

## **Developing a Serious Game for decision making for the water-land-food-energy-climate Nexus in Sardinia-Italy: The SIM4NEXUS approach**

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A four-year EU H2020 project “Sustainable Integrated Management FOR the NEXUS of water-land-food-energy-climate for a resource-efficient Europe (SIM4NEXUS)” started in June 2016, with an overall grant of € 7.9M ([www.sim4nexus.eu](http://www.sim4nexus.eu)). The project involves 25 partners from 15 European countries.

SIM4NEXUS has four objectives: (i) to adopt existing knowledge and develop new expertise on the water-energy-food-climate-land use Nexus; (ii) to reduce uncertainties of how policies, governance and institutions affect complex environmental systems; (iii) to showcase the implementation via a network of three regional, five national, two transboundary case studies in Europe, as well as continental and global studies; (iv) to valorise the project outputs by suitable business models.

SIM4NEXUS develops an innovative concept and methodologies to facilitate the design of policies and bridge knowledge and technology gaps in the field of the Nexus under global change. The project will develop a methodology of integration using a complexity science approach and a Serious Game (a decision-based platform that allows policy makers to play out scenarios to see what would bring the best outcome) as an integrating tool for testing and evaluating policy decisions. The Serious Game is based on Aqua Republica (<http://www.dhigroup.com/upload/publications/scribd/172629015-Exploring-the-World-of-Aqua-Republica-DHI-Case-Story.pdf>) and will cover a vast array of scenarios for all the case studies, over short, medium and long terms.

In this presentation we focus on all the stages of the development of the Serious Game for one of our Case Studies (Sardinia, Italy) which is being used as a pilot example prior to wider rollout. Specifically we detail the components and steps involved in Game development including: (i) linking thematic models (CAPRI- <http://www.capri-model.org/dokuwiki/doku.php> and E3ME- <http://www.e3me.com/>) and downscaling to regional level; (ii) climate change scenarios (using and downscaling HADGEM2 models - <http://www.metoffice.gov.uk/research/modelling-systems/unified-model/climate-models/hadgem2>); (iii) socio-economic inputs and projections (GTAP - [http://en.openei.org/wiki/Global\\_Trade\\_and\\_Analysis\\_Project\\_\(GTAP\)\\_Model](http://en.openei.org/wiki/Global_Trade_and_Analysis_Project_(GTAP)_Model)) with System Dynamic Modelling (SDM) using STELLA for the visual environment- <http://www.iseesystems.com/store/products/stella-professional.aspx> and STELLAR as an open source programming language - <http://www.r-gis.net/stellar/>); (iv) creating a Knowledge Elicitation Engine (KEE), providing nexus semantics to the outputs of the SDM and (v) generating knowledge from Serious Game user interaction. Local data from Sardinian experts and stakeholders are being used in the pilot, which has been developed with their participation.

The presentation will show results from sample scenarios and the approach to simulating uncertainties using SDM, as well as the overall data transfer and management scheme.

It should be pointed out that the process of linking thematic models to System Dynamics (Complexity Science Modelling) and creating a KEE out of this combination is, to the best of our knowledge, novel and does not exist in the literature.