

CLIMATE ADAPTATION MISSION

OVERVIEW OF PROJECT TOOLS



This overview aims to compile the different tools which are in process of development by the first four EU Climate Adaptation Mission projects ARSINOE, IMPETUS, REGILIENCE and TransformAr.

Its main purpose is to:

- Foster co-creation of and synergies between tools in the development stage
- Enable uptake of tools by other Mission projects or initiatives
- Enable the European Environmental Agency to identify tools to be integrated into *Climate-ADAPT's* Adaptation Support Tool (AST) and its steps:
 1. Preparing the ground for adaptation
 2. Assessing climate change risks and vulnerabilities
 3. Identifying adaptation options
 4. Assessing adaptation options
 5. Implementing Adaptation
 6. Monitoring and Evaluating Adaptation

This list provides a first overview, especially of tools already developed or under development, and it is structured by the Climate-ADAPT AST steps, as indicated in the below table:

		Climate-ADAPT AST steps					
Name of tool		1	2	3	4	5	6
1	ARSINOE Data Catalogue	x					
2	Hot Spot Risk Assessment Tool		x				
3	Resilience Knowledge Boosters		x	x			
4	Cascading impacts and permutable services modelling tool		x	(x)	x		
5	System Dynamics Modelling (SDM) tool		x		x		
6	Distributed Hybrid Modelling for Climate Resilience Analysis		x		x		
7	Traffic Impact Assessment Model		x		x		
8	Playbook for transformational adaptation			x	x		
9	Maladaptation self-assessment tool				x		
10	Choice experiment survey for understanding the acceptance of transformational adaptation solutions				x		
11	Socio-economic impact assessment of adaptation solutions				x	x	
12	Climate adaptation funding overview tool					x	
13	Knowledge Graph (SustainGraph)						x



These projects have received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreements no.101036560 (REGILIENCE), 101037424 (ARSINOE), 101037084 (IMPETUS) and 101036683 (TransformAr). The sole responsibility for the content of this publication lies with the authors. It does not necessarily reflect the opinion of the European Union. Neither CINEA nor the European Commission are responsible for any use that may be made of the information contained therein.

Additional tools will be developed by the projects in the coming years, thus this is a living document.

ARSINOE Data Catalogue

Description	The ARSINOE Data Catalogue will act as the single place for collecting and hosting all datasets, together with their metadata, that will be produced, generated and/or used by the ARSINOE case studies. It will offer a User Interface where these can log in and upload their datasets, while it will also be available to external users, providing access and filtering capabilities to the public datasets of the project.
Timing	The first release of the catalogue will be done in January 2024.
Link to AST steps	Step 1.
Easiness to use or adapt	The catalogue exploits open-source tools and can be adopted by other projects if needed to host their datasets.
Materials available to support the use	The catalogue offers a web User Interface, together with a REST web service which supports both user and machine-to-machine access to the information.
Comparable existing tools and possible integration or synergies	Similar tools exist in general, but in the ARSINOE Data Catalogue, a specific metadata schema has been adopted to support the description of different types of datasets for all the different case studies and the option to efficiently filter and identify interesting datasets.
Contact	ARSINOE (WP4) Panagiota Koltsida (p.koltsida@athenarc.gr)

Hot Spot Risk Assessment Tool

Description	A tool devoted to the identification of hot spot points and regions related to potential risks and hazards related to climate change. This tool considers information from COPERNICUS, EEA and other public repositories to identify potential risks.
Timing	Version 1.0 is ready and will be improved throughout the project
Link to AST steps	Step 2
Comparable existing tools and possible integration or synergies	Some similar tools exist for the collection of data from open repositories. However, the difference is in the elaboration of specific models to determine hot spots.
Added value	Elaboration of specific parametric models to calculate the hot spots.
Contact	IMPETUS (WP3) Dionysis Nikolopoulos (nikolopoulos.dio@gmail.com)

