"Open Access" Climate Resilience Tools for Landscape Architects

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Keynote DLA 2023

Abstract: The devastating effects of climate change we are witnessing, such as the floods throughout Germany in 2022, are placing more pressure on designers to predict and mitigate such events while designing various sites. Greenskinslab's researchers at the University of British Columbia, Canada have spent many years developing digital tools to predict, mitigate and provide design suggestions on how to manage increasing human risk to natural hazards, focusing particularly on flooding and more recently landslides. These globally "open access" and user-friendly digital tools support both students and professionals in the early site planning and design phase of projects to calculate the risks of landslides and flooding. This article briefly highlights two "open access" climate resilience tools. These are: 1) a *stormwater calculation (LID) application* that dimensions the correct LID strategies (living roof, retention pond, swale) needed as a holistic system to manage rainwater on new and existing sites, published in 2021, and 2) a *landslide susceptibility toolkit* for landscape architects comprised of a GIS-based analysis tutorial and multi-sensorial on-site analysis instructions, developed in 2022 by a multi-disciplinary UBC student team. These tools are based on computer software which is widely accessible and affordable and analog methods of investigation. Greenskinslab's mandate is to combat climate change by supporting designers' planning processes with digital and analog tools to assist them to better envision a more climate resilient future.

Keywords: Digital online tools, climate change, climate resilience, education

1 Introduction

The global Covid 19 pandemic in early 2020 initiated academia to learn digital communication and teaching tools at lightning speed to continue teaching at a satisfactory standard in landscape architectural programs around the world. Suddenly instructors had to depend on computers to deliver lectures and provide design reviews, demonstrating to academics and students the potential of online communication software. In my case it confirmed the teaching effectiveness to include instantly recorded 'digital' hand drawn three-dimensional visualizations in teaching. It confirmed how versatile and fast the tablet is in recording how environmental holistic systems functioned, in landscape architectural design. Additionally, it allowed for animations of diagrams and audio explanations of the process shown.

This online teaching experience led to two areas of research focus: 1) to include the tablet and smart phone as observation and recoding tools when teaching my multisensory landscape design method, described in my second book: *Multisensory Landscape Design: A Designer's Guide for Seeing*, (2022), and 2) in creating "open access" climate resilience tools in my lab to mitigate or predict global destructive climate change effects such as floods and landslides. These tools are partially based on the research of my first co-authored book: *Living Roofs in Integrated Urban Water Systems* (2015). The book describes the effective combination of LID tools (retention pond and swales) at grade with living roofs to manage urban flooding.

Journal of Digital Landscape Architecture, 8-2023, pp. 585-587. © Wichmann Verlag, VDE VERLAG GMBH · Berlin · Offenbach. ISBN 978-3-87907-740-3, ISSN 2367-4253, e-ISSN 2511-624X, doi:10.14627/537740061.

In order to manage the ongoing impacts of climate change, evidenced through the deadly 2021 heat dome in British Columbia, the floods and landslides in British Columbia later the same year and the 'biblical' Flood in Pakistan in 2022, I propose to increase applied on site quantitative and qualitative research to mitigate current climate change effects in landscape architecture. Extensive research is currently being carried out to determine climate change predictions and how to manage the postulated effects. However, we are already witnessing an increasing magnitude and frequency of natural hazards due to climate change that is causing devastating impacts. Therefore, landscape architects and researchers should contribute more to mitigate current climate change effects through their work. I propose "open access" tools for landscape architects to enhance their site analysis investigation and design process. These tools help determine potential risk in the landscape (i. e. landslides) prior to development of a site, or measure the size and suggest LID interventions needed to mitigate future floods in the preliminary design phase. These analysis and preliminary design calculations will strengthen the initial design proposal and contribute to climate resilience in the planning process of landscape architectural design. Two "open access" tools created in Greenskinslab are presented here. It is anticipated that these tools increase professional analysis and design practice, and should also be incorporated into landscape architecture design education. "Open access" tools enhance design teaching.

