Shared strategic drought risk management in the transboundary Rhine River basin

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SUMMARY

The Rhine basin faces increasing extreme drought events due to climate change and rising water demand from socio-economic growth, challenging existing drought management practices.

There is an urgent need for enhanced transboundary cooperation and action among countries sharing the Rhine river.

The three Rhine commissions (CHR, CCNR, ICPR) are collaborating with the EU-funded STARS4Water project to co-develop shared narratives for better drought risk understanding and water allocation.

The three narratives are described in a quantitative way and modeled using the innovative Wflow-RIBASIM tool to conduct a comprehensive drought risk assessment.

The findings will inform updates to the Rhine River basin climate adaptation plan, helping countries to be better prepared for future water scarcity challenges during dry periods.

INTRODUCTION

Nine states and regions in the Rhine transboundary river basin closely co-operate in order to harmonize the many interests of use and protection in the Rhine area. Switzerland, France, Germany, Luxemburg, the Netherlands co-operate with Austria, Liechtenstein, Belgium and Italy. Climate change is causing shifts in precipitation and temperature patterns. Related droughts, floods and high water temperatures may have a negative impact on the ecosystem of the Rhine and its tributaries as well as on water usage.

Figure 1: Rhine riparian states (Schulte-Wülwer-Leidig et al, 2018)

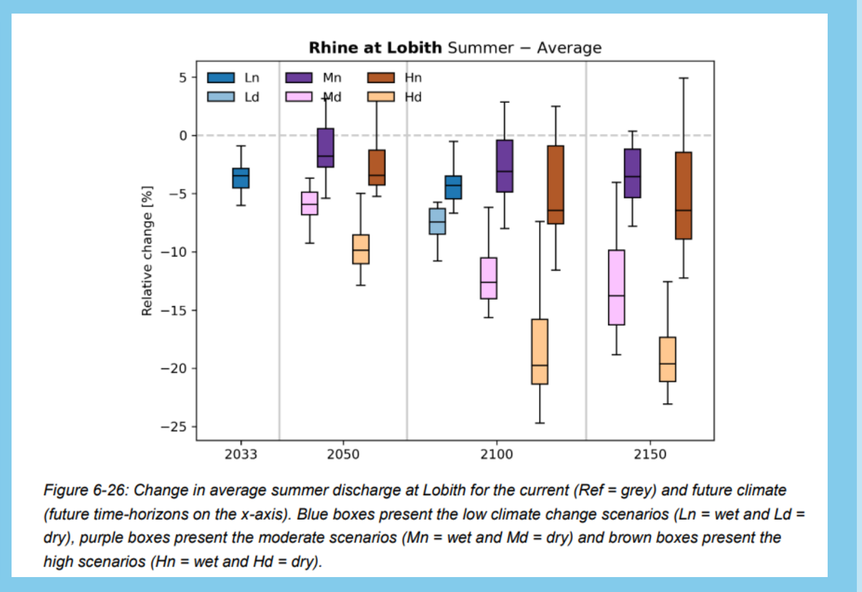

Figure 6-26: Change in average summer discharge at Lobith for the current (Ref = grey) and future climate (future time-horizons on the x-axis). Blue boxes present the low climate change scenarios (Ln = wet and Ld = dry), purple boxes present the moderate scenarios (Mn = wet and Md = dry) and brown boxes present the high scenarios (Hn = wet and Hd = dry).

Figure 2: Rhine at Lobith (Delta Scenarios, 2023)

METHODS

In a co-creative approach with stakeholders, the current situation (A) was described through the perspective of the biosphere (green), society & economy (orange) and the institutional setting (blue). On these levels scenarios (B) were developed describing climate and socio-economic drivers (C) and their impact on the water use(rs) (D) in the Rhine basin. This served as modelling input for the modelling tools (E).

