UCAT – URBAN CLIMATE ADAPTATION TOOL

A screening tool for climate adaptation solutions

Challenges of our cities in relation to climate adaptation

The short version:

- Huge challenges, numerous solution options, many stakeholders

- Not that many tools that can help creating and keeping an overview and support the stakeholder dialogues…

Creating and maintaining climate adaptation master plans

A master plan for climate adaptation typically includes:

Value distribution maps

Flood inundation maps (aka bluespot maps)

Which are combined to create:

Flood risk maps

The maps are the basis for:

4. Prioritizing areas of concern – selecting an overall structure of the master plan
5. Cost-benefit analyses
6. Sensitivity analyses

This process is cyclic. Everything needs to be updated regularly as new facts and data emerge.

Based on recommendation developed by professionals

UCAT builds on recommendations for rational implementation of climate adaptation solutions developed by the of Danish Society of Engineers.

UCAT supports all steps in the development of a climate adaptation master plan, typically including:

- **Risk maps**

UCAT enables the user to conduct an overall cost-benefit analysis of existing and planned climate adaptation solutions starting from either:

- a **cost-benefit-analysis**, or
- a (differentiated) **service level** for water on the surface

Value distribution maps

The primary benefit of having detailed value distribution maps is to establish an overview over the areas where the most severe damages could occur in case od flooding.

Physical assets are an important subset of the values.

UCAT includes a tool which creates value distribution maps based on extracts from building asset databases. The tool can also take immaterial values into account.

In UCAT the value distribution maps establish the reference for a mapping of damage curves. These are in turn used in the computation of risk maps.

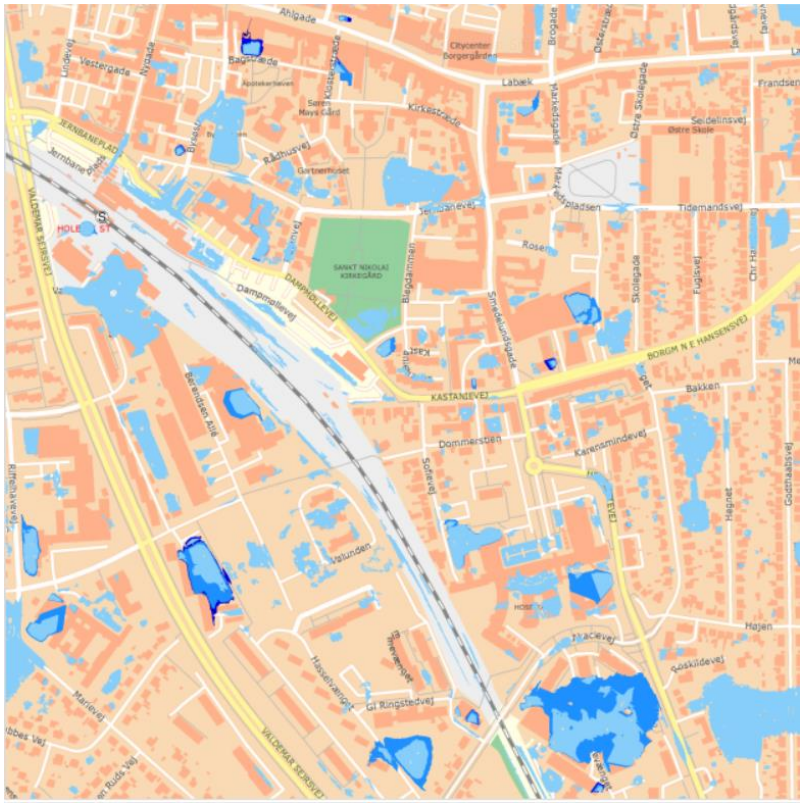
Flood inundation maps

Flood inundation maps (blue-spot maps) are produced using modelling tools. These use terrain elevation maps as input together with precipitation data (cloud burst estimates) or coastal water level statistics (for storm floods).

For screening purposes, non-dynamic models are inexpensive, easy to use and sufficiently accurate.

For detailed assessments or for final verification, it may be more appropriate to use results from a fully dynamic model.

UCAT requires blue-spot maps corresponding to return periods that cover the range of events, which can be expected to contribute significantly to the total flood damage pattern.



