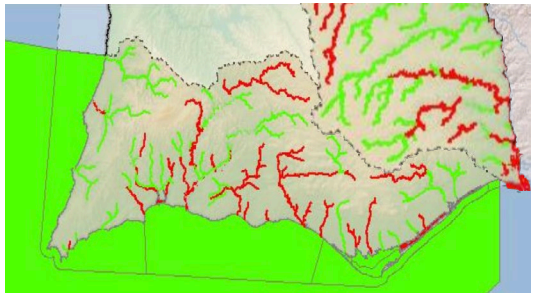
Nature-based solutions as climate change adaptation measures in Mediterranean watersheds



2024 INTERNATIONAL SWAT CONFERENCE, STRASBOURG, FRANCE

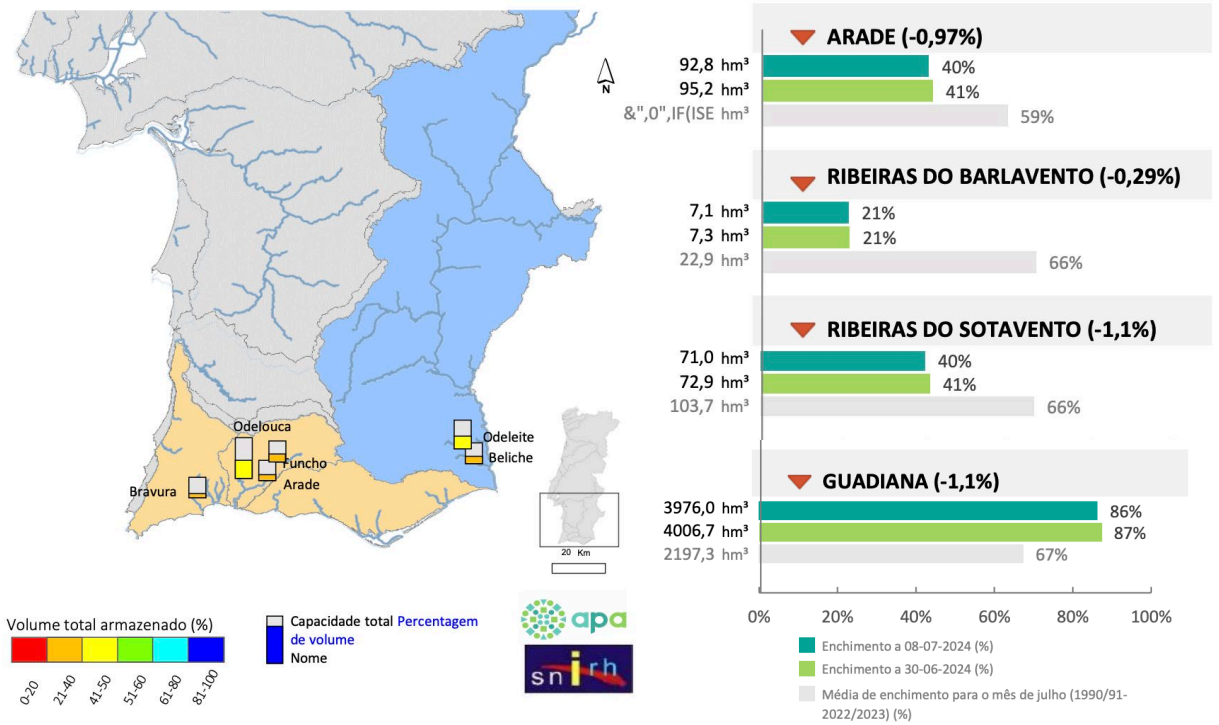
MIGUEL RODRIGUES - CE3C/FCUL- 11 JULY

Index

Study case (Algarve region)

