Comprehensive database for use in LCA-based water footprinting

Results and case studies

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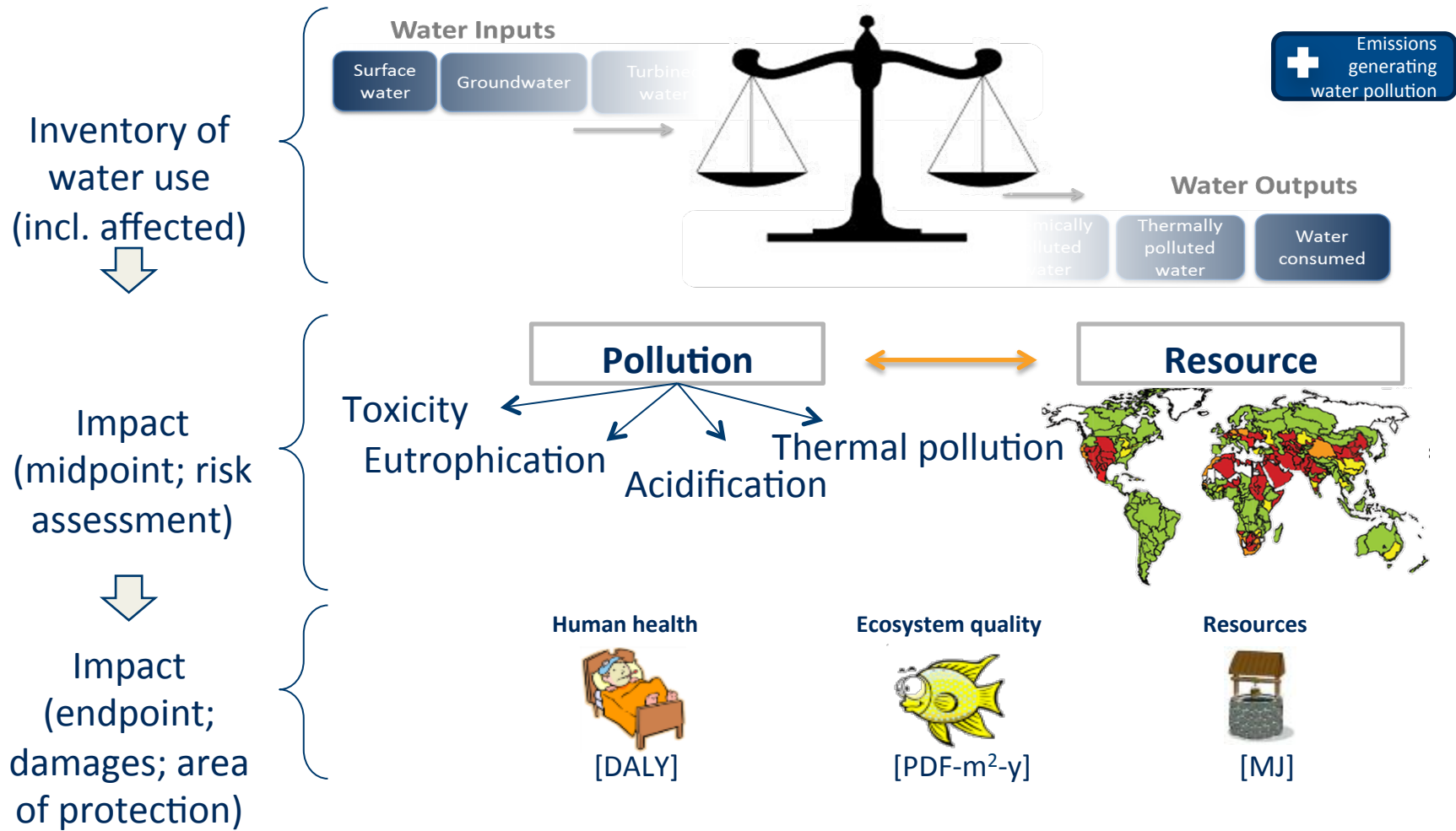*anna.kounina@quantis-intl.com*

