

## **Climatescan.nl: the development of a web-based map application to encourage knowledge-sharing of climate-proofing and urban resilient projects**

**J. Tipping\***, **F. Boogaard\*+\*\***, **R. Jaeger\*\*\***, **A. Duffy\*\*\*\***, **T. Klomp\*\*\*\*\***, **M.Manenschijn\*\*\*\*\***

\* Hanze University of Applied Sciences, Zernikeplein 7, P.O. Box 30030, 9700 RM Groningen, the Netherlands; E-Mail:

[j.j.tipping@pl.hanze.nl](mailto:j.j.tipping@pl.hanze.nl)

\*\* Tauw bv, PoBox 133, 7400 AC Deventer, the Netherlands; E-Mail: [Floris@noorderruimte.nl](mailto:Floris@noorderruimte.nl)

\*\*\* Technische Universität München, Arcisstraße 21, 80333 München, Germany, Email: [Rick.jaeger@tum.de](mailto:Rick.jaeger@tum.de)

\*\*\*\* Abertay University, Kydd Building, Bell St, Dundee DD1 1HG, Email: [A.Duffy@abertay.ac.uk](mailto:A.Duffy@abertay.ac.uk)

\*\*\*\*\* Municipality Hoozevee, Raadhuisplein 24 7901 BW Hoozevee, Email: [t.klomp@dewoldenhoogeveen.nl](mailto:t.klomp@dewoldenhoogeveen.nl)

\*\*\*\*\* Water Authority Reest en Wieden, Blankenstein 540, 7943 PA Meppel, Email: [m.manenschijn@reestenwieden.nl](mailto:m.manenschijn@reestenwieden.nl)

### **Abstract:**

Over recent years, there has been an explosion in the number and diversity of projects undertaken to address urban resilience and climate proofing. Sharing the knowledge gained from these projects demands increasingly innovative and accessible methods. This paper details the outcomes of one such initiative: an interactive web-based map application that provides an entry point to gain detailed information of various ‘blue-green’ projects. The climatescan.nl has proven to be a successful tool in several international workshops, not only for field-based practitioners but also for those involved in teaching and research. Further upscaling is needed however if the full potential of such an application is to be achieved.

**Keywords: climate adaptation; urban resilience; international knowledge sharing**

### **Introduction**

In the field of urban resilience and climate proofing there has been a surge of innovation and creativity in recent years resulting in a vast diversity of solutions responding to specific local needs. The Netherlands, in particular, has been at the forefront of much research and experimentation in areas of floating buildings, green infrastructure and sustainable urban drainage systems or SUDS (permeable pavements, swales, helophyte filters, etc.). The decentralised and relative small-scale nature of these interventions mean that they are often not widely publicised or information available is fragmented and difficult to access.

It is also apparent that the rise of the digital-age means that traditional forms of information transfer (books, journals, proceedings) need to be supplemented by different media formats and platforms. Much of the project and research data relevant for those working and studying in this field is in the form of photographs, videos, digital drawings and web-based sites.

Collaboration amongst water professionals for more sustainable water management is a fundamental requirement of the EU Water Framework Directive (EC, 2000) and the INSPIRE Directive aims to ensure that spatial data infrastructures are compatible and usable in a community and transboundary context, requiring that common Implementing Rules (IR) are adopted in a number of specific areas (Metadata, Data Specifications, Network Services, Data and Service Sharing and Monitoring and Reporting). To this end, visualisation and interaction plays an important role in water management. Innovative tools are used as communication aids to promote engagement with stakeholders in the field of climate change

and related environmental issues. Examples of tools that are used on an international scale are: 2D/3D flood visualisation (e.g. Blanksby et al., 2012, Verlaat et al., 2015), ‘serious’ games (Jefferies et al., 2012, augmented reality (Boogaard et al., 2012), an immersive and non-immersive 3D virtual city: decision support tool for urban sustainability (Isaacs et al., 2011) and interactive sessions with tools like a touch-table (Figure 1).



**Figure 1: examples of interactive tools to promote engagement with stakeholders: touch tables, augmented reality and serious gaming**

The internet has become the de-facto platform to store, filter and translate knowledge into these new formats. Any new information sharing tool must utilise the benefits the internet offers, while at the same time acknowledging and tackling the numerous challenges, one of which is the necessity to respond to user needs and not simply opt for a one-way, supply-driven approach (Hammill *et al*, 2015). In order to gain the greatest participation by the user, a knowledge sharing system must be both easy to use and also be perceived as being useful (Hall, 2001).

