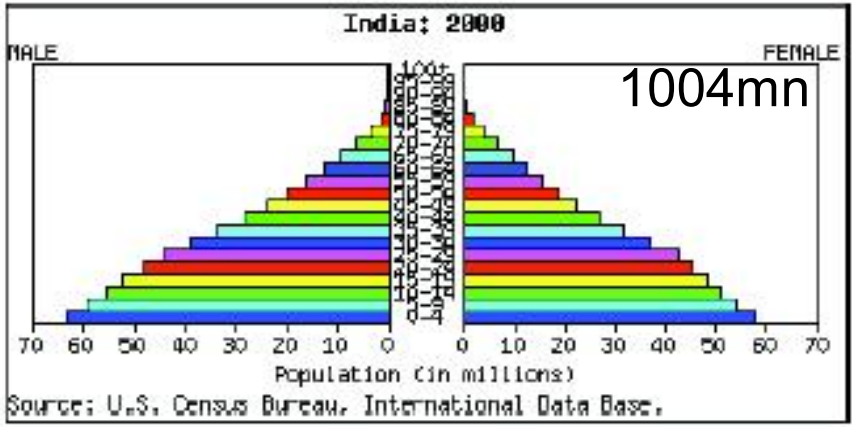


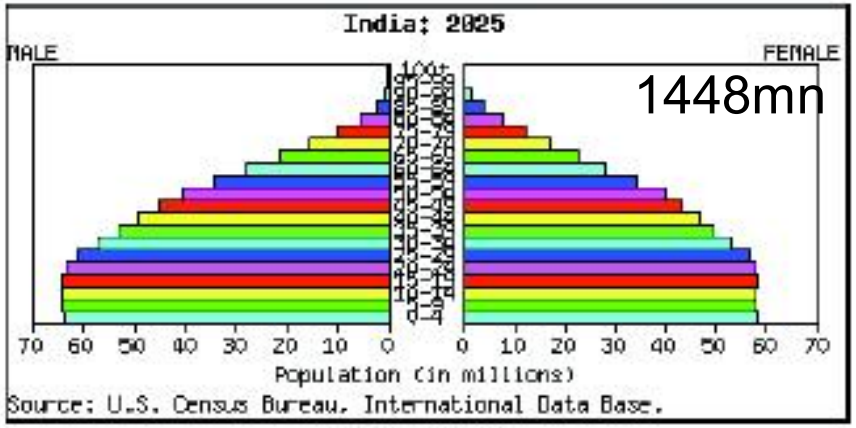
Consequences of different political cultures

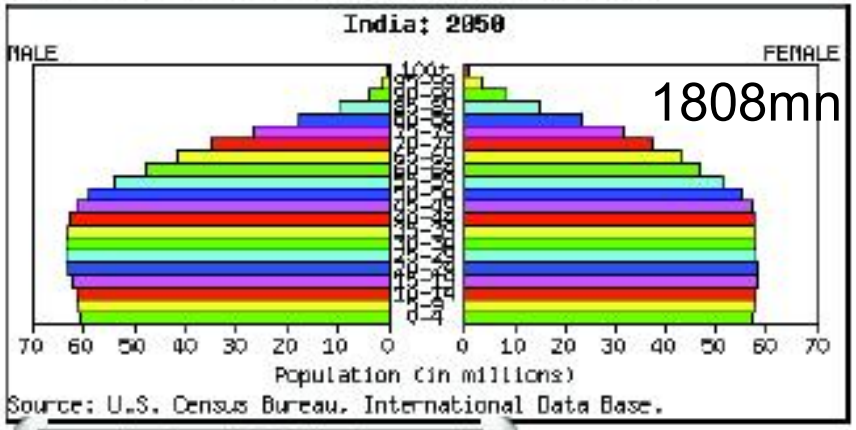




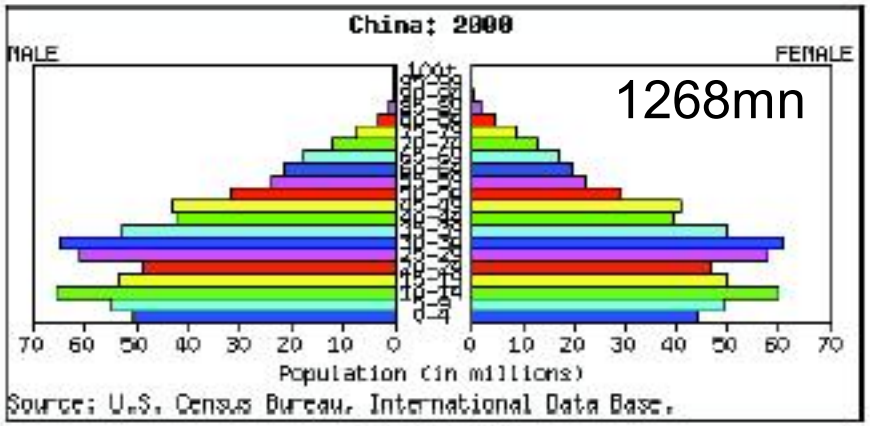


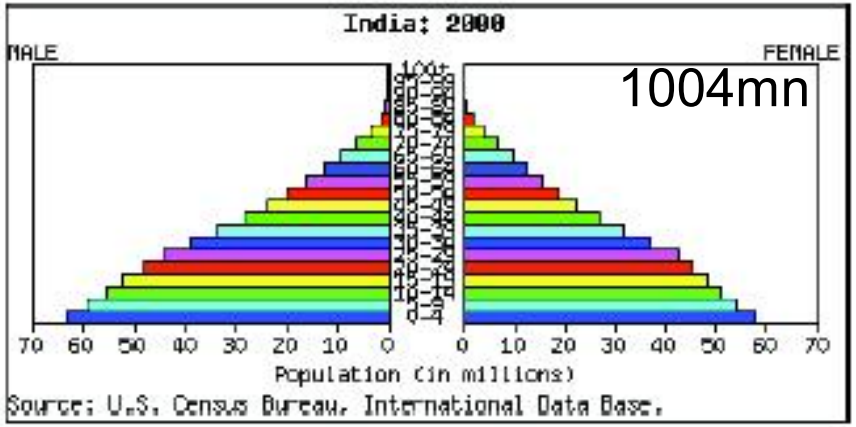


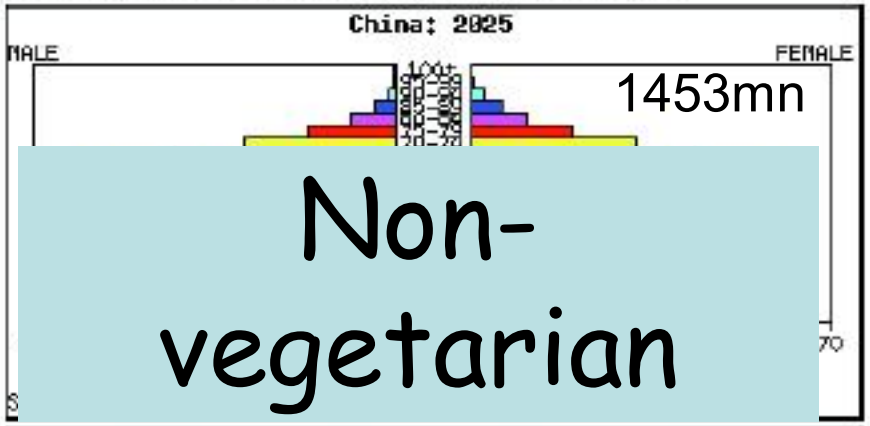




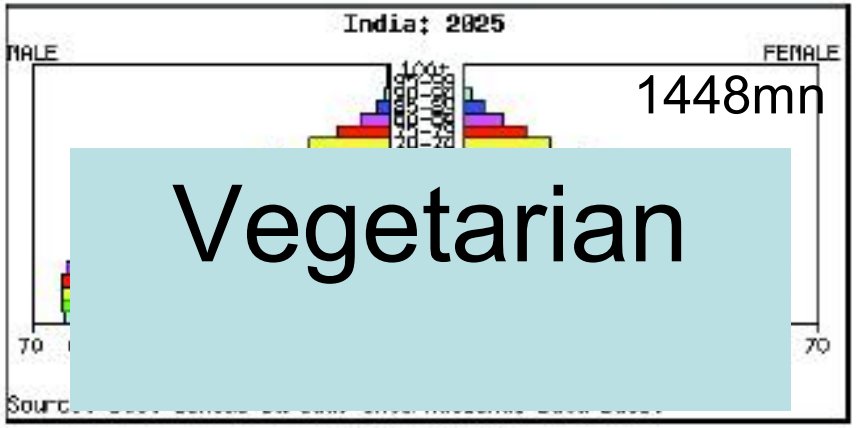
Consequences of different politcal cultures



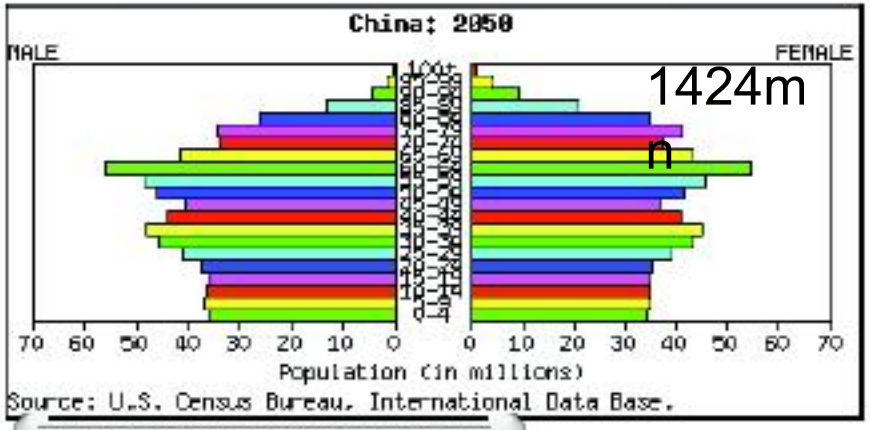


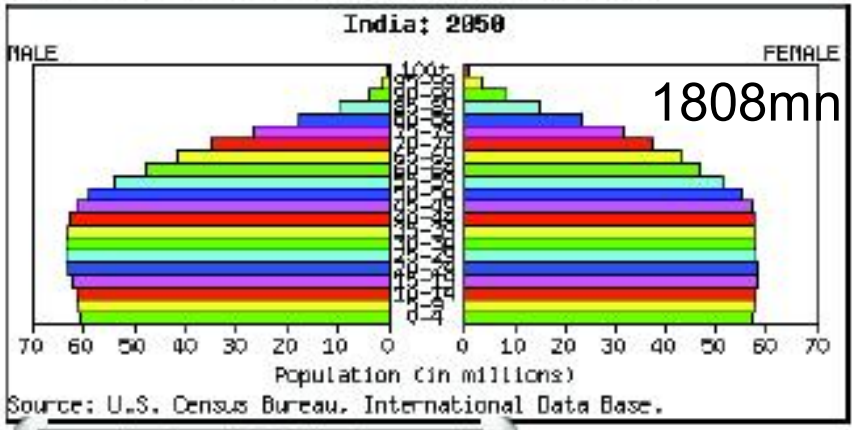


Non-vegetarian

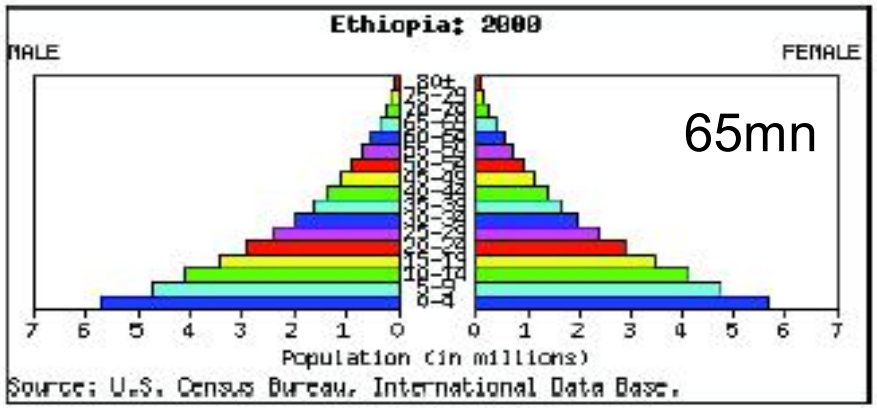


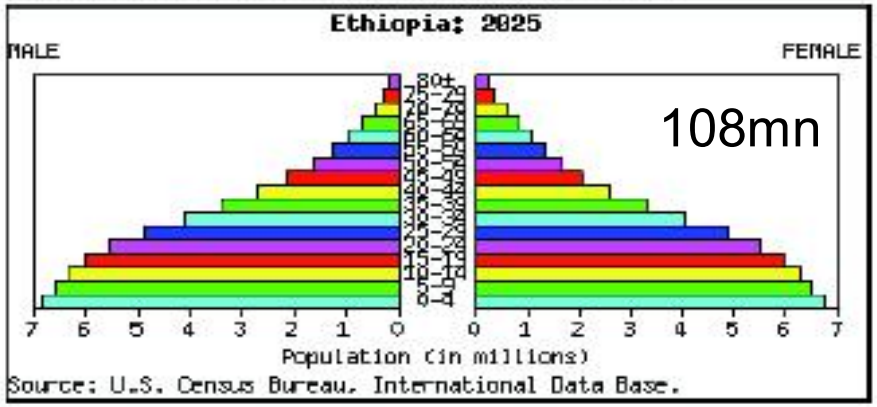
Vegetarian

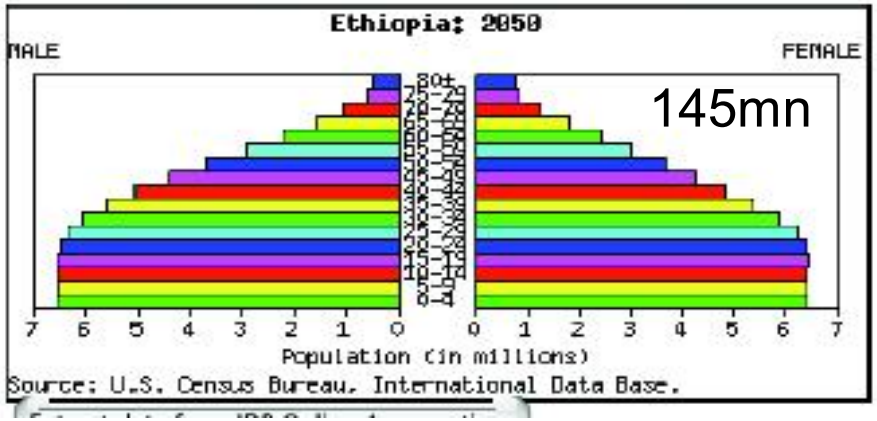




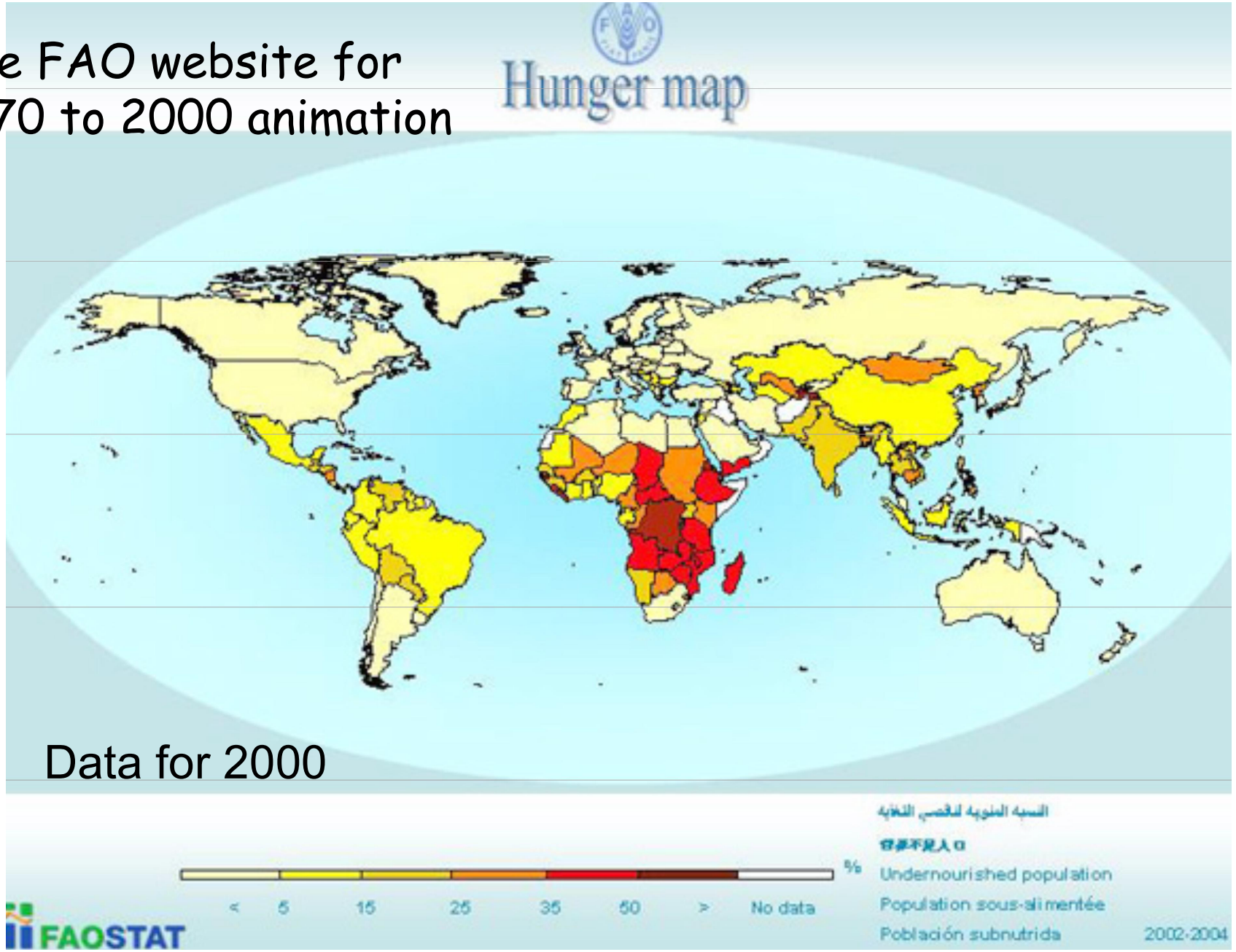
2008


Ethiopia: 2000
MALE
FEMALE
65mn
Population (in millions)
Source: U.S. Census Bureau, International Data Base.


Ethiopia: 2025
MALE
FEMALE
108mn
Population (in millions)
Source: U.S. Census Bureau, International Data Base.


Ethiopia: 2050
MALE
FEMALE
145mn
Population (in millions)
Source: U.S. Census Bureau, International Data Base.

See FAO website for
1970 to 2000 animation



Important contexts & issues in Africa

Southern economies:

- have limited adaptive capacity - economic diversification, infra- structures, capital, institutions, regulatory capacity
- endure very negative terms of trade including the impacts of EU & US export prices for staple foods

Virtual water 'trade' in an era of subsidised grain prices is a very mixed blessing especially in Africa

WORLD PRICES PROBLEM?

Important contexts & issues in the South

Southern economies:

- have very diverse political economies

Consider China and India where there is significant poverty associated with rapid socio-economic transformation and the capacity to engage in, or avoid, VW 'trade'

AND

Africa - for example Ethiopia where its capacity to trade and transform are limited and world prices are a serious problem

Important contexts & issues in the South

The POLITICS of resource use and allocation in Africa are hard to manage and regulatory measures are difficult to install.

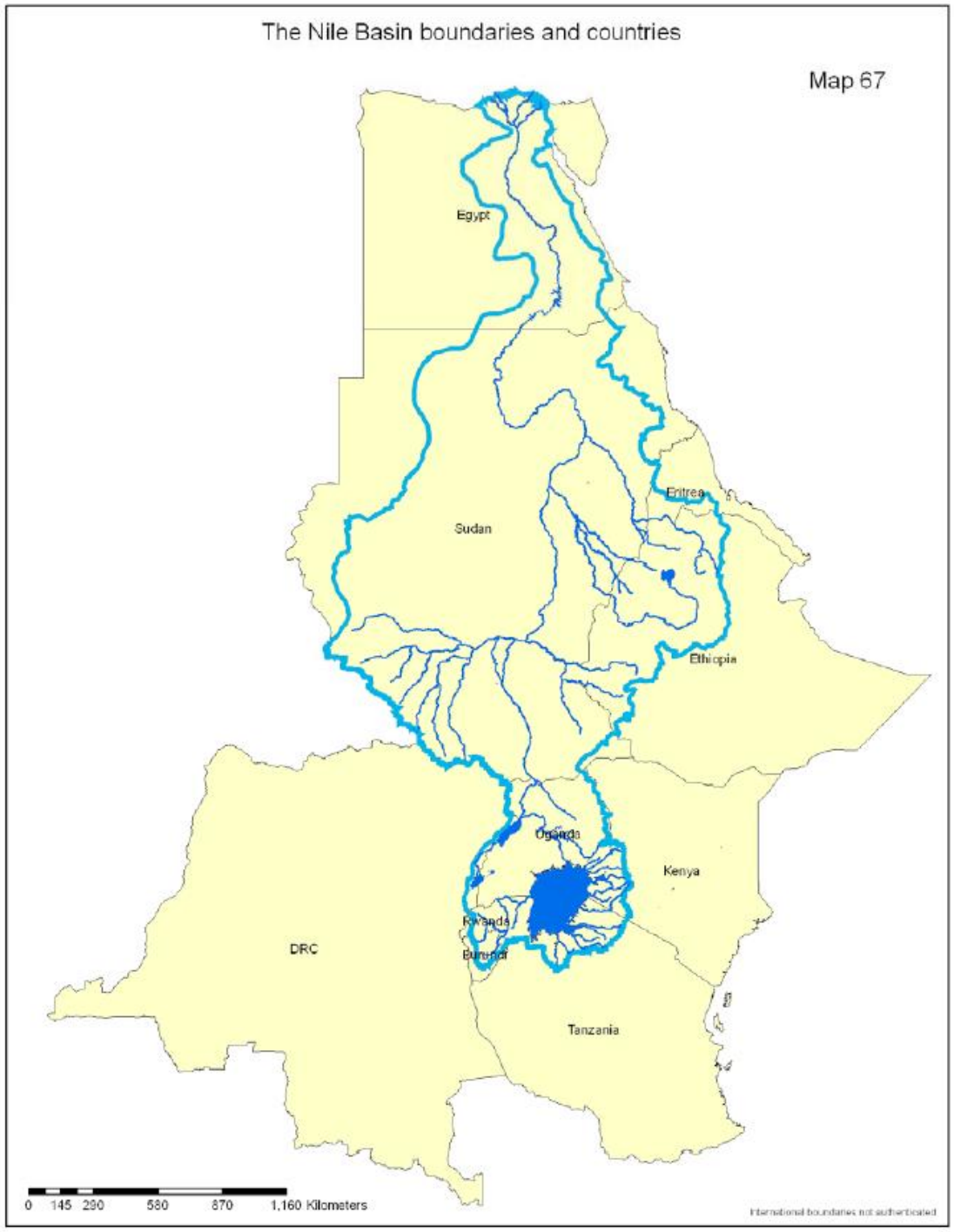
Economic efficiency and consideration of the environment are not high priorities.