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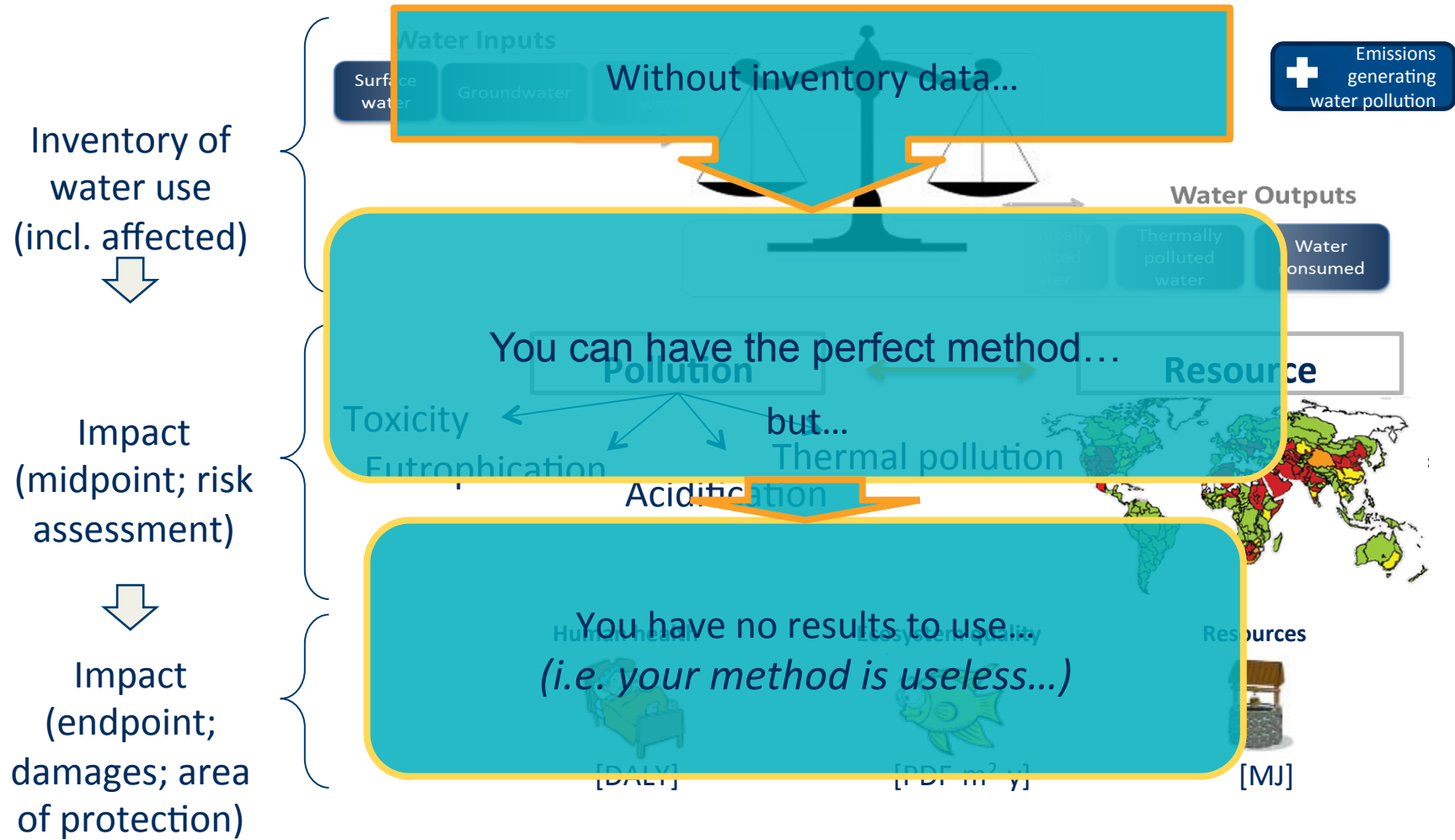*samuel.vionnet@quantis-intl.com*

Water inventory (accounting)
Main problem for application?

Going from inventory to risk and impacts

Inventory of water use (incl. affected)

Water Inputs

| Surface water | Groundwater | Turbine water |

Emissions generating water pollution

Water Outputs

| ...mically ...luted ...ater | Thermally polluted water | Water consumed |

Impact (midpoint; risk assessment)

Pollution ⟷ **Resource**

Toxicity

Eutrophication

Acidification

Thermal pollution

Impact (endpoint; damages; area of protection)

Human health

[DALY]

Ecosystem quality

[PDF-m^2-y]

Resources

[MJ]

Going from inventory to risk and impacts

Inventory of water use (incl. affected)

Impact (midpoint; risk assessment)

Impact (endpoint; damages; area of protection)

Water Inputs

Surface water

Groundwater

Emissions generating water pollution

Water Outputs

Thermally polluted water

Water consumed

Pollution

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[DALY]

[PDF·m²·y]

[MJ]

Without inventory data…

You can have the perfect method…

but…

You have no results to use…
(i.e. your method is useless…)

The Water Database Project

- Made possible through a **collaboration with nine partners**

- Allows users to perform a **regionalized water footprint**, consistent with other indicators

- Includes **over 4'000 processes** (based on existing ecoinvent processes)

- Enables users to perform a water footprint which **encompasses the entire life cycle** of a product or company

