WATER FOOTPRINT, EXTENDED WATER FOOTPRINT AND VIRTUAL WATER TRADE OF THE CANTABRIA REGION, SPAIN

A CRITICAL APPRAISAL OF RESULTS, UNCERTAINTIES AND METHODS

SEMINARIO NACIONAL – OA FMB

"La huella hídrica como instrumento para la planificación hidrológica y reducción de conflictos"

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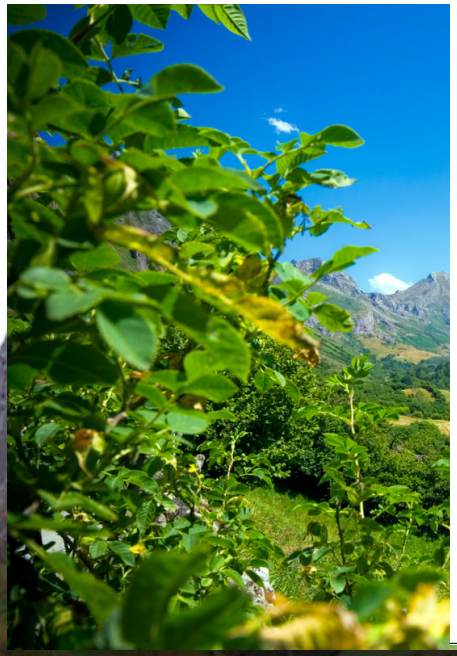