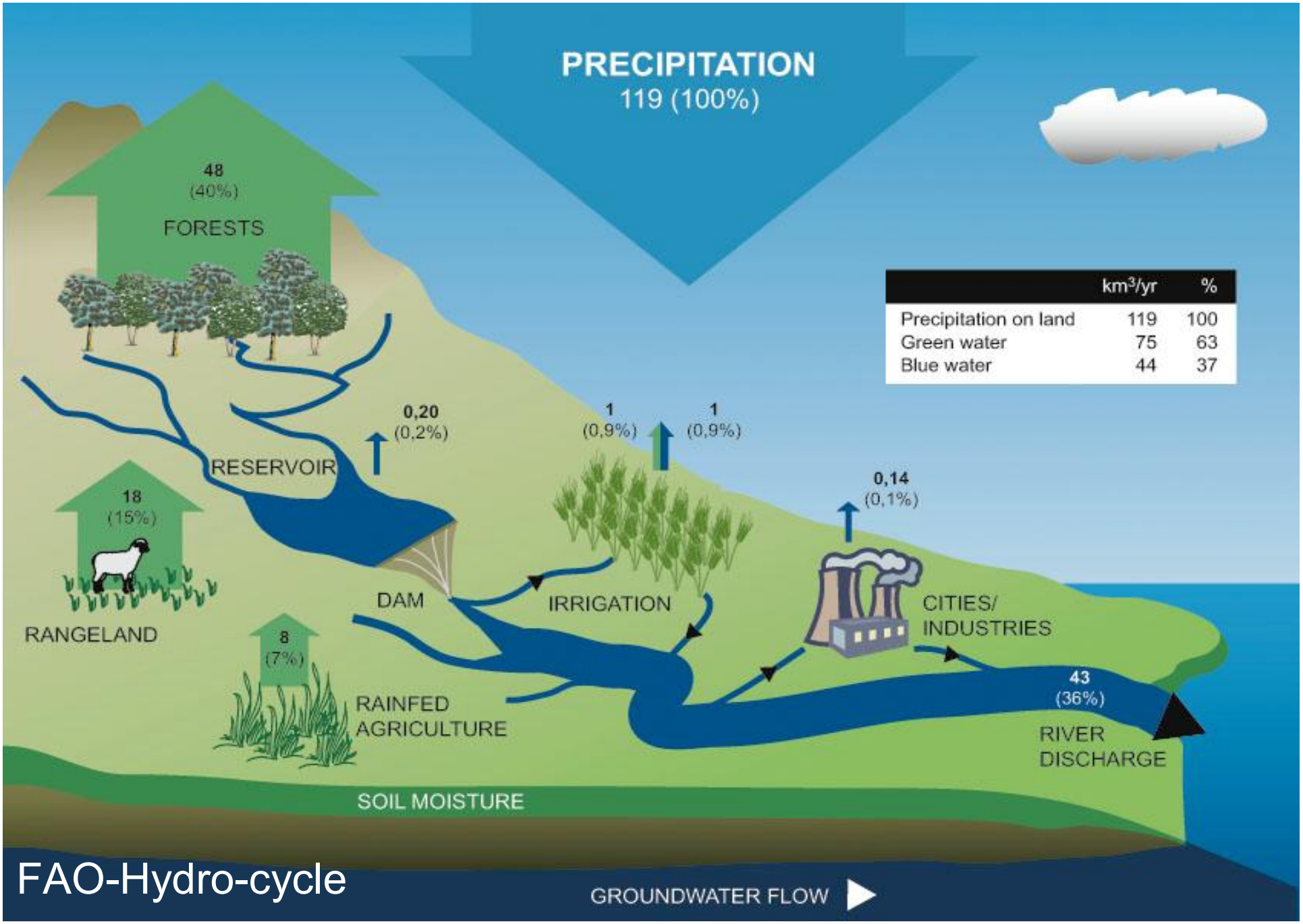
Virtual water 'trade' is a welcome 'solution' mainly because it is:

AN ECONOMICALLY INVISIBLE &
A POLITICALLY SILENT SOLUTION.

As a consequence if is not easily introduced into policy discourse.

Nile Basin - some exemplification of regional variation and water resources consequences




PRECIPITATION
119 (100%)
48
(40%)
FORESTS
0,20
(0,2%)
RESERVOIR
1
(0,9%)
1
(0,9%)
0,14
(0,1%)
18
(15%)
RANGELAND
DAM
IRRIGATION
CITIES/
INDUSTRIES
8
(7%)
RAINFED
AGRICULTURE
43
(36%)
RIVER
DISCHARGE
SOIL MOISTURE
GROUNDWATER FLOW
km³/yr
%
Precipitation on land 119 100
Green water 75 63
Blue water 44 37
FAO-Hydro-cycle

2008

Livestock not included

Table 2.2 Freshwater Flows in the Nile, from Upstream to Downstream.

	Average Annual Precipitation (mm)	Nile River Freshwater Flows* Inflow (Mm3/y)	Nile River Freshwater Flows* Outflow (Mm3/y)	Soil Water Consumption** (for agriculture) (Mm3/y)	Groundwater Production*** (Mm3/y)
DR Congo	1,245	0	1,500	31,909	421,000
Burundi	1,110	0	1,500	6,132	2,100
Rwanda	1,105	1,500	7,000	11,000	3,600
Tanzania	1,015	7,000	10,700	31,583	30,000
Kenya	1,260	0	8,400	20,386	3,000
Uganda	1,140	28,700	37,000	45,804	29,000
Eritrea	520	0	2,200	843	-
Ethiopia	1,125	0	80,100	31,075	40,000
Sudan	500	117,100	55,500	50,313	7,000
Egypt	15	55,500^	< 10,000 (to sea)	0	1,3000
Total in System		approx. **100,000**		approx. **229,000**	

* Evaporation from natural & constructed storage not accounted. **2002 soil water data based on Nile Basin Dataset (FAO 2006a – see also Appendix B). The figures do not include soil water used by natural vegetation.
*** Aquastat *production* figures. Groundwater *availability* data are not available. No production data available for Eritrea. ^Allocation to Egypt after deduction of evaporation from Lake Nasser, according to 1959 Sudan-Egypt Nile Basin Treaty. Precipitation and freshwater data from FAO (1997: Table 20). Evaporation from Lake Nasser is currently high because the level of the lake is high after almost two decades of above average rainfall in Ethiopia. Evaporation fell to between five and six cubic kilometres in the drought years of the mid-1980's (Stoner 1995).

Table 3.3 Average Virtual Water Crop 'Imports' Within the Nile Basin, 1998 – 2004 (Mm3/y).

Basin as a Whole	905
Egypt	372
Kenya	197
Sudan	184
Rwanda	48
Uganda	41
Tanzania	31
Burundi	30
Ethiopia	0.7
DRC	0
Eritrea	0

Table 3.4 Average Virtual Water Crop 'Exports' Within the Nile Basin, 1998 – 2004 (Mm3/y).

Basin as a Whole	905
Kenya	403
Uganda	169
Tanzania	132
Sudan	122
Egypt	51
DRC	15
Ethiopia	10
Burundi	2
Rwanda	1
Eritrea	0

Table 3.5 Average Virtual Water Crop 'Imports' by Nile Basin States from the Rest of the World, 1998 – 2004 (Mm3/y).

Basin as a Whole	39,230
Egypt	30,195
Sudan	3,565
Tanzania	1,818
Kenya	1,817
Ethiopia	1,061
Uganda	682
Rwanda	56
Burundi	28
Eritrea	8
DRC	0

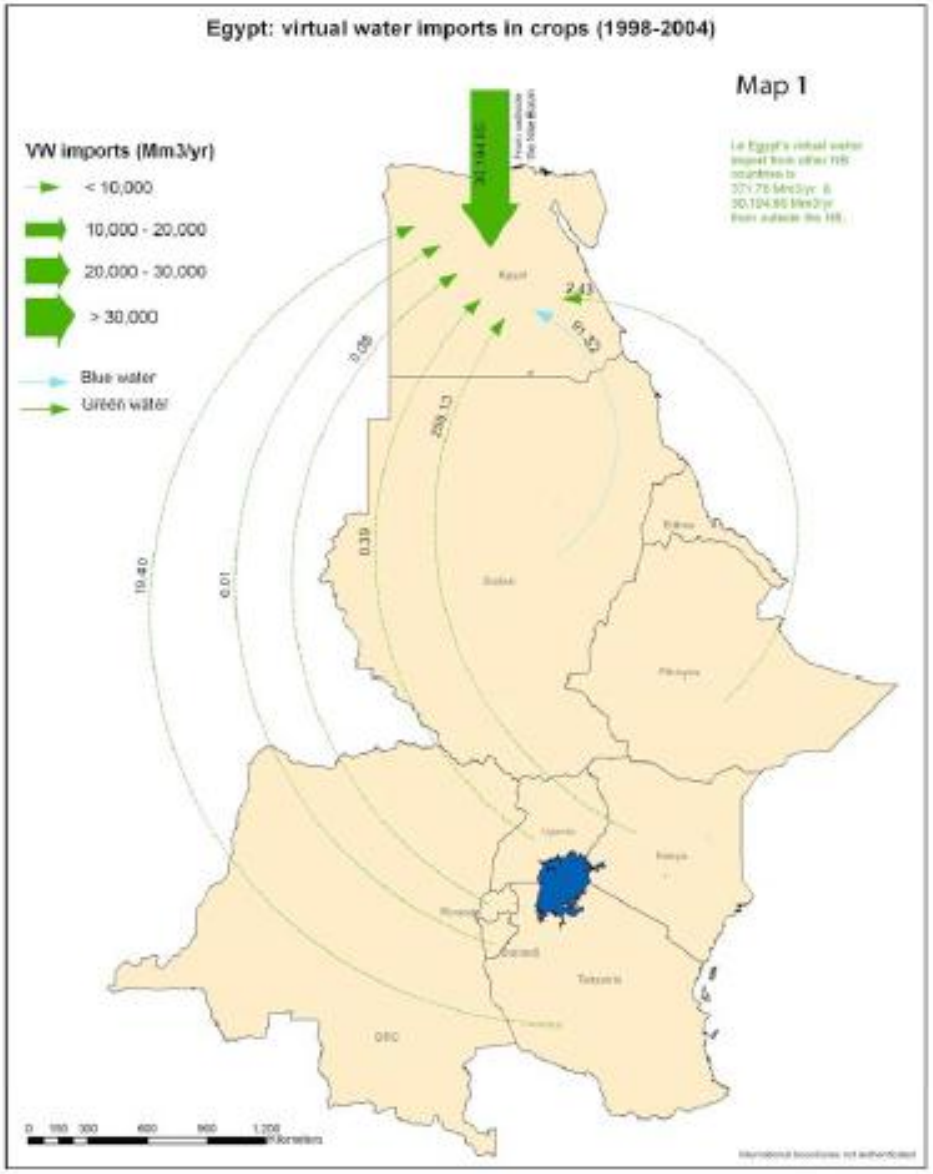
Table 3.6 Average Virtual Water Crop 'Exports' from Nile Basin States to the Rest of the World, 1998 – 2004 (Mm3/y).

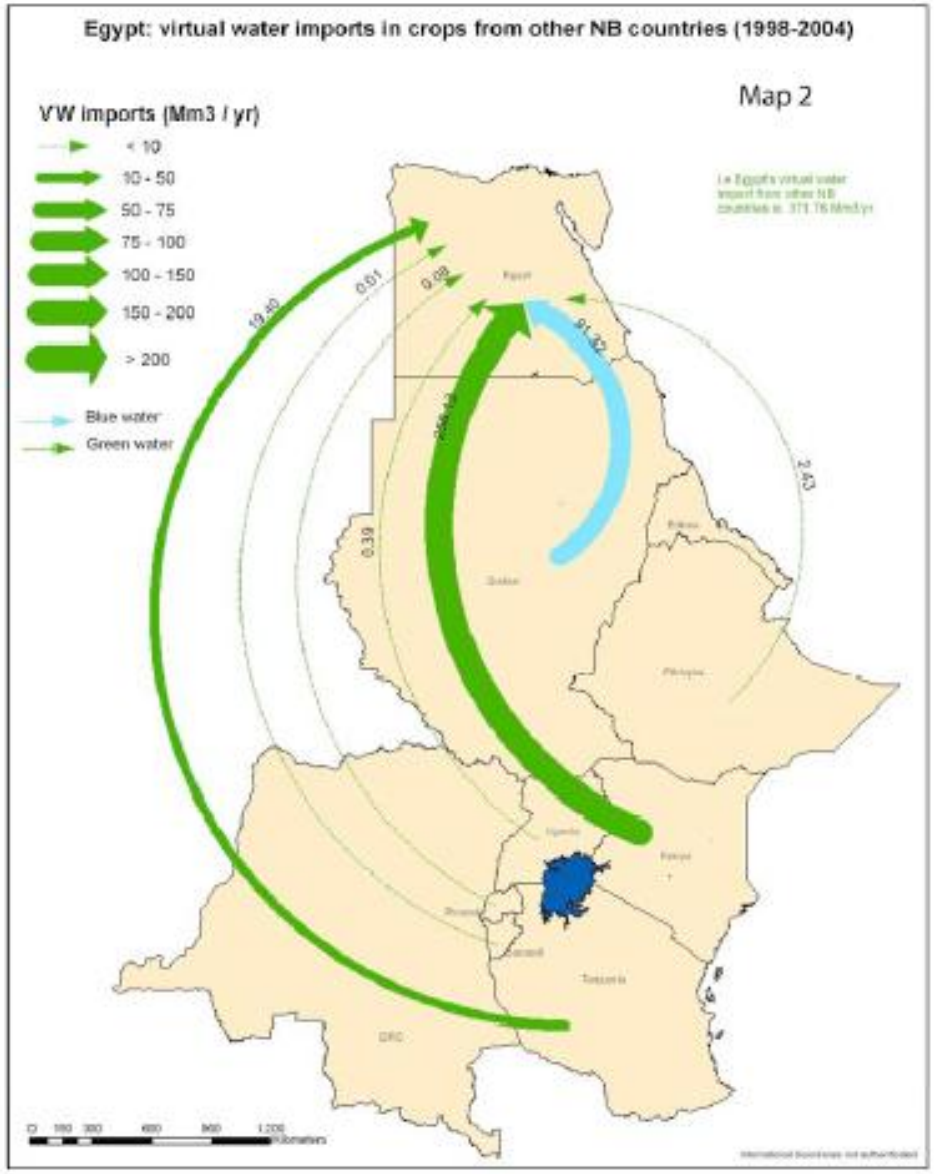
Basin as a Whole	11,321
Kenya	2,909
Uganda	2,501
Tanzania	1,888
Ethiopia	1,053
Egypt	1,034
DRC	666
Sudan	652
Burundi	318
Rwanda	300
Eritrea	0.68

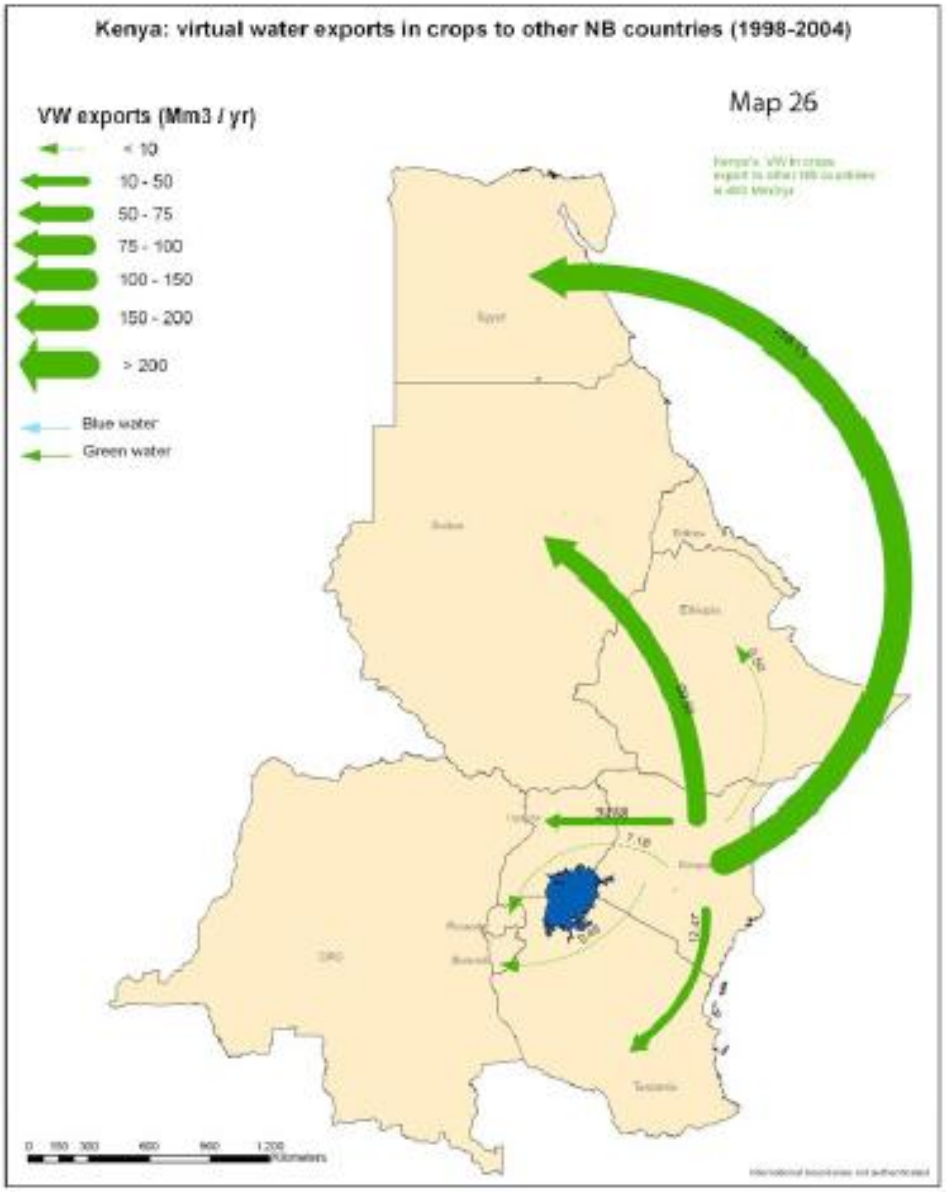
Table 3.6 Average Virtual Water Crop 'Exports' from Nile Basin States to the Rest of the World, 1998 – 2004 (Mm3/y).

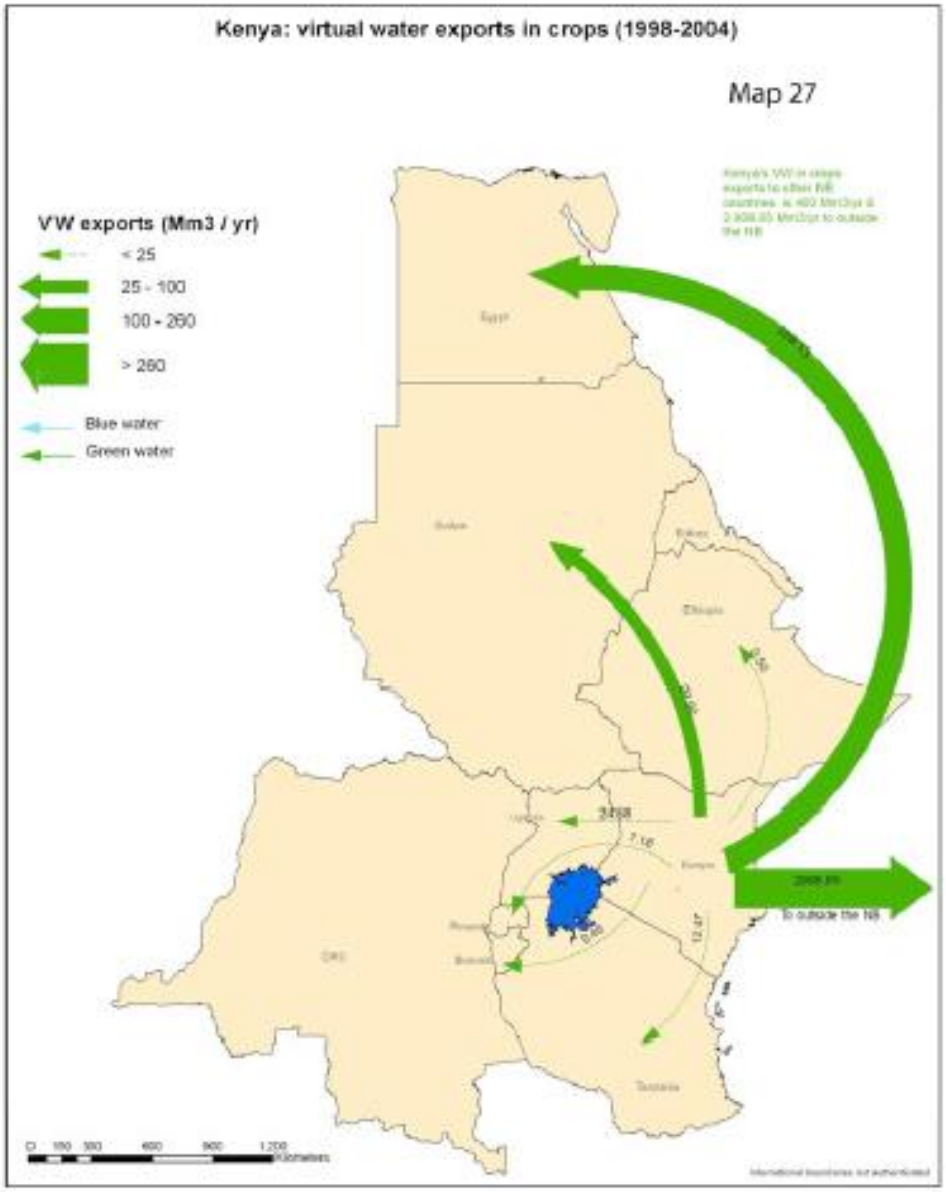
Basin as a Whole	11,321
Kenya	2,909
Uganda	2,501
Tanzania	1,888
Ethiopia	1,053
Egypt	1,034
DRC	666
Sudan	652
Burundi	318
Rwanda	300
Eritrea	0.68