Resilience Knowledge Boosters

Description	An exploratory data tool to share data and knowledge through regions. It will be a tool to support the elaboration of climate pathways and select potential innovation actions.
Timing	Mock-up elaborated. The initial version will be ready in June 2023.
Link to AST steps	Primarily to steps 2 and 3.
Comparable existing tools and possible integration or synergies	No similar tool exists.
Added value	Data collection but also the incorporation of regional models and AI to understand the data and elaborate climatic pathways.
Contact	IMPETUS (WP2) Aitor Corchero (Aitor.corchero@eurecat.org)

Cascading impacts and permutable services modelling tool

Description	Modelling tool aiming at the assessment of direct and cascading impacts of climate-change-related hazards and the evaluation of mitigation and recovery strategies at the regional level, which include the novel idea of permutation of service nodes.
Timing	The first version is under development.
Link to AST steps	Steps 2, (3) and 4.
Easiness to use or adapt	Can be adapted for different regions and hazards with a fair amount of effort.
Comparable existing tools and possible integration or synergies	Similar tools for evaluating cascading impacts of disruptions of various types to infrastructure and communities exist (albeit much to a lesser extent for the latter one), however as the idea of permutation has not been explored and the community impacts are not being taken into account in great detail, possible synergies could be explored.
Added value	The tool provides a fast resilience assessment method (in contrast to more rigorous frameworks) that explores the novel idea of the permutation of service nodes.
Contact	ARSINOE (WP3) Mehdi Khoury (M.Khoury@exeter.ac.uk)

System Dynamics Modelling (SDM) tool

Description	System Dynamics is a computer-aided approach to strategy and policy design. The main goal is to help people make better decisions when confronted with complex, dynamic systems, based on analysis and understanding. The approach provides methods and tools to model and analyzes dynamic systems. Model results can be used to communicate essential findings to help everyone understand the system's behaviour.
Timing	The first SDM for one of the case studies is under development. Others will follow.
Link to AST steps	Steps 2 and 4
Easiness to use or adapt	It can be used by anyone but needs effort to be customised to another case study's specifications.
Materials available to support the use	The models are developed in the <u>Stella Architect</u> environment. There are also other commercial solutions.
Comparable existing tools and possible integration or synergies	Such efforts have been already done in the context of sustainability, resilience, water-energy-food (WEF) resources management, etc. Some examples can be found in [1], [2], and [3].
Added value	The SDMs will unveil hidden relationships within the complex systems that determine resilience against climate change, they will quantify interlinkages, stresses and effects, and will allow for scenario and intervention testing to facilitate decision-making.
Contact	Chrysi Laspidou (laspidou@gmail.com)

Traffic Impact Assessment Model

Description	Flood model outputs will be coupled with the Open-Source Software “Simulation of Urban MObility” (SUMO) via the use of Python scripts developed at the University of Exeter. This will allow for the simulation of potential disruption/impacts to traffic flows within the transportation network.
Timing	The development of the model for the Torbay case study is carried out in two primary stages: Develop baseline dry weather traffic flows within the city using traffic count data (where available from the local authority). Develop and couple time-series flood model outputs into transportation networks and analyse behaviours of vehicles in response to floods
Link to AST steps	Step 2.
Easiness to use or adapt	The approach outline will be adaptable to other regions.
Materials available to support the use	A collection of Python scripts will be developed along with a user guide detailing the steps required for building a model within a different region.
Comparable existing tools and possible integration or synergies	Previous works by Pyatkova et al., 2019 and Evans et al. 2020 have developed means of integrating flood model outputs into micro-scale traffic models. This work will be expanded upon for assessment in ARSINOE with the plan of linking it with other model outputs to define recovery time and use of permutable nodes.
Added value	Coupling a micro-scale traffic model with flood model data will allow for a more comprehensive assessment of flood impacts whereby the disruption of traffic re-routing to avoid flooded areas can be captured. This will emphasise how localised flooding on the road network impact regions outside the flood extent
Contact	Barry Evans (b.evans@exeter.ac.uk)