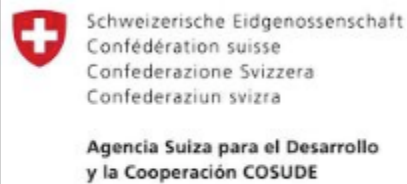# Water Database Project - Life cycle inventory framework
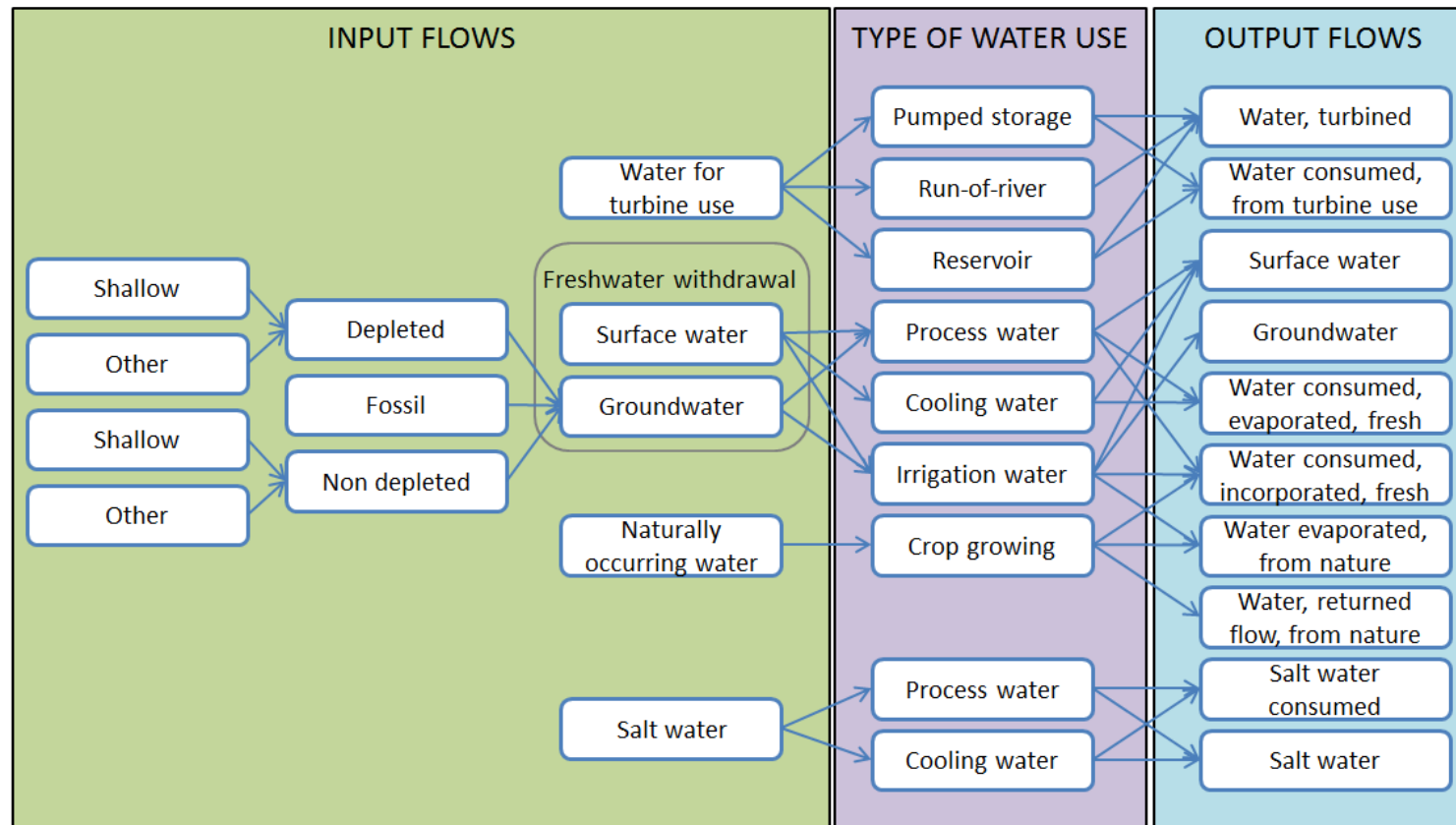
INPUT FLOWS = OUTPUT FLOWS
The water balance is important for transparency purposes, for understanding the system and for assessing the opportunities to reduce water use
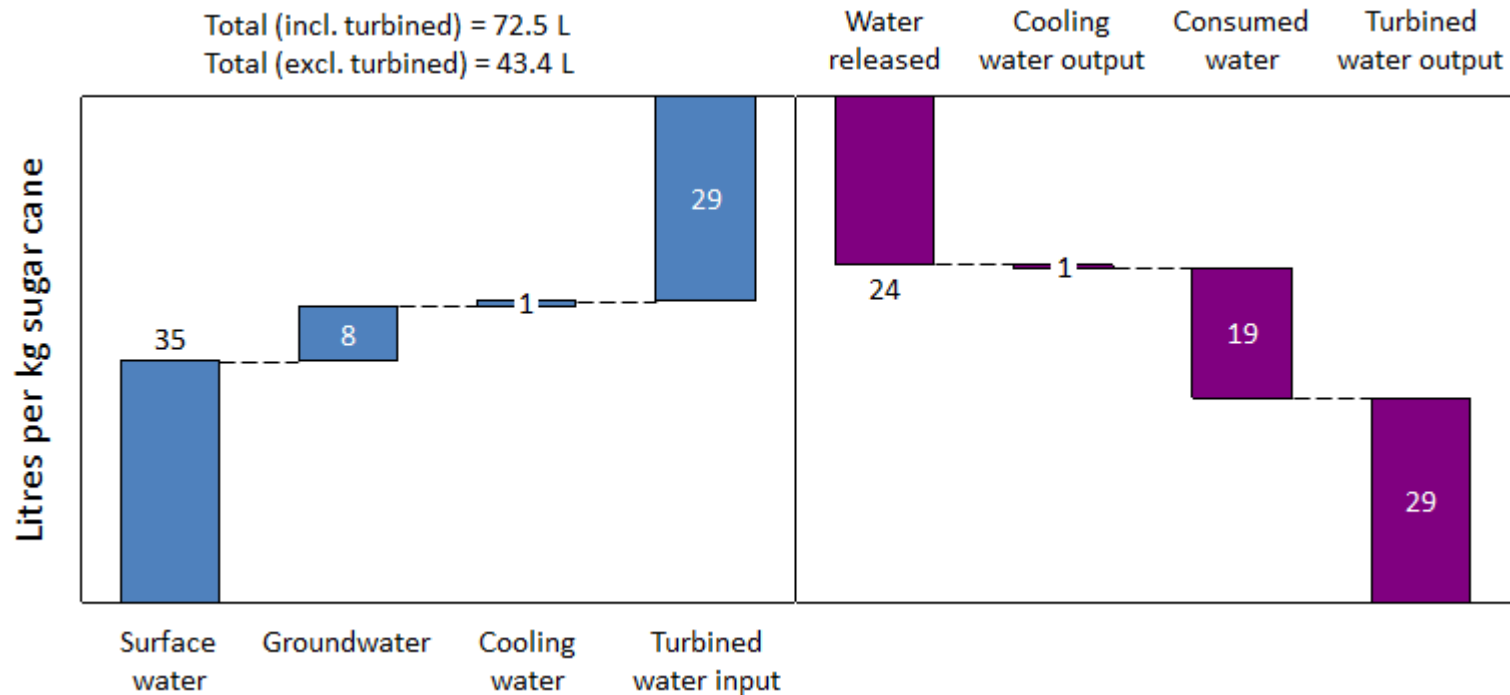
Case studies