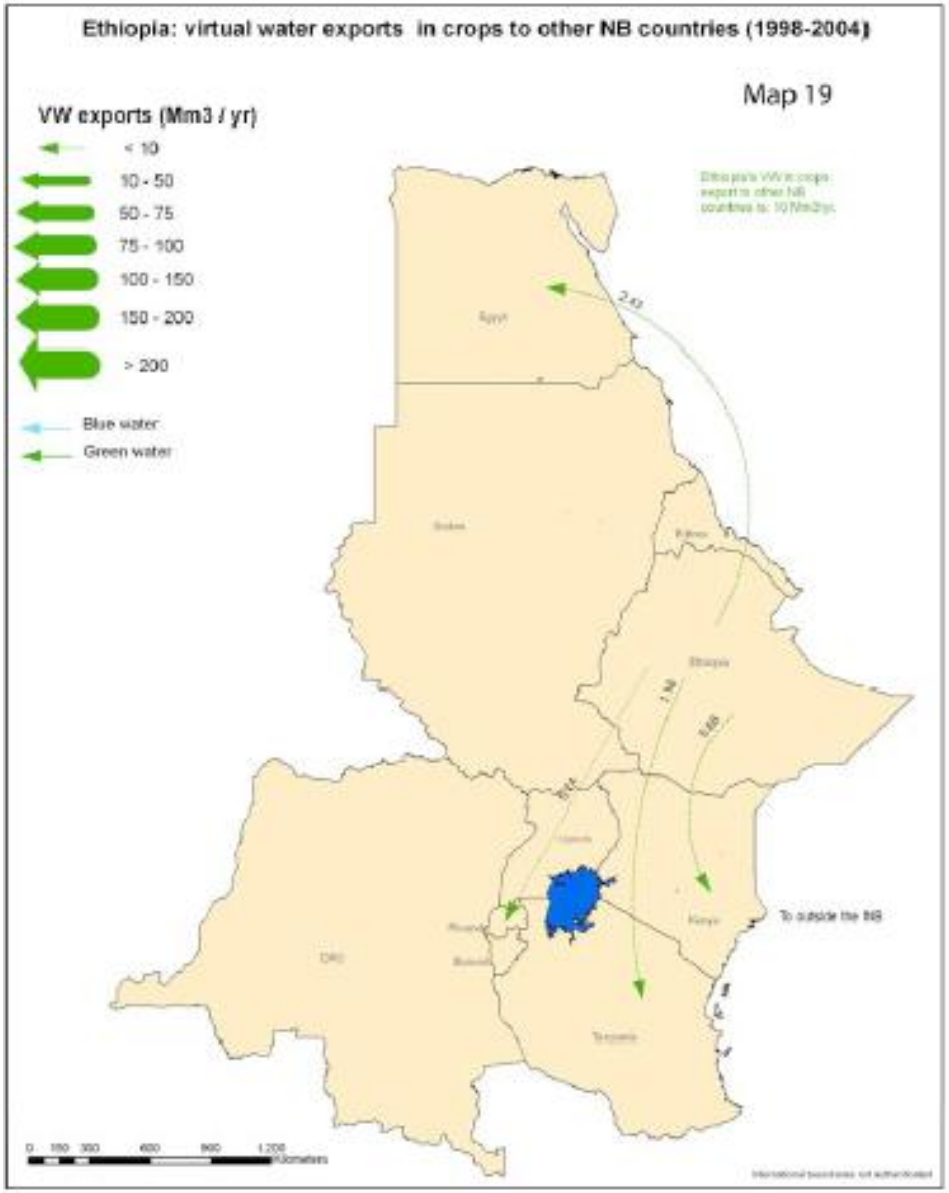
75%

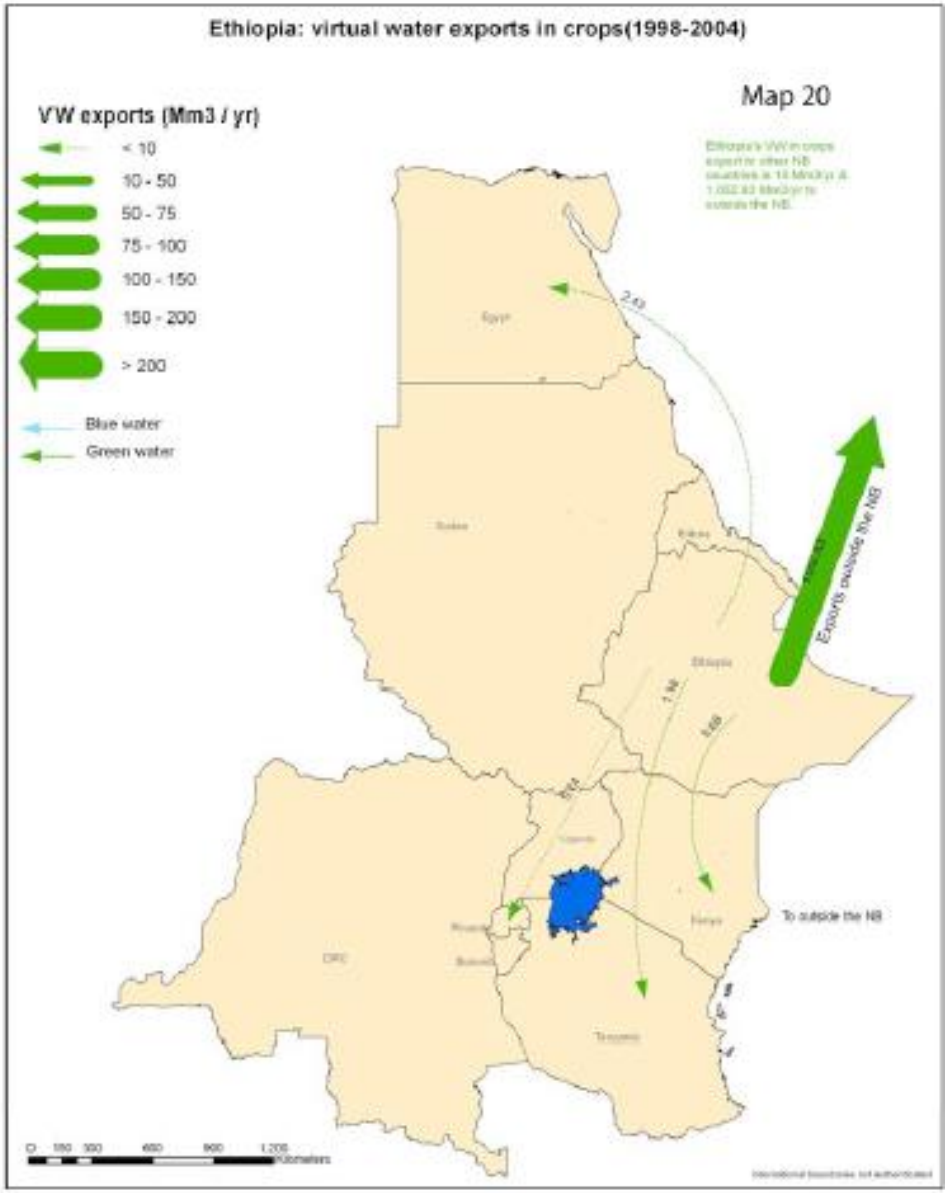

Egypt: virtual water imports in crops (1998-2004)
Map 1
VW imports (Mm3/yr)
< 10,000
10,000 - 20,000
20,000 - 30,000
> 30,000
Blue water
Green water


Egypt: virtual water imports in crops from other NB countries (1998-2004)
Map 2
VW imports (Mm3 / yr)
< 10
10 - 50
50 - 75
75 - 100
100 - 150
150 - 200
> 200
Blue water
Green water


Kenya: virtual water exports in crops to other NB countries (1998-2004)
Map 26
VW exports (Mm3 / yr)
< 10
10 - 50
50 - 75
75 - 100
100 - 150
150 - 200
> 200
Blue water
Green water


Kenya: virtual water exports in crops (1998-2004)
Map 27
VW exports (Mm3 / yr)
< 25
25 - 100
100 - 260
> 260
Blue water
Green water


Ethiopia: virtual water exports in crops to other NB countries (1998-2004)
Map 19
VW exports (Mm3 / yr)
< 10
10 - 50
50 - 75
75 - 100
100 - 150
150 - 200
> 200
Blue water
Green water
To outside the NB


Ethiopia: virtual water exports in crops(1998-2004)
Map 20
VW exports (Mm3 / yr)
< 10
10 - 50
50 - 75
75 - 100
100 - 150
150 - 200
> 200
Blue water
Green water
Exports outside the NB
To outside the NB

Whose ideas matter in managing water?

Ideas of science - observed science

Ideas of society on say sustainability - constructed knowledge

Ideas and discursive processes

Ideas in the Governance Processes and the problems of engaging with the assumptions and expectations of consumers

Consumers are embedded in society not in science

Who knows what about managing water?

What is the role of science?

Prediction

Explanation

To influence society & the political economy

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Different ways of scientific knowing?

To predict	Modelling Sciences
To explain	Social & politics theory
To influence	Activist science

Different assumptions of the 3 types of science about:

What is relevant?

What methods used?

What is truth? - significance of precision & accuracy

What knowledge Observed versus constructed

Constructed knowledge will always overwhelm observed science

The abstract always overwhelms the concrete.

Marx 1850

The abstract always overwhelms the concrete.

Marx 1850

Politicians were invented to deal with ambiguity which is always associated with uncertainty

Modeling scientists deal with risk which can be captured with the numbers and the language of probability

Politicians know what the game is about and *accept* the excitement of uncertainty

Most scientists *avoid* the excitement of uncertainty.

TYPES OF >> SCIENCE	Empirical–analytic inquiry	Interpretive inquiry	Liberatory Inquiry (e.g. Participatory Research)
Purpose	Experimental science in search of causal explanations and laws in order to make predictions	Interpretive science in search of subjective meanings and understanding in the world of lived experience.	Liberating (Humanising) science to create movement for personal and social transformation in order to redress injustices, support peace and form democratic spaces.
Nature of reality	A unique, real, social world exists to be studied by independent observers. Recognition is given to distinct, positive facts and observable phenomena	Pluralistic and relativist (multiple realities dependent on individual's perceptions). People make purposeful acts based on their perceptions of feelings and events and so shape their realities by their behaviour.	The social world is humanly and collectively constructed with and within a historical context. People are active subjects in the world and are constantly in relationships of power: with the self, with others, with nature.
Nature of Knowledge	Objective truth exists. Objectivity (detached neut-rality) and value-free science is possible and desirable. Logical, deduc-tive, rational findings. Know-ledge is an end in itself.	Knowledge is a social, subjective construction. Language contextualises the meaning of data. The method used justifies the knowledge produced.	People can change their level of consciousness through learning. Objectivity does not exist. Fundamental human needs drive the process of inquiry. Holistic dimensions of knowing.
Know'Produc'd	Technical instrumental	Interpretive Interactive	Critical, Spiritual
Values reflected	Deterministic application:. Concerned with 'mainten-ance of evolutionary change of status quo'. Control over behaviour & environment	Humanistic application: 'growth metaphor with self-actualisation of indi-viduals within meritocratic forms of social life.	Transformative process. Belief in people's capacity to work together for equitable decision-making and fair distribution of resources.

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Modelling science

Explanatory science

Activist science

Conceptualising trajectories of secure & sustainable water use

defined by

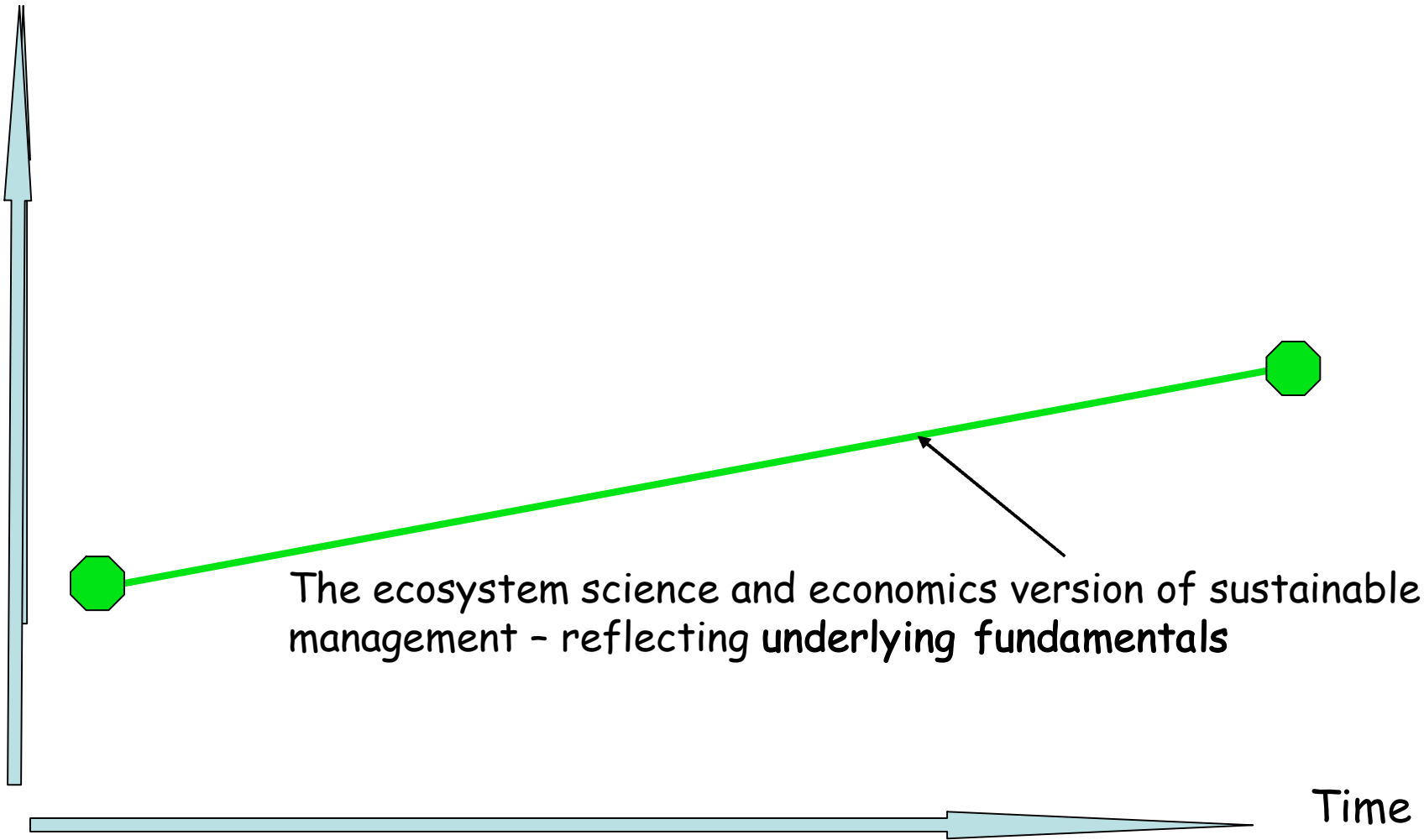
Society and water managing professionals and policy-makers
- POLITICAL PROCESSES

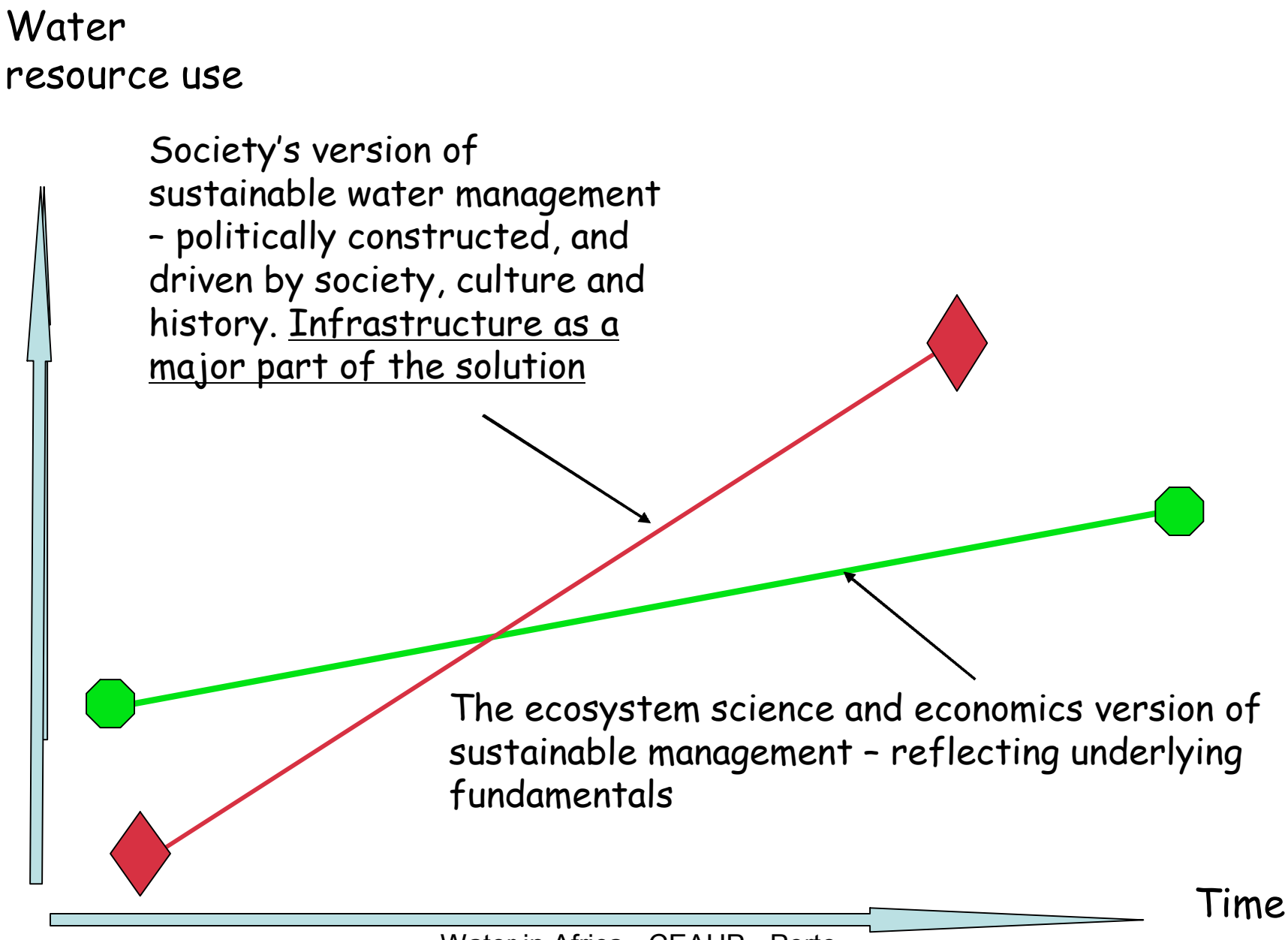
Ecosystem scientists and economists
- UNDERLYING FUNDAMENTALS

