

Three decades of Nature-based Solutions in the Netherlands: Assessing their contribution to national Climate Resilience

Trois décennies de solutions fondées sur la nature aux Pays-Bas : évaluation de leur contribution à la résilience climatique nationale

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RÉSUMÉ

L'adaptation au changement climatique exige des approches novatrices pour favoriser l'échange collaboratif de connaissances et la résolution multidisciplinaire des problèmes. Depuis plus de dix ans, ClimateScan propose une plateforme open source permettant de cartographier la résilience urbaine et les solutions d'adaptation au changement climatique mises en œuvre dans le monde entier. Outre la fourniture de données, cet outil soutient également une démarche de science participative, contribuant ainsi à l'implication active des parties prenantes. Cette étude vise à développer et à appliquer des méthodes de calcul et des techniques de visualisation à la base de données afin de générer une compréhension approfondie des modèles d'adaptation au changement climatique et de leur contribution à la résilience urbaine aux Pays-Bas. Les premières indications issues des données analysées montrent que les capacités de stockage des infrastructures intégrées de gestion des eaux pluviales, telles que les noues de biorétention et les zones humides, ont considérablement augmenté au cours des 20 dernières années, atteignant un volume de stockage minimal de près de 1,6 million de m³. Cette tendance est manifeste aussi bien dans les grandes agglomérations que dans les petits villages, soutenant ainsi des stratégies d'adaptation au changement climatique durables. Grâce à l'utilisation de cet outil open source, il est possible d'impliquer un large éventail de parties prenantes dans le développement de la base de données pour une zone spécifique, créant ainsi un « ADN d'adaptation au changement climatique » détaillé pour chaque cas d'étude.

ABSTRACT

Climate adaptation requires innovative approaches to address collaborative knowledge exchange and multidisciplinary problem solving. For over a decade, ClimateScan has provided an open-source platform to map urban resilience and existing climate adaptation solutions implemented all over the world. Apart from providing data, this tool also supports a citizen science approach, contributing to active stakeholder engagement. This study aims to develop and apply calculation methods and visualisation techniques to the database in order to generate comprehensive insights into climate adaptation patterns and their contribution to urban resilience in the Netherlands. Initial indications of analysed data show that storage capacities of integrated stormwater infrastructure, such as bioswales and wetlands, have increased significantly over the last 20 years resulting in close to a minimum of 1,6 million m³ storage volume. This trend is evident in both large urban areas as well as small villages, thereby supporting sustainable climate adaptation strategies. Through the application of this open-source tool, it is possible to engage a wide range of stakeholders to contribute to developing the database for a specific area, thereby creating detailed 'climate adaptation DNA' per study case.

KEYWORDS

Knowledge exchange, stakeholder engagement, climate resilience, open-access mapping tool, climate adaptation DNA, échange de connaissances, mobilisation des parties prenantes, résilience climatique, outil de cartographie en libre accès, ADN d'adaptation au climat

1 INTRODUCTION

1.1 Introduction

Given current climate and urbanisation challenges, there is a clear demand for collaborative knowledge-sharing on climate adaptation and mitigation strategies. From 2014, approximately 22.000 climate adaption projects have been uploaded on the open-source database ClimateScan.org (Boogaard et al 2017). This paper describes capacity calculations of this database to get basic insights in (inter-)national climate adaptation. Municipalities and water authorities, in particular, need insights in the following (research question):

the type and amounts of measures and the related water storage volumes of nature-based solutions: most NBS are implemented on street or house level without knowledge of their contribution (amount and volume) on the national and regional climate adaptation ambition or demand of a city or a country.

1.2 Method

To answer the research question, a large dataset is required of sustainable urban drainage systems (SuDS) or nature-based solutions (NBS). The open-source citizen science platform ClimateScan mapped over 21.000 projects related to climate adaptation around the globe in 10 years with an average of more than 3000 registered users uploading projects on account of the openness of the website and active online and offline promotion. The platform is the is one of the largest inventories of nature-based solutions projects around the globe used for international knowledge exchange (EEA, 2021 & Restemeyer & Boogaard 2021).