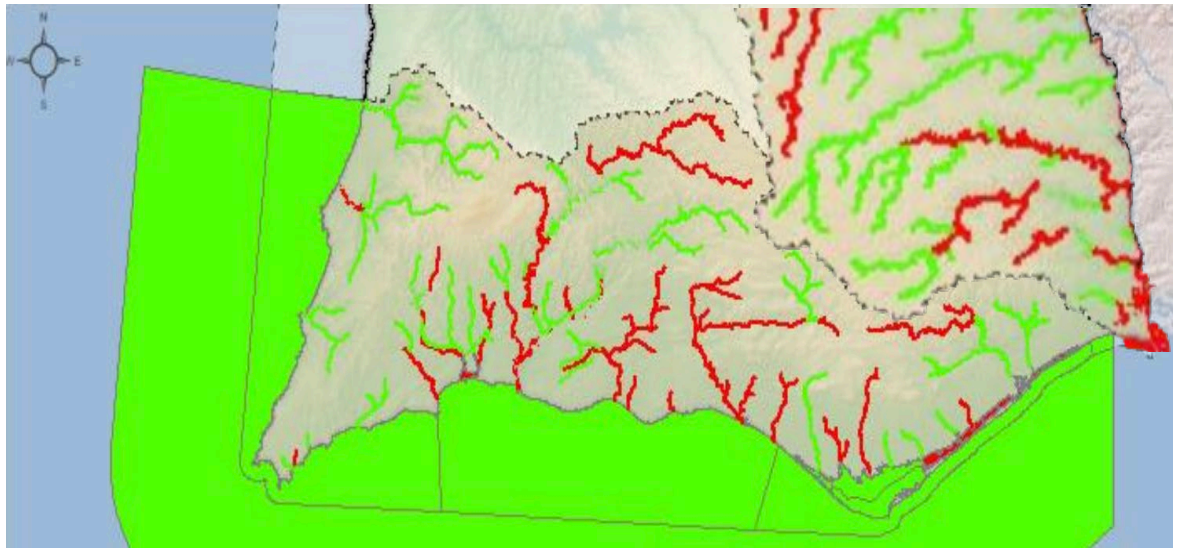
Motivation[1,2]

Water availability 8th July 2024[1]



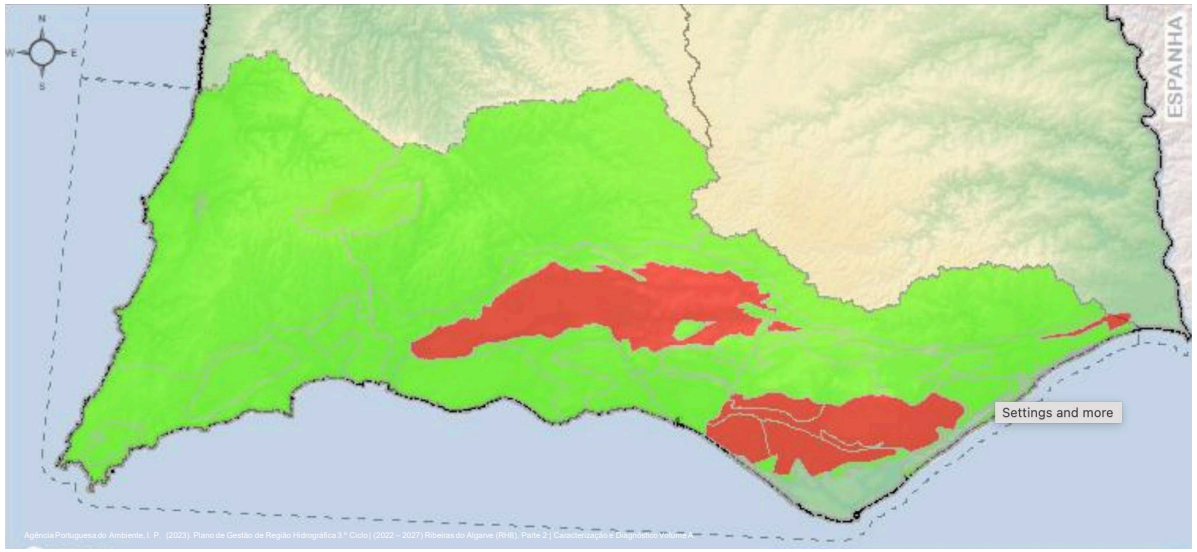
Water availability in reservoirs in CC scenarios[2]

Motivation[5,6]



Rivers and streams (Global status)

- Good and above
- Below good



Aquifers (Global status)

- Good
- Mediocre

Motivation[3]

Present

FLOODABLE AREA

20 year return period
100 year return period

2071-2100 (RCP 8.5)

FLOODABLE AREA

20 year return period
100 year return period

Research question

How can Nature-based Solutions (NbS) contribute to strengthen the resilience and adaptive capacity of Mediterranean watersheds to mitigate water-related problems?