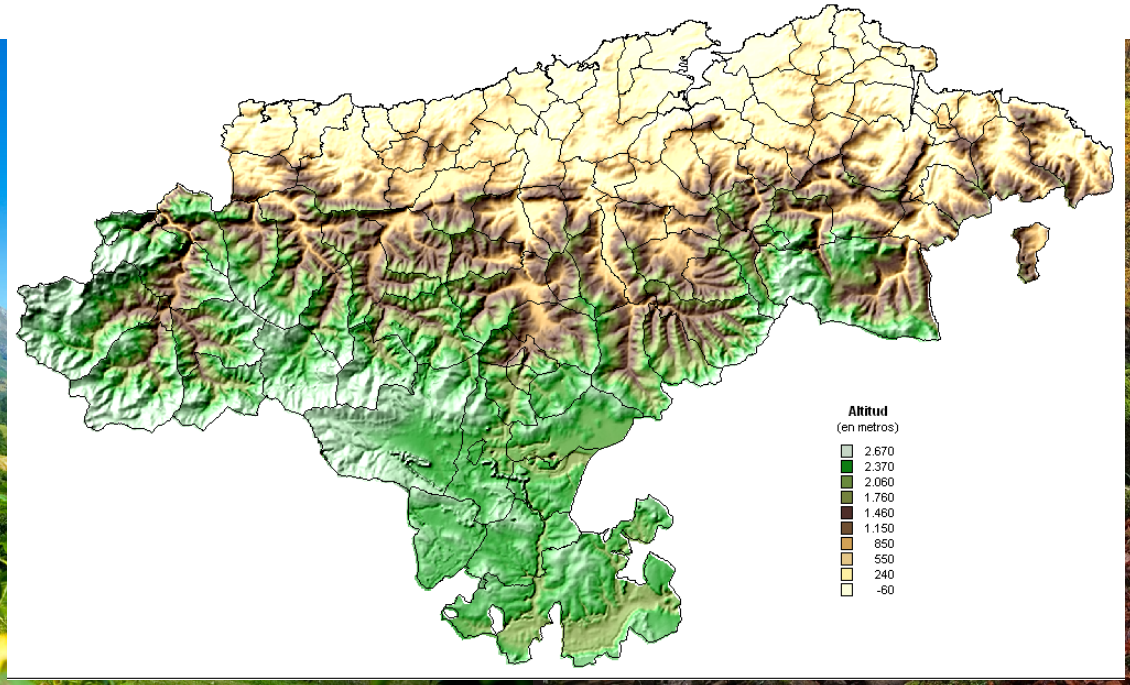

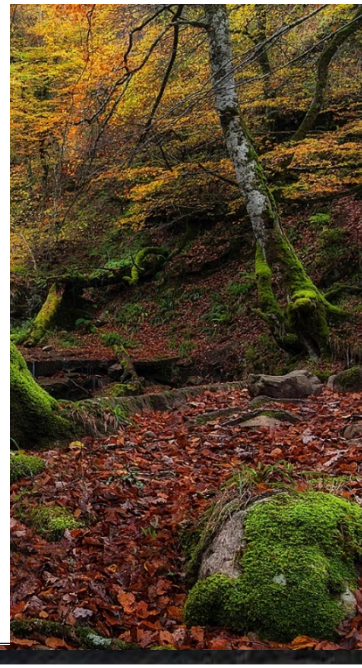

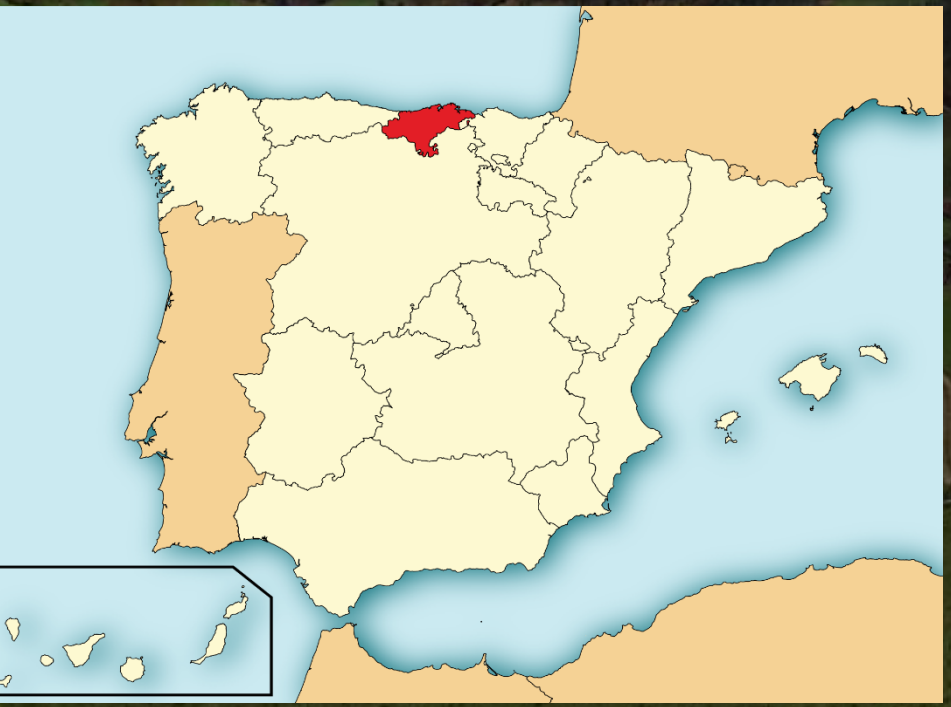

CANTABRIA

Surface: 5.300 km^2
Population: 600.000
Population density: 110 inh/ km^2
Rainfall: 700-2.500mm/yr
Capital city: Santander
GDP per capita: 22.328€

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OBJECTIVES

This project aims at evaluating the water footprint of one of Spain's "green regions"

The analysis is extended to cater for:

- Virtual water flows
- Extended water footprint
- The integration of green water in the regional water balance

Grey water is not accounted for

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APPROACH TO COMPUTING THE REGIONAL WATER FOOTPRINT

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APPROACH TO COMPUTING THE REGIONAL WATER FOOTPRINT

Sector-based calculations follow standard approaches:

Livestock	$WF_{direct} = \Sigma$ (animals · direct use per animal) $WF_{indirect} = \Sigma$ (animals · virtual water embedded per ton of food · tonnes of food)
Agriculture	$WF = \Sigma (Evapot_{green} \cdot$ Total Surface + $Evapot_{blue} \cdot$ Irrigated Surface)
Forestry (+ nature)	$WF = P \cdot [(1 + w \cdot ETo / P) / [(1 + w \cdot Eo / P)+(P / ETo)]]$ $WF = P \cdot \sum n,z=1\ r \cdot [(1 + wz \cdot ETo / P) / [(1 + wz \cdot ETo / P) + (P / ETo)]]$
Domestic use	WF = (Inhabitants · average allowance) – Return
Tourism	WF= (Rooms · occupation rate · allowance)
Industry	WF = Demand – Return WF = Number of workers · allowance per worker (and activity)
Reservoirs	WF = 0.010 · Surface – 1.117 WF = Evaporation rate · surface