Distributed Hybrid Modelling for Climate Resilience Analysis

Description	A modelling framework and methodology aiming at integrating and operating multiple individual models synchronously to conduct the resilience analysis from the view of systems thinking. The distributed modelling framework and methodology allow effective and simultaneous communications amongst individual models. The core of the modelling is based on a hybrid simulation model that features the combination of a system dynamics approach, discrete event simulation approach, and agent-based simulation approach.
Timing	The framework is under development.
Link to AST steps	Steps 2 and 4.
Easiness to use or adapt	Can be adapted for different regions and hazards, featuring interaction between human-based event simulation and nature-based event simulation.
Materials available to support the use	The hybrid modelling is developed through AnyLogic platform.
Comparable existing tools and possible integration or synergies	Similar examples of methodology for distributed modelling exist, whilst it still lacks applications and further development. Moreover, the interaction between human-based and nature-based event simulation is still absent, which is the core demand of climate resilience analysis.
Added value	The methodology may be extended to the application of the Digital Twin approach by integrating real-time data.
Contact	ARSINOE (WP3) Prof Nav Mustafee (N.Mustafee@exeter.ac.uk) Otto Chen (c.chen2@exeter.ac.uk)

Playbook for transformational adaptation

Description	Step-by-step guidance to co-develop the way forward for a region to become climate resilient, tested in TransformAr demonstrators. It guides how to co-develop adaptation pathways, and in particular, provides guidance for engaging in stakeholder workshops. It includes specific guidance on which content to provide, what tools to use and which outcomes can be looked for.
Timing	Playbook ready, and tested in all demonstrators.
Link to AST steps	Primarily steps 3 and 4.
Easiness to use or adapt	Can be easily used or adapted. Each demonstrator did apply it in a tailored way. Estimated time for a workshop, depending on wanted detail and the number of pathways to be developed, ranging from 2 hours to 2 days.
Materials available to support the use	The Playbook document can be shared and will be posted on the TransformAr website soon.
Comparable existing tools and possible integration or synergies	Can be connected to the maladaptation self-assessment tool (REGILIENCE). The playbook is similar to the AST and similar to Deltares' dynamic adaptive policy pathways approach , but in our view, the playbook is easier to use. The Playbook will also be applied in the focus regions of the REGILIENCE project in 2023.
Added value	Providing practical guidance and examples on how to co-develop adaptation pathways at regional level.
Contact	TransformAr Jan Cools (jan.cools@uantwerpen.be) Amalie Bjornavold (amalie.bjornavold@uantwerpen.be) The playbook has been developed together with the project partners Acterra and Verhaert.

Maladaptation self-assessment tool

Description	A self-assessment question list that allows regional planners and other actors to assess the risk of maladaptation of the chosen adaptation action. The checklist shall be used in the planning phase. Then, to overcome the risks in the future, it will give users at hand some examples where adaptation planning was done thoroughly, by providing links to AST actions and maybe to the Climate-ADAPT case studies.
Timing	Version 2.0 ready by Nov 22. Later versions and training events are planned.
Link to AST steps	Primarily to step 4.
Easiness to use or adapt	Can be easily used or adapted. Estimated time for fill-in: 1-3 hours.
Comparable existing tools and possible integration or synergies	No similar tool exists. Climate-ADAPT AST is quite linked and covers several of the items, but not all.
Added value	The tool provides a full check on identifying the risks of maladaptation, rather than checking only important steps in adaptation planning and implementation.
Contact	REGILIENCE (WP3) Teresa Geidel (Teresa.geidel@fresh-thoughts.eu) Guido Schmidt (guido.schmidt@fresh-thoughts.eu)

Choice experiment survey for understanding the acceptance of transformational adaptation solutions

