# Open science for collaborative exploration of fluvial futures

Oliver Schmitz, Edwin H. Sutanudjaja and Menno W. Straatsma
Department of Physical Geography, Utrecht University, The Netherlands (o.schmitz@uu.nl)

RiverCare
Towards self-sustaining multifunctional rivers

Universiteit Utrecht
*Faculty of Geosciences*

## Motivation

Managing densely populated fluvial areas and adapting to climate-change present major challenges for sustainable development. To democratise the decision-making process it is desired that stakeholders and planning professionals can evaluate common interventions by straightforward access to intervention plans, source data, and model code. **We aimed at the creation of an interactive environment based on free and open-source software for intervention planning and evaluation.** We used RiverScape (Straatsma et al., 2017, 2018, 2019), which is based on the spatio-temporal modelling environment PCRaster (Karssenberg et al., 2010). We developed Jupyter notebooks to integrate explanatory text, user-defined parameterisation of measures, execution of RiverScape (Fig. 1) code, and interactive visualisation. **All within your browser.**

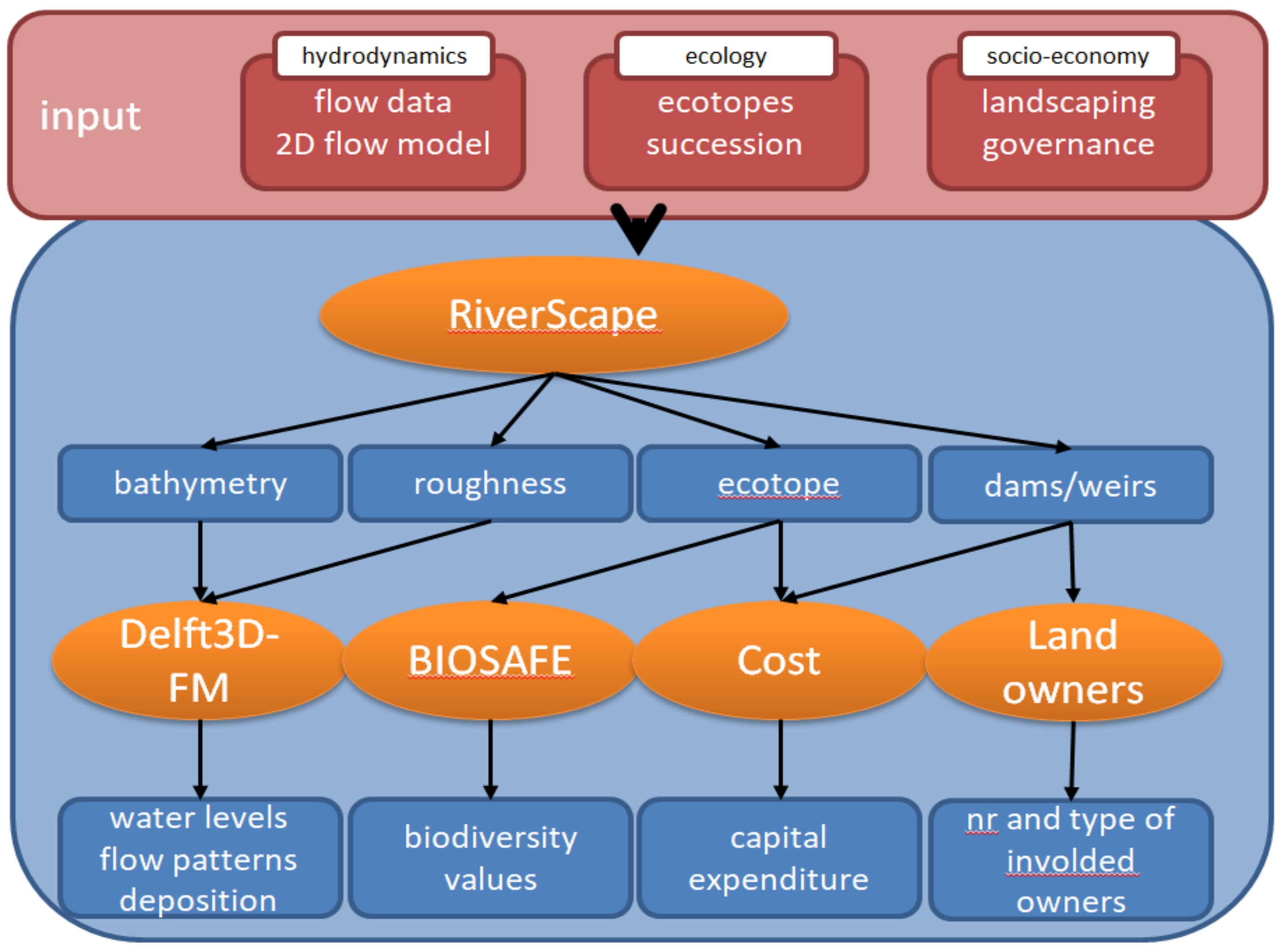


Figure 1. Typical workflow to generate and evaluate interventions.