NbS for water ecosystem services

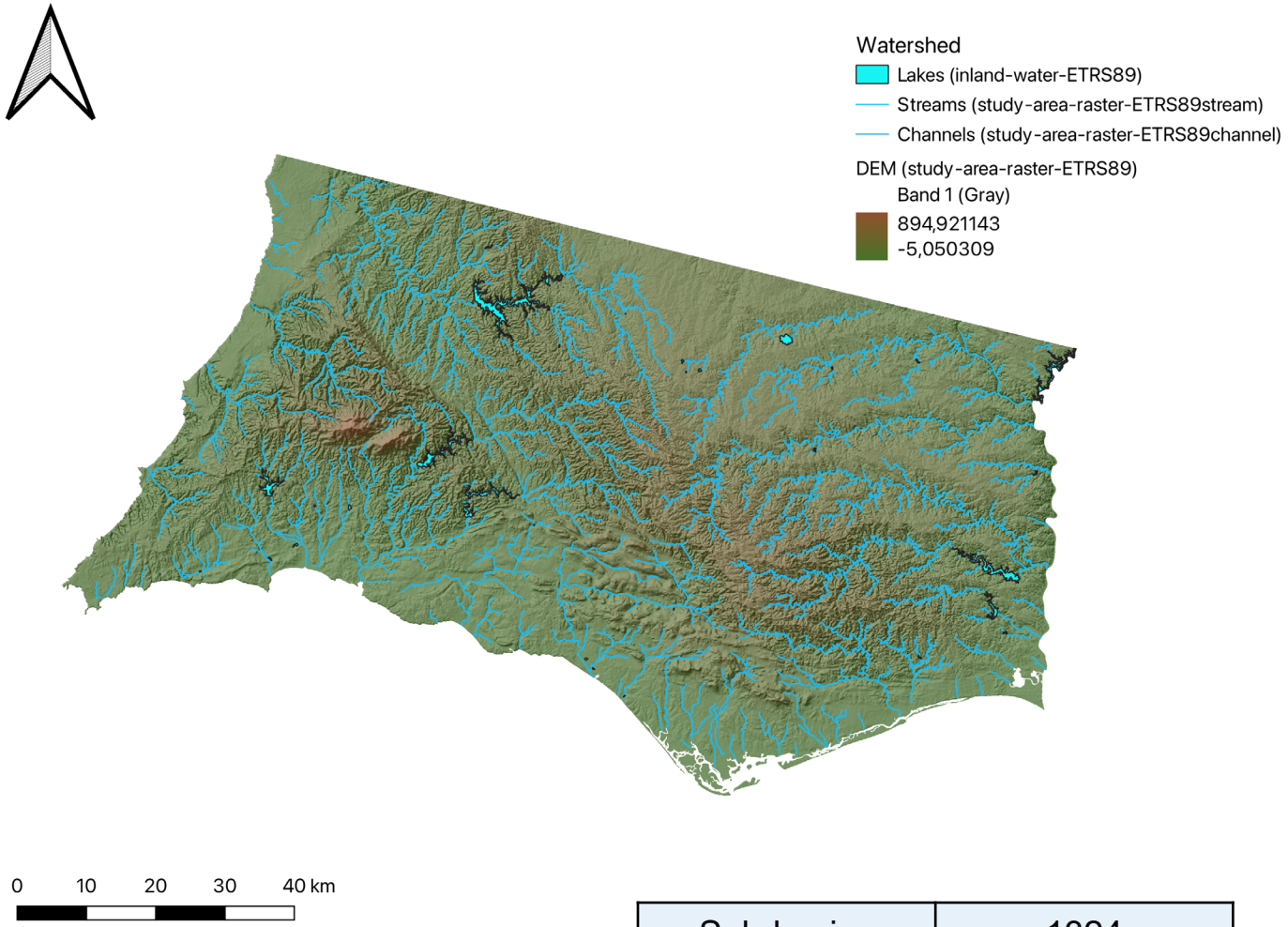
- Measure the effects of NbS on:
  - Water yield
  - Water quality
  - Groundwater recharge
  - Flood control

Integration of global change scenarios

- Assess the influence of climate and land-use change scenarios on the effects of NbS