Example of dataset results
1 kg sugar cane cultivated in Brazil

Water inventory

Total (incl. turbined) = 72.5 L
Total (excl. turbined) = 43.4 L

Litres per kg sugar cane

29

35

8

1

Surface water | Groundwater | Cooling water | Turbined water input

Water released | Cooling water output | Consumed water | Turbined water output

24

1

19

29

Of total freshwater withdrawal **43% is consumed**

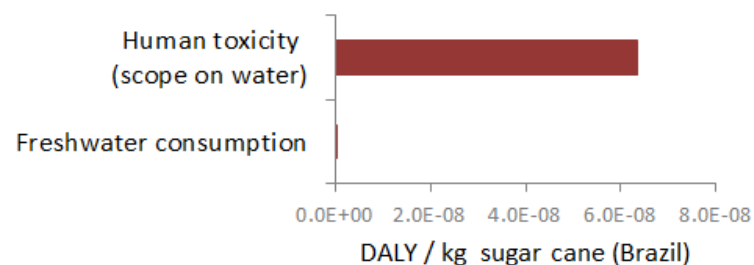# Example of dataset results
1 kg sugar cane cultivated in Brazil

Impacts on human health (from water use)

Human toxicity (scope on water)

Freshwater consumption

0.0E+00   2.0E-08   4.0E-08   6.0E-08   8.0E-08
DALY / kg sugar cane (Brazil)

Impacts on ecosystems quality (from water use)

quality
- Aquatic acidification
- Freshwater eutrophication
- Ecotoxicity
- Thermally polluted water

quantity
- Hydropower
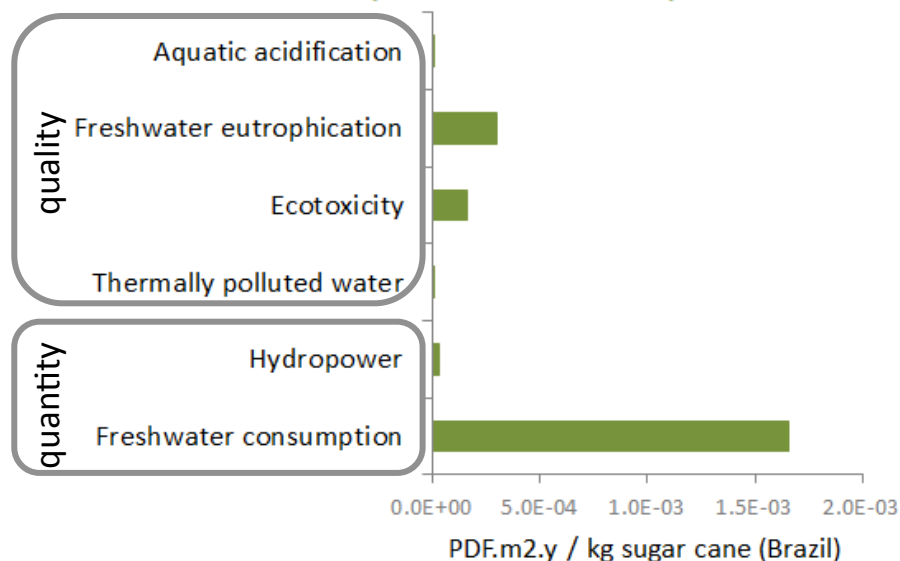- Freshwater consumption

0.0E+00   5.0E-04   1.0E-03   1.5E-03   2.0E-03
PDF.m2.y / kg sugar cane (Brazil)

Human health impacts are dominated by direct and indirect **toxic emissions** to environment
Little irrigation in Brazil