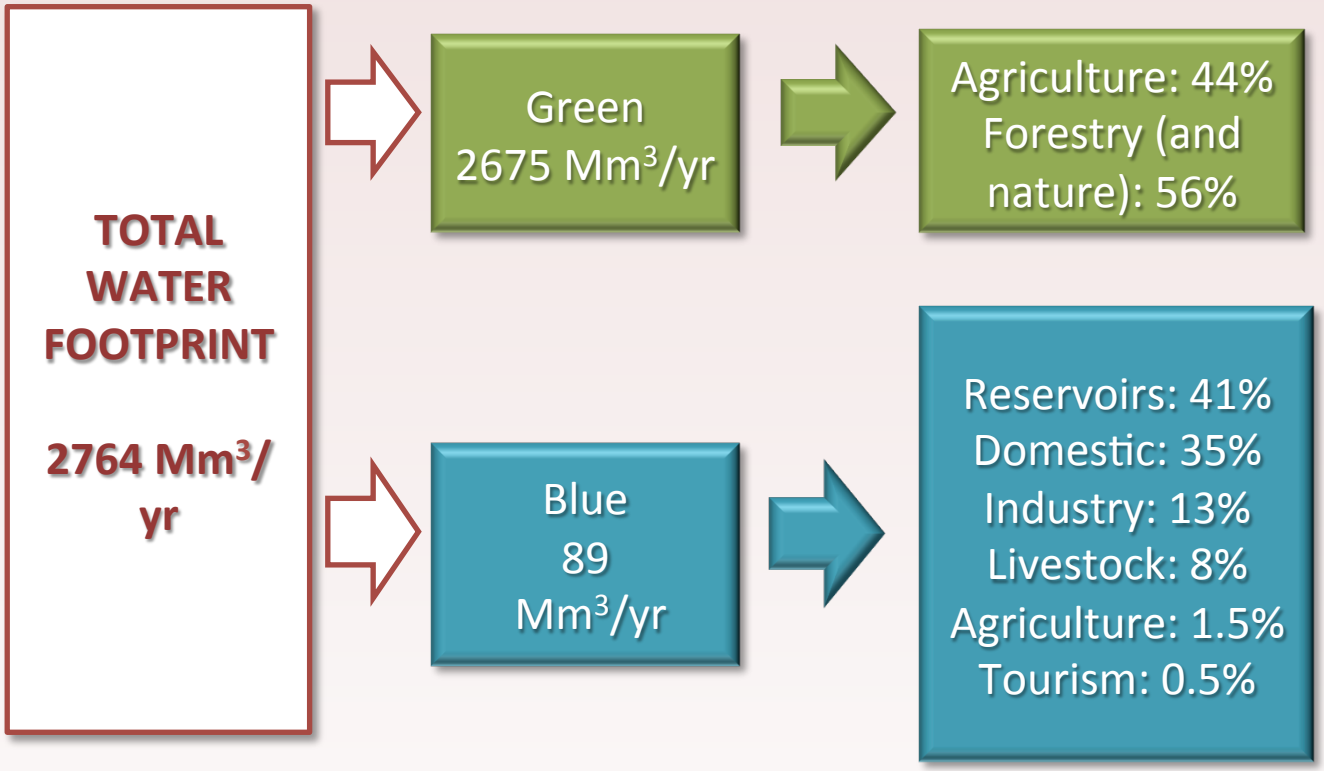
Double counting is avoided (i.e. indirect livestock WF vs agricultural WF)

Most calculations are based on existing databases, coefficients and the like

RESULTS OF THE REGIONAL WATER FOOTPRINT

Sector	Green water (Mm^3/yr)	Blue water (Mm^3/yr)	TOTAL (Mm^3/yr)
Agriculture 	1173	1.5	1175
Forestry (+ nature) 	1502	-	1502
Livestock 	-	9	9
Domestic use 	-	8	8
Tourism 	-	0.4	0.4
Industry 	-	25	25
Reservoirs 		45	45
TOTAL	**2675**	**89**	**2764**