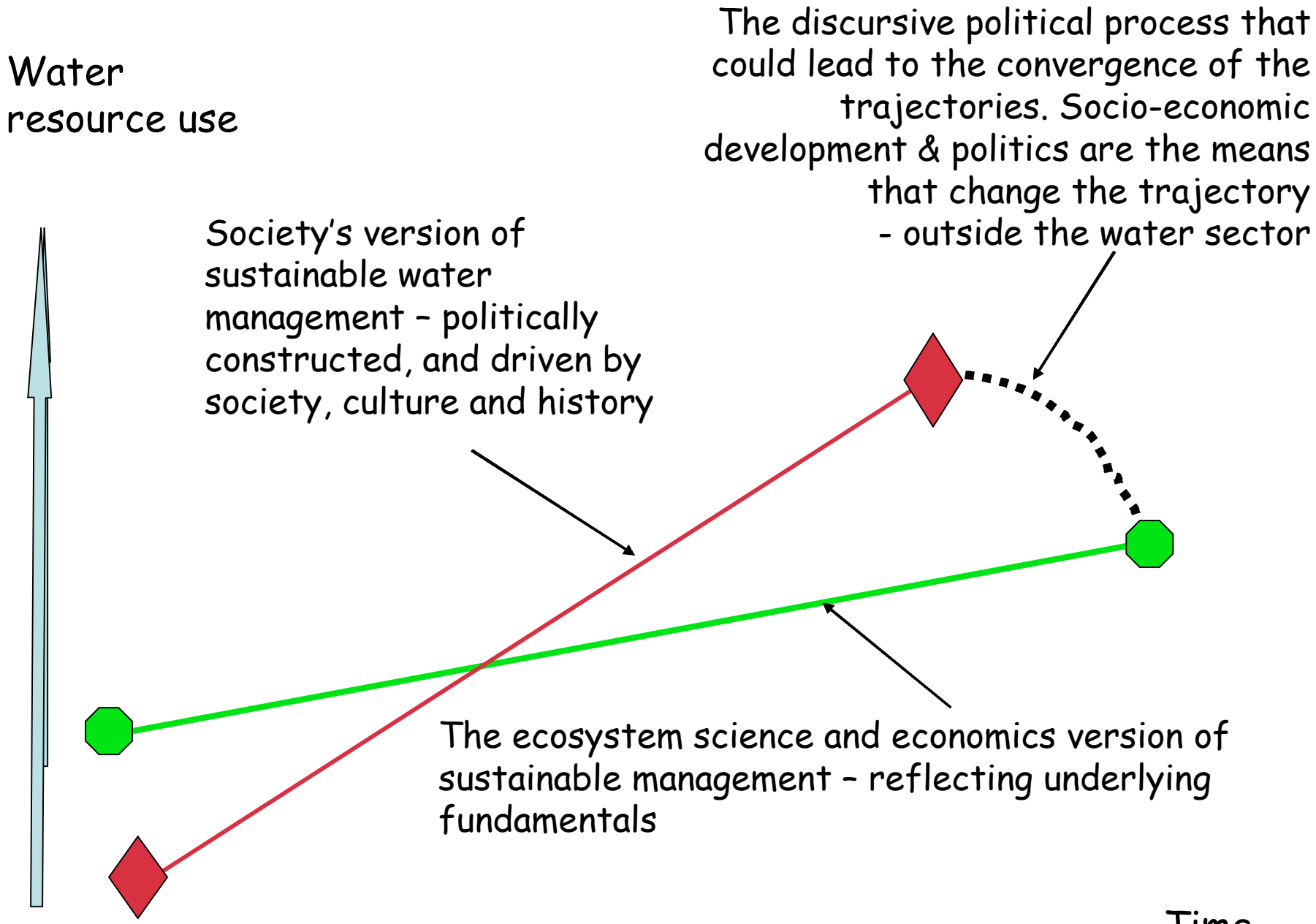
Water
resource use

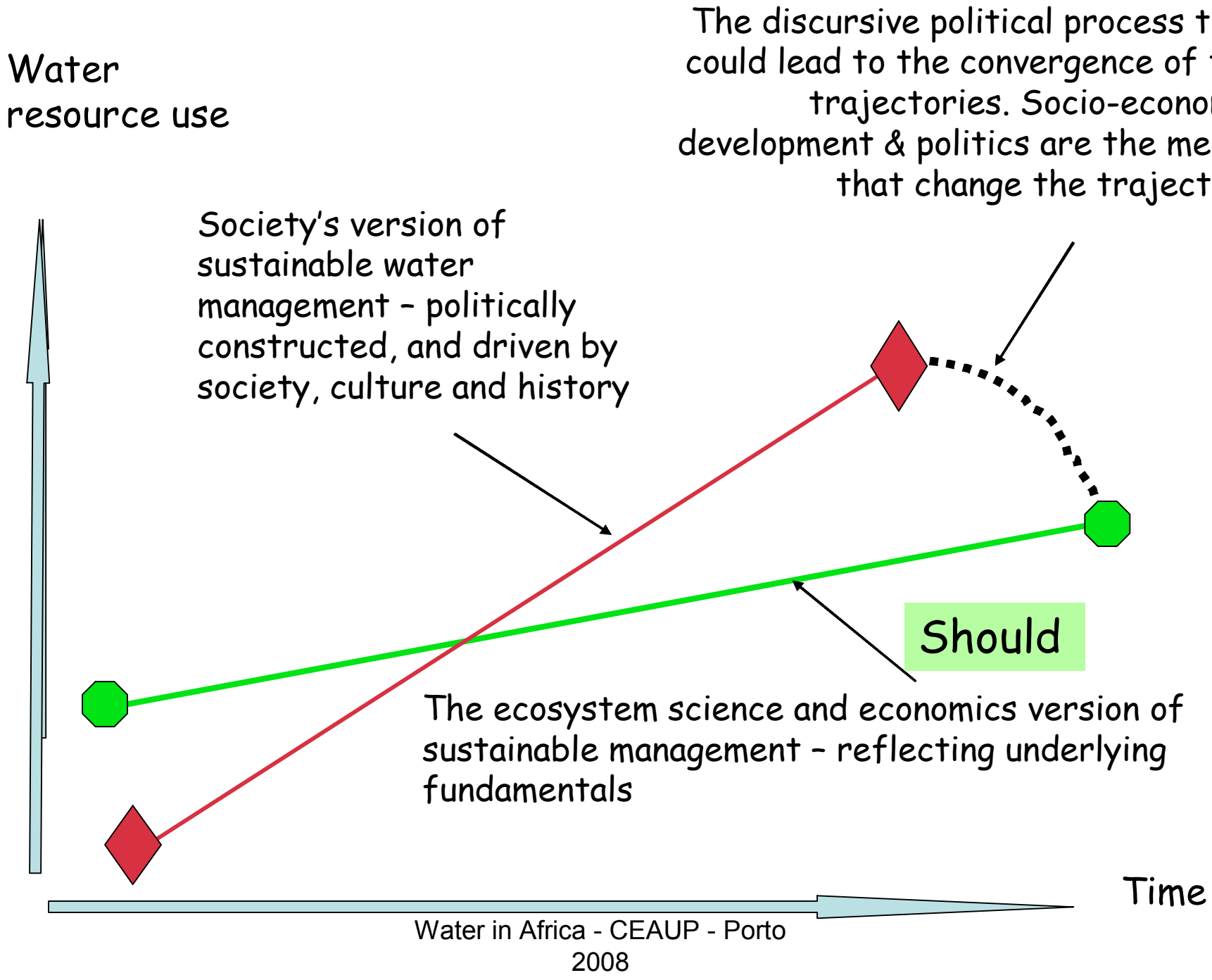
Time

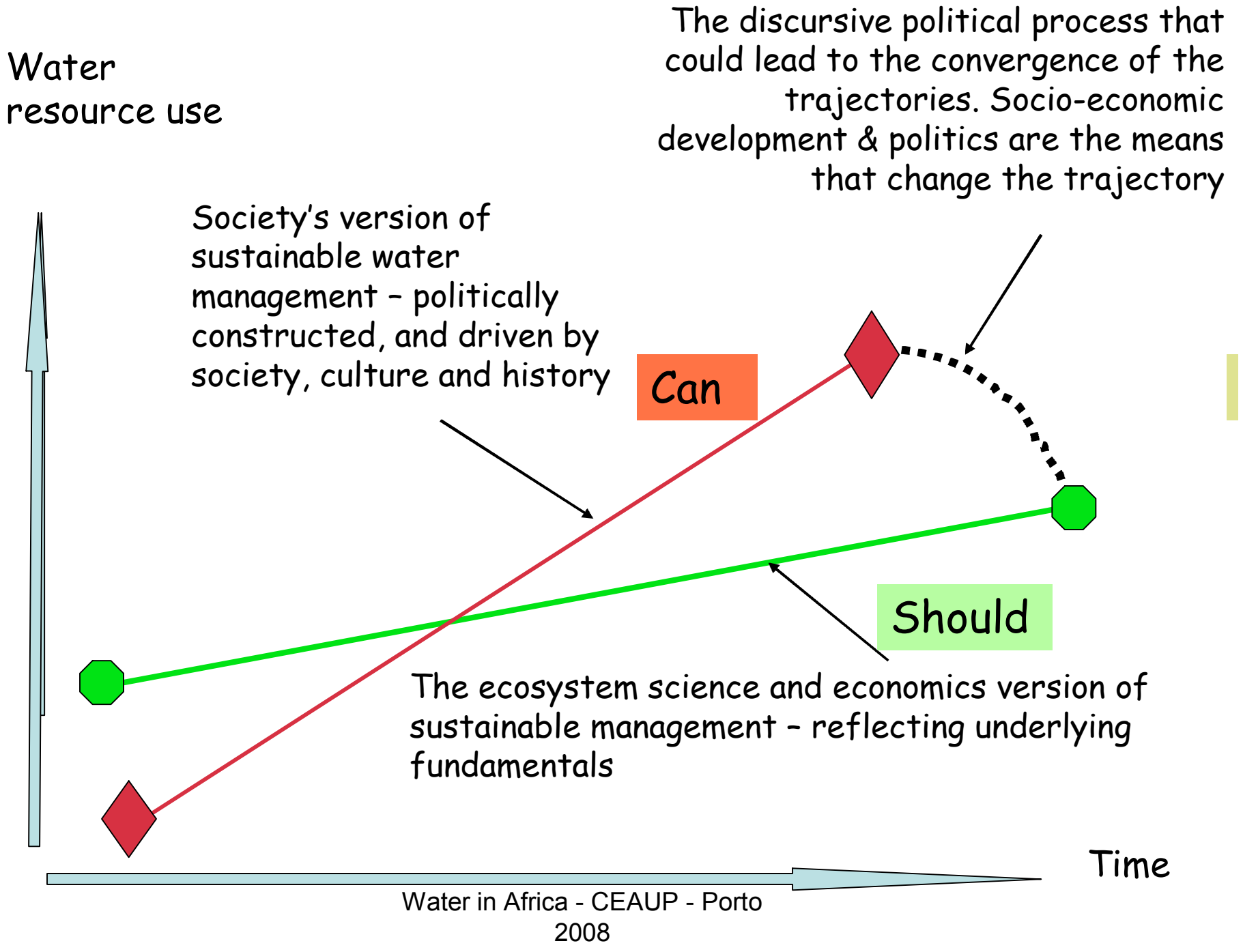
Water
resource use




Water
resource use
Society's version of
sustainable water management
– politically constructed, and
driven by society, culture and
history. Infrastructure as a
major part of the solution
The ecosystem science and economics version of
sustainable management – reflecting underlying
fundamentals
Time


Water
resource use
The discursive political process that could lead to the convergence of the trajectories. Socio-economic development & politics are the means that change the trajectory - outside the water sector
Society's version of sustainable water management – politically constructed, and driven by society, culture and history
The ecosystem science and economics version of sustainable management – reflecting underlying fundamentals
Time


Water resource use
The discursive political process that could lead to the convergence of the trajectories. Socio-economic development & politics are the means that change the trajectory
Society's version of sustainable water management – politically constructed, and driven by society, culture and history
Should
The ecosystem science and economics version of sustainable management – reflecting underlying fundamentals
Time


Water resource use
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Society's version of sustainable water management – politically constructed, and driven by society, culture and history
Can
Should
The ecosystem science and economics version of sustainable management – reflecting underlying fundamentals
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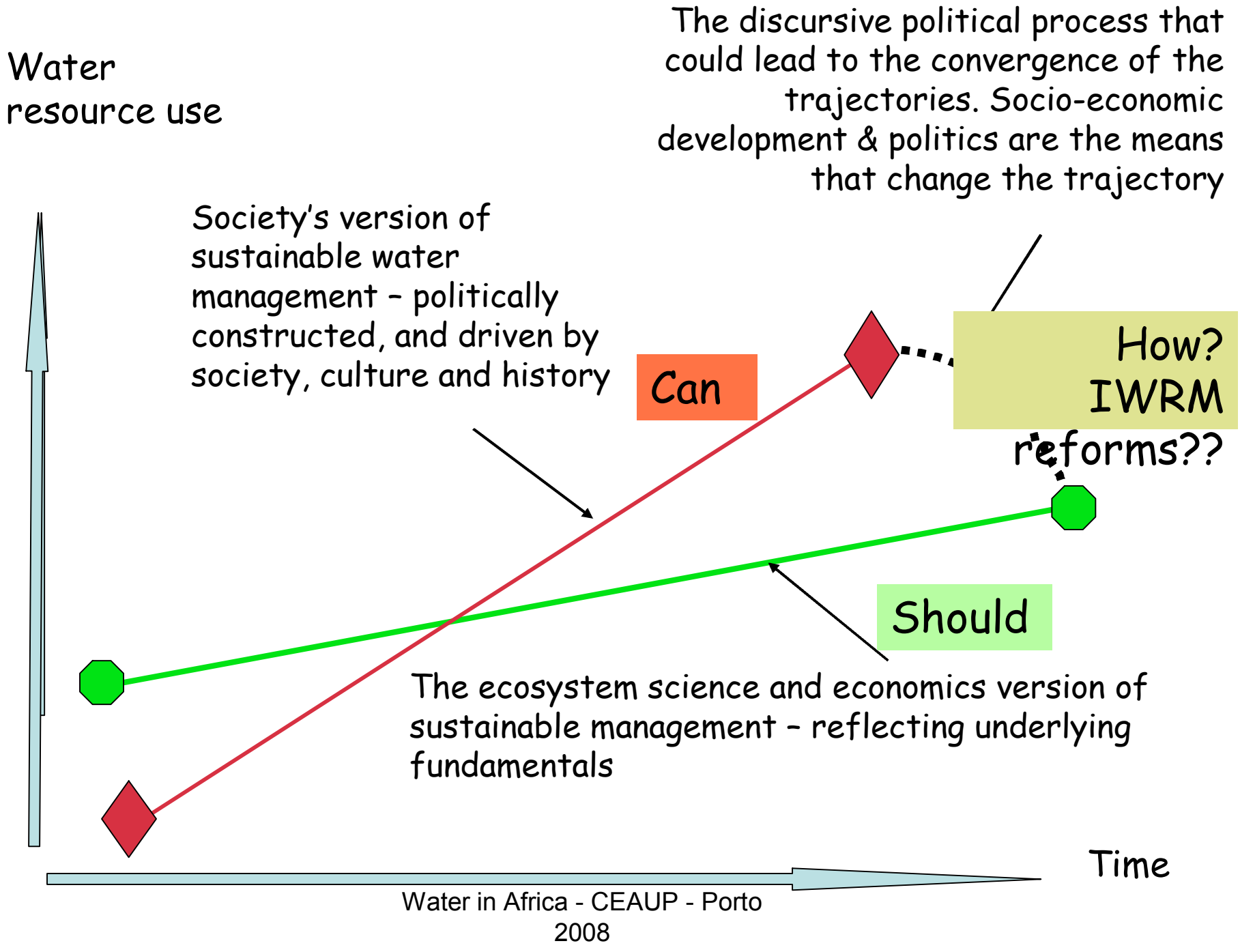
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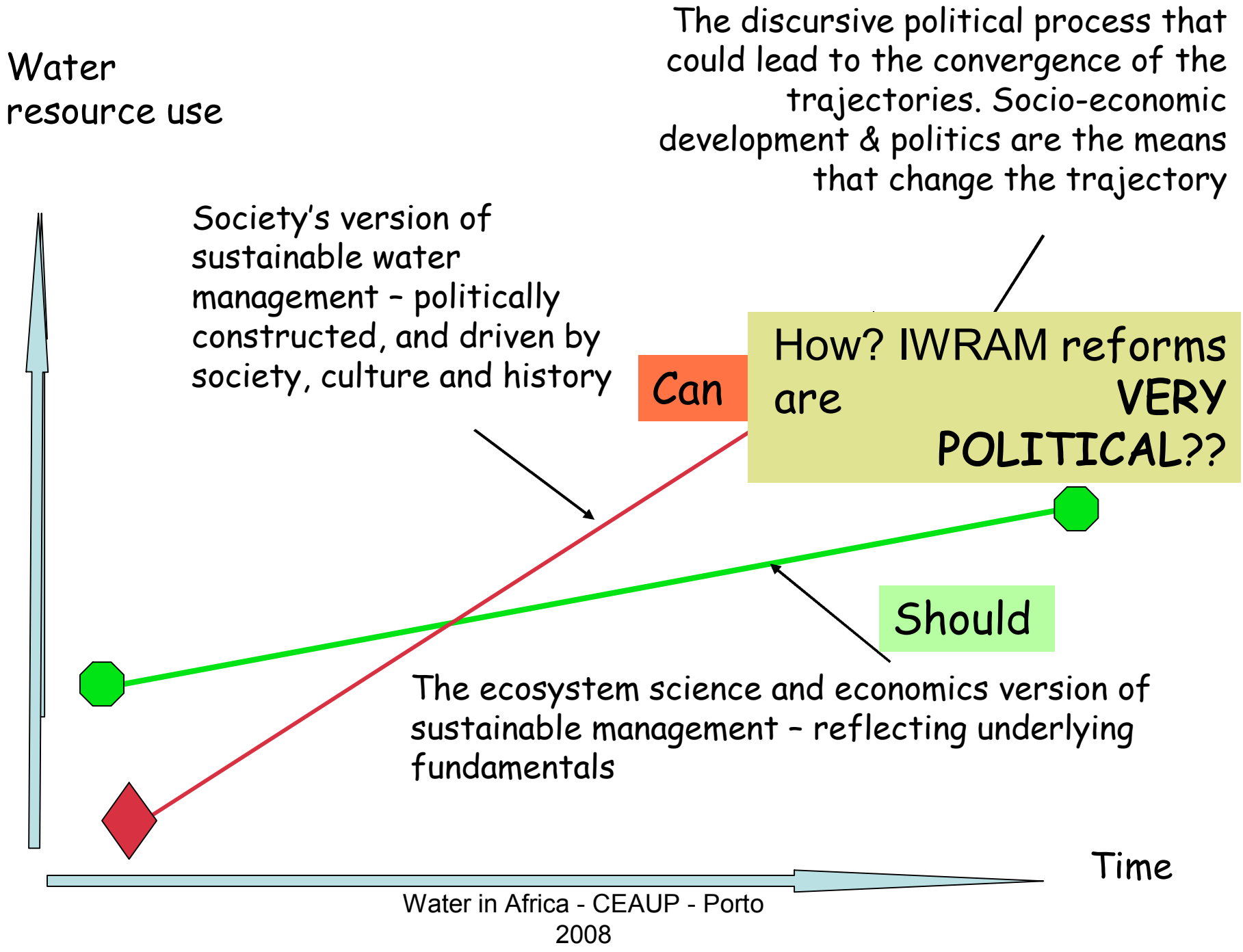
Society's version of sustainable water management – politically constructed, and driven by society, culture and history
Can
How? IWRM reforms??
Should
The ecosystem science and economics version of sustainable management – reflecting underlying fundamentals
Time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The discursive political process that could lead to the convergence of the trajectories. Socio-economic development & politics are the means that change the trajectory
Society's version of sustainable water management – politically constructed, and driven by society, culture and history
Can
How? IWRAM reforms are VERY POLITICAL??
Should
The ecosystem science and economics version of sustainable management – reflecting underlying fundamentals
Time

Water demand is determined by consumers
who have beliefs and expectations
that are based
on experience, cultural preferences, history
and NOT on science

Consumers and their assumptions are very
important indeed

The extravagant consumers in the North
The optionless irrigators in the South

Figure 1.4 A conceptual framework: water resource science and political discourse

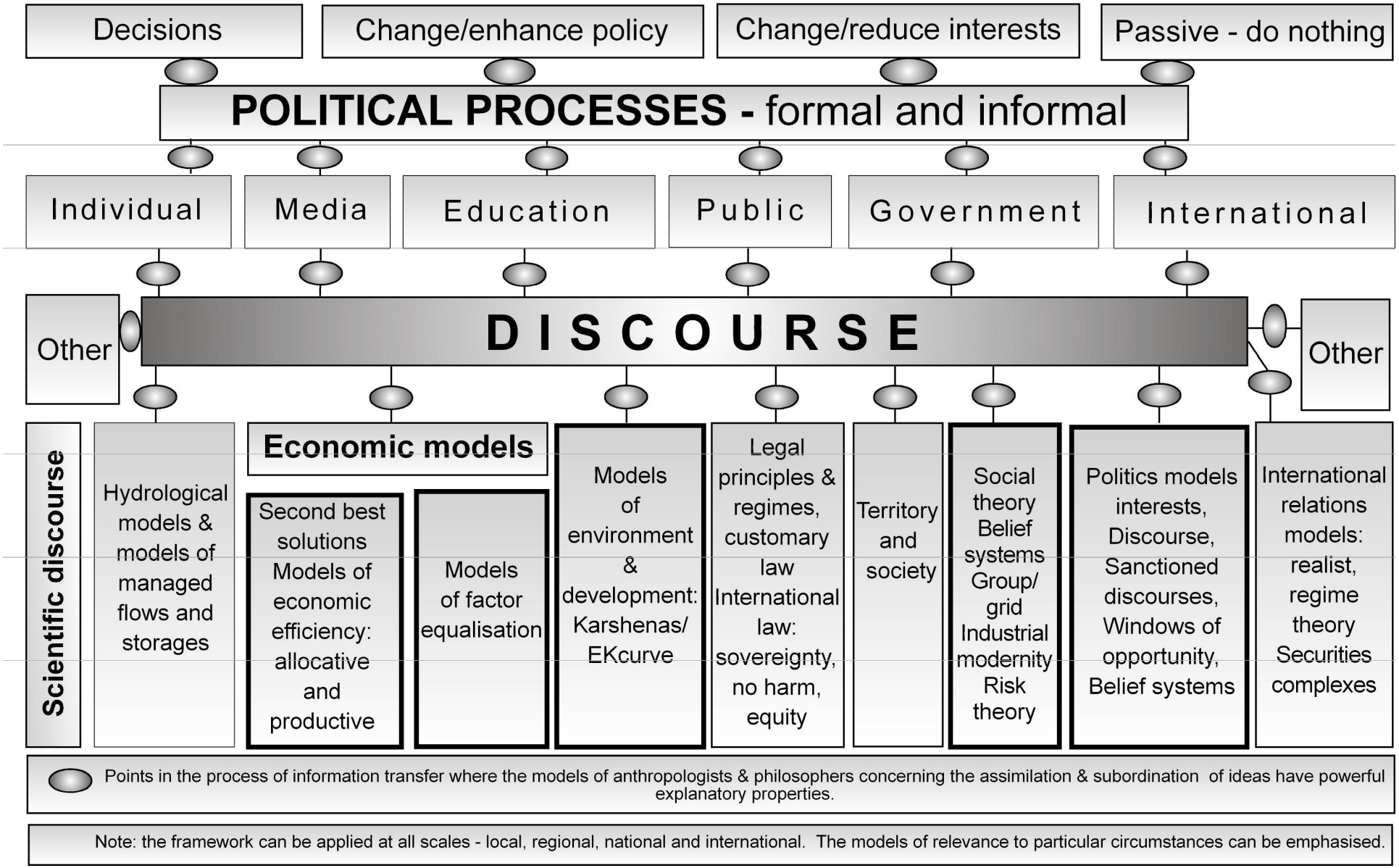
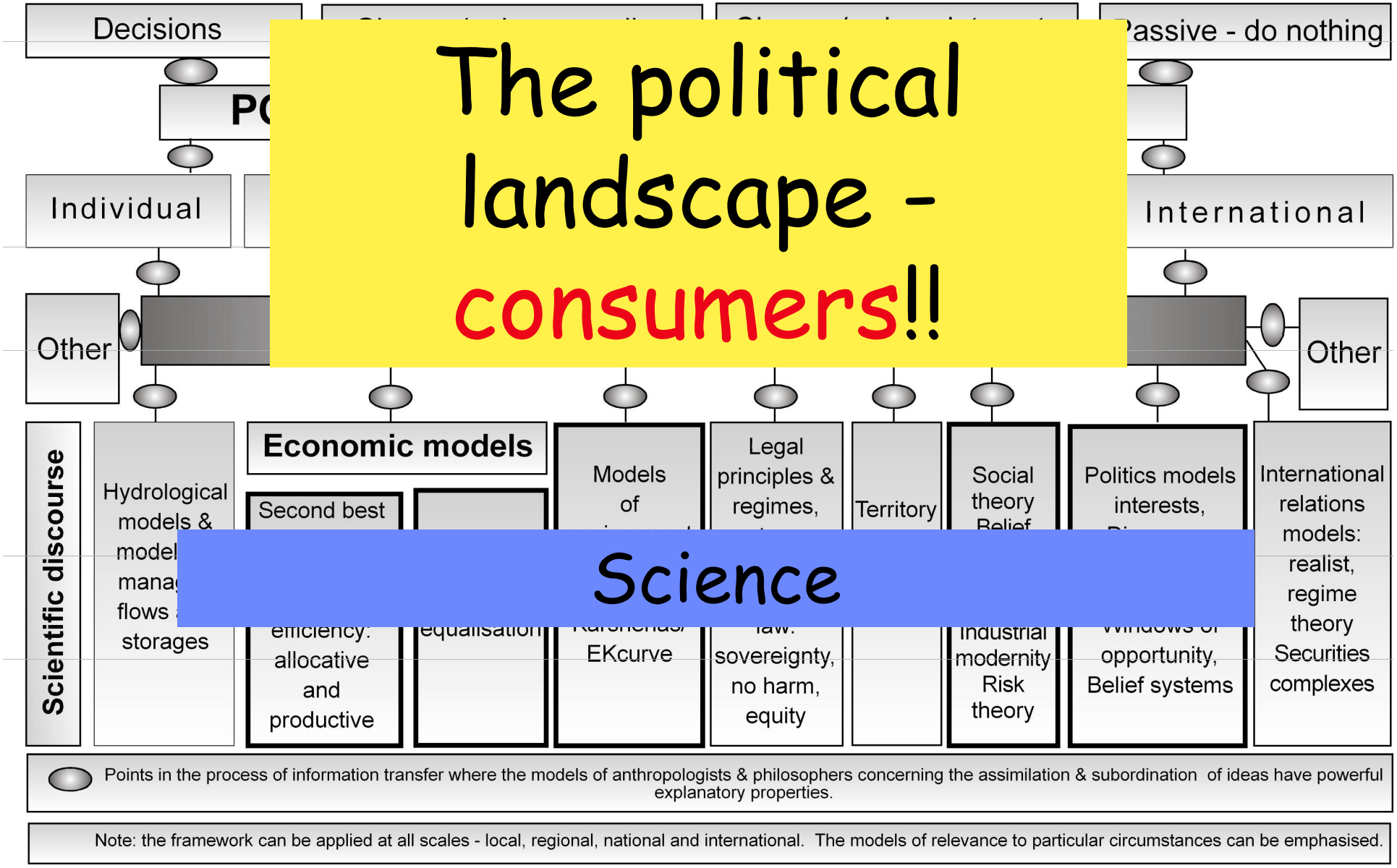