Model setup

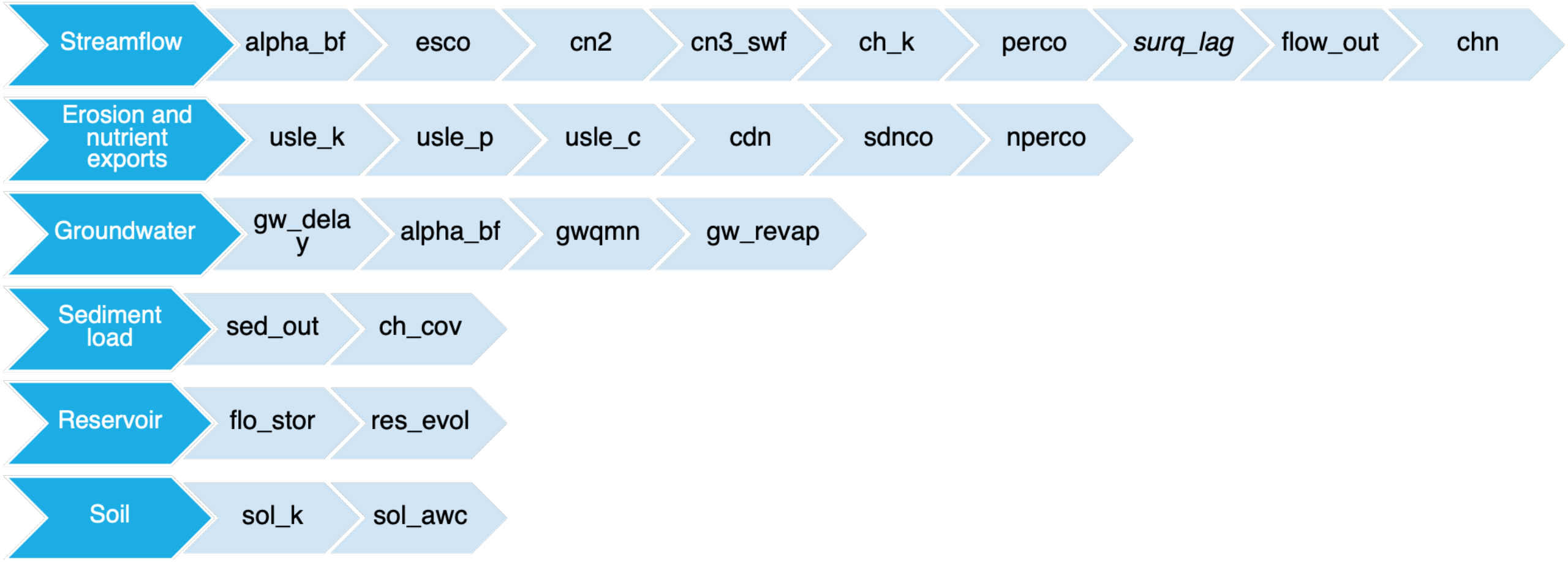
DEM	• Copernicus EU-DEM (25m res)
Hydrographic dataset	• Copernicus EU-HYDRO (stream network and lakes)
Soil physical and Land use data	• National Soil Inventory and Land Use map
Hydrometeorological and water quality data	• Portuguese Water Resources Information System • IBERIA01
Climate change	• CMIP6



Model setup

Sub-basins	1324
Soil types	20
Land uses	178

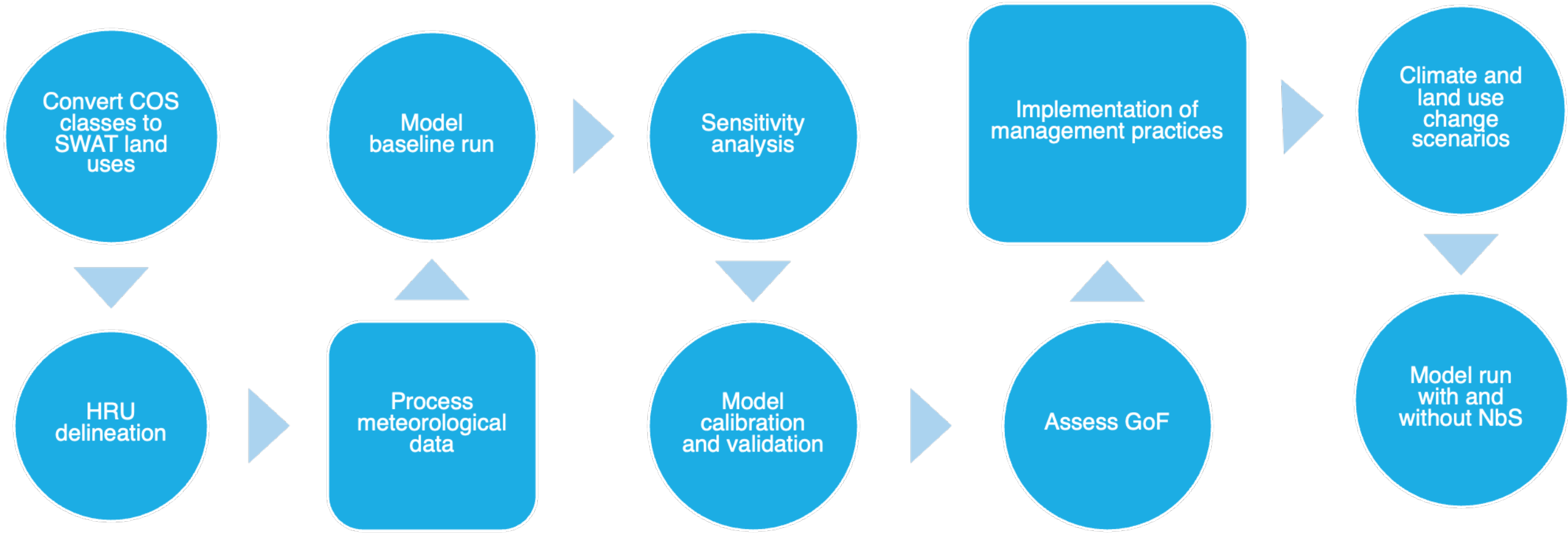
Model parameterisation[9,10,11]



