

# USING WSS TO PRIORITIZE BETWEEN WATER PROTECTION MEASURES

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## WHAT IS THE PROBLEM?

- > **Competing interests** when implementing water protection measures – a challenge for decision makers
- > Typically **disregard of additional services** (e.g., cultural services) provided by a clean drinking water source
- > **Benefits** of protection efforts are therefore **underestimated**
- > **Needed:** Holistic view that illustrates how water protection measures affect all services

## Selected services of a drinking water source



## 1. WHAT ARE WSS?

**Water System Services (WSS)** are all services provided by drinking water sources that contribute to human wellbeing.

- > Similar to Ecosystem Services (ESS) but including biotic and abiotic services
- > WSS are derived from the Common International Classification of Ecosystem Services (**CICES**) v. 5.1, expert elicitations and a literature review
- > They include provisional, regulating and cultural services
- > Specifically tailored for a **Scandinavian context**
- > All WSS are listed in an extensive table with examples

## 2. HOW TO ASSESS WSS?

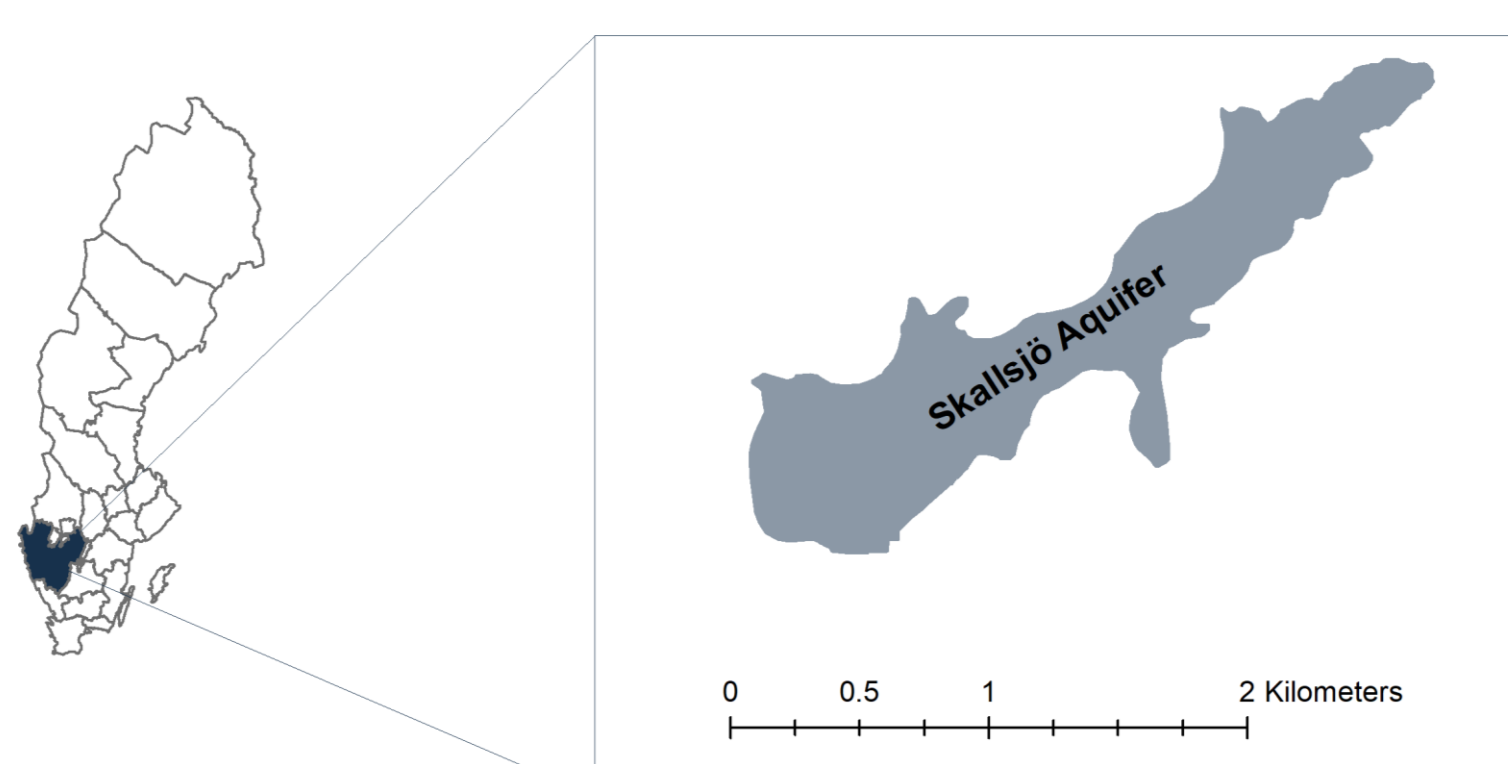
> Mapping and quantification of WSS via **remote sensing** and **expert elicitation** by going through our developed list (checklist approach)