Figure 1.4 A conceptual framework: water resource science and political discourse



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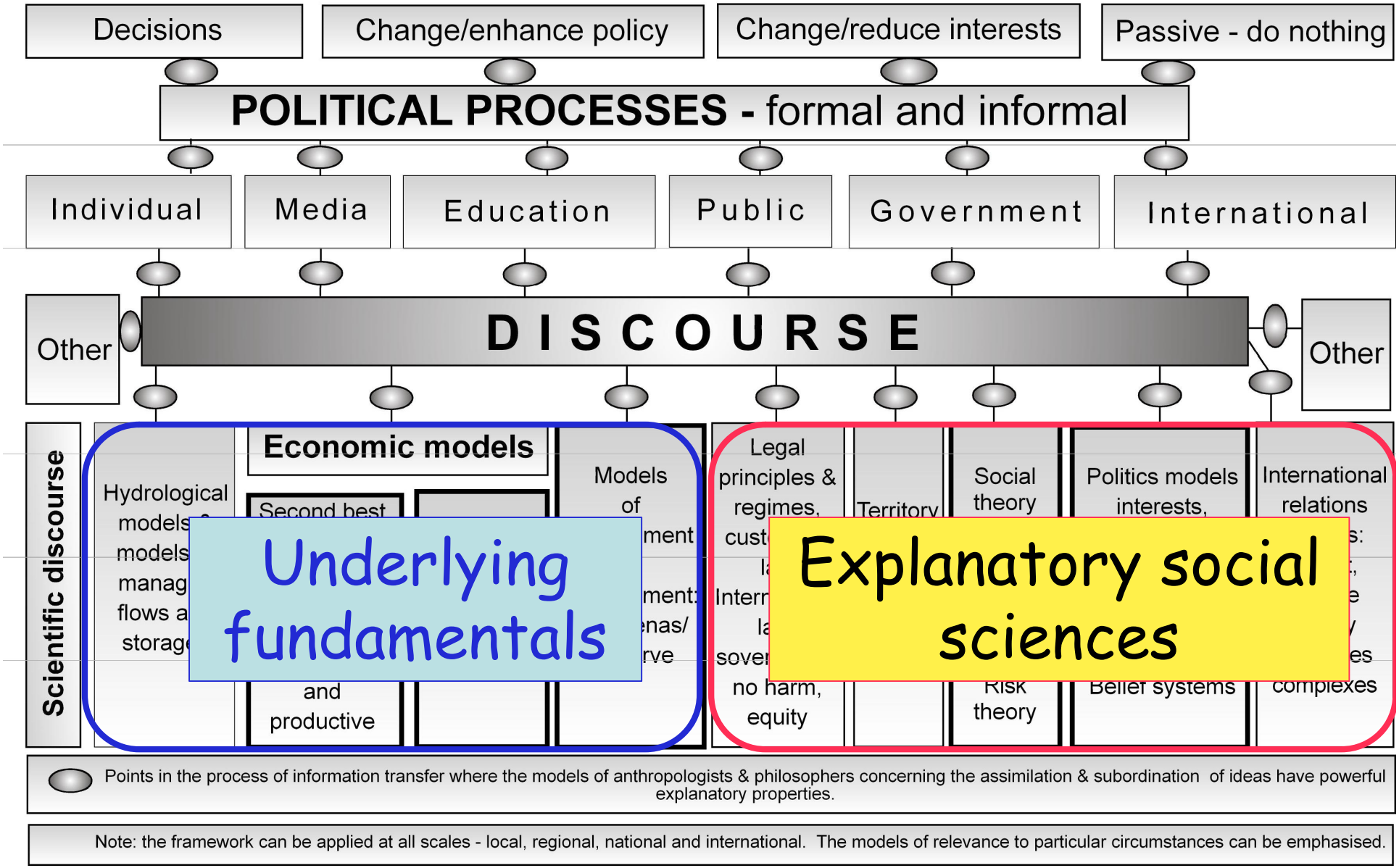

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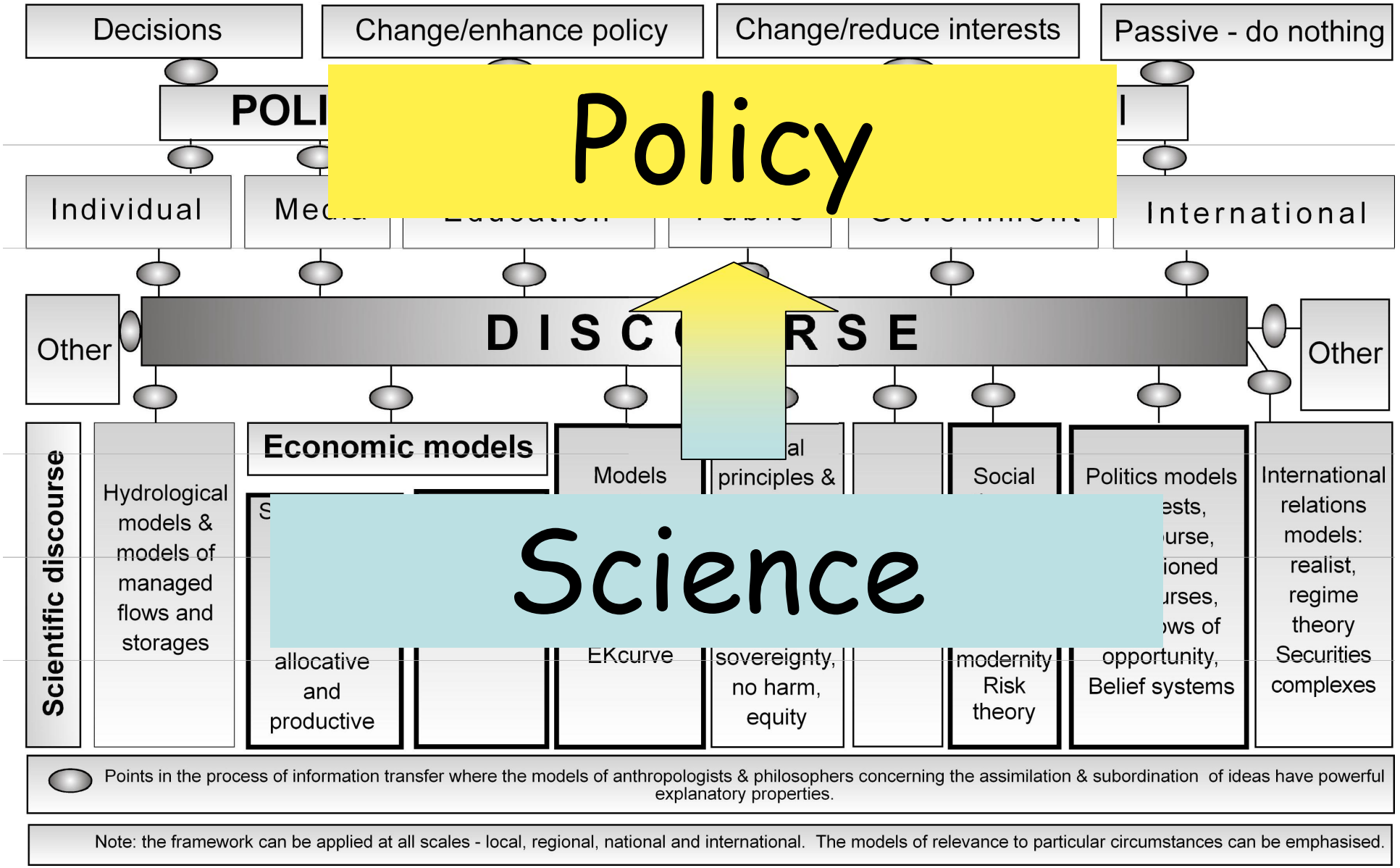


But note

Reason

- the underlying fundamentals

cannot prevail

against

the juggernaut of consumers' emotions

The view from ... Canada

Illustrator David Parkins works for the Guardian, the Observer, Times supplements, Nature magazine and, in Canada, the Globe and Mail www.davidparkins.com

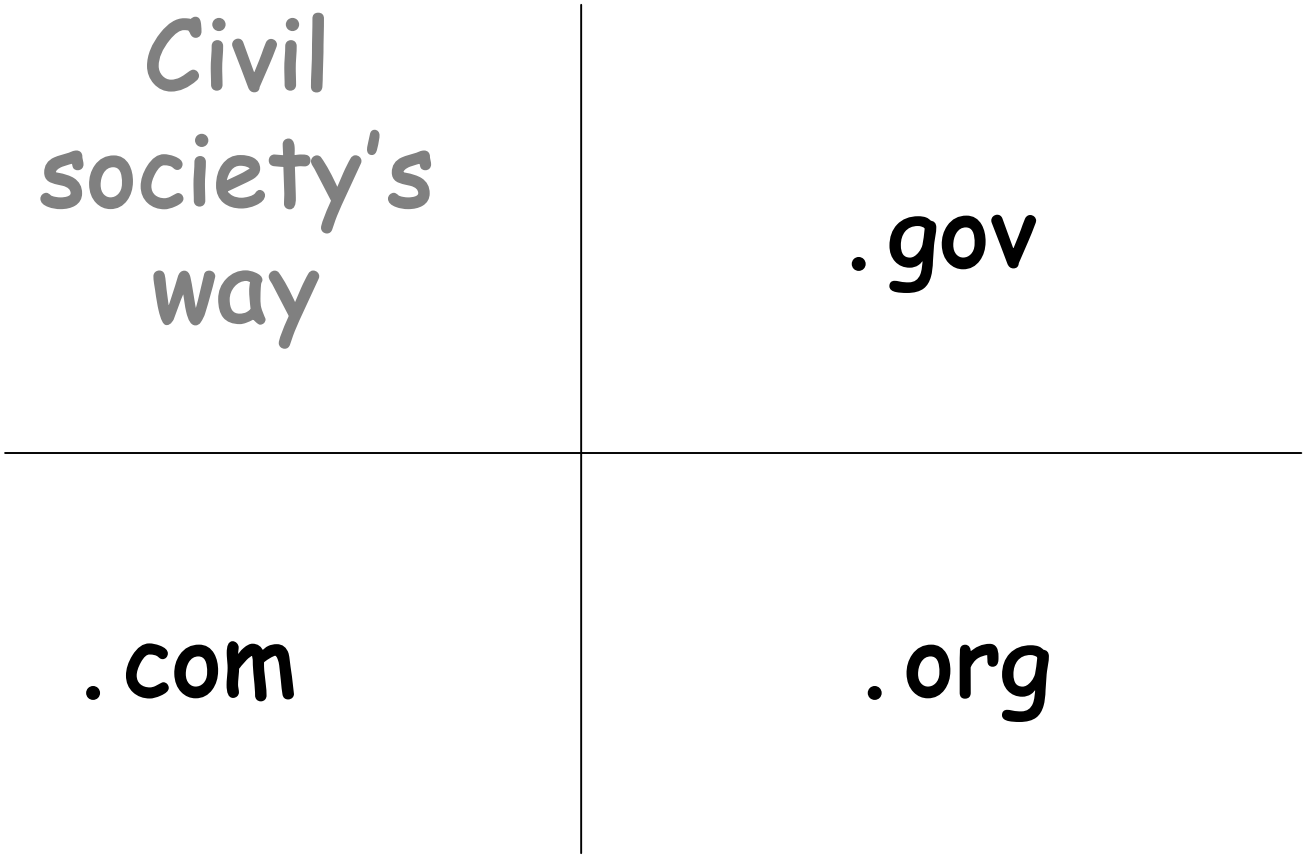
As scientists have different ways of knowing -
in
modelling, explaining and as engaged activists

Society

also has different ways of knowing

The four ways of knowing

Douglas et al.



The four ways of knowing

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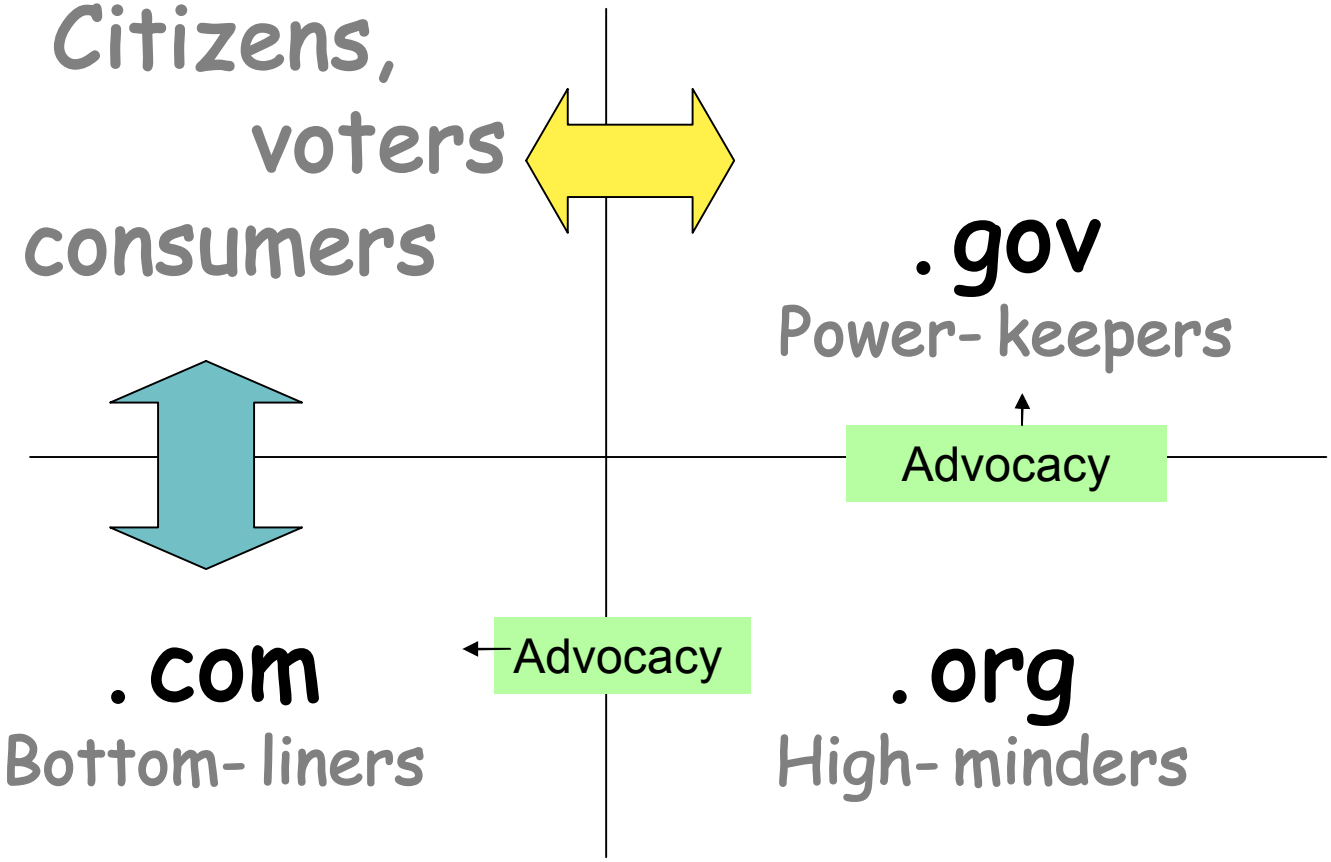
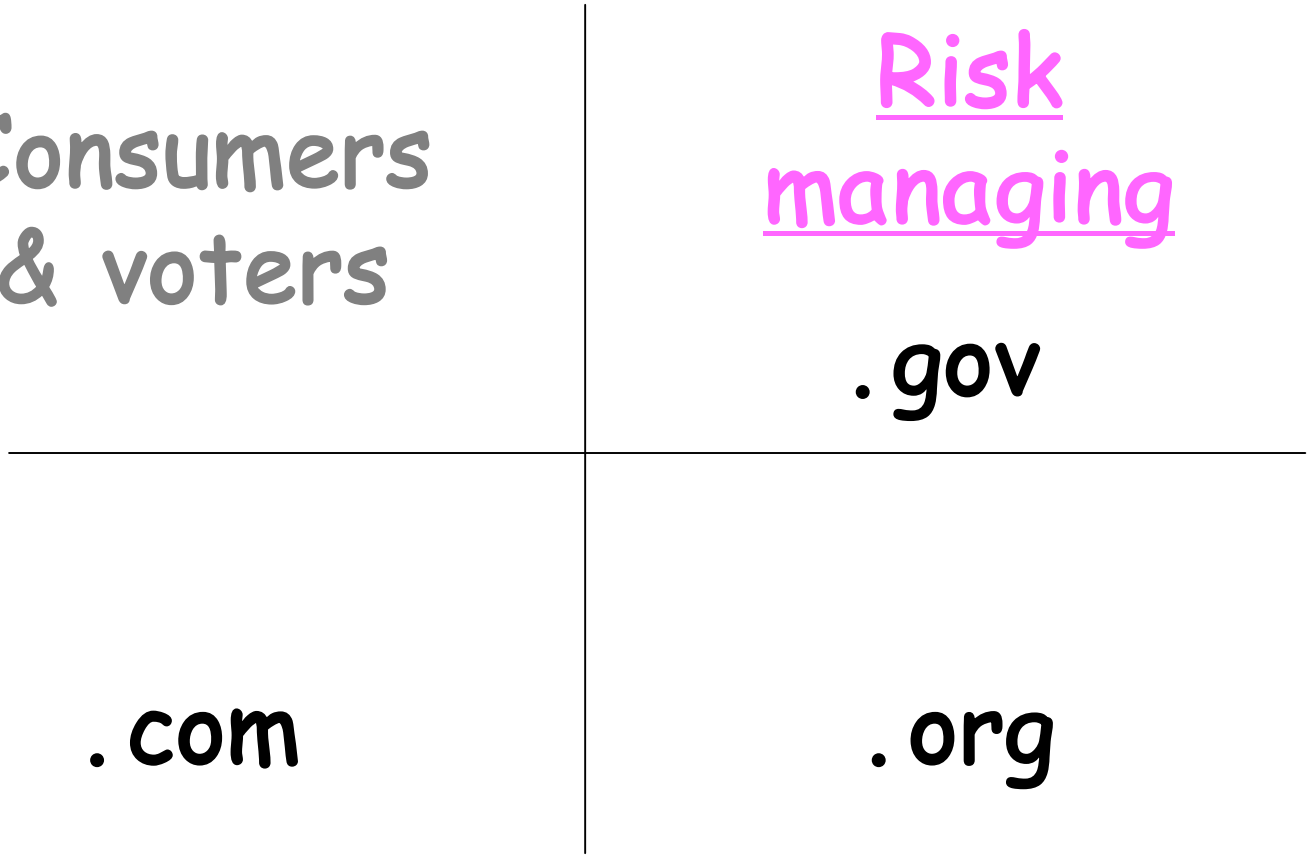


The policy-making contribution of the three contributing social solidarities on for example 'risk'



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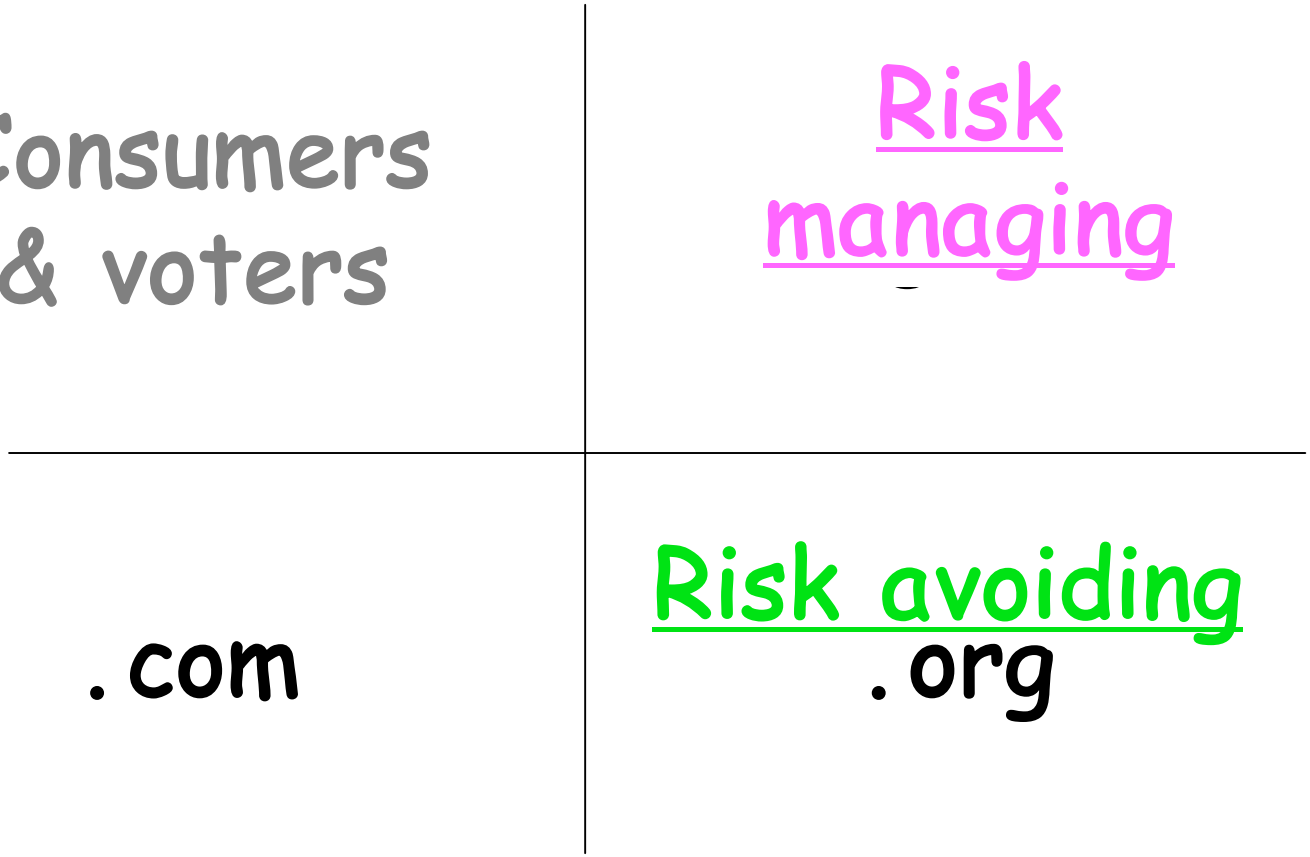

The policy-making contribution of the three contributing social solidarities on for example 'risk'

Consumers & voters	Risk managing .gov
Risk taking .com	Risk avoiding .org

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Neo-liberal democracy copes with difficulty with natural resources management

.gov

.com

.org

Neo-liberal democracy copes with difficulty with natural resources management

.gov

.org

Neo-liberal.democracy copes with difficulty with natural resources management

Government without options. The emotions of consumers prevail

.org

Neo-liberal.democracy copes with difficulty with natural resources management

Illustrator David Parkins works for the Guardian, the Observer, Times supplements, Nature magazine and, in Canada, the Globe and Mail www.davidparkins.com

Government without options - the emotions of society prevail

Civil movements know best without power. Try to influence consumers especially

:a - CI
2008

Some thoughts on
virtual water
and water footprints

and

How such new ideas engage
with society and politics.