2 "Open Access" Tools

The more tools are available online, the higher are the opportunities they are used. At Greenskinslab they are developed by a team comprised of both students and alumni that are interested in focused research opportunities against climate change. The inclusion of alumni provides them with an opportunity to integrate their professional office experience into the creation of the tools they are interested in to refine and use for their design process. The tools are created firstly for British Columbia's local use and then expanded for global use (This was also done because of the extensive data available online in BC on precipitation, soil types etc.). For all the tools created, the premise was to be able to use affordable and easily available hard- and software, to allow access and use in regions with limited resources. The tools are user-friendly and self-explanatory in layout and operation and accessible to students and professionals. An overarching goal is to encourage the next generation of landscape architects to co-lead ideas and research tools, to empower them to design for society and the environment in a climate resilient impactful way. In recent years digital visualization of designs in landscape architecture schools has experienced a boost and focused often on learning sophisticated three-dimensional rendering tools. These renderings and video animations created a more and more realistic spatial design narrative. The open access tools presented are enabling additional design rigour to advance the technical and scientific skills to combat climate change on site. They include digital and analog components.

The ***landslide tool*** uses user-friendly (free trial) ArcGIS software and access free data from Copernicus Access Open Hub, LiDAR BC, and Fresh Atlas Stream Network BC to locate mass movement areas at a map scale determined by the grid size. In a second field investigation phase, 'multisensory' applications (sight, touch, smell) are used to investigate the land form, geological processes, soil profile, texture, geological processes, hydrological characteristics and vegetation. The students and practitioners are instructed through a field guide posted on the blog how to examine the site. This tool allows landscape architects, architects and urban planners to develop a deeper understanding and awareness of mass movements phenomena, and eventually prevent these hazards on site and around it. It is an additional site investigation tool in the preliminary design phase to reduce the risks of destruction due to climate change.

The *stormwater calculation (Low Impact Development LID) application* focuses on estimating the size and types of LID tools needed to manage stormwater on site of a new development. "Water drives design" was the strategy in mind when designing it (1). When designing a new site, the LID application uses the current local climate data (supplied by the airports close to future design project), to calculate the LID tool dimensions and types needed.

This application has been created for the preliminary design phase of a project to enhance climate resilience strategies such as stormwater management on site. This tool can also be used to design and dimension LID strategies in existing blocks of cities (2).

Both tools attempt to inspire and lay a foundation for other researchers to develop open access tools with their students and alumni for their area of expertise. Landscape architecture is a land-based profession, the design impact is "outside" in the environment, landscape architecture designs are exposed and constantly changing. More 'applied research' should be carried out in design school, to increase evidence-based designing with quantitative and qualitative data. Landscape architects have a responsibility to design all projects with climate resiliency in mind today.

3 Conclusion

I believe that multidisciplinary applied research contributions such as the open access tool examples above can support climate change resilience effectively. They can be adapted to local needs and expertise. Not only such tools are, in most cases, easily adaptable to local needs and expertise, they can often be used immediately by the public, rather than depending on time-consuming grant funding process. In the instances where funding is necessary, the students involved in the projects may subsequently support them as alumni.

I also suggest further that all landscape architecture students should learn basic 'coding', best applied directly in a research project or class exercises which involves the creation of a small application which can be used in landscape architecture, for example a cut and fill calculator for grading (3). This applied teaching will encourage and inspire the next generation (students and graduates) to co-lead ideas to implementation, and empower them to act for their future. Students need to be provided a research platform to experiment and shape the environmental future. Landscape architecture students are often thinking idealistic in "saving the world" through designing. This positive energy should be channeled into the "shaping" or land scapeing − the environment with more applied research driven projects and tools, helping others.

Notes

1. WAHI DUA, G. (2021), Water-Science, Design and Sustainability. TOPOS, 116, 48-52.
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