Intro

**the Upper Tana Waterfund :** 60% of Nairobi’s residents do not have access to a reliable water supply. To solve this issue, the Upper Tana-Nairobi Water Fund undertakes upstream water and soil conservation measures, resulting in improved water quality and supply.

The goal here is to optimize which interventions to undertake in the Upper Tana basin, in order to improve water quality and quantity supplying Nairobi. Three ES objectives are being acted upon:

\* maximize annual water yield (AWY),

\* minimize sediment reaching streams (SDE)

\* minimize soil loss for agricultural productivity (SDL)

About **800 scenarios were generated,** arising from parametric uncertainty (4 parameters with 2 to 4 possible values) and 15 combinations of objectives weights.

TEXTS FOR THE EXPLANATION BUTTONS

***General***

***Maragua watershed.***

ES objectives :

\* maximize annual water yield (AWY) (units !)

\* minimize sediment reaching streams (SDE) (units !)

\* minimize soil loss for agricultural productivity (SDL) (units !)

**800 scenarios were generated,** arising from parametric uncertainty (4 parameters with 2 to 4 possible values) and 15 combinations of objectives weights.

The full dataset table can be viewed. It is also linked to the other views: the dataset shrinks to match the selection when a subset of scenarios is chosen (upon brush on the parallel coordinates plot, or a slide over a sub-range of the sliders for example). Upon click on a specific row, this solution is highlighted in all plots (corresponding point in scatterplots, and line in parallel coordinates plot) and the maps corresponding to this scenario are displayed.

***Parcoords***

***Parallel coordinates plot displays the tradeoffs among the ES objectives (vertical axis), for each scenario (represented as lines).*** The values plotted correspond to the overall aggregated objective score, for the scenario considered (i.e the sum of all pixels’ scores for this objective, across the raster).

AWY: Annual water yield [in 10^5 cubic meters water/year]

SDE: Sediment export to stream [in 10^5 tons of sediments eroded annually] SDL: Soil loss to stream [in 10^5 tons of sediments eroded annually]

\*Features\*

Select a subset of solution : by brushing on any axis

Flip axis direction: upon double clicking on their name.

Re-order axis: by dragging them.

***Sliders wt***

The objective weights corresponds to the relative importance given to each ES objective in each run. Different scenarios were generated by varying the objective weights combination (*that always sums to 100% : e.g a run where each objective is given equal importance : AWY\_weigth = SDE\_weight = SDL\_weight = 33%).*

Here, 15 combinations of objective weights were generated. Slide to select a subrange of scenarios.

***Sliders pu***

Several model input parameters are subject to uncertainty. To account for this, the model is run for several possible values of each uncertain parameter.

<ul>

The uncertain model input parameters are :

<li> the seasonality factor, Z is an empirical constant used to calculate the AWY in the [\*Hydropower InVEST model\*](http://data.naturalcapitalproject.org/nightly-build/invest-users-guide/html/reservoirhydropowerproduction.html#summary). It captures the local precipitation pattern and additional hydrogeological characteristics. No unit. </li>

<li> the soil erodibility value, K is used to calculate the amount of annual soil loss in the [\*sediment retention InVEST model\*](http://data.naturalcapitalproject.org/nightly-build/invest-users-guide/html/sdr.html#summary). It measures the susceptibility of soil particles to detach and transport by rainfall and runoff. Unit is ton\*ha\*hr/(MJ\*ha\*mm). </li>

<li> Spatial (\*\*?? bpb ??\*\*) </li>

<li> The budget level (\*bpb, why specifically these 3 levels?\*) </li>

</ul>

***Scatterplots***

Tradeoff curves display the tradeoffs between each pair of ES objectives. Each plotted point corresponds to a scenario.

The colorscale provides additional information about which value of some uncertain input parameters were used: the orange (respectively blue) points correspond to scenarios generated under the spatial scenario A (respectively B). The color gradient gives an indication of the budget level (a lighter color is a smaller budget). Lines can be plotted, conecting the dots generated under the same combination of uncertain input parameters values.

***Map***

Maps provide an essential view of spatial results. The maps can be calculated from 3 distinct selection cases :

\* for all scenarios: these map show results summarizing all scenarios, they are displayed initially when no selection had occurred.

\* for a subset of scenarios: these map show results summarizing the scenarios selected through the other views. This situation occurs when the button \*Calculate map for selection\* is clicked.

\* for a single scenario: these maps displays the results corresponding to a specific solution; this occurs upon clicking on the corresponding scenario row in the data table.

In total 6 types of maps can be displayed :

\* Current land cover map shows the context. Any categorical map (such as a portfolio) may be overlayed on top.

\* Portfolio maps display the modal portfolio (for each pixel, the most frequently selected intervention across scenarios selected, see \ref{sec:comp\_map\_many}). For the case of a single scenario display, it shows the corresponding portfolio.

\* Footprint maps show the areas selected consistenly for interventions, across several scenario. For the case of a single scenario display, it is just the overall footprint of its portfolio.

\* Agreement maps displays the frequency map of the modal portfolio, expressing consistency between runs (see \ref{sec:comp\_map\_many}). It is not relevant for the case of a single scenario display.

\* Absolute objective score maps, for each ES objective, display the local objective scores averaged (\*averaged or summed bpb?\*) over the selected scenarios.

\* Marginal objective score maps corresponds to the change in objective score between the current situation and the scenario considered. Therefore they are calculated as the difference between the absolute objective score map of the scenario, and the absolute objective score map of the baseline (current situation).

Map control buttons allow to pick the map to be displayed among the 10 possible (the two latter exist for each of the 3 objectives). The legend, as well as corresponding map summary statistics are computed and update automatically. The map window is enhanced with zooming abilities.