In view of the above, a research group from the Centre of Research & Innovation for Built Environment (Hanze University of Applied Sciences) has been investigating ways in which information on local climate proofing and adaptation initiatives can best be shared. This article describes one of the outcomes of this project: an interactive online map application that provides an easy-to-access database of international project information in the field of urban resilience and climate adaptation. The stages of development of the application will be discussed along with the future plans and expectations.

## **Material and Methods**

### **Pilot Groningen**

The internet site, [climatescan.nl](http://climatescan.nl), was originally developed by honour students of the Hanze University of Applied Sciences to map high flood risk areas, or ‘wet spots’ in the Province of Groningen in 2013. The aim was to collate information from various sources into one comprehensive database. The information collected ranged from TV news reports to residents’ own videos of flood events posted on youtube. The map based format ensured the information could be easily accessed and reviewed by practitioners in Groningen involved in flood resilience planning. The data was able to support the tasks of prioritising risks, evaluating flood models and designing appropriate remedial measures. A screen snapshot of this stage in the website development is shown in Figure 2.



# AMSTERDAM INTERNATIONAL WATER WEEK



Figure 2: Snapshot of Groningen Wetspots Map

The *climatescan.nl* application utilises the free Google Maps platform which was chosen as it is the most popular online mapping service and is arguable the unofficial industry standard. Most internet savvy users are very familiar with this service and are able to easily manoeuvre around such a site. In addition, Google Maps has a free service (Google Maps API) that allows developers to integrate the maps into their external websites on to which specific data can be overlaid.

The positive response by the municipality and other stakeholders to the 'wet-spots' website led to an initiative to develop the application further. The goal was to provide a universal tool where information about innovative, international 'green-blue' climate adaptation projects could be uploaded and shared with the wider global community. The application was first piloted in Groningen Province working with the local authorities, research institutions and private companies to determine what information was needed by the potential users of the website and how it should best be presented. The *climatescan.nl* application was first launched (see Figure 3) at a climate toolbox experience day in March 2014 that was organised by Hanze University of Applied Sciences Groningen, STOWA and SBRCURnet (Hanze, 2014). This event enabled experts and practitioners in the field to experience climate change and best management practices by participating in several workshops; fieldtrips to several sustainable urban drainage systems, observe a full scale test on permeable pavement and a 3D visualisation of a flood- and heat stress model with the opportunity to 'fly' to any location in the city and discuss the problem areas and possible solutions (Figure 3). At this stage the *climatescan.nl* application illustrated problem locations identified in the Groningen region along with numerous adaptation initiatives, including green roofs, swales, permeable pavements, constructed wetlands and water-squares. The advantage of presenting at the climate toolbox day was that professionals from all over the Netherlands had the opportunity to test, review and provide feedback on the map application. It was clear that the participants of the workshop were very supportive of this information-sharing initiative.



Figure 3: Launch of climatescan.nl in March 2014 with over a hundred participants (left), full scale permeable pavement test (middle) and 3D visualisation of flood mapping and heat stress in Groningen (right).

### Pilot Hoogeveen

A follow-up, second pilot project is currently being implemented in Hoogeveen with the Municipality and the Water Authority: Reest and Wieden. As a first step, a small number of problem flood locations have been identified by the municipality and uploaded onto the website (Figure 4). Over the coming weeks, all the major problem flood locations will be uploaded along with a number of innovative solutions that will be or have been implemented in the region.