For example via the press??

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2008

Guardian 20080813

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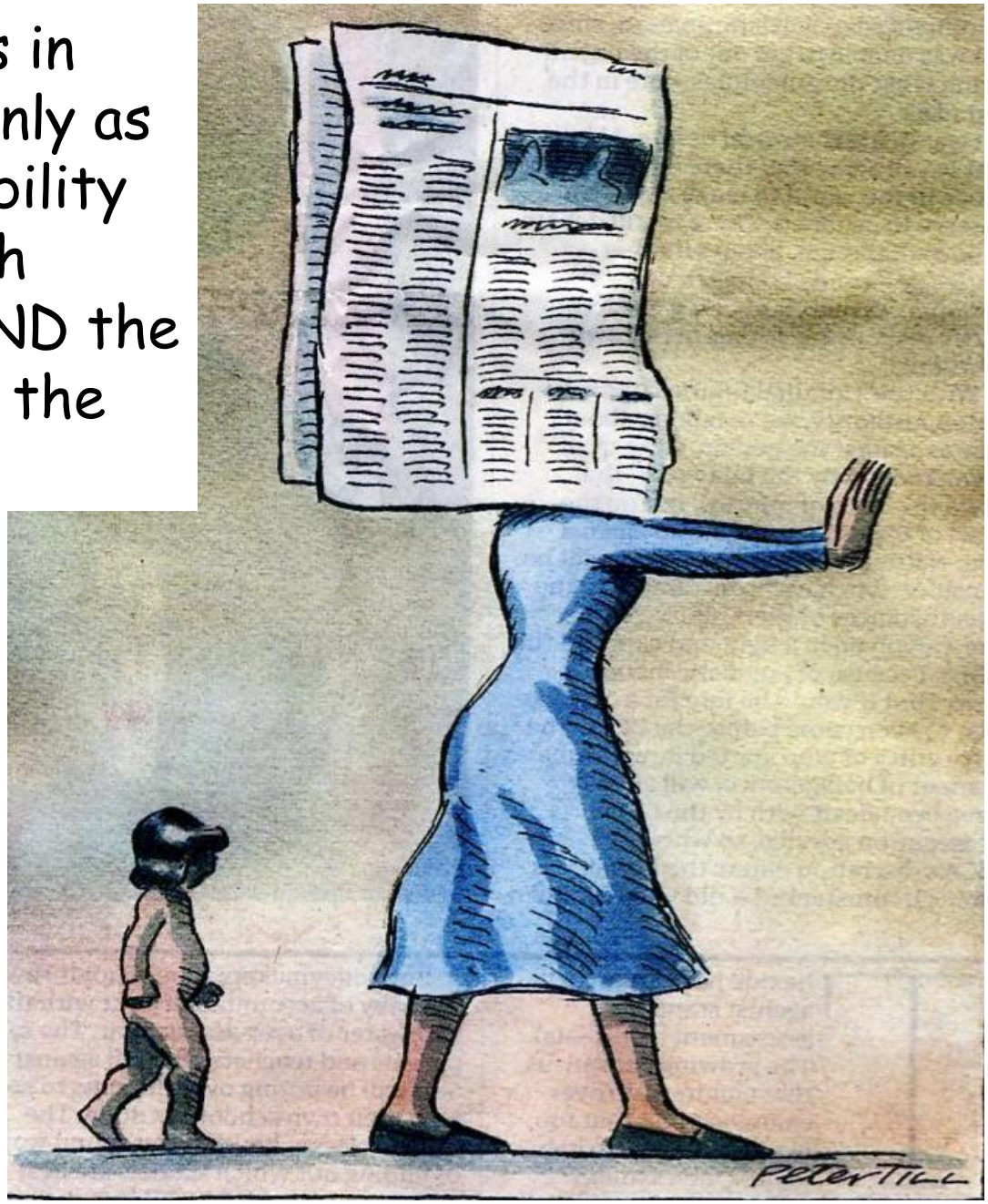
2008

What appears in the press is only as good as our ability to engage with journalists AND the prejudices of the media owners



Guardian 20080813

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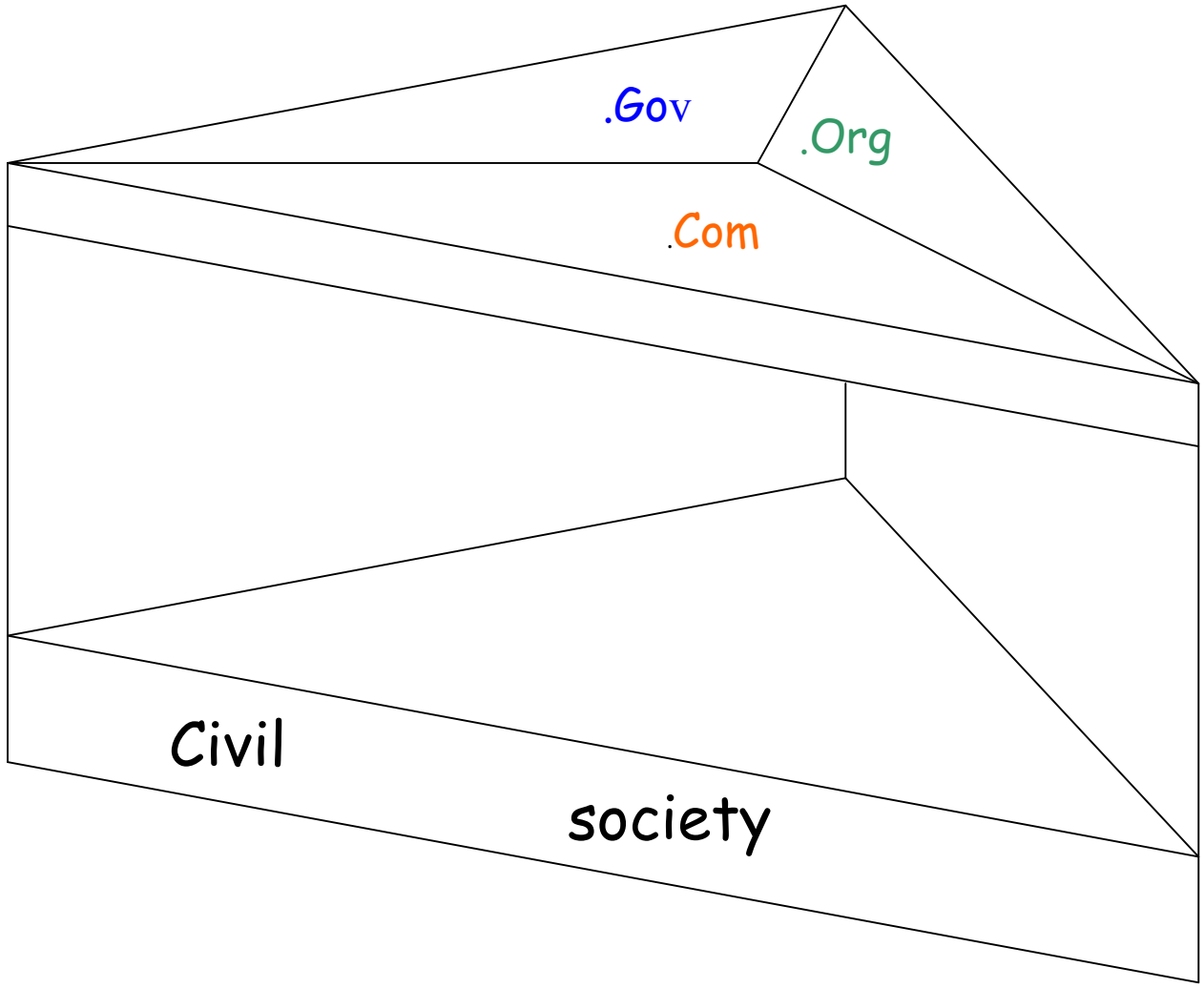
We must expect the political landscape
to be determining.

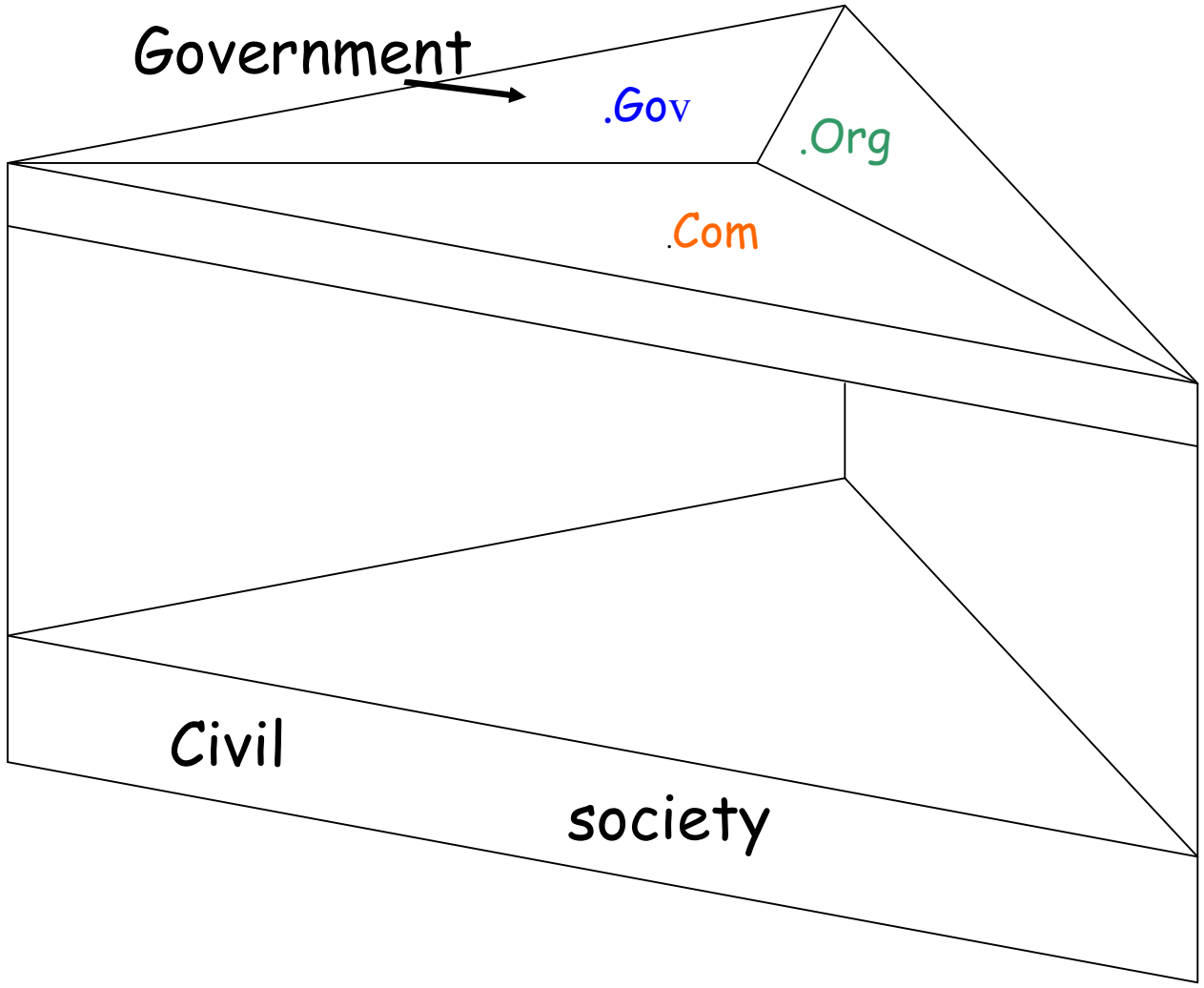
Consumers are embedded in this landscape.