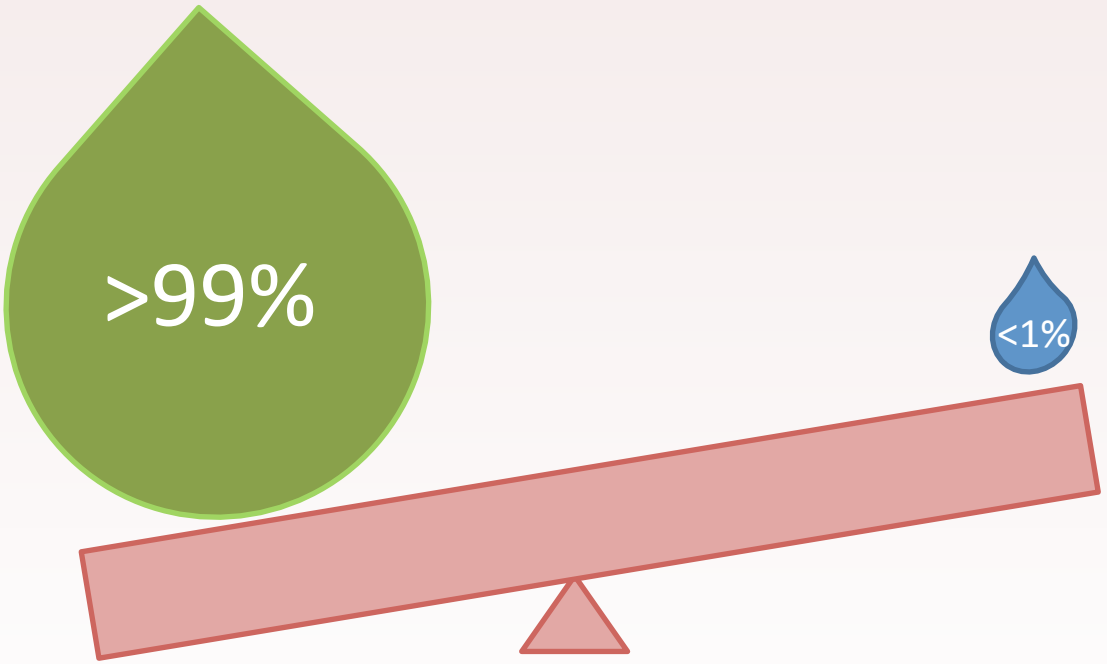
RESULTS OF THE REGIONAL WATER FOOTPRINT



RESULTS OF THE REGIONAL WATER FOOTPRINT

Green water accounts for the vast majority of the regional water footprint

This is due to the prevalence of pastures and forests (pastures alone account for 50% of the total surface of the region and 95% of the agricultural land)