Example of how the services are listed and described:

Division	Group	Class	Qualification of services	Semi-quantification of services
Water	Water for drinking	Municipal and private water supply, for humans (ex-situ)	Drinking water (municipal water supply)	740 m <sup>3</sup> /d
		Drinking water for animals (ex-situ)	Drinking water (household water)	27 wells
	Water for non-drinking purpose	Irrigation (ex-situ)	Water for grazing horses	1 establishment with grazing horses
		Irrigation (ex-situ)	Irrigation of gardens	1 well
Energy	Groundwater and surface water as an energy source	Heat pumps	318 wells = 2289 MWh/a	

## 3. CASE STUDY SITE

> The aquifer is exemplary for a small Swedish groundwater source (*glaciofluvial deposit, semi-rural, abstraction rate: 740 m<sup>3</sup>/d*)



## SUMMARY

- > We developed a list of water system services (WSS) based on the **CICES Ecosystem service assessment**
- > WSS are specifically tailored to assess **drinking water sources**
- > WSS in combination with a **hazard assessment**: it provides a **risk matrix** for identifying different mitigation options
- > We tested the approach on a Swedish drinking water source
- > Comprehensive **decision support**: illustrates all effects of a mitigation measure
- > **Communication tool**

## 4. HOW TO INTEGRATE WSS?

WSS-mapping is a good tool to illustrate the status quo of a drinking water source.

- > **BUT:** To prioritize protection measures, we contrast hazard sources and their effects on all WSS
- > **Hazard assessment** is based on the TECHNEAU-database for hazards towards drinking water sources
- > **Risk matrix:** Scoring of hazard's impact on WSS-delivery from no impact (0) to high impact (3) considering e.g., number of sources, location within catchment, probability of release, and type of contaminant

## 5. RESULTS

### RISK MATRIX

Hazard Sources	Provisional Services					Regulating Services			Cultural Services	
	Municipal DW supply	Household wells	Water for grazing horses	Irrigation of gardens	Heat pumps	Prevention of subsidence	Quality control of freshwater	Springs regulating temp. and humidity	Hiking in the area around the spring	Looking at the spring
Tire and car company	3	3	2	0	0	0	3	0	0	0
Car repair shop	3	3	2	0	0	0	3	0	0	0
Septic tanks	3	3	1	0	0	0	2	0	0	0
Road E20	3	3	2	1	0	0	3	0	0	0
Heat pumps	3	3	1	0	1	0	3	1	0	0
Mature forest	3	3	1	0	0	0	3	0	0	0
Forestry activities	2	2	1	0	0	0	2	0	0	0
Impervabilizations	1	1	1	1	1	1	0	1	1	1
Lake precipitation	1	1	1	1	1	2	0	2	2	2
Overabstraction	1	1	1	1	1	1	0	1	1	1