ClimateScan collects climate adaptation locations from all over the world [Restmeyer & Boogaard, 2021]. The global platform can be used as a first step to collect data and share the knowledge on realized climate adaption measures of a certain city or region and compare this to other parts of the world. The tool ClimateScan focuses mainly on the topics surrounding the areas of urban resilience and climate proofing and climate adaptation. The main objective of this interactive international open access platform is knowledge exchange on climate adaptation projects through the platform itself and the connected social media channels such as Twitter, Instagram and Facebook. The online citizen science, knowledge-sharing platform ClimateScan.org contributes to accelerated climate adaptation by promoting more green and blue spaces in urban areas. Basic insights can be made from the projects that contain information on the category and location and additional info (if available: photos, videos, research papers and data). Currently, all the data points are categorized into 7 sub-groups (Water, People, Nature, Heat, Energy, Urban Agriculture and Air quality) holding over 20 categories, which are each assigned a different colour as shown in the legend to the left of the webpage.

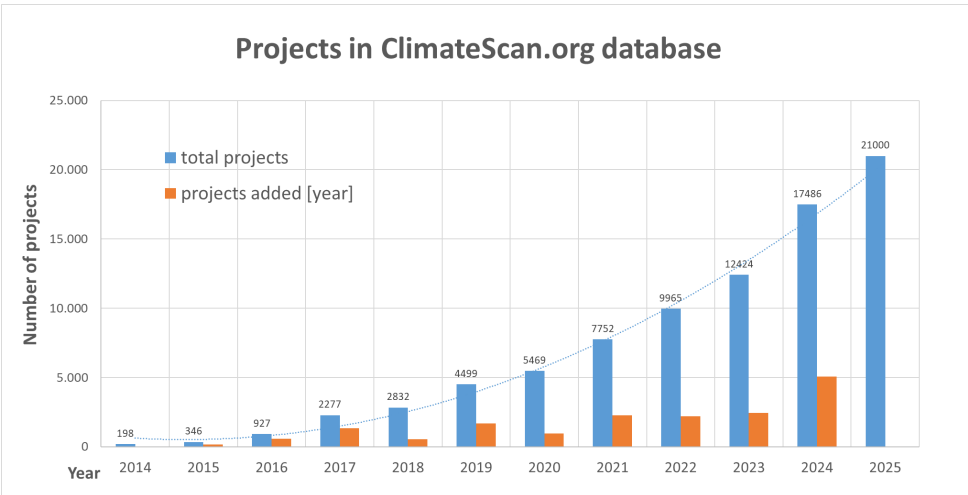


Figure 1 amount of projects in 10 years

Most of the uploaded projects belong to categories related to NbS, SuDS, WSUD and blue-green infrastructure that are designed to reduce the rate and quantity of surface water runoff from developed areas and to improve runoff water quality. Uploads on ClimateScan include constructed wetlands, bioswales, green roofs and walls, permeable pavements, rainwater gardens, and floating structures on public and private property (Table 1). Figure 2 shows the number and distribution of projects in the world.