Risk Maps

Risk is calculated in terms of the estimated annual damaged (EAD) caused by cloud bursts or/and storm floods:

$$EAD = \int_{x_{T_S}}^{\infty} D_x(x_T) f_x(x_T) dx_T$$

In which

x_{T_S} is the smallest event which causes damages,

$D_X(x_T)$ is the cost associated with the event x_T, and

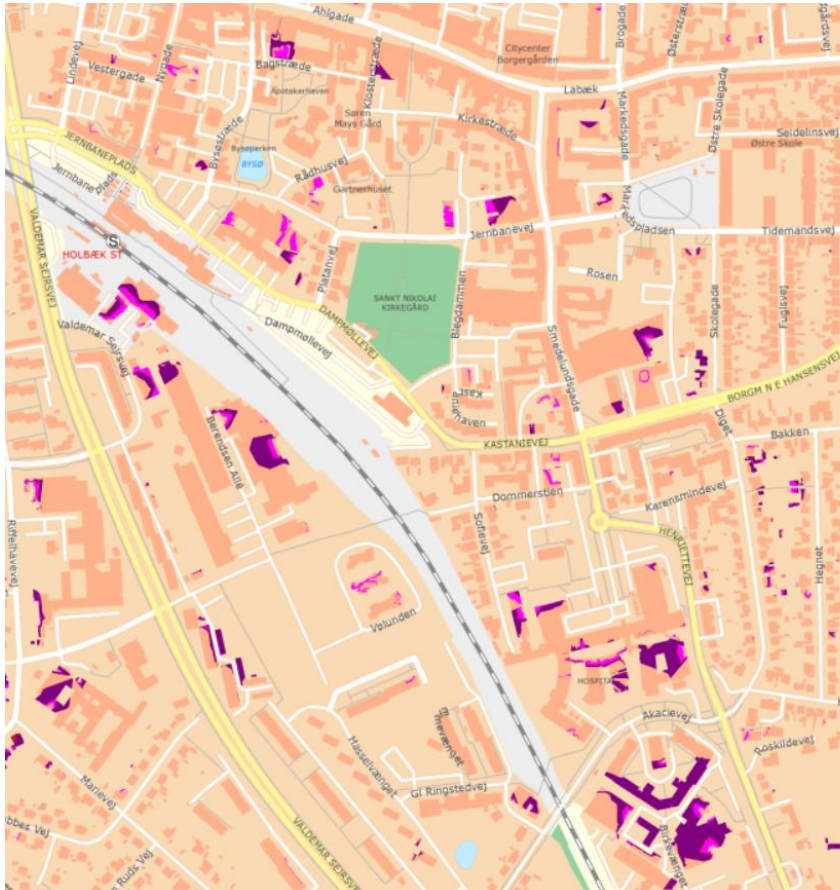
$f_X(x)$ er probability density function for annual maximum events and the probability p = $^1/_T$

Risk Maps

The risk of physical damages depends on the values of assets in a certain area combined with the vulnerability of these assets. EAD is calculated for each cell of a map. The output is a detailed risk map for the specific area (community, city, catchment).

The Risk Map is used for identifying areas
of high risk where it is most important to develop mitigating solutions.

UCAT uses a database of damages associated
with the flooding of different asset types – drawn from insurance records. The user may edit this data as needed.



Construction and operation of climate adaptation solutions

The optimization process also requires estimates of the costs associated with the construction and operation and maintenance of climate adaptation solutions. These costs can be expressed in terms of the costs per year (CPY) during the lifespan of the solution - using a net current value as the basis:

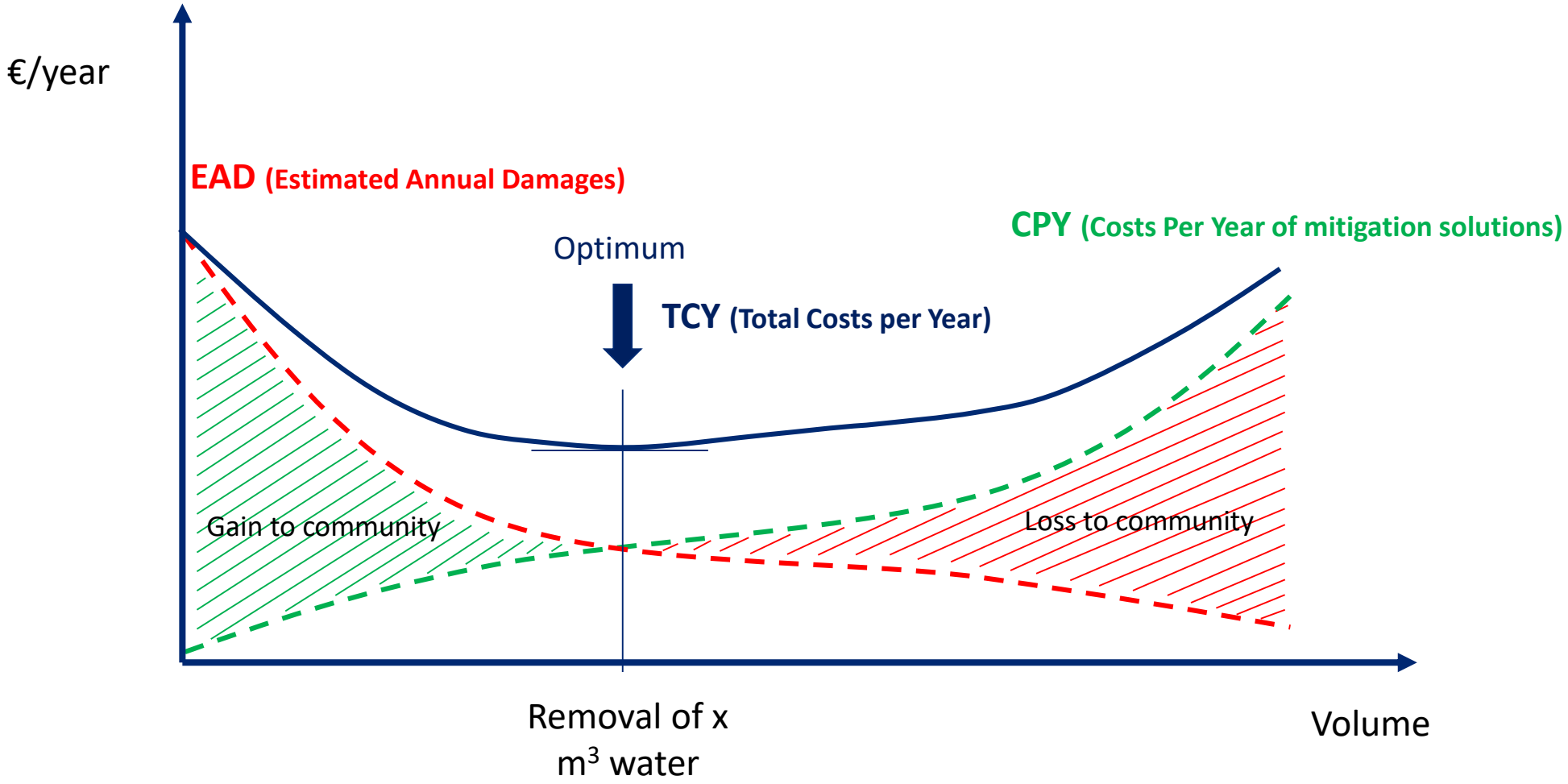
$$\text{NCV} = \sum_{t=t_0}^{t_e} \frac{Benefit_t - Cost_t}{(1+r)^t}$$

In which $Benefit_t$ og $Cost_t$ are benefits (such as property value increases) and costs for year t, r is the is the discount rate and t_0 og t_e are start and end years corresponding to the lifespan of the solution.

UCAT includes an extensive database of climate adaptation solutions with corresponding cost estimates. The database allows for localization of the cost levels to each new country or region.

Optimizing the solutions

Main principles:

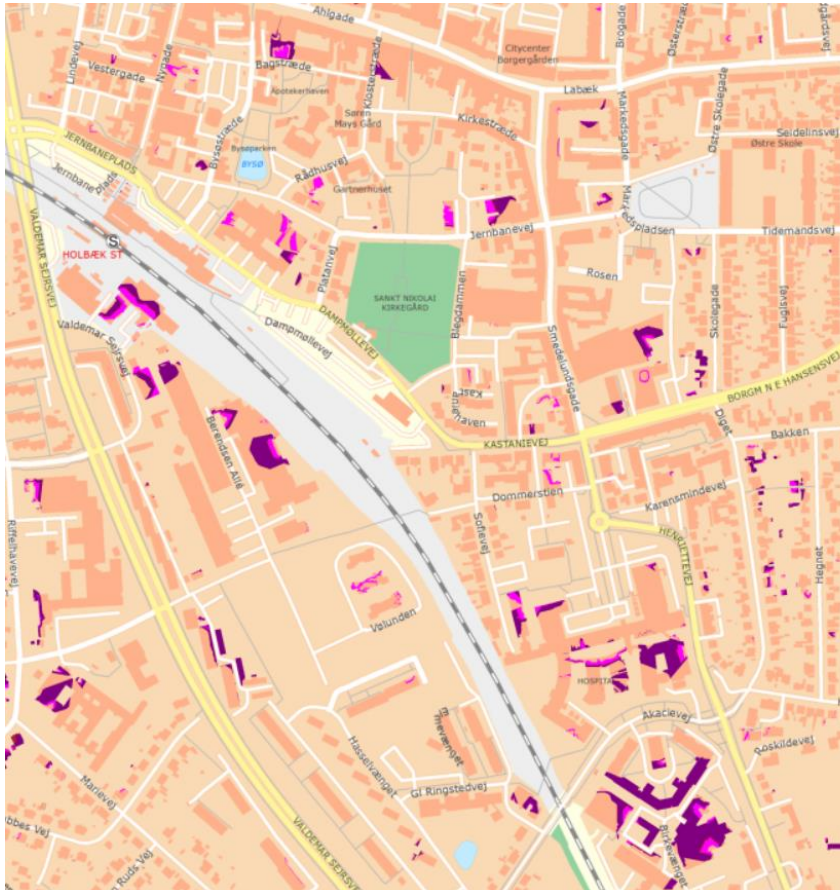


Risk Maps - Results

The output from UCAT includes:

Risk Maps and financial key figures **before and after** implementation of the optimal combination of climate adaptation solutions.

UCAT can also calculate before and after maps and financial figures for any other user specified set of climate adaptation solutions. That could include solutions based on a fixed budget or solutions tailored to a specific service level.



Typical application areas

- UCAT can be applied in the optimization of mitigating measures for cloud bursts as well as sea level rise and storm floods

- UCAT is well suited for sensitivity analyses in relation to climate adaptation measures

Why use UCAT?

- The city/utility can save costs for consultants by taking care of the early screening of solutions themselves.

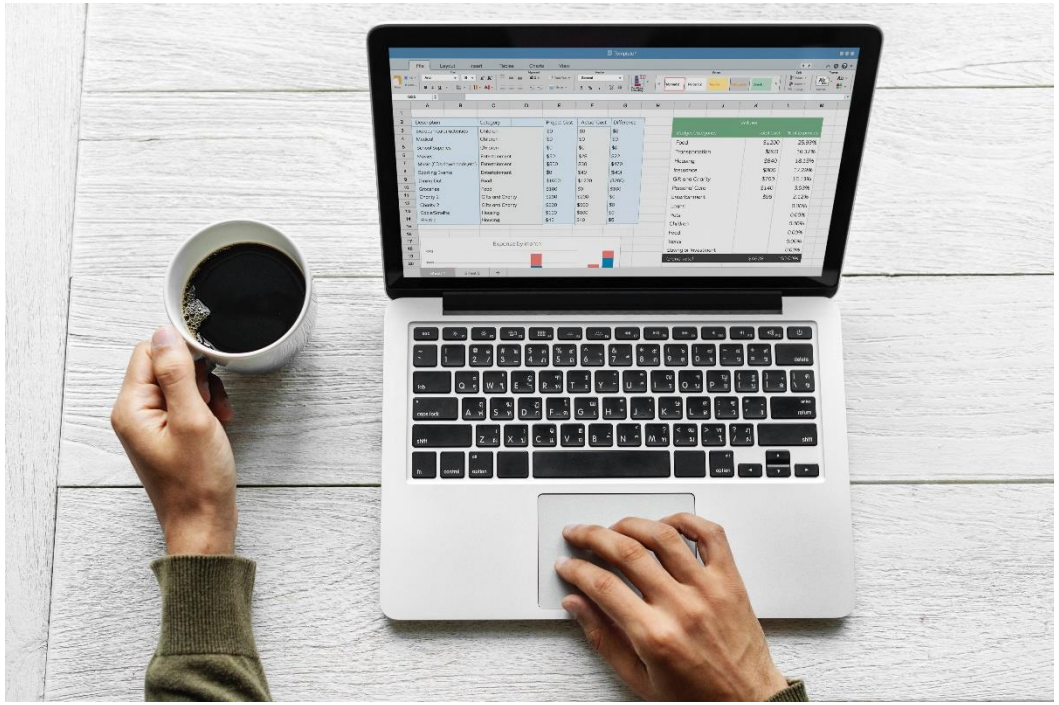
- The project manager of the city/utility will be more efficient in his/her interactions with and management of consultants, designers and construction companies.

Why use UCAT?

- Create a quick overview of the cost-benefit to society of any combination of climate adaptation measures

- The user doesn’t have to be an expert – neither within climate change, engineering, nor within financials - in order to harvest the benefits of UCAT

- The user will be much better qualified to manage dialogues with citizens, politicians and other stakeholders.



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