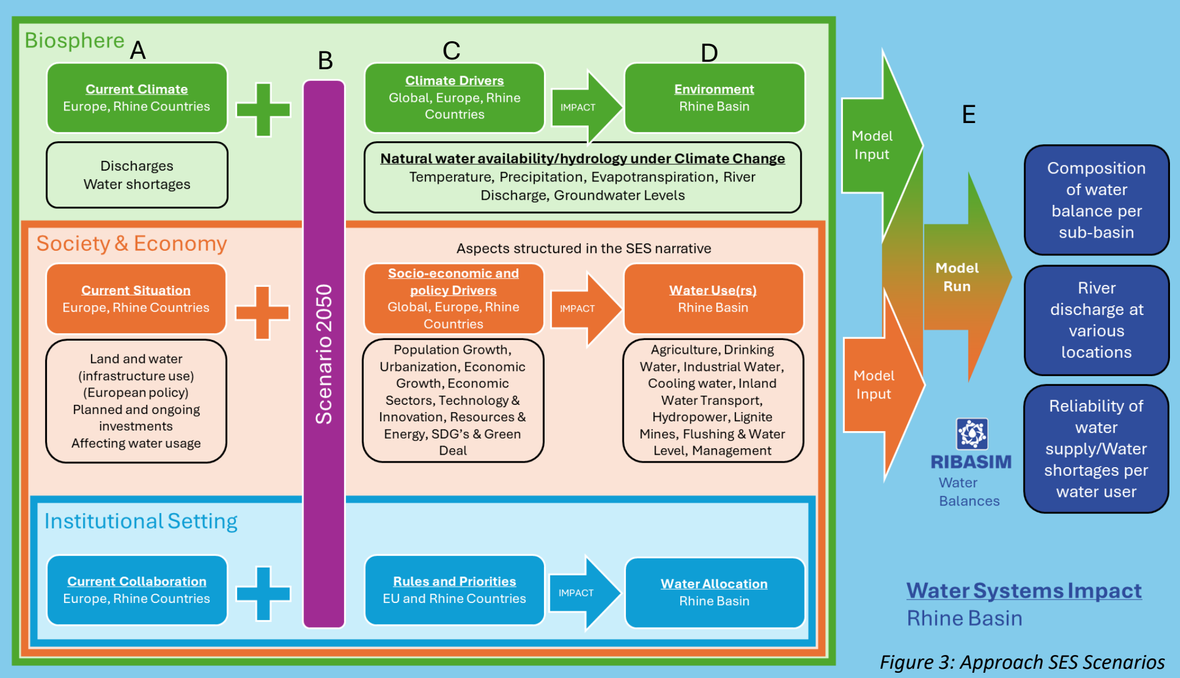

Figure 3: Approach SES Scenarios

The three scenarios for the Rhine basin narrate different plausible futures. The key aspects of the three scenarios can be seen on the right figure. Each scenario provides a unique perspective on an uncertain future and how to navigate the complexities of drought management in a changing climate.