## Interactive Jupyter notebooks

### The intervention plannning notebook

In the intervention planning notebook you can position and parameterize typical river interventions. Spatial input data such as terrain, ecotopes and trachytopes can be visualised and inspected interactively. The areas of measures can be specified arbitrarily, e.g. everywhere, per floodplain section or per owner. The following measures can be parameterised: side channel creation (Fig. 2), floodplain lowering, groyne lowering, minor embankment lowering, main dike raising and roughness smoothing

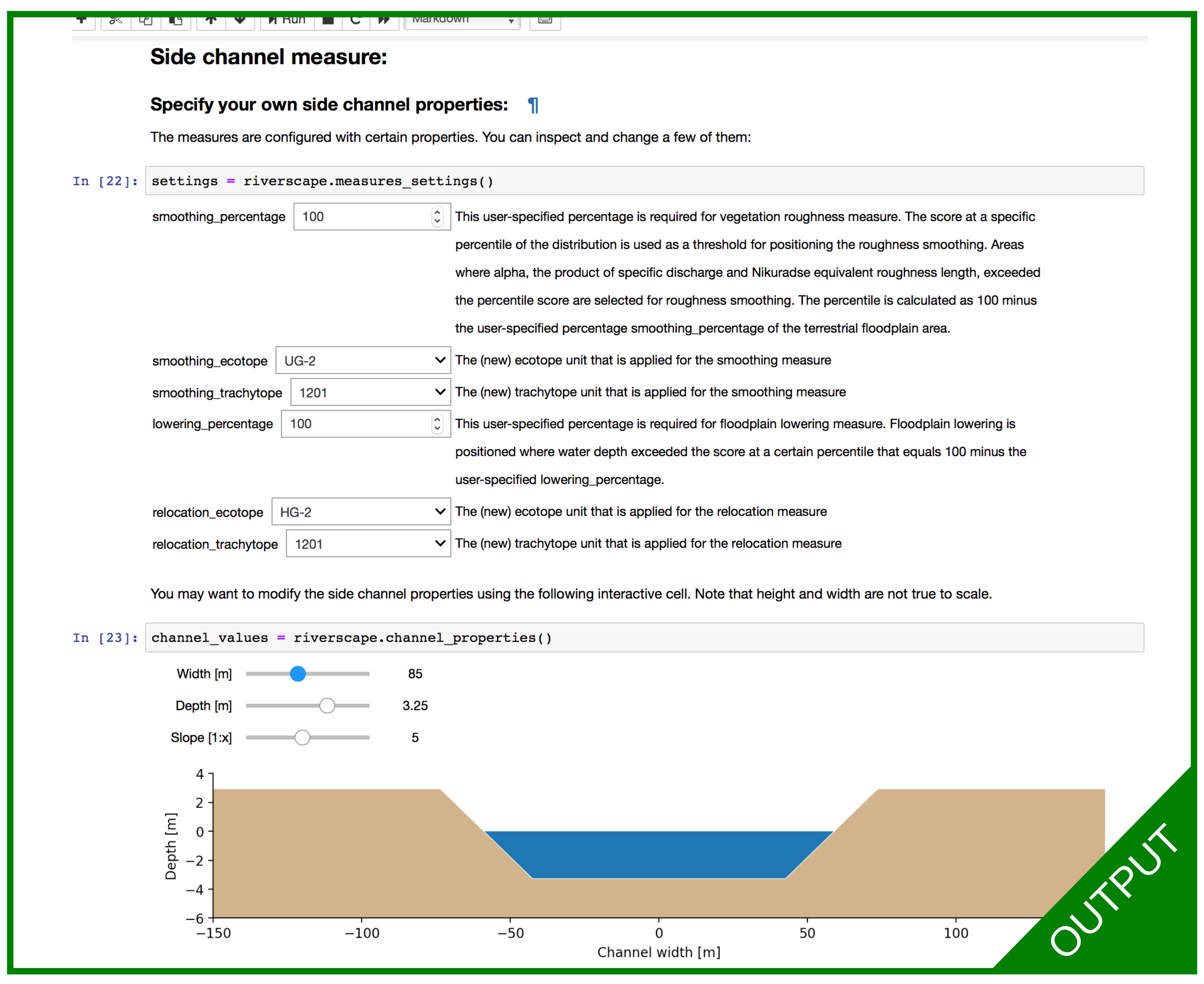


Figure 2. GUI input for side channel parameterization. Direct feedback is provided by interactive graphs such as the changing channel transect. **Lift figure for output.**