Ecosystem quality impacts are dominated by **freshwater consumption** (crop irrigation)
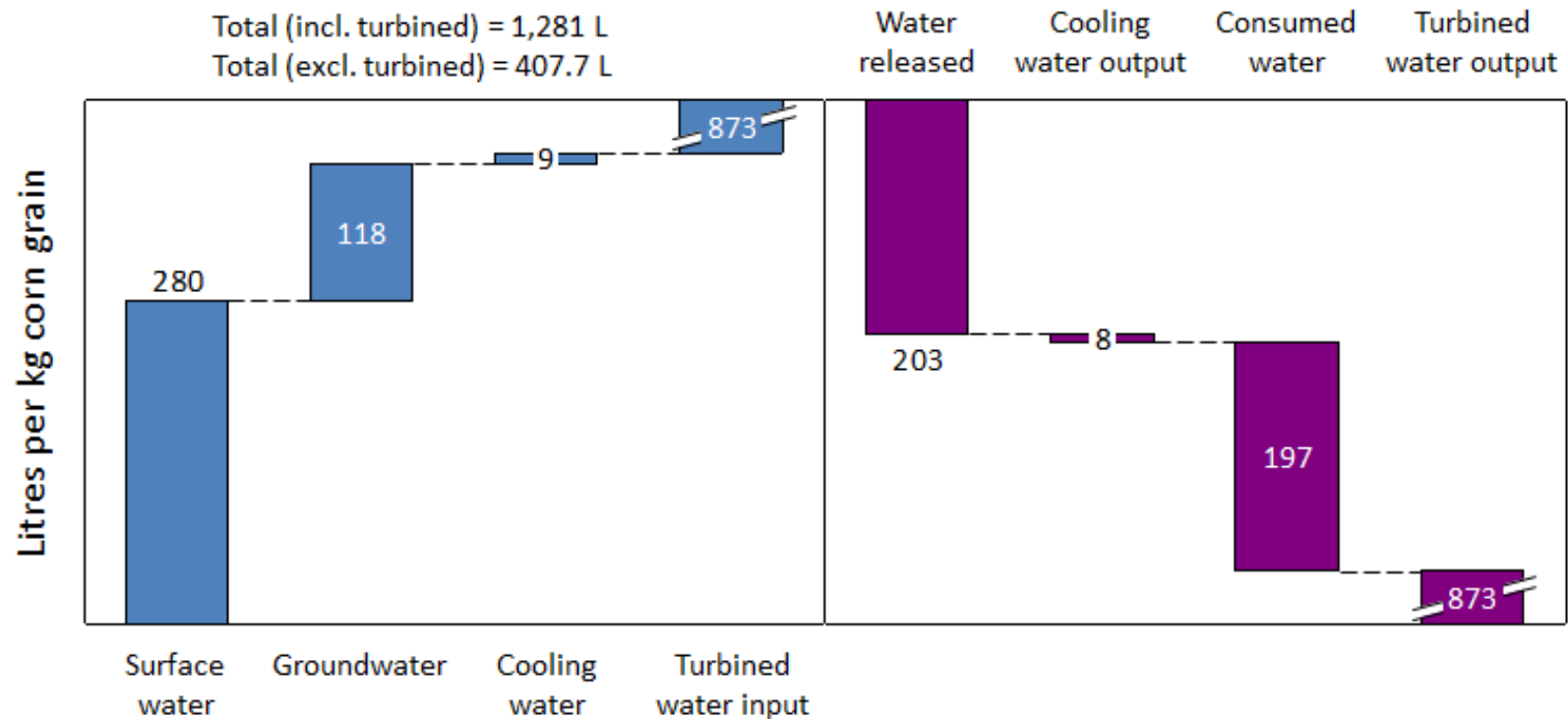Freshwater **eutrophication** (fertilisers) and **ecotoxicity** are also contributors (herbicides)

Example of dataset results
1 kg maize cultivated in China

Water inventory

Total (incl. turbined) = 1,281 L
Total (excl. turbined) = 407.7 L

Of total freshwater withdrawal **48% is consumed**

Example of dataset results
1 kg maize cultivated in China

Impacts on human health
(from water use)
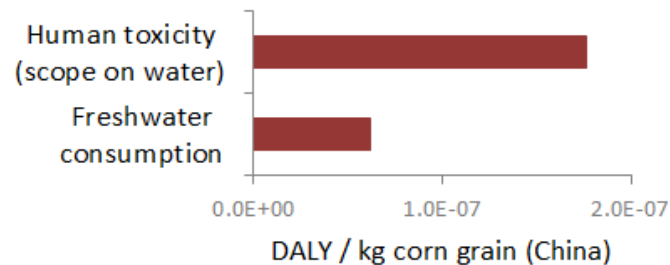
Human toxicity (scope on water)

Freshwater consumption

0.0E+00	1.0E-07	2.0E-07

DALY / kg corn grain (China)

Impacts on ecosystems quality
(from water use)

quality:
- Aquatic acidification
- Freshwater eutrophication
- Ecotoxicity
- Thermally polluted water