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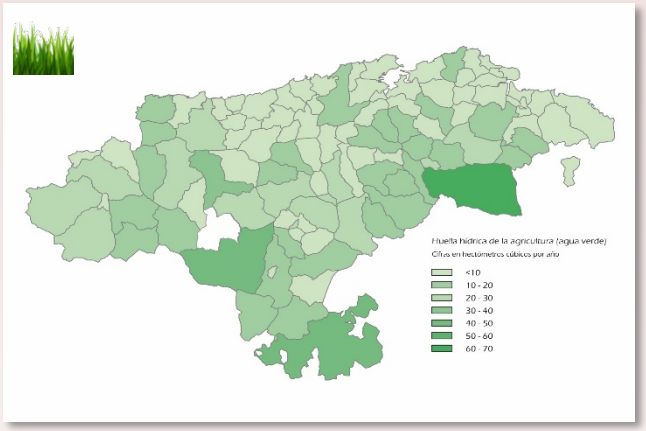
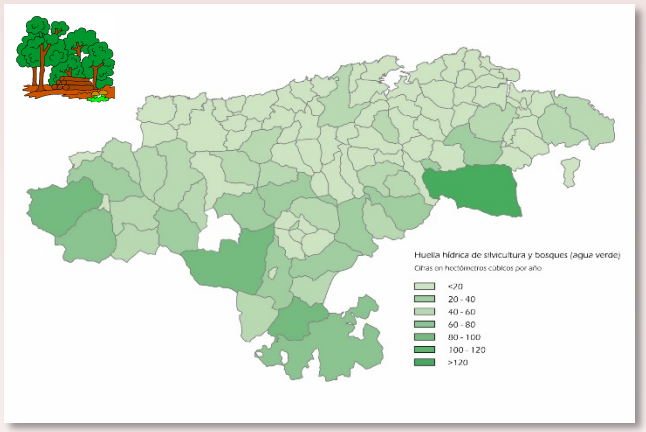
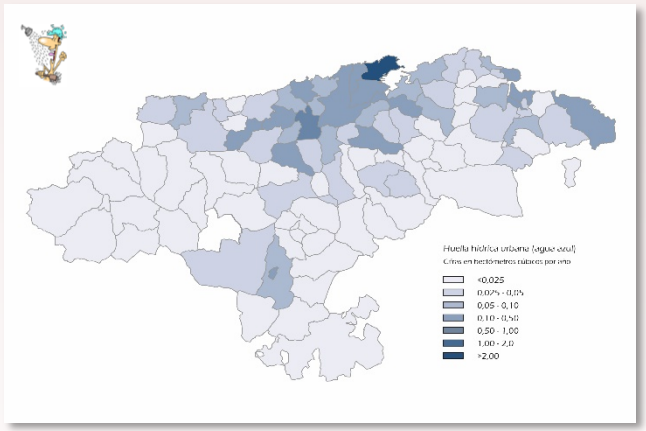
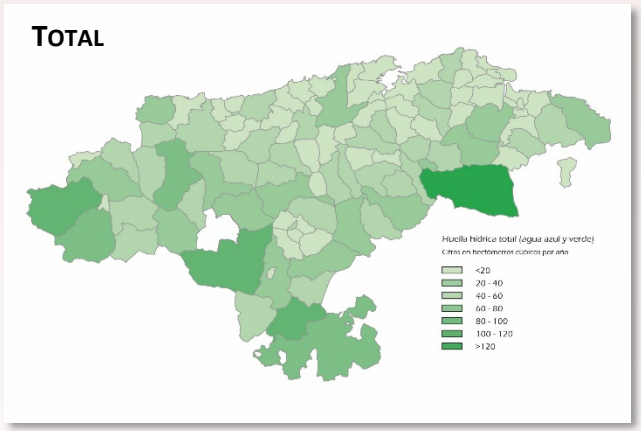
RESULTS OF THE REGIONAL WATER FOOTPRINT







TOTAL



The water footprint is located preferentially in lesser-populated municipalities

RESULTS OF THE REGIONAL WATER FOOTPRINT

In truth, a lot of the agricultural water footprint can be attributed indirectly to livestock

Indirect  → 99% 927 Mm^3/año

Direct  → 1% 9 Mm^3/año

This is because extensive cattle livestock predominates over other types

Cows graze freely in mountain areas – overall, there is very little fodder consumption

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CALCULATION OF VIRTUAL WATER FLOWS

Virtual water flows were computed based on trade statistics

Imports and exports within Spain are difficult to compute, since the available stats only pertain to road transport

Import and export statistics with the rest of the world are highly detailed

Virtual water coefficients computed specifically for Spain (CYII 2011) were used for products generated within Cantabria and Spain; WFN coefficients were used for products generated outside Spain