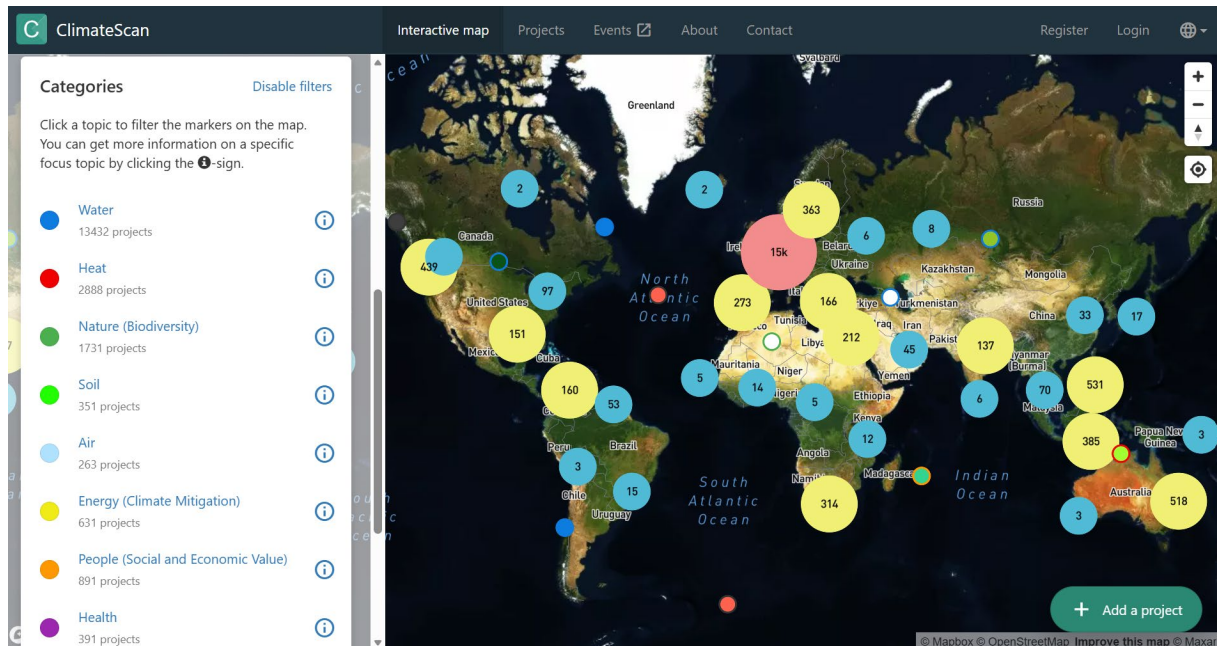


Figure 2 global spread of 22000 projects on climatescan.org

2 RESULTS

Calculation water storage volume distribution of NBS

To determine the dimensions of the green infrastructure there are two types of input from ClimateScan:

1. The surface (length and width) is determined from polygon of ClimateScan projects. Large surfaces of $>10.000m^2$ (unlikely in urban dense area) are checked or removed.
2. If no polygon is available (a point) the average is taken of all points in that category. The depth is estimated according to guidelines in table 1. Note that the presence of green infrastructure doesn't mean that its effective, therefore conservative depths are used for this first calculation.

Table 1 Estimation of depth of the green infrastructure in calculations.

category /number of mapped objects in The Netherlands	Dimensions [m]	Depth [m] For calculations
(Bio)Swale 3400	According to guidelines swales have an average slope of 1:3. Depth average 0.3m and maximum 0.5m.	0.2
Raingarden 117	Raingardens (often without slopes as the bio-swales) are 0.3-0.5m deep. With swales we can refer to 'biofiltration' but raingardens regularly have more storage depth.	0.3
Green roof 865	Most green roofs are flat allowing more than 0.1m water height as storage but there is also a high amount of green roofs with a slope. 'Blue roofs' allow a water depth up to 0.5m.	0.1
Permeable Pavement 1100	Four types of pavements with different constructions. Most will allow a water depth more than 0.1m and have storage underneath. Since clogging and low permeable infiltration rates are determined, a water depth of 0.05 m is used in the first calculations.	0.05
Constructed Wetland 172	Constructed wetlands allow 0.3-0.5m water depth as storage	0.3
Retention pond 250	Retention ponds allow a water level rise of at least 0.2m since isolated ponds usually have no overflow, for water quality reasons they are often connected with circulation measures and the lowest overflow height will dictate the maximum level.	0.2
Watersquare 31	Watersquare allow almost in every case a water depth of >0.5 m as storage volume.	0.5

Conclusions

First, national calculations of all Dutch NBS show that at least 1.604.840 m³ of storage volume has been created in the last 20 years in the Netherlands for climate adaptation. Large cities score well in volume and number but related to the population small villages often score higher. In the process of calculations and visualisations we came across some basic improvements to have more accurate outcomes which we will discuss with frequent users of ClimateScan:

- Use polygon to sketch the shape of the project for more accurate calculations.
- Evaluating the platform with an increasing number of expert users.
- Detailed check on outcomes of the data with stakeholders from municipalities and water authorities.

LIST OF REFERENCES

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