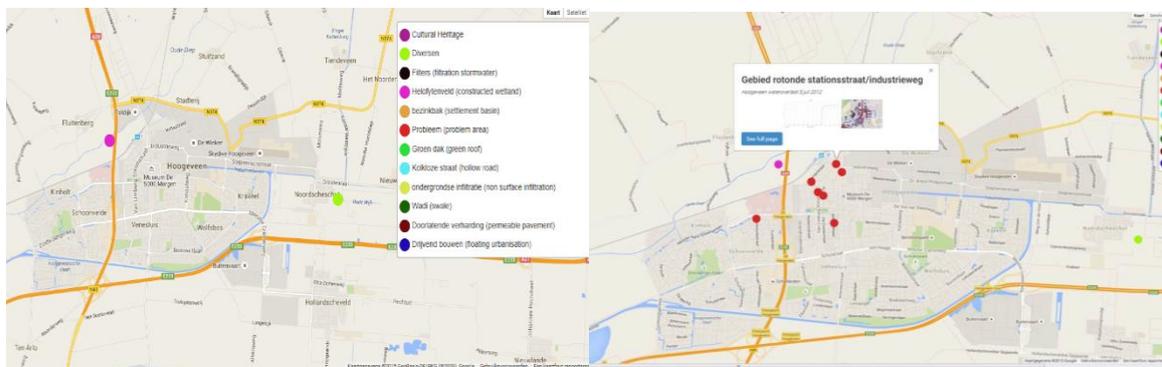


Figure 4: Development pilot study in Hoogeveen (August 2015). Categories with some points of interest (left), problem areas mapped where measures will be designed and implemented after workshops with stakeholders.

The design of the mapping application enables the user to click on a location point where a pop-up appears providing the name of the project, a brief overview, thumbnails of images and diagrams, and a link to a full page site (see Figure 5). This full page site provides more data including detailed descriptions, (scientific) papers, video clips and further information and contact details.



**Figure 5: Screenshots showing design on pop-up and full-page information**

As alluded to in the introduction, the results and analysis data for much research in this field is in the form of digital media (videos, photographs, maps, diagrams, etc). By far the most effective way to store and share this content is via online platforms. It was found by most of the stakeholders involved that the *climatescan.nl* application was an ideal resource for managing such research data. Any form of digital data, be it youtube clips of experiments or urban flood maps, can be uploaded and incorporated onto the map. In addition, most of the research data within the theme of urban resilience and climate proofing is location specific which allows research data to be collated for a particular planned or constructed project. Using a spatial API online tool such as Google Maps, allows users to quickly and easily search geographic data in a much more user friendly way than more structured online databases (Bell *et al*, 2007). It is much simpler and more attractive to zoom in on a map to a known location than search a list of documents.

An example of how *climatescan.nl* has been used for storing and sharing research data is in the area of testing for the operational characteristics of SUDS. New testing methods have been designed and developed to assess the performance of permeable pavements and swales after they have been in operation for a number of years in the Netherlands (Boogaard, 2015). These methods have included innovative techniques that include stop-motion photography and underwater filming (de Lima *et al.*, 2015). *Climatescan.nl* has allowed test results from a number of locations around the world to be uploaded. The data is open-source and easily accessible for anyone who needs it - the only requirement being that they have an internet connection.

## Results and Conclusions

The *climatescan.nl* application is in continuous development as more data is uploaded and improvements are made to respond to feedback from users. Figure 6 shows a snapshot view of the current *climatescan* site showing location points in Europe. There are also data points and accompanying datasets provided for sites in the USA, South America, Africa, Thailand and the Philippines.