Cantabria exports three times as much water as it imports

The rest of Spain is Cantabria's main virtual water trade partner

Agricultural products and livestock: 33%
Foodstuffs and fodder: 67%
Rest: <1%

VW Imports:
4.500 Mm^3/yr from Spain
800 Mm^3/yr from the world

VW Exports:
15.500 Mm^3/yr to Spain
1.500 Mm^3/yr to the world

Agricultural products and livestock: 7%
Foodstuffs and fodder: 93%
Rest: <1%

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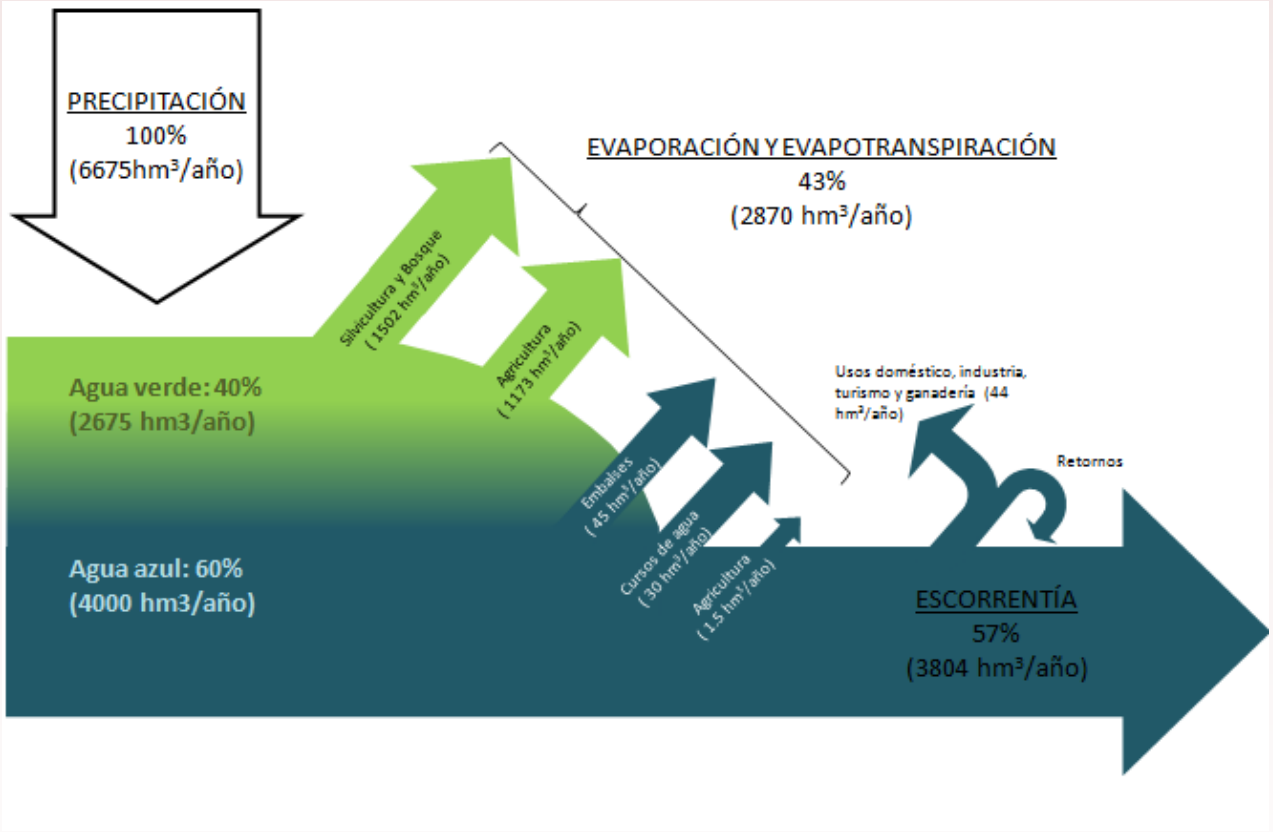
GREEN WATER AND THE REGIONAL WATER BALANCE