We must expect there to be
different types of governance

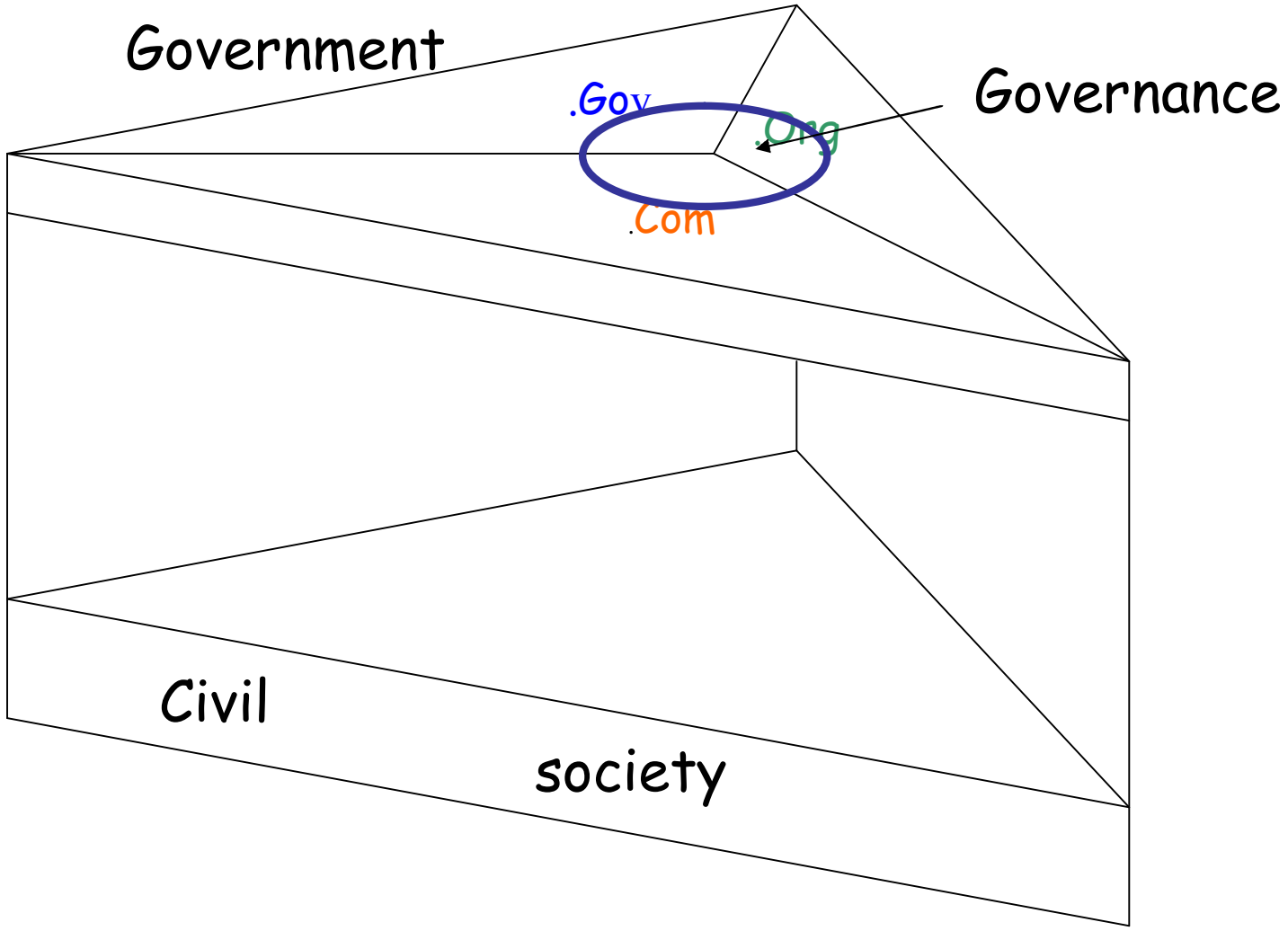
Government & Governance



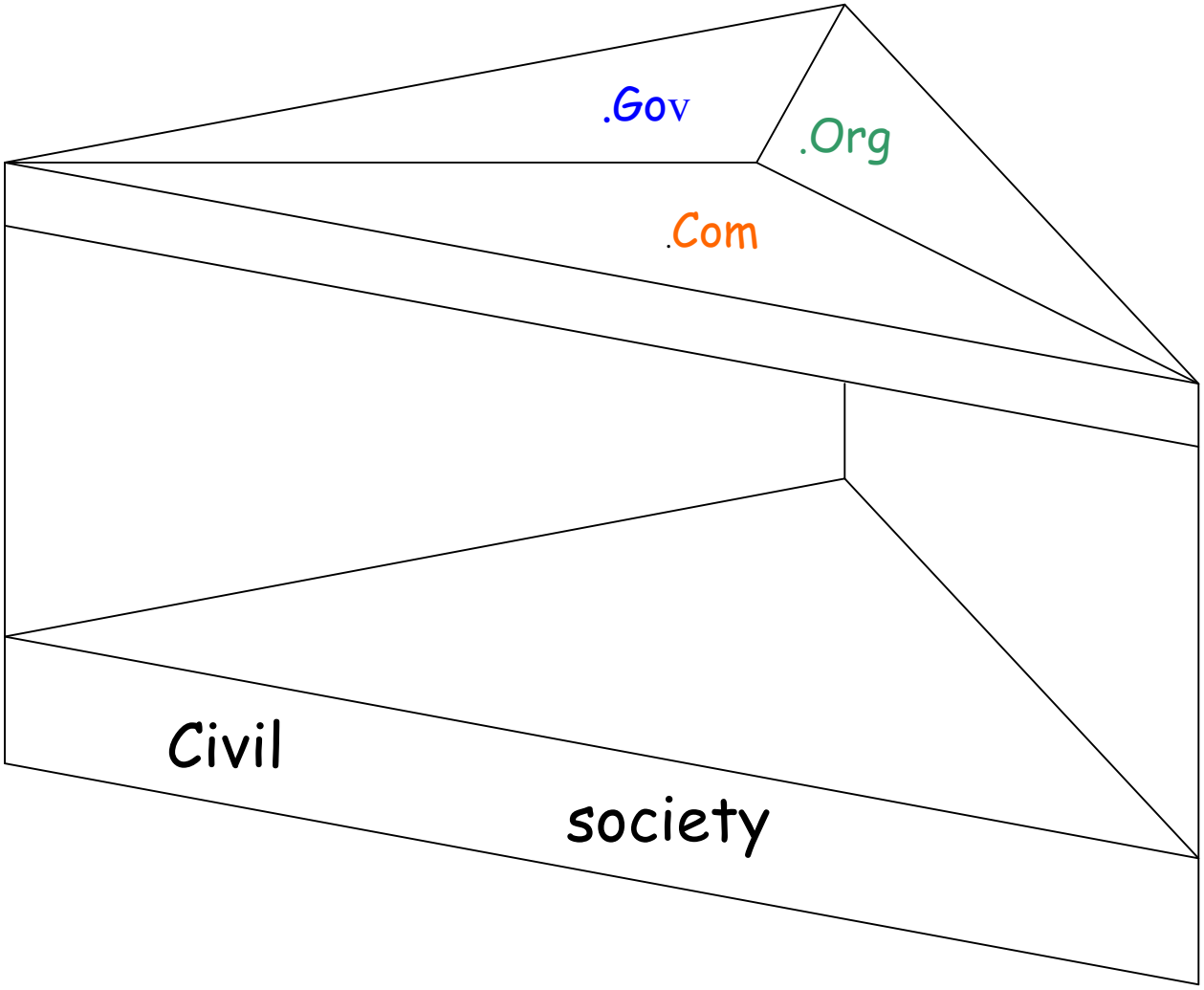
Government & Governance



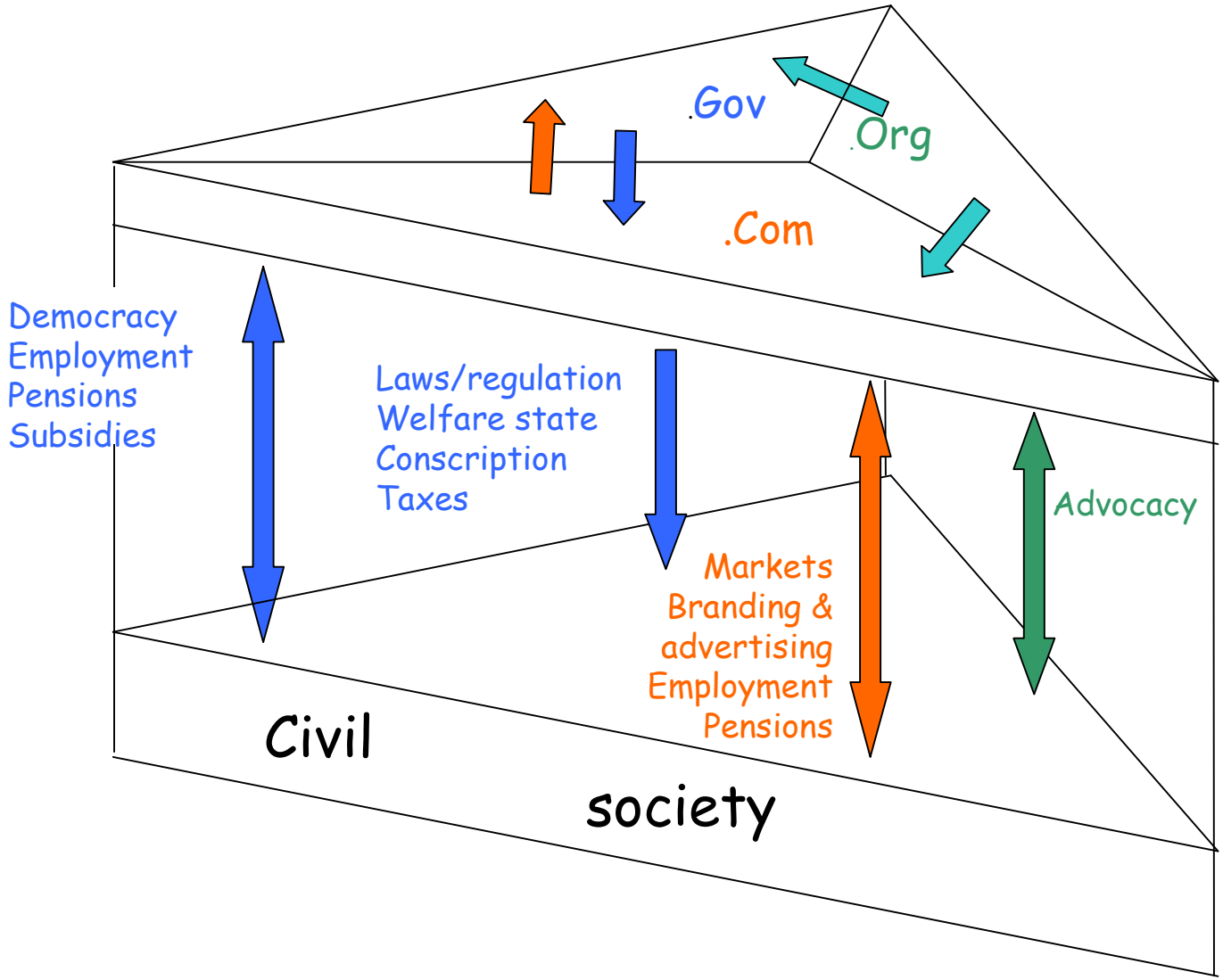
Government & Governance



Governance in a neo-liberal political economies - US, EU etc



Governance in a neo-liberal political economy



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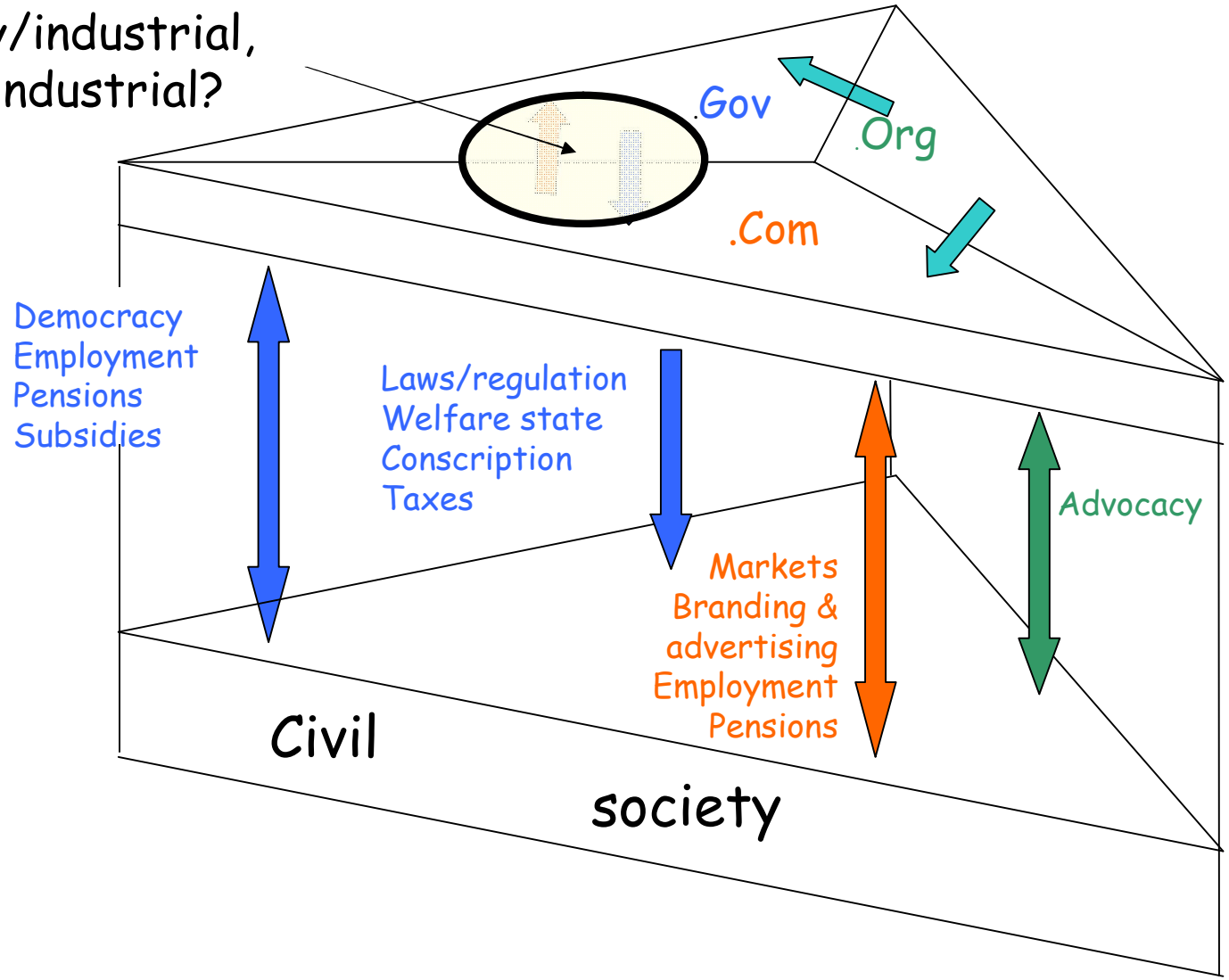
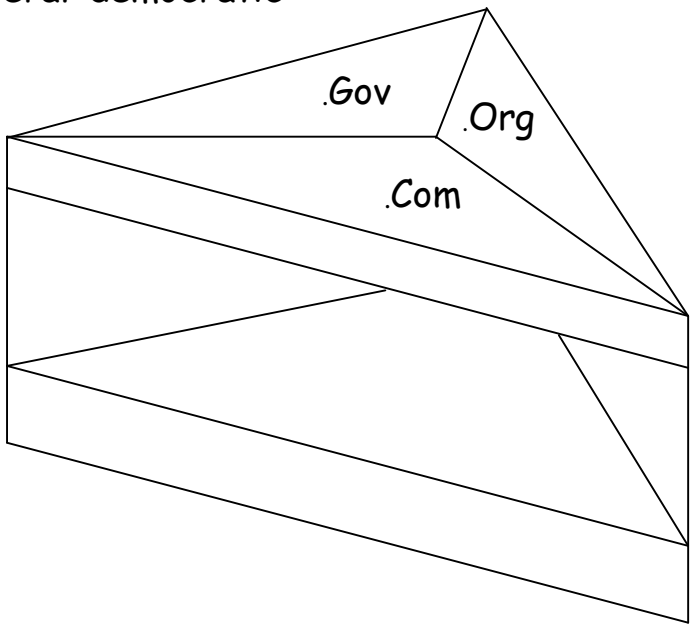
Governance in a neo-liberal political economy

Dangerous alliances - military/industrial, water/industrial?

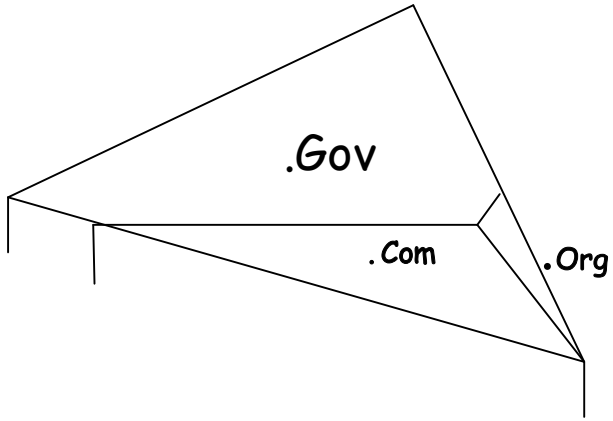


Government/Governance in different political economies

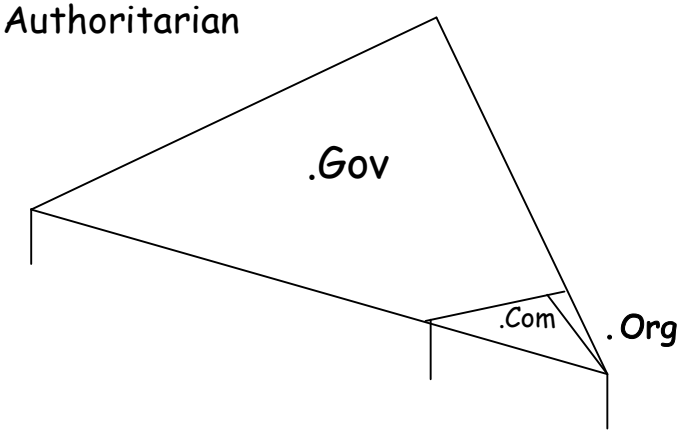
Neo-liberal 'democratic' regime



Common Southern



Authoritarian



Big idea ideas that society needs to know:

1 Consumption behaviour of water users is important

In the North – about wasting water thro' over-consumption of food and thro' pollution

In the South – how to use irrigation water and soil water more effectively

2 In both the North and the South
Virtual water and migration are invisible
and are very important

For example if you are from the North

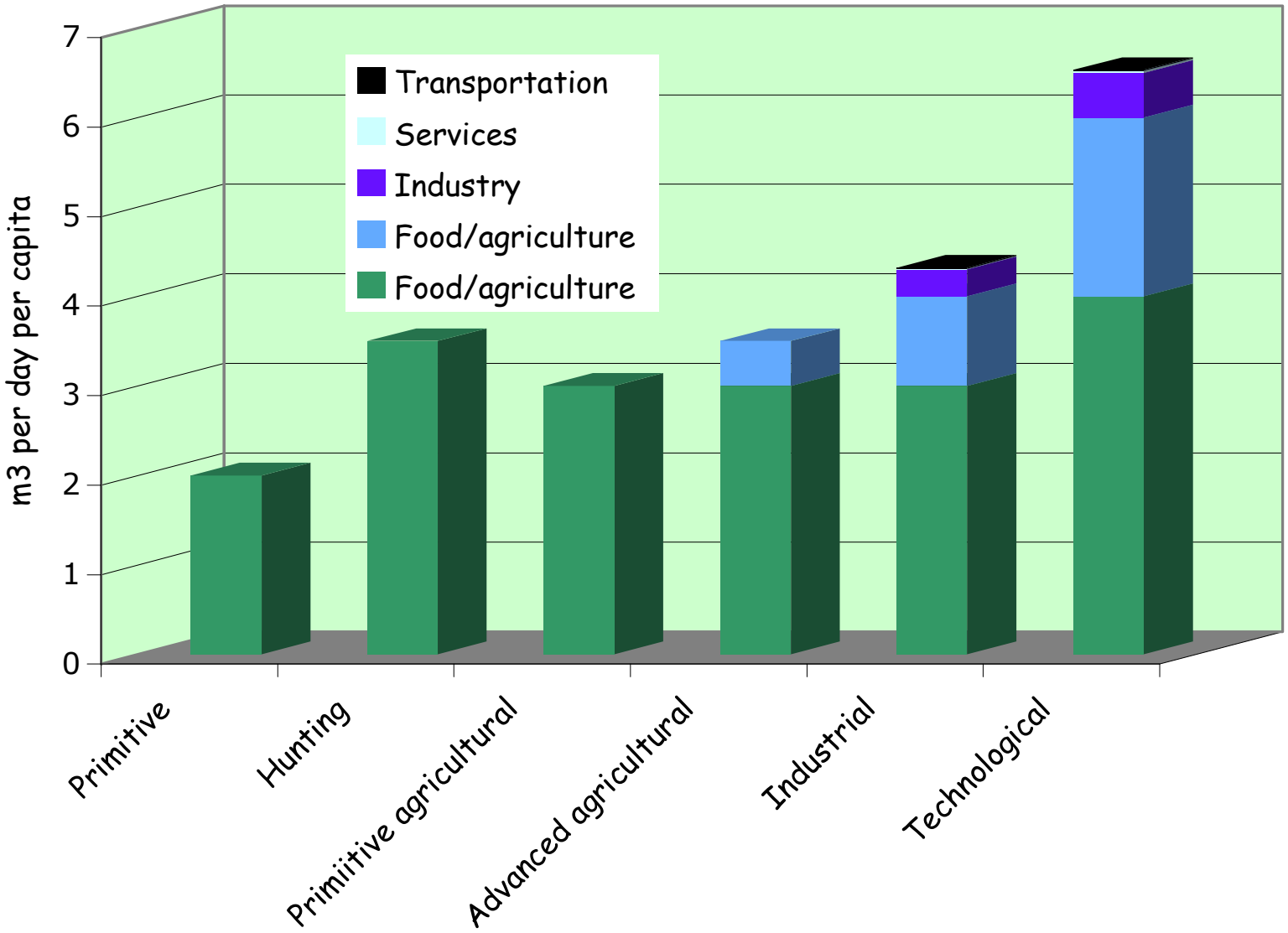
Are you a
5 CUBIC METRES a day person

or a
2.5 CUBIC METRES per day person?

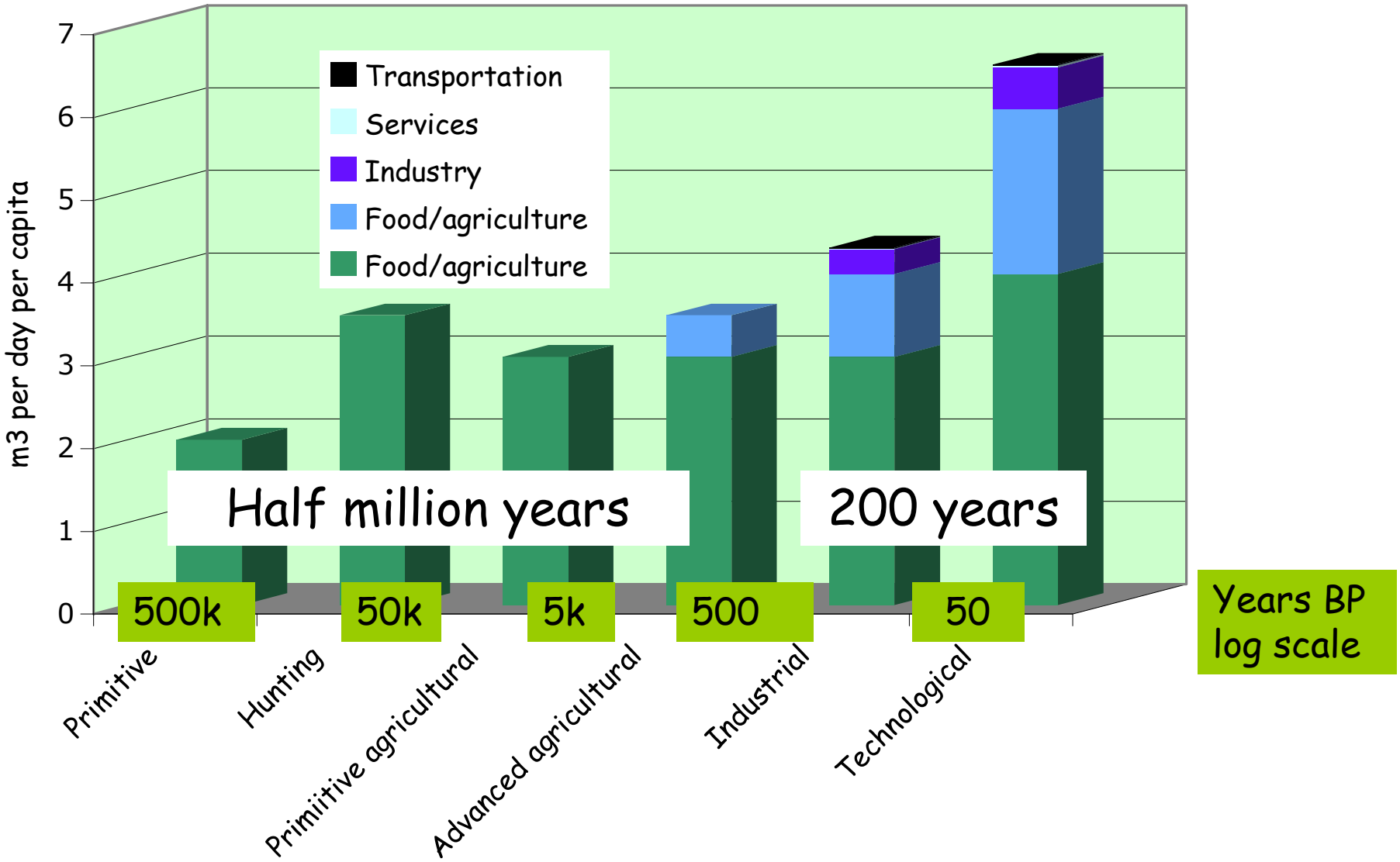
We have a choice
We can halve our water footprint
by changing our diet.

Through evolution we have been both
mainly vegetarian and not

Estimates of historical consumption of the different types of water



Estimates of historical consumption of the different types of water



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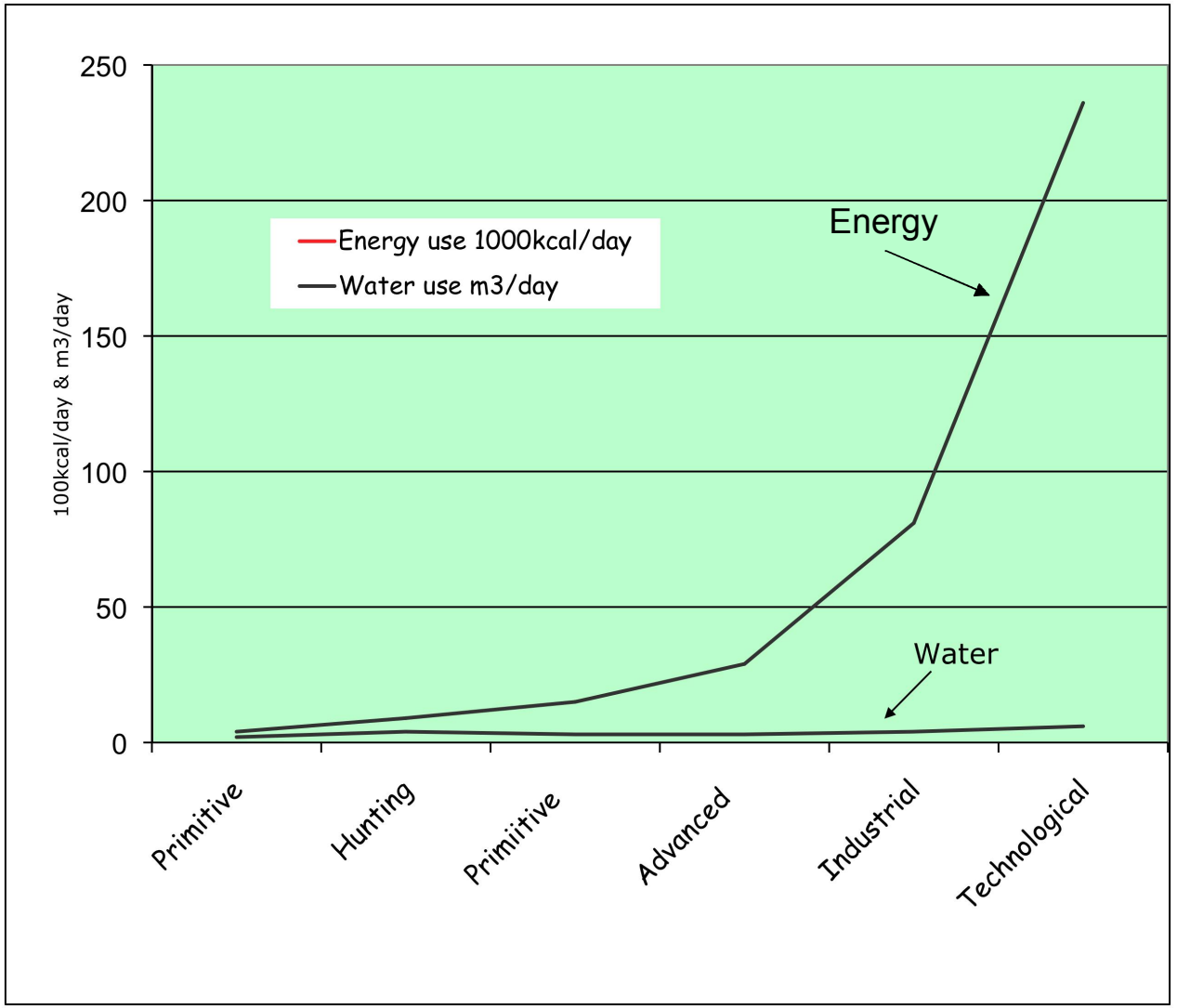
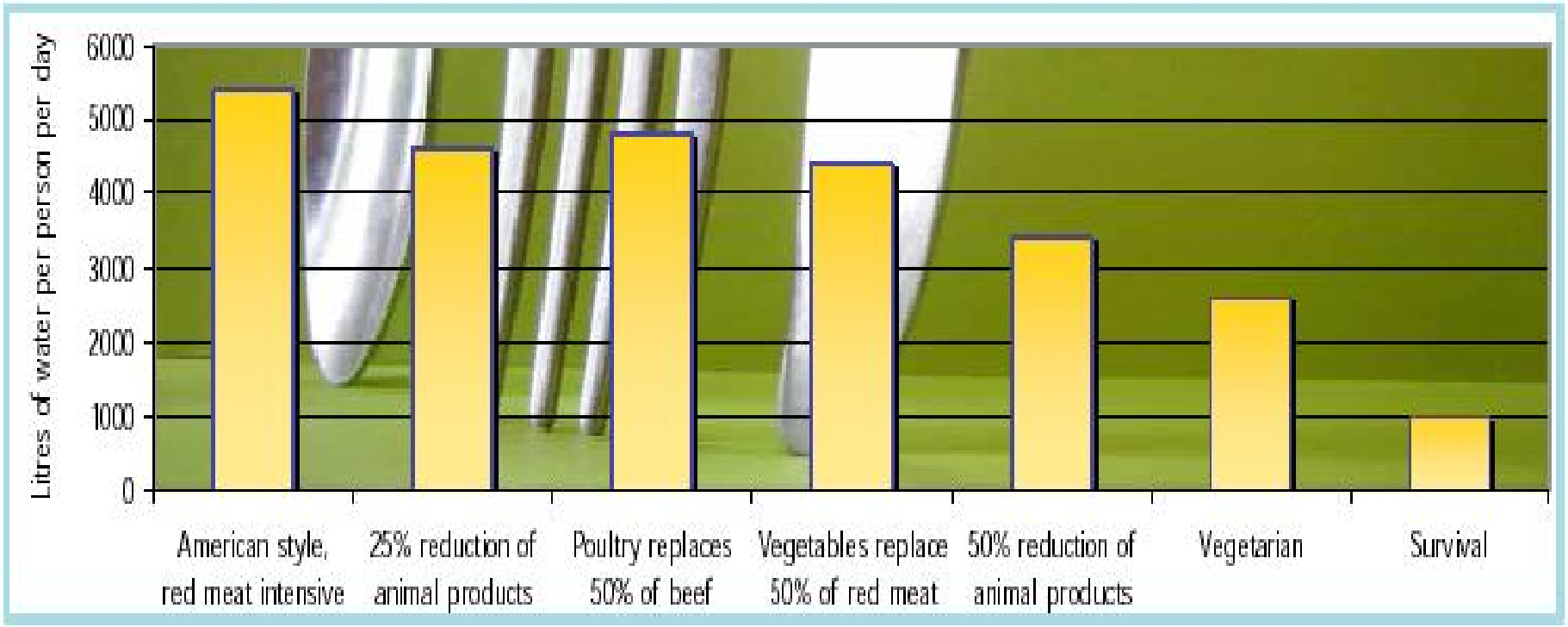
Comparison of historical consumption of energy [1000kcal/day] and water capita [m3/day]



So do you all use?