### The biodiversity evaluation notebook

Evaluating the effects of the measure on biodiversity is crucial to comply with the national and international regulations. The notebook the BIOSAFE model (de Nooij et al., 2003), where various biodiversity scores can be evaluated for seven taxonomic groups. BIOSAFE can be executed as a non spatial model, or fed with ecotope maps and spatial observations of species monitoring data (Fig. 3).

## Feedback

Download the repository to plan and evaluate your own measures!
https://github.com/UU-Hydro/RiverScape

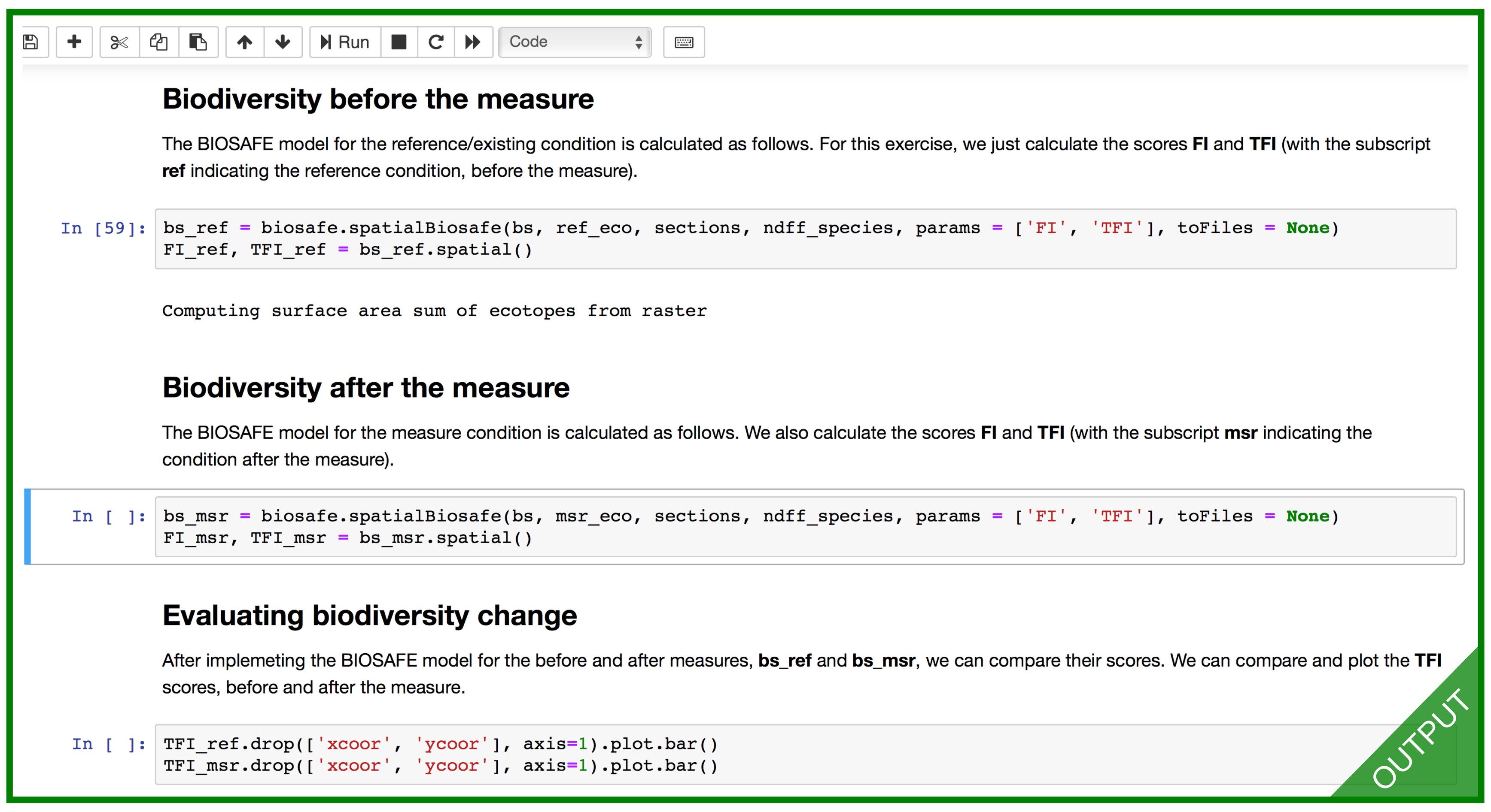


Figure 3 BIOSAFE model instantiated and evaluated with spatial data for the conditions before and after measure implementation. **Lift figure for output.**

### Exploring a set of existing measures

To provide insight into the trade-offs of measures between water level lowering, biodiversity, implementation costs and number of land owners show all interventions in a scatterplot matrix (Fig. 4). The lower left corners of each panel indicates the utopian situation; the upper right the situation gets dystopian. Pareto fronts indicate the measures with optimal combinations of the evaluated parameters.