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UNCERTAINTY SOURCES

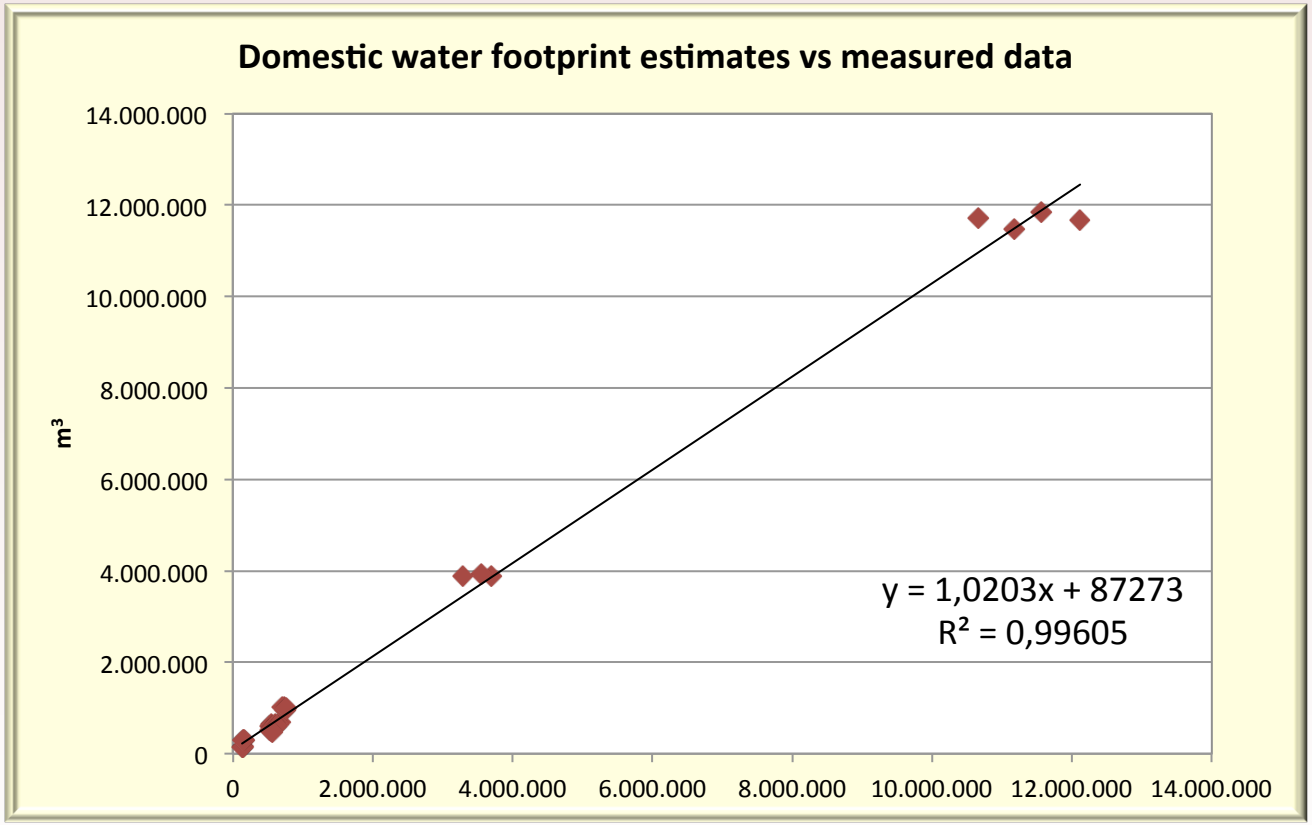
This research involved little fieldwork

Calculations are based mostly on existing databases (oficial statistics, coefficients, etc)

There's no guarantee that these databases are strictly compatible

Some double-checks were performed in order to evaluate uncertainty

For instance, our estimate for domestic consumption was checked against actual water supply data (FCC Aqualia, a major sponsor, is a water supply company)



UNCERTAINTY SOURCES

For other sectors, such as reservoirs or industry, we used several different approaches to appraise the uncertainty in our results

Industry:

WF = Demand – Return = 14.5 Mm^3/yr

WF = Number of workers · allowance per worker = 12 Mm^3/yr

Reservoirs:

WF = 0.010 · Surface – 1.117 (Hardy et al 2010) = 75 Mm^3/yr

WF = Evaporation Rate · Surface = 45 Mm^3/yr

UNCERTAINTY SOURCES

The sectors that can really be fine-tuned are those which are:

- More easily measured/estimated (domestic use, etc)
- Comparatively smaller in magnitude

However, it is a lot more difficult to estimate green water consumption in agriculture and forestry

Uncertainty can be quite high in these sectors

POLICY-RELATED PRECISIONS

For water policy purposes:

- Knowing your WF helps you better understand the basin: to what extent does it contribute additional info?
- Incorporating green water into the picture
- Cantabria exports a lot of virtual water: can that be used as a negotiation tool?
- Other?

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CONCLUSIONS

Cantabria's water footprint amounts to about 2765 Mm^3/yr

The green water footprint exceeds 99% of this figure

The green water footprint is attributable to agriculture (indirectly, livestock) and forestry (including nature)

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CONCLUSIONS

Cantabria's is a net virtual water exporter

It exports three times as much virtual water as it imports

Most imports and exports are related to the food industry

Most virtual water trade takes place between Cantabria and Spain

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CONCLUSIONS

Computing water footprints and virtual water flows is relatively easy from the methodological standpoint

However, counting on reliable data is a lot more difficult: due to the vast amount of work involved in obtaining enough data, resorting to official databases is frequent

There is no guarantee that these are compatible for practical purposes

Besides, we often find important uncertainties in the main components of regional water footprints (i.e. anything related to green water/vegetation)

Working with uncertainty ranges appears to be a sensible course of action