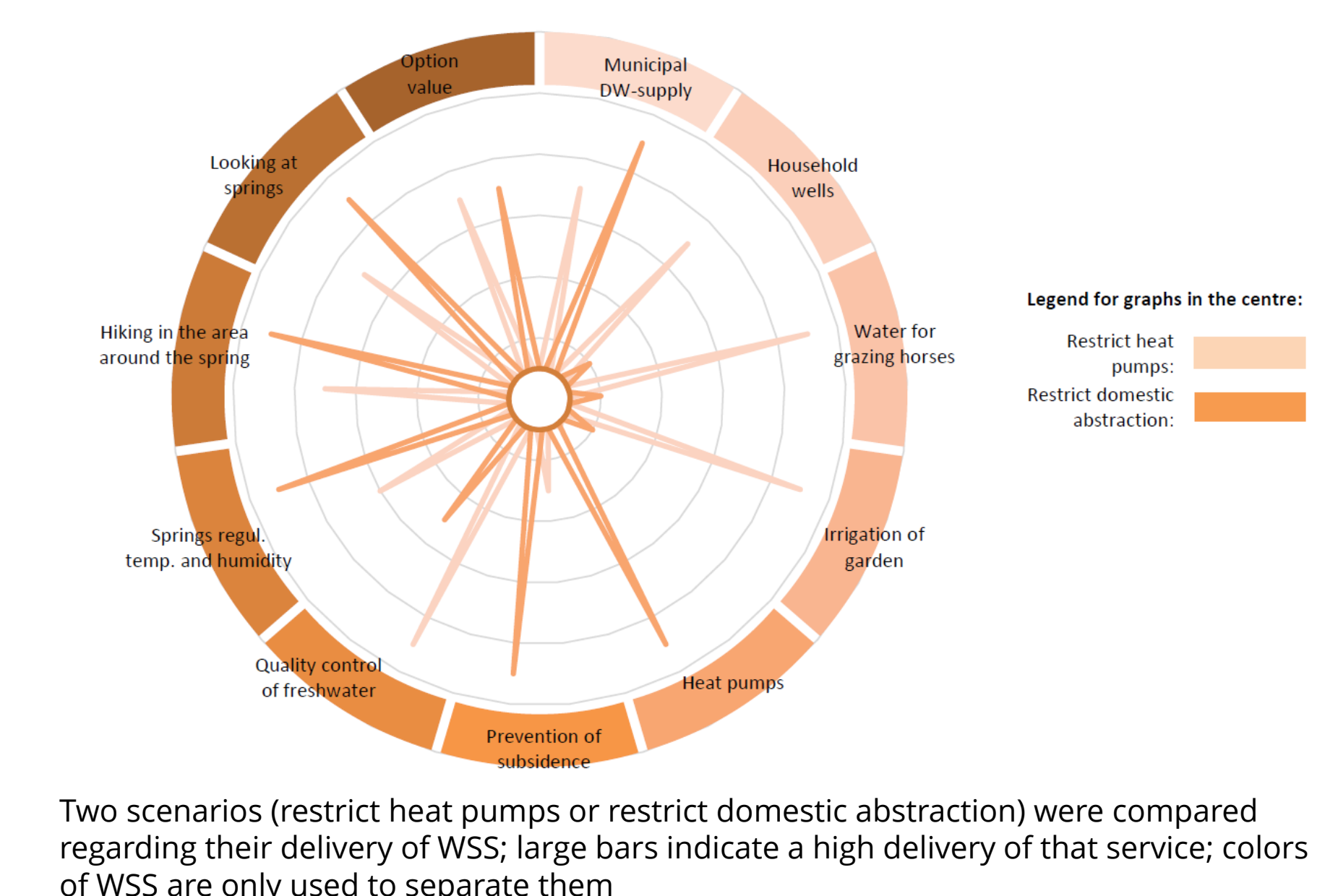
LEGEND:  
No impact: 0    Low impact: 1    Medium impact: 2    High impact: 3

## 6. DECISION SUPPORT

With the risk matrix, we can select which hazard sources should be mitigated from two different points:

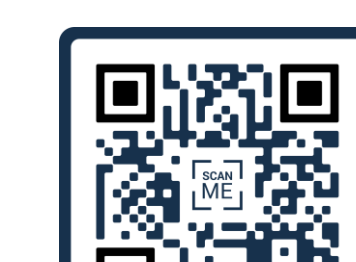
- > 1. based on the services which are selected to be especially protected or
- > 2. choose the hazard sources which are the biggest contributor to the overall risk
- > WSS-assessment provides transparency for decision making
- > **Communication tool** for affected stakeholders for consensus building
- > **Advantage:** Illustrates the risks a hazard source poses towards a variety of services, not only to the service of providing drinking water

## CHANGES OF WSS UNDER SCENARIOS



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Project Website