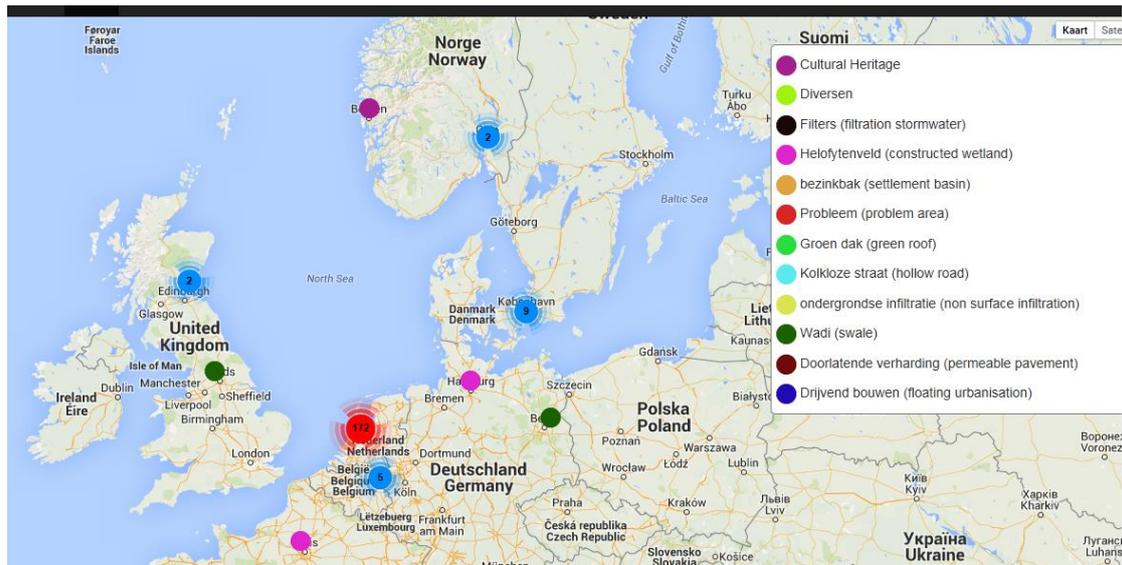


Figure 6: Snapshot of climatescan.nl, Europe

Currently, all the data points are categorised into twelve sub-groups which are each assigned a different colour as shown in the legend to the right of the webpage. Most of the categories relate to sustainable urban drainage systems (SUDS) including constructed wetlands, swales, green roofs, settlement basins, and permeable pavements. The webtool also provides projects that use SUDS for specific purposes. For example there is a category named ‘cultural heritage’ which identifies locations where innovative techniques are being used at a local level to protect buildings and the environment. There is also a category ‘floating urbanisations’ which provides research and project data on climate adaptation aspects of floating homes and buildings around the world

The website has proven to be helpful not only for practitioners working in this field but also as a useful tool for students, lecturers and researchers. The webtool has been used during international fieldtrips around Holland with participants from countries such as Denmark, Australia, UK, Sweden, Norway and USA. The topics included ranged from operational SUDS to new, innovative floating urban structures. A survey among international project partners showed that the ease that projects can be found and viewed is highly advantageous when compared with more traditional data retrieval methods.

The main challenges for future development of the webtool and opportunities for further research are outlined below:

- Uniqueness: there are currently a number of similar map based tools to store and share information in the field of sustainable drainage and climate adaptation measures. These include the Knowledge Portal for Spatial Adaptation (Kennisportaal Ruimtelijke Adaptatie, 2015), weAdapt (2015) and SusDrain (2015). Each of these have their own particular characteristics based on abstraction level, location and data types however there are inevitably overlaps with climatescan.nl. The developers of climatescan.nl are making links and are looking to see whether there can be collaborations with other groups to ensure as much information as possible is accessible and valid. To avoid becoming too broad, we acknowledge that the theme boundaries of the data that is uploaded to climatescan.nl are clear and that users are informed as to what information they can expect to find on the site.

- **Language:** in order to appeal to a wider audience, text must be in a universal format. At the moment most of the information relates to projects in the Netherlands and consequently much of the text is in Dutch, however a translation of categories is given and most of the photos and videos will speak for themselves. The aim is to have all information in English with country specific translations where appropriate.
- **Contributions:** There is a difference between information--sharing and knowledge-sharing. Information--sharing can be seen as supply driven where data is transferred to inform us. Knowledge-sharing however is where the information received is understood and can be interpreted and passed on (Sharratt & Usoro, 2003). It could be argued that [climatescan.nl](http://climatescan.nl) and similar mapping tools are information-sharing platforms. Although the aim is to present the data in an accessible and attractive manner, it is not known whether the user understands the context.  
The rise of what is known as web 2.0 (social software: blogging, social networking, twitter, etc) in recent years offers a huge opportunity for a website like [climatescan.nl](http://climatescan.nl). If users had the opportunity to contribute and be involved with content and sharing then they would be more likely to understand it and promote its dissemination. McCloughlin and Lee (2007, p.664) state that ‘beyond the walls of formal places of learning, there is a plethora of online groups of individuals that are self-directed, vital, self-managed and active in the generation of new ideas, and that are compelling examples of thriving knowledge creating communities, open to all who wish to participate’. Given that urban resilience and climate adaptation is such a dynamic and innovative field of work, it seems only logical to adopt current online trends to stimulate knowledge sharing. For example, users could be encouraged to comment on projects through discussion forums or link sites they find interesting using social networking sites.
- **Data Input:** At present inputting data to the [climatescan.nl](http://climatescan.nl) could be more user-friendly and accessible. To input data, a username and password are required, including basic training. In order to upscale the website, the aim is to enable more people to input data. This will require a simple data input sheet with clear instructions to be developed. However, as Flanagan and Metzger (2008) highlight, the increase in volunteered geographic information brings into question the quality, reliability and overall value. For such a site as [climatescan.nl](http://climatescan.nl) it is likely that a registration procedure for those who input data will be necessary possibly linked to the organisation that the inputter is employed or linked with.
- **Education:** It is already evident that the [climatescan.nl](http://climatescan.nl) is a valuable tool for use in education both in a university setting but also in the workplace. The aim is to promote its use by organising workshops and events where students and professionals can become accustomed to using the map for their own needs and also be instrumental in future developments of the website.