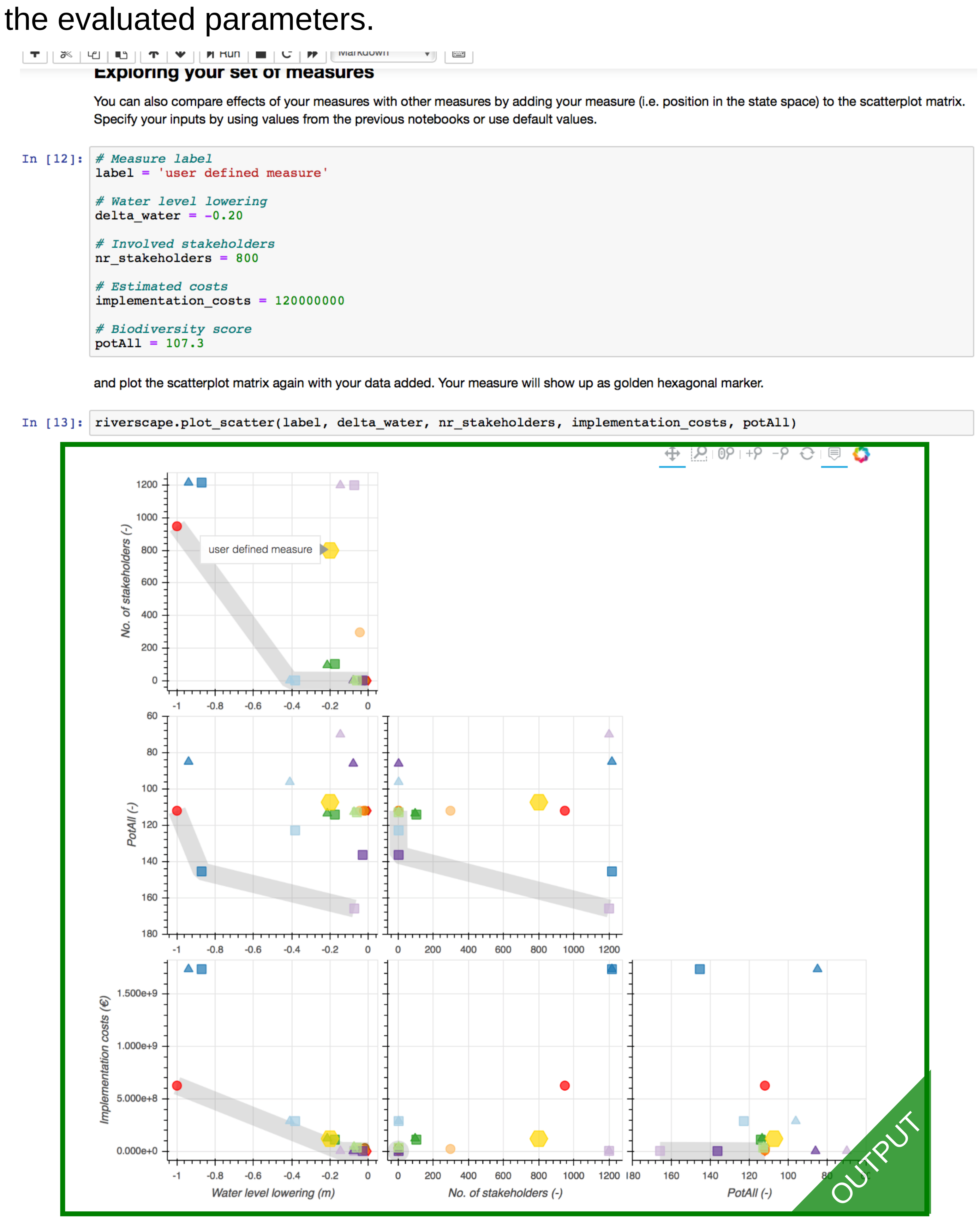


Figure 4 Multiparameter evaluation of existing measures compared with user-defined measure.

### References

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