Expected model outputs

Water yield	wateryld
Streamflow	surq_cha, surq_res, flo_out
Groundwater	perq, flo, stor
Soil	sol_awc
Reservoir	flo_stor, no3_stor, no2_stor, nh3_stor, flo_out
Nutrients	surqno3, no3_out, nh3_out, no2_out
Sediments	sedyld, usle

Next steps


Convert COS classes to SWAT land uses
HRU delineation
Process meteorological data
Model baseline run
Sensitivity analysis
Model calibration and validation
Assess GoF
Implementation of management practices
Climate and land use change scenarios
Model run with and without NbS

References

1. Agência Portuguesa do Ambiente I.P. (2024). Boletim semanal de albufeiras. Boletim de Armazenamento nas Albufeiras de Portugal Continental. Retrieved April 15, 2024, from https://snirh.apambiente.pt/index.php?idMain=1&idItem=1.3&n_anoH=2022

2. Agência Portuguesa do Ambiente (APA). (2024). RNA2100 – Portuguese Territorial Climate Change Vulnerability Assessment for XXI Century. National Roadmap for Adaptation 2100. Retrieved from rna2100.apambiente.pt

3. Dias, L. F., Aparício, B., C Veiga-Pires, C., & Santos, F. D. (2019). Plano Intermunicipal de Adaptação às Alterações Climáticas do Algarve, CI-AMAL (PIAAC-AMAL).

4. MedECC (2020) Climate and Environmental Change in the Mediterranean Basin – Current Situation and Risks for the Future. First Mediterranean Assessment Report [Cramer, W., Guiot, J., Marini, K. (eds.)] Union for the Mediterranean, Plan Bleu, UNEP/MAP, Marseille, France, 632pp.
ISBN: 978-2-9577416-0-1 / DOI: 10.5281/zenodo.4768833

5. Agência Portuguesa do Ambiente, I. P. (2023). Plano de Gestão de Região Hidrográfica 3.º Ciclo | (2022 – 2027) Guadiana (RH7). Parte 2 | Caracterização e Diagnóstico Volume A.

6. Agência Portuguesa do Ambiente, I. P. (2016). Plano de Gestão de Região Hidrográfica 2.º Ciclo | (2016 – 2021) Ribeiras do Algarve (RH8). Parte 2 - Caracterização e Diagnóstico.

7. MedECC (2020) Climate and Environmental Change in the Mediterranean Basin – Current Situation and Risks for the Future. First Mediterranean Assessment Report [Cramer, W., Guiot, J., Marini, K. (eds.)] Union for the Mediterranean, Plan Bleu, UNEP/MAP, Marseille, France, 632pp.
ISBN: 978-2-9577416-0-1 / DOI: 10.5281/zenodo.4768833

8. Rodrigues. M. R. et al (2024). The positive effect of Nature-based Solutions for achieving the Sustainable Development Goals in Mediterranean agroecosystems: a meta-analysis. Manuscript submitted for publication in the Journal of Environmental Management.

9. Smit, E., van Zijl, G., Riddell, E., & van Tol, J. (2024). Model calibration using hydropedological insights to improve the simulation of internal hydrological processes using SWAT+. Hydrological Processes, 38(5), e15158.Chicago

10. Abbas, S. A., Bailey, R. T., White, J. T., Arnold, J. G., White, M. J., Čerkasova, N., & Gao, J. (2024). A framework for parameter estimation, sensitivity analysis, and uncertainty analysis for holistic hydrologic modeling using SWAT+. Hydrology and Earth System Sciences, 28(1), 21-48.Chicago

11. Barresi Armoa, O. L., Sauvage, S., Houska, T., Bieger, K., Schürz, C., & Sánchez Pérez, J. M. (2023). Representation of Hydrological Components under a Changing Climate—A Case Study of the Uruguay River Basin Using the New Version of the Soil and Water Assessment Tool Model (SWAT+). Water, 15(14), 2604.Chicago

Thank you for your attention

msirodrigues@fc.ul.pt