quantity:
- Hydropower
- Freshwater consumption

0.00	0.01	0.02	0.03	0.04	0.05

PDF.m2.y / kg corn grain (China)
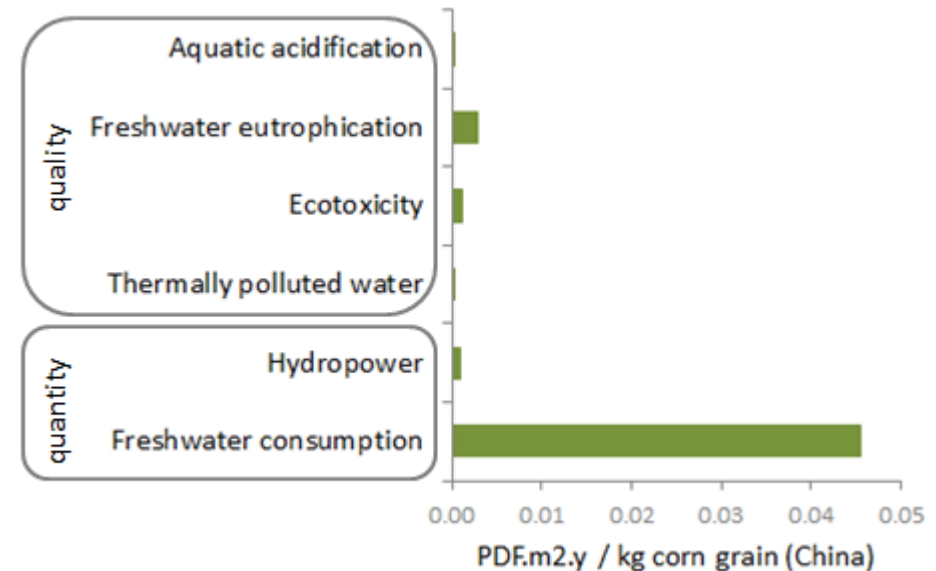
Human health impacts are dominated by direct and indirect **toxic emissions** to environment
Freshwater consumption impacts are due to **irrigation water use**
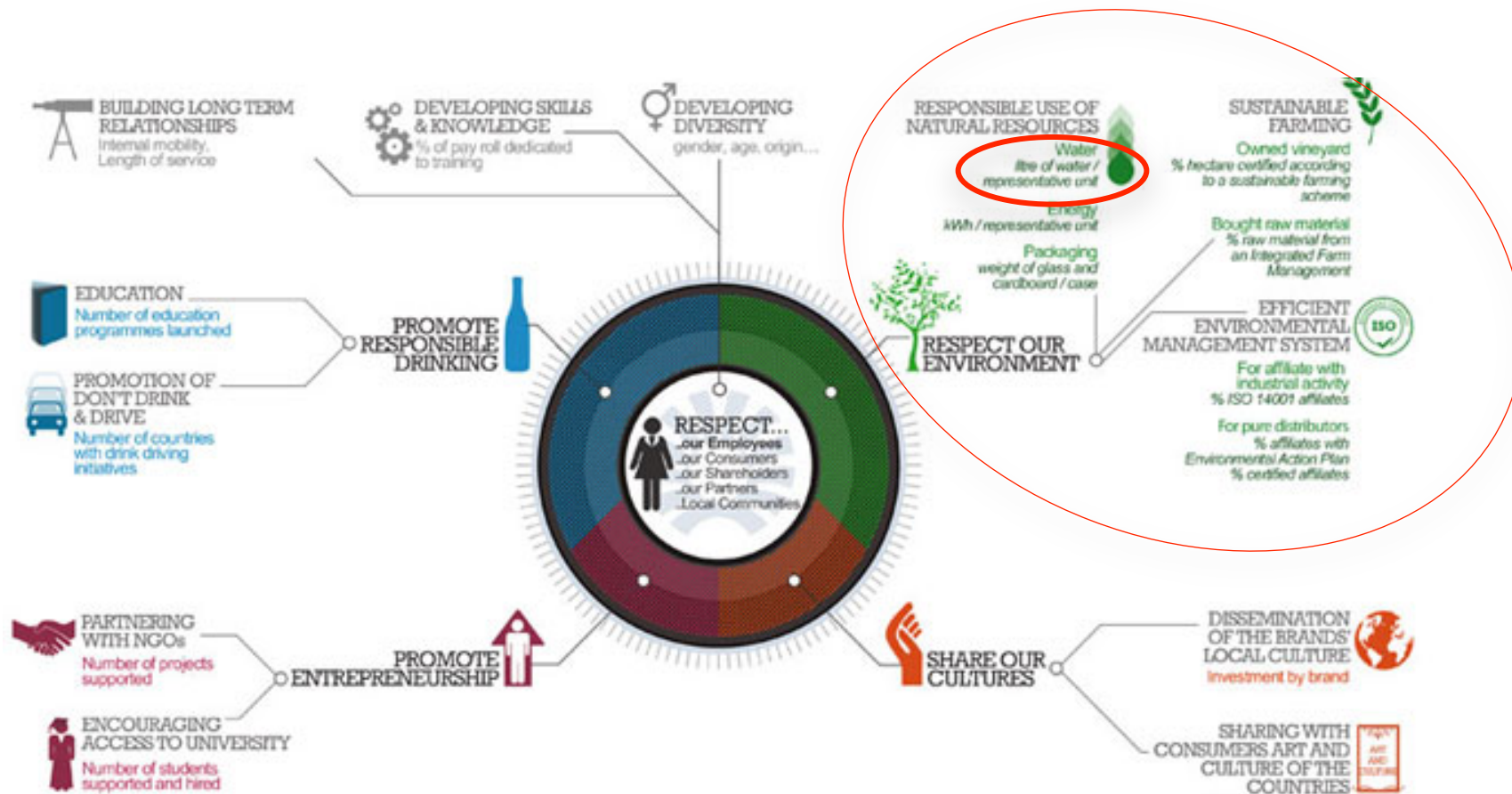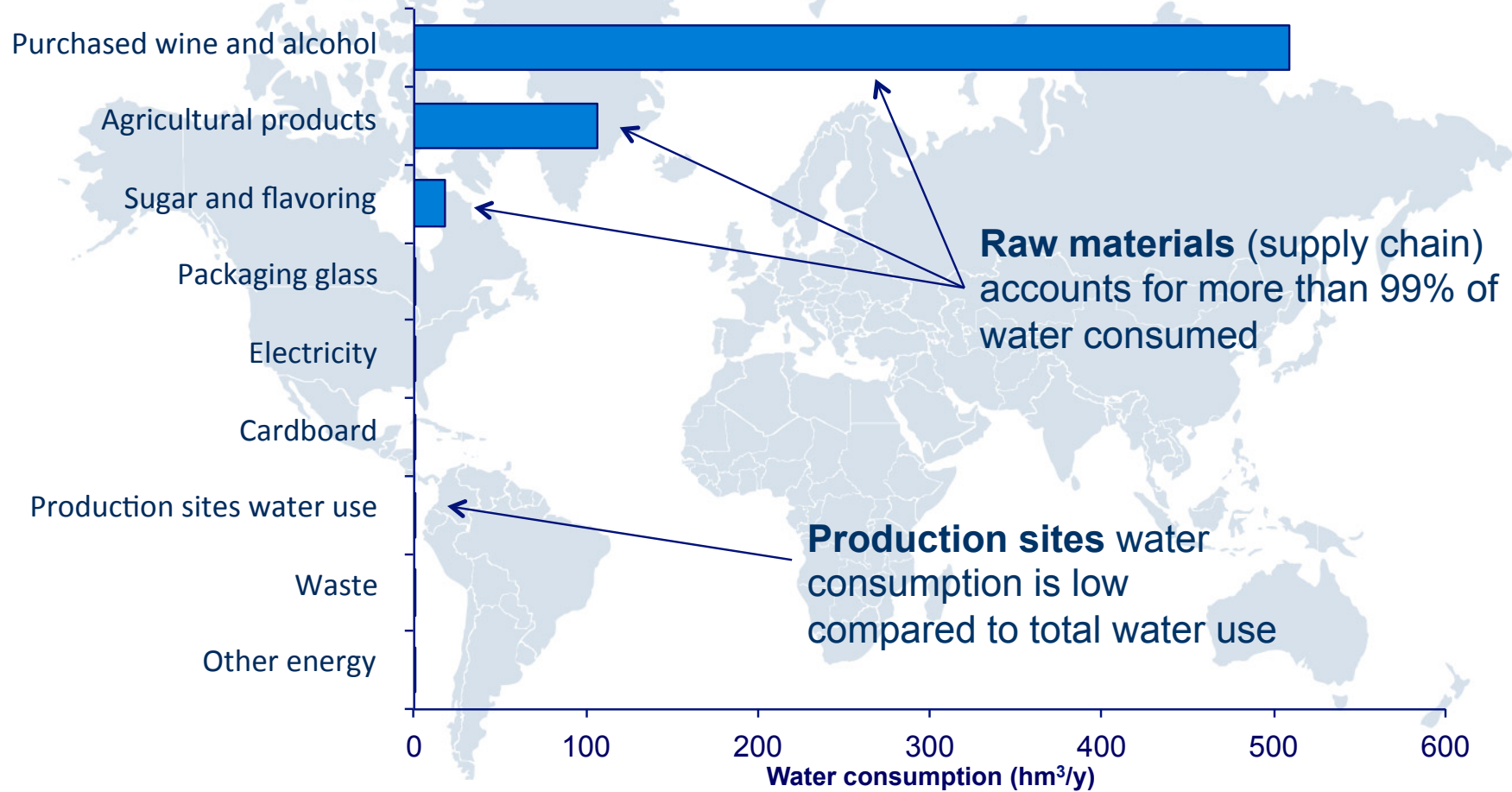
Ecosystem quality impacts are dominated by **freshwater consumption** (crop irrigation)