In conclusion, the outcomes of this project have shown there is a clear demand for a collaborative, knowledge sharing tool where first impressions of different urban resilience projects can be quickly gained. The [climatescan.nl](http://climatescan.nl) map application has proven successful in the two described pilot schemes with Dutch municipalities, as well as gaining positive feedback in international workshops and meetings. However it is clear that upscaling and further improvements are required if the application is to meet its full potential.

## References

- Bell, T., Straup-Cope, A. & Catt, d. (2007) *The Third Spatial Revolution*. National Center for Geographic Information and Analysis: Position paper for workshop on Volunteered Geographic Information, December 13-14 [Online], Available at [http://www.ncgia.ucsb.edu/projects/vgi/docs/position/Bell\\_paper.pdf](http://www.ncgia.ucsb.edu/projects/vgi/docs/position/Bell_paper.pdf), (Accessed 20 June 2015)
- Blanksby J. Kluck J., Boogaard F.C., Simpson S., Shepherd W. and Doncaster S., (2011) *Modelling and mapping of urban storm water flooding – Using simple approaches in a process of Triage*. aquatech Hamburg Germany.
- Boogaard F. (2015), Stormwater characteristics and new testing methods for certain sustainable urban drainage systems in The Netherlands, July 2015, Delft
- Boogaard F.C., M. Claassen, E.G. Claessen, R. Newman (2012) *Augmented reality: Interactive visualisation and communication water projects for European water managers*, IT Water Amsterdam November
- European Commission. (EC) (2000). Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for the Community action in the field of water policy; 2000a. 23 October 2000.
- European Commission. (EC) (2007). Directive 2007/2/EC of the European Parliament and of the Council establishing an Infrastructure for Spatial Information in the European Community. 15th May 2007.
- Flanagin, A. & Mezger, M. (2008) The Credibility of Volunteered Geographic Information. *Geojournal* 72. 137-148.
- Hall, H. (2001) Input Friendliness: motivating knowledge sharing across intranets. *Journal of Information Science* 27 (3), 139-146
- Hammill, A., Harvey B. & Echeverria D. (2013) Knowledge for action: an analysis of the use of online climate knowledge brokering platforms. *Knowledge Management for Development Journal* 9 (10), 72-92
- Hanze University of Applied Sciences (2014) Seminar: Climate Toolbox Experience Day. Available at <https://www.hanze.nl/nld/organisatie/overzichten/agenda/climate-toolbox-experience-day-27-03-2014> (Accessed 20 August 2015).
- Isaacs, J., Falconer, R., Blackwood, D. & Gilmour, D. (2011) Immersive and non-immersive 3D virtual city: decision support tool for urban sustainability. *Journal of Information Technology in Construction*. Vol. 16
- Jefferies C., Berwick N., Cernagovs D. and, Boogaard F. (2012), *Watertown – a computer game for city water planners*, aqua alta Hamburg
- Kennisportaal Ruimtelijke Adaptatie (2015) Showcases [Online], Available at <http://www.ruimtelijkeadaptatie.nl/en/praktijkvoorbeelden-ruimtelijke-adaptatie> (Accessed 15 August 2015).
- de Lima R., Sazonov V., Bogaard F.C., de Graaf R., Dionisio M., (2012) *Monitoring the impacts of floating structures on the water quality and ecology using an underwater drone*, Den Haag, IAHR.
- Sharratt, M. & Usoro, A. (2003) Understanding Knowledge Sharing in Online Communities. *Electronic Journal on Knowledge Management* 1(2), 187-196.
- SusDrain (2015) Case Studies Maps [Online], Available at <http://www.susdrain.org/case-studies> (Accessed 15 August 2015).
- Verlaat M, van der Meulen L, Schoof G, Boogaard F, Kluck J, (2015) Disaster Risk Management: Urban Flooding and heatstress, *Geomatics Workbooks* n° 12 – "FOSS4G Europe Como 2015"
- WeAdapt (2015) Maps [Online], Available at <https://www.weadapt.org/placemarks/maps> (Accessed 15 August 2015).