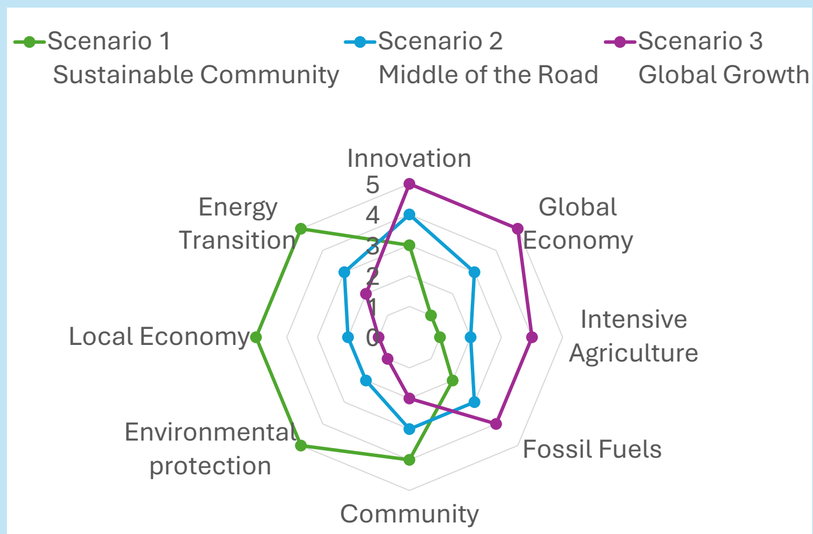

Figure 4: Key characteristics Rhine scenarios

(PRELIMINARY) RESULTS

1. **Scenario narratives:** Three Rhine scenario narratives were developed (Figure 4) imagining plausible future developments in the catchment.
2. **Quantification**: Important drivers and water users in these narratives were quantified such as population growth, GDP or water use.
3. **Modelling tools**: These quantifications were translated into input for Wflow a grid-based model for rainfall-runoff model and RIBASIM a node-link model for water availability, water allocation and use (Figure 5).

The figure below shows the links between the two modelling tools:

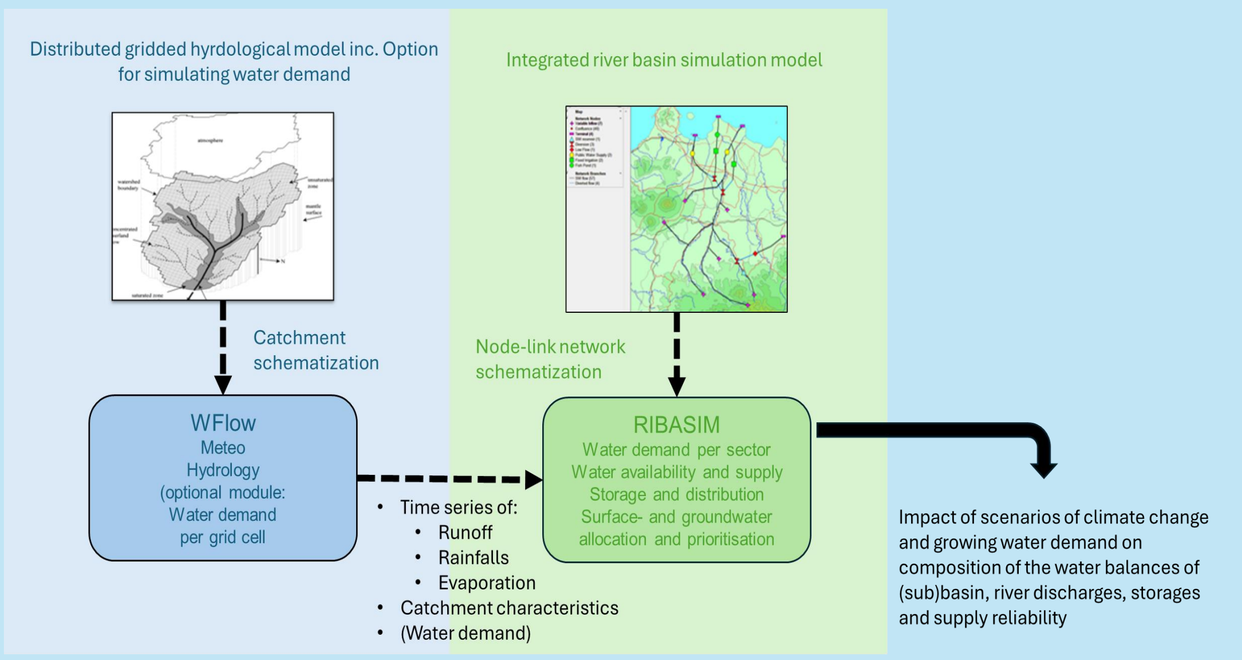

Figure 5: Modelling tools for scenarios assessment for the Rhine basin

ENVISIONED OUTCOMES

1. Joint message by policy makers and experts about socio-economic and climate change scenarios impacts on low flows, informing updates to the Rhine River basin climate adaptation plan.
2. Shared understanding of problems and solutions among Rhine countries, facilitating cohesive adaptation strategies & actions.
3. Better preparedness for future droughts in the Rhine catchment.