Pernod Ricard Case study
Water to be integrated into a sustainability strategy

Overview – Global water footprint of Pernod Ricard

Purchased wine and alcohol
Agricultural products
Sugar and flavoring
Packaging glass
Electricity
Cardboard
Production sites water use
Waste
Other energy

0   100   200   300   400   500   600
Water consumption (hm³/y)

Raw materials (supply chain) accounts for more than 99% of water consumed

Production sites water consumption is low compared to total water use
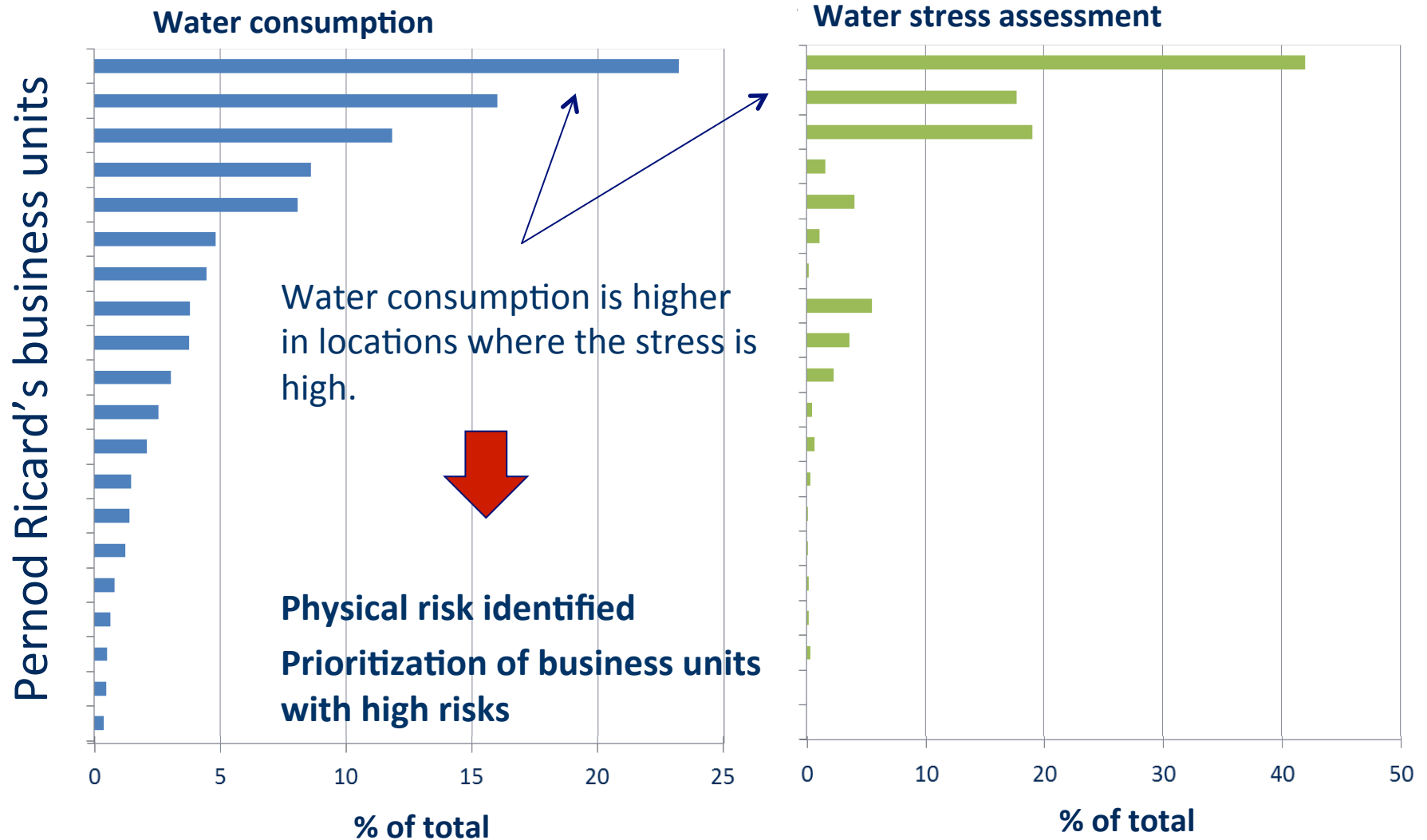
SuizAgua Colombia case study

