A preliminary study of evidence-based tool for wetland optimization

- A case study using QSWAT+

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Due to the ongoing climate change, consequences such as natural disasters have become more common. From an increase in drought to events such as rising sea levels becoming more frequent. The reason for the fast acceleration of climate change has been due to, among other things, to greenhouse gases created when solar radiation is absorbed and trapped in the atmosphere. A more significant reason is the combustion of fossil fuels such as coal and oil, which in turn releases enormous amounts of carbon dioxide into the atmosphere. On the other hand, wetlands contribute to various ecological services; such as purifying water, storing water and sequestering carbon dioxide. This makes wetlands a resistance that should, to a certain extent, be able to act as a resistance to climate change. To expand the creation of new wetlands, a group of employees at LTH, Water Department together with a group from the KTH, within the Ecodiver project want to develop an evidence-based tool for optimizing wetlands in terms of location, design and management.

The purpose of this work was to investigate whether the open-source program QSWAT + as a plugin for QGIS can act as a basis for the creation of an evidence-based tool for wetland optimization. The questions for this work were formulated as follows:

- Investigate the availability of the QSWAT+ possibilities.
    - How is the result from QSWAT+ presented?
    - Potential of using QSWAT+ for a future evidence-based tool
- Investigate the potential area of application for hydrological purposes

The collected data for this study is mostly obtained from authorities, such as Lantmäteriet, SLU, SGU, SMHI and more.

The study area is limited to Kävlinge river catchment area. Data that could not be obtained from authorities were replaced by data from SWAT's own database. Weather data were downloaded from four different stations both inside and around the Kävlinge river catchment area, and these stations are currently located in Hörby, Lund, Malmö and Vombsjön. Flow data were provided from the stations in Ellinge, Högsmölla and at Vombsjön. It is important to note in this work that this study is only a validation of the QSWAT + program and not a validation of data.

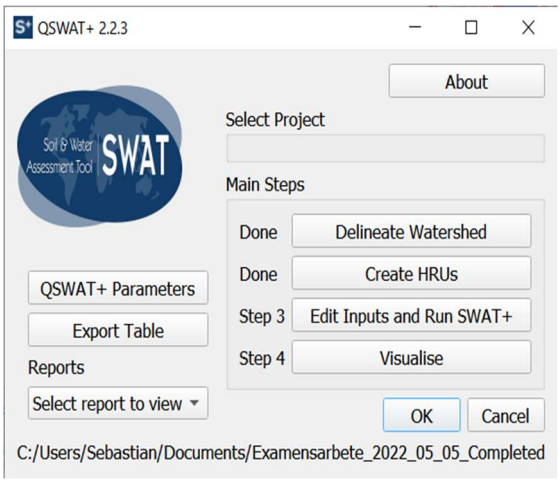

Figure 1: QSWAT+ interface with the four steps being presented.

The approach of the study has mainly been in learning the program QSWAT+ and in the investigation of what QSWAT+ has to offer, in

the form of functions, opportunities and availability. QSWAT+ consists of four steps that can be seen on figure 1 and described as follows: *Delineate watershed* (1), *Create HRUs* (2), *Edit inputs and Run SWAT +* (3) and *Visualize* (4). The first two steps (*Delineate watershed, Create HRUs*) consist of insertion of data such as land use and elevation data, but also of the creation of catchment areas and lakes that the program itself detects using inserted data and changes can be made, as well as inputting additional information. Finally, in step four (*Visualize*) one can choose how the result should be presented, and the options available are that the model is presented statically according to figure 2, in animation or with the help of graphs according to figure 3.

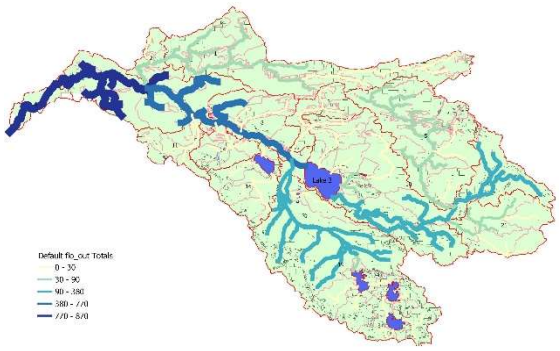

Figure 2: Presentation of the result where the model is presented statically.

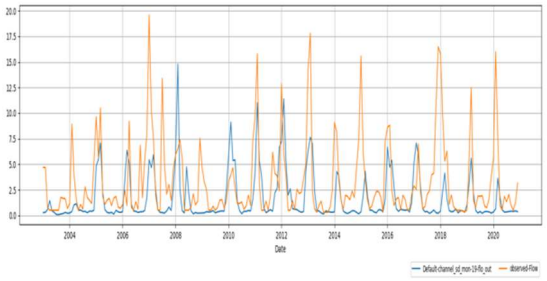

Figure 3: Presentation of the result where it is presented in a plot with graphs. Orange line corresponds to historical (observed) data, while blue line corresponds to simulated data.

Generally, it can be stated that QSWAT+ has great potential in acting as a basis for the evidence-based tool for wetlands that Ecodiver intends to create. The program adds lots of hydrological functions, as well as opportunities for the creation and design of new wetlands. Concerns, on the other hand, have arisen during the work in the form of sudden error codes that have appeared - resulting in a considerable consumption of time. It has also been unfortunate when SWAT's data was used as a substitute due to instructions on how to convert data for plant and urban to CSV files not being available. In general, QSWAT+ can act as a basis for the evidence-based tool that will be created by the project group within Ecodiver. However, due to uncertainties that have arisen, it is currently not possible to call this tool evidence based.