



Earth systems have existed in balance for millions of years, but recent human development has yielded unprecedented influence on global ecosystems and climate. Yet, in this interconnected world, we still have an isolated understanding of how urban-ecological systems interlink, and human society is struggling to cope with rapid urbanisation. Our efforts to accommodate for these populations will not be sustainable without holistic service planning and ecosystems preservation which supports human life.

As part of the solution, The Ecological Sequestration Trust is developing the **resilience.io** platform, a resource-economic human ecosystem model that will map a city region’s environmental, social and economic resilience, provide the ability to measure effects of infrastructure and policy decisions and help evidence the value of investment in resilient projects leading to transformational change.

The model will provide four high level functionalities for investment and decision-making at city, regional and national scales:

- A ‘system of systems’ approach which identifies human society as a set of systems within an ecosystems context with tight knit interrelationships acknowledged. Different scenarios for development interventions can then be assessed and tested.
- The capture of inclusive metrics, with resource and financial costs expressed as indicators, across environmental, economic, and social domains.
- A tool to help with i) evaluating on the ground decisions, taken by local stakeholders in the context of strategic issues; ii) addressing societal challenges; and iii) achieving city-wide goals.
- Universal access to knowledge, data and information for stakeholders globally.

The **resilience.io** modelling objective is aimed at the **spatial representation of a city**, its supply hinterland, and connections to the outside world. **Users** will be able to

input different scenarios (e.g. combinations of technology and policy interventions) to test them. Model outputs can be used as an evidence-base for decisions taken in a city-region. Insights will be delivered through a substantial set of **indicators**, including those relating to the UN Sustainable Development Goals and Sendai Disaster Risk Framework, to evidence how a city-region is performing. The vision is that this **open source** model will be available to city-regions across the world as a tool for guiding long-term transformational change.

**Collaborative use** of the model will support community-led development which is the key to achieving transformational outcomes. Stakeholders will drive an iterative process to develop **intuitive user cockpits** configured to visualise and explore the environmental, social and economic effects of scenario and policy proposals.

For example Ms. R. works in the planning department of a municipality with a large informal settlement at its centre. She uses **resilience.io** within the context of **city regional development** to simulate population and economic dynamics in the area. Using output metrics, she gains insights into how the city can best support the livelihoods of the slum population, based on different planning decisions, e.g. no action vs. the city investing in basic infrastructure vs. relocation of the settlement.

**resilience.io** can also be applied to **technology choice evaluation**, for example, Mr. S. lives in a city with increasing traffic and diesel scooters. He is the owner of a business selling locally made vehicles and is starting to diversify into imported electric scooters. He uses the model to simulate current impacts of diesel vehicles and associated pollution flows, plus their detrimental effect on people’s health and well-being. Additional simulations illustrate how these impacts are ameliorated if the population is encouraged to purchase electric scooters, through supportive policies such as a phased ban on diesel scooters and a subsidy program for electric scooters.

**What should the model do**

- Provide a solutions driven user experience
- Integrate a number of key models adapted to user needs
- Generate a resource driven picture of the economy
- Establish a spatial map of a city region
- Simulate agent behavior and impact on resource flows
- Simulate supply, demand and market exchange and impact on agent behavior

**What information will it provide?**

- Insights for key user questions
- Defining the initial state of city-regions
- The examination of future developments
- The evaluation of decision options and impacts
- Model results as outcome indicators
- Representing a realistic view of outcome uncertainty

**How will resilience.io be used ?**

- Collaboration and policy-making
- Integrated planning
- Investment and procurement
- Economics and circular economy
- Learning and research