Description	An important challenge in transforming society towards resilience is behavioural. In TransformAr, the acceptance of climate solutions is being researched in various ways. More specifically, the following research is done: Large-scale discrete choice experiment to understand broad brush acceptance, and preference, of citizens across Europe for climate change adaptation. The choice experiment asks citizens, in a survey-based approach, to choose between options. Economic arguments are typically provided to assist the choice. Small-scale discrete choice experiment in Lappeenranta, Finland, to understand the preference and readiness of private plot owners to invest in sustainable urban drainage on their property.
Timing	Will be done in 2023.
Link to AST steps	Mainly step 4.
Easiness to use or adapt	Designed to let citizens choose easily.
Materials available to support the use	The survey will become available.
Comparable existing tools and possible integration or synergies	Not much was done for adaptation. The outcome of the experiment indicates how to prioritise solutions, and where additional enabling conditions need to be created.
Added value	Gives insights into which measures are more or less ready for implementation.
Contact	TransformAr Jan Cools (jan.cools@uantwerpen.be) Amalie Bjornavold (amalie.bjornavold@uantwerpen.be) Developed together with project partner CMCC (lead: Andrea Bigano)

Socio-economic impact assessment of adaptation solutions

Description	A variety of tools and methods are developed and applied to better understand the socio-economic consequences (benefits or trade-offs) of climate adaptation solutions. Offered are: Downscaling of macro-economic modelling to regional scale Societal cost-benefit assessment of adaptation investments Avoided damages from floods & droughts
Timing	Planned for 2023-2024
Link to AST steps	Steps 4-5
Easiness to use or adapt	Less easy.
Materials available to support the use	Results will be published.
Comparable existing tools and possible integration or synergies	Methods are readily existing but typically not applied in practice for climate change adaptation.
Added value	Socio-economic assessments are typically more scarce than compared to bio-physical impacts.
Contact	TransformAr Jan Cools (jan.cools@uantwerpen.be) Amalie Bjornavold (amalie.bjornavold@uantwerpen.be) Developed together with the project partners E3M, CMCC and PIK.

Climate adaptation funding overview tool

Description	Overview and information of available financial support on European and national levels dedicated to supporting regional climate resilience.
Timing	First version to be published in January 2023.
Link to AST steps	Primarily step 5.
Materials available to support the use	A training session will be developed under the REGILIENCE capacity building programme (2023).
Comparable existing tools and possible integration or synergies	Comparable tools exist for the focus on energy or European level only.
Added value	Easy-to-use overview of funding opportunities and well-structured first-level information on the funding source and application process.
Contact	REGILIENCE (WP2) Matthias Watzak-Helmer (matthias.watzak@fedarene.org)

Knowledge Graph (SustainGraph)

Description	<p>SustainGraph is a Knowledge Graph that considers in a holistic way the tracking of the progress towards the SDG targets and the evolution of indicators at national and regional levels, along with their relationship with specified policies and the implementation of case studies across Europe. SustainGraph is considered the basis for the systemic representation of knowledge related to the SDGs, enabling the collection and homogeneous representation of data along with their semantics and overcoming data management barriers. One of the main objectives of SustainGraph is to enable the development of participatory modeling and analysis processes (e.g., socio-environmental models), taking advantage of the semantic alignment of the represented terms and the knowledge produced through the analysis of the information that is made available.</p>
Timing	A release of SustainGraph is available (see links in the material). The evolution of SustainGraph with new concepts and new data introduced is an ongoing process.
Link to AST steps	The main relevance is with the 6th step.
Easiness to use or adapt	A user-friendly visualisation kit is going to be made available for end users. Advanced usage of the tools requires some expertise in data science concepts.
Materials available to support the use	A detailed description of the SustainGraph is available at [1]. The SustainGraph is made openly available in a GitLab repository at [2].
Comparable existing tools and possible integration or synergies	To our knowledge, SustainGraph is the first Knowledge Graph that considers the tracking of the progress towards the achievement of SDGs at the national, regional and local levels. SustainGraph is going to be interoperable with the ARSINOE Data Catalogue. An integration with open-source modelling tools would be very beneficial.
Added value	Enable interdisciplinary scientists to do participatory socio-environmental systems modelling over qualitative and semantically-aligned data. Monitor and assess progress within the case studies to achieve posed targets based on the tracking of various indicators.
Contact	ARSINOE (WP4) Anastasios Zafeiropoulos (tzafeir@cn.ntua.gr)