Appui scientifique par **SUIZAGUA COLOMBIA   PHASE 1   2010 -2013**

Quantis Sustainability counts   **Clariant**   **Holcim**   **Nestlé**   **syngenta**

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Objectives:

Agencia Suiza para el Desarrollo
y la Cooperación COSUDE

1. Water footprint evaluation and reduction

2. Promoting initiatives for improved water management and CSR

3. Communication and scaling up

• Second phase of the project launched in 2012 with 7 Clombian companies

• New projects in Chile and Peru

SuizAgua Colombia Project – Nestlé Case study

- Direct and indirect water inventory is considered
- Water Impact Index (Veolia) methodology applied as well as sensitivity analysis with other LCA oriented methodology (Pfister et al. 2009, etc.)

Milk production
- Silvopastoral farms
- Traditional farms

Pre-condensed milk
(Florencia)

2 kg powdered milk

Final production and packaging
(Bugalagrande)

Results

Pre condensed milk plant
(Florencia)

Direct water use — 16%
Electricity — 10%
Fuel Oil — 74%

Final production
(Bugalagrande)

Direct water use — 41%
Electricity — 54%
Natural gas — 5%

Milk production (Caquetá) 7%, 6%

Milk production
(Caqueta)

Grass — 43.44%
Direct water uses — 48.83%
Electricity — 0.17%
Diesel — 7.56%

87%

Water consumed

150 – 210 litres / 2 kg powdered milk

- Dominated by on-farm milk production
- Energy is a non negligible source of water impacts

✓ **Actions of Nestlé** carried out at **three levels**: production sites, indirect water footprint (electricity, packaging, etc.) and milk production

Thank you for your attention

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+Quantis

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Presentation of Quantis

Quantis: a leader in Life Cycle Assessment

CIRAIG Quantis Sustainability counts

Social LCA

Database development

LUCAS

MONTREAL
18 collaborators

Extensive **cumulated experience**

- More than 150 years of accumulated experience
- > 150 clients / > 250 projects
- Internationally recognized experts
- Rapidly growing company

RISK science Communication Quantis Sustainability counts

Impact modeling
(human health, ecosystems)

USEtox

BOSTON
10 collaborators

Quantis Sustainability counts

Carbon footprint

Environmental product labelling

PARIS, LYON
12 collaborators

Quantis Sustainability counts **EPFL** ÉCOLE POLYTECHNIQUE FÉDÉRALE DE LAUSANNE

Water footprint & database

Impact assessment (IMPACT2002+)

Supply chain impact and risk assessment

LAUSANNE
35 collaborators

Quantis: pioneers in water footprinting

DEVELOPING METHODS AND DATA

WATER DATABASE

INVENTORY
WHAT?
WHERE?
HOW?

IMPACT ASSESSMENT

WATER SCARCITY
LOCAL ISSUES

HUMAN HEALTH
ECOSYSTEMS
RESOURCES

YOUR STRATEGY

ACTION PLAN

UNDERSTANDING
OPTIMISATION/REDUCTION
ACTION PLAN
RISK ASSESSMENT
COMMUNICATION
REPORTING
LABELLING

WATER FOOTPRINT
PROJECTS

WATER FOOTPRINT
DATABASE

WATER FOOTPRINT
TRAINING

WATER FOOTPRINT
FOOTPRINTERS

Comprehensive water footprint methodology

Midpoints

Cause effect chains (CF)

Area of protection

Inventory (water use & direct and indirect emissions to water)

- Human toxicity (USEtox/Quantis)
- Ecotoxicity (USEtox)
- Acidification (IMPACT2002+)
- Eutrophication (ReCiPe)
- Thermal pollution (Verones et al. 2010)
- Hydropower (Maendly and Humbert – in review)
- Water scarcity (Pfister et al. 2009 or alternative)

- River water consumed (Hanafiah et al. 2011)
- Water consumed (Pfister et al. 2009)
- Shallow groundwater withdrawal (van Zelm et al. 2010)

Water impacts

- Human health
- Ecosystem quality
- Resources & ecosystem services