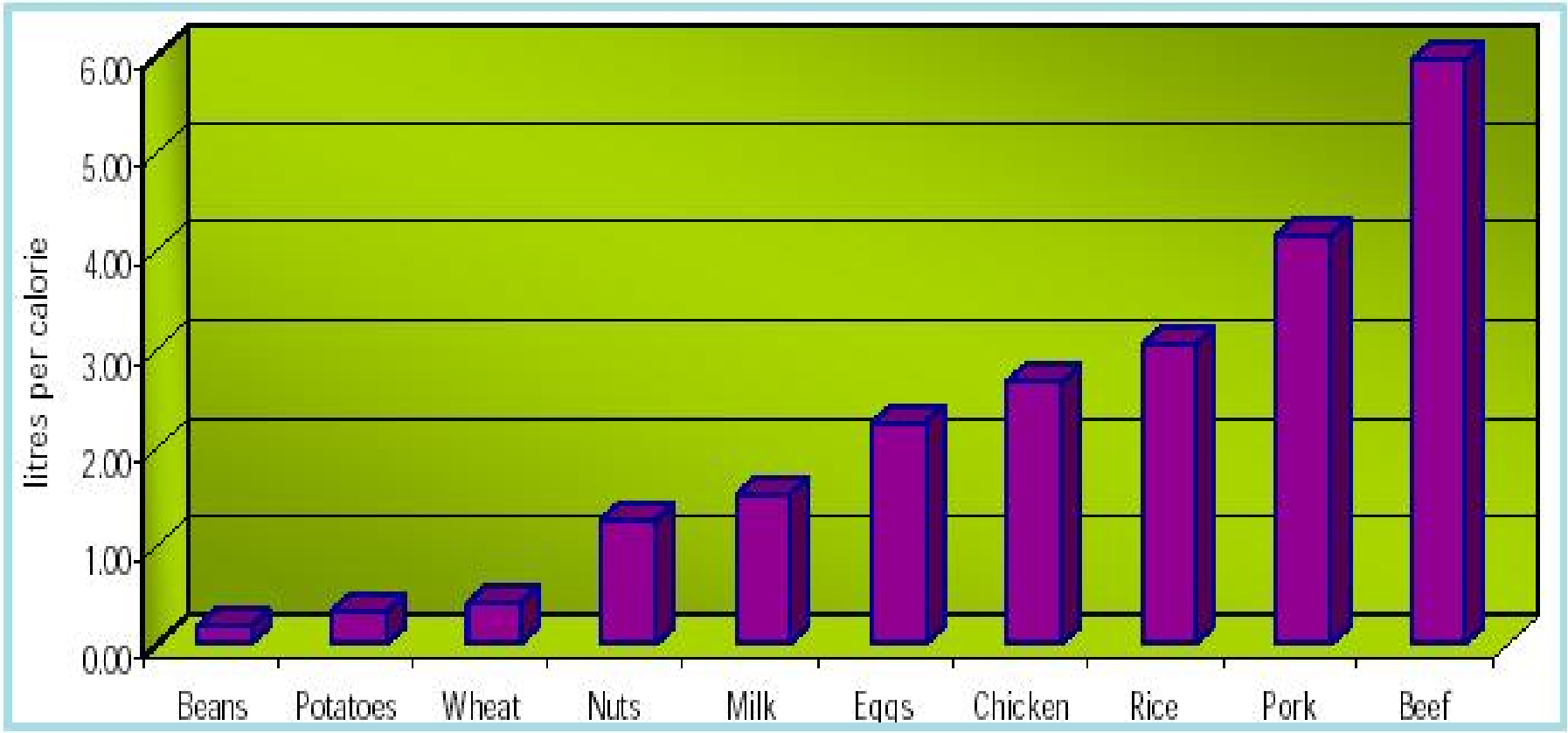
2.5 or 5.0 m3/day for food

FIGURE 10. Water intensity comparison of various diets. After: Renault and Wallender 2000.



Hoekstra et al

FIGURE 11. Water embedded in foods, per calorie of food.
Data from: Chapagain and Hoekstra 2004 and the author's own calorie estimates.



Hoekstra et al

A new idea

- demographic water footprints

- vw and water footprints of migration

SIWI *Water Front* 2008

Thoughts

The emotion rich political landscape is more determining than science knowledge

The political landscape can wreck high minded science invested for example – in IWRM

Key issues

We must help each other:

to learn about political landscapes

to understand consumption behaviour - in the North & the South

to enhance human resources and create jobs with high returns to water. They solve the water and food problems of the water scarce.

If we all eat sensibly.

In the North

Down from five
To two point five

WATER

Down from seven
To save the heavens

ENERGY USE & CLIMATE CHANGE
To reduce the impact of methane on the atmosphere

In Africa

The challenge is to use existing water resources

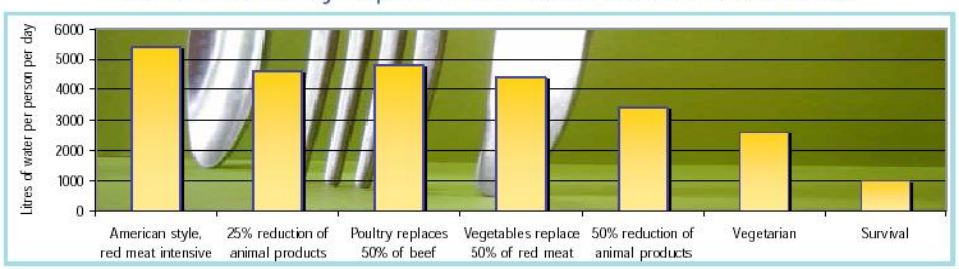
blue water - surface water and groundwater

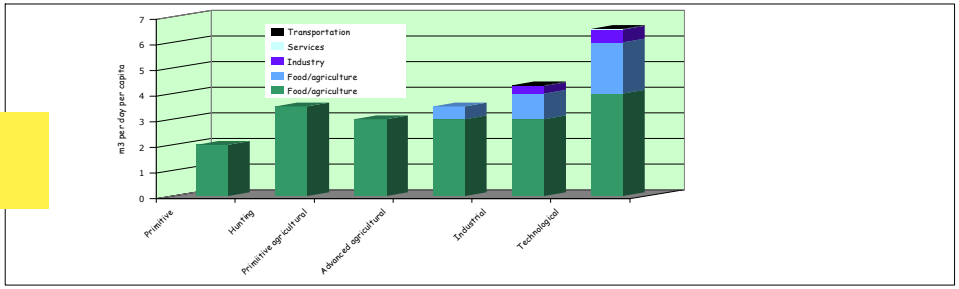
green water - in the soil for rainfed crop & livestock production

The yield gap - controversial

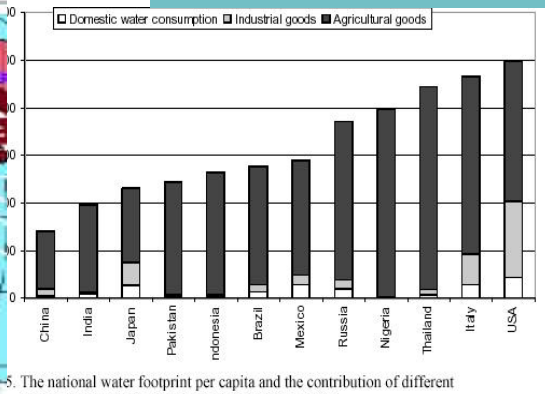
Increase storage - also controversial

Society & politics

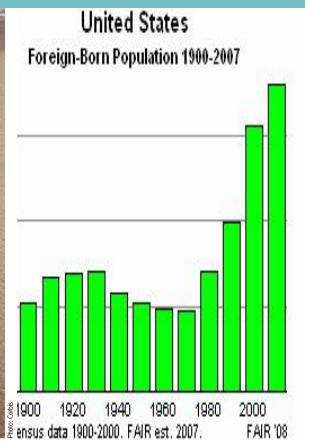


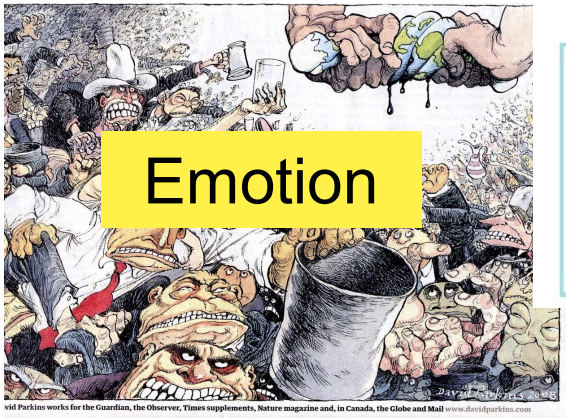


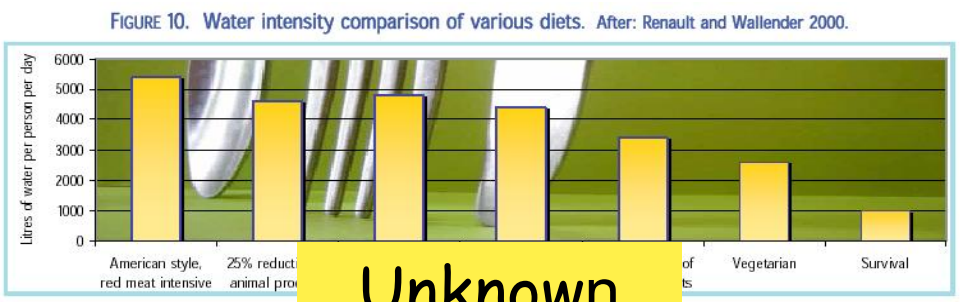
Underlying fundamentals - science

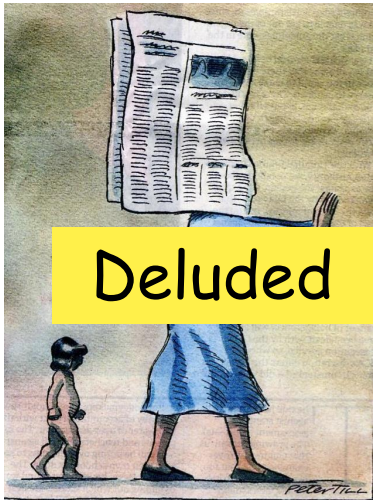


5. The national water footprint per capita and the contribution of different consumption categories for some selected countries.



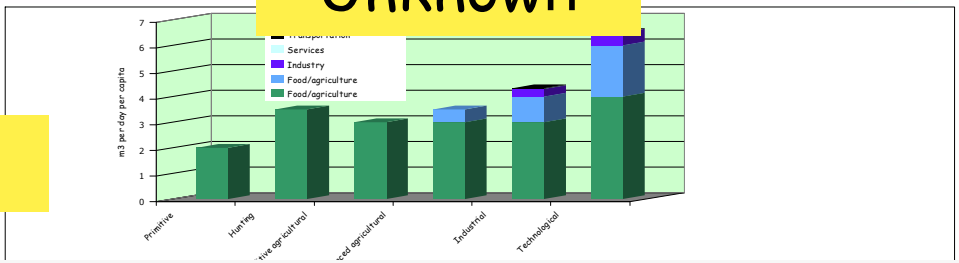






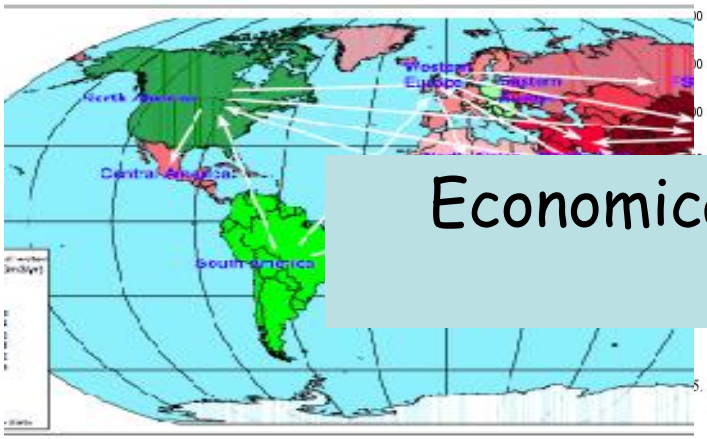
Unknown

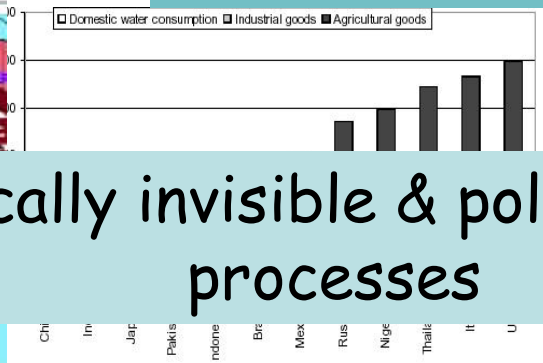
Society & politics



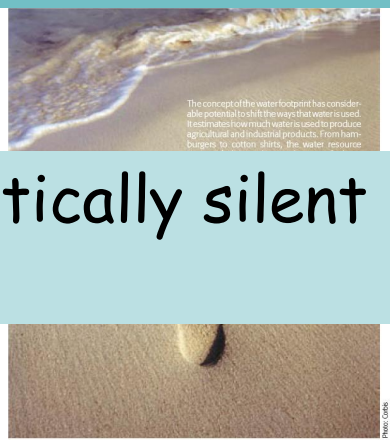
We have seen how important understanding governance is in managing deluded consumers and disadvantaged African water users especially when the underlying fundamentals are invisible

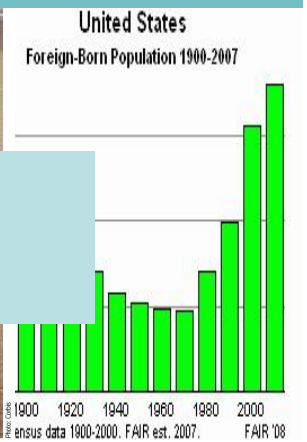
Underlying fundamentals - science



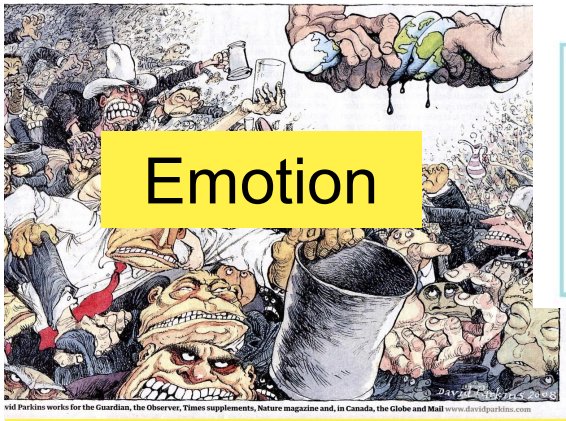


5. The national water footprint per capita and the contribution of different consumption categories for some selected countries.

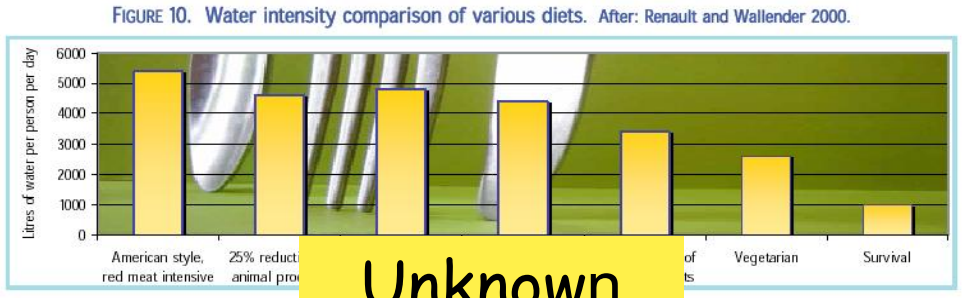




Economically invisible & politically silent processes



Emotion



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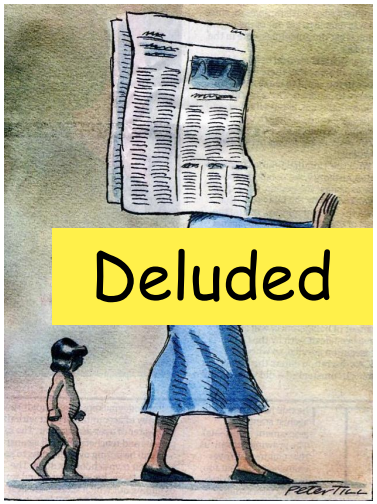
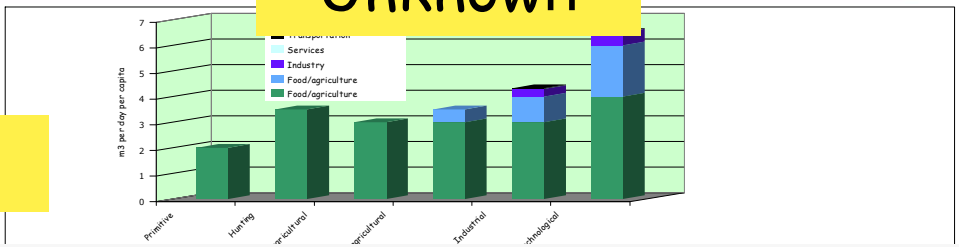


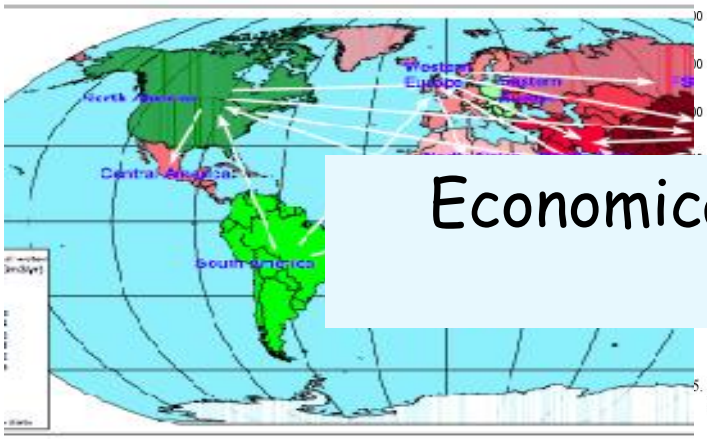
Deluded

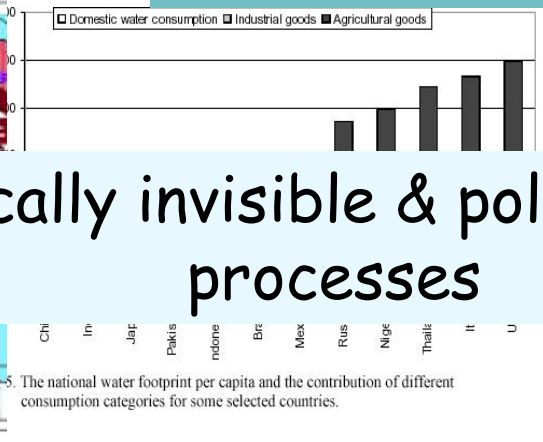
Society & politics



Thank you

Underlying fundamentals - science





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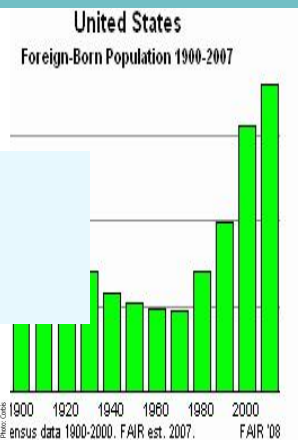
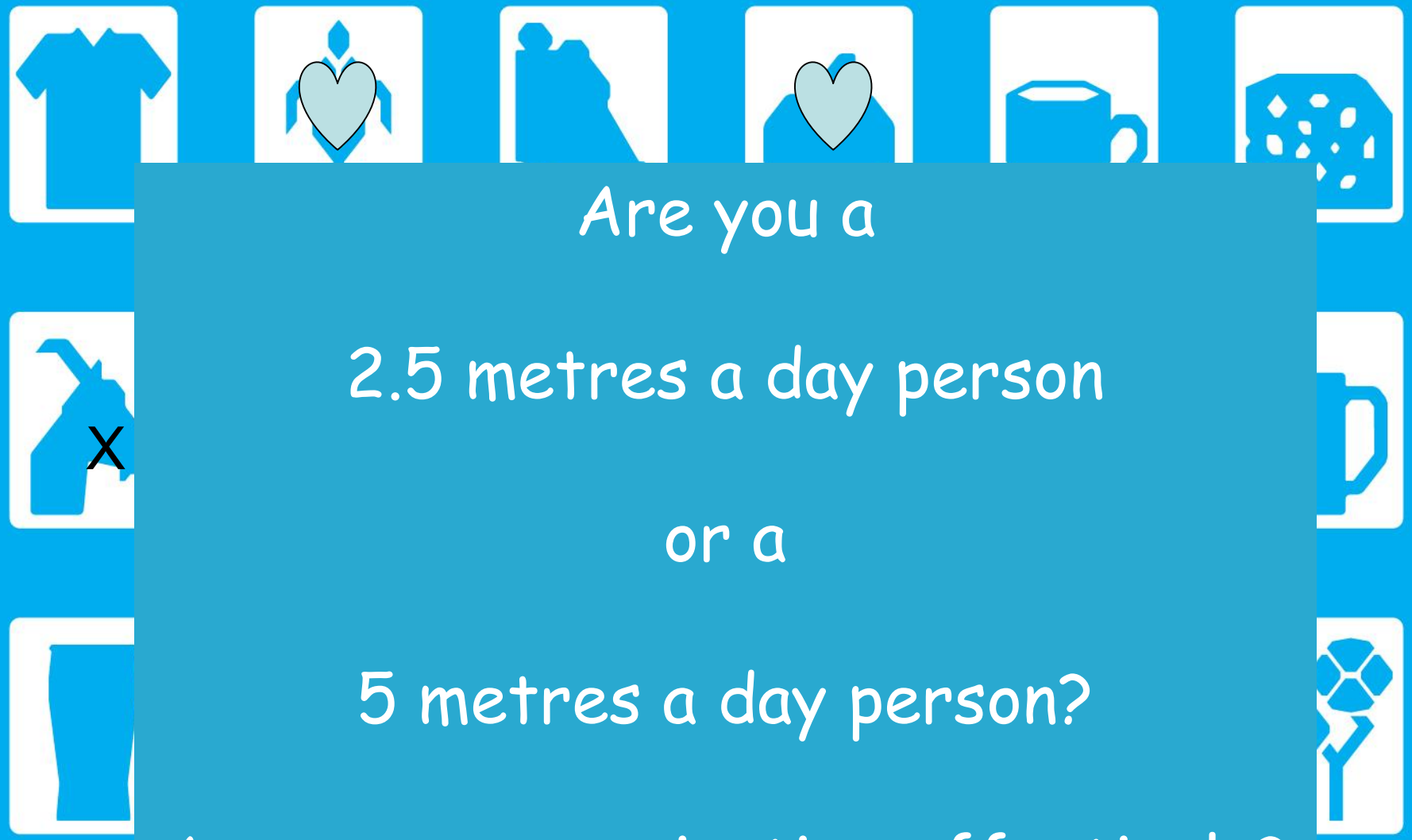


Economically invisible & politically silent processes



Moving the minds of consumers

Angela Morelli 2008