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Topography as the Groundwork for Landscape Design —Interview With Karen M'Closkey and Keith VanDerSys


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ABSTRACT

Perceiving and understanding topography is not only fundamental for landscape architects, but also a core issue in landscape construction practice. In this interview, two prominent scholars, Karen M'Closkey and Keith VanDerSys, offer their insights about the theoretical and historical foundations of topography in landscape architecture, the influence of mapping on landscape architects' site observations and design actions, the role of new navigation and sensing technologies in understanding and designing landscapes, and the enriched visualization methods for landscape design by advanced digital media. Finally, they also share their teaching experience in training students about site surveying and its translation into design responses.

KEYWORDS

Topography;
Mapping;
Land-forming;
Geo-referenced Data;
Digital Media Tools;
Remote Sensing;
Environmental Media

HIGHLIGHTS

- The decisions landscape architects make about what and how we represent topography set the ground—conceptually and practically—for design
- Mapping exerts a huge influence on how we understand or convey an idea about a place or site
- The flood zones depicted on maps are not physical realities but statistical inventions about certain kinds of storms and floods
- Landscape architects tend to be users, rather than makers, of environmental and spatial data, who may not have a thorough understanding of those data sets
- Teaching the "how" without the "why" leaves students without the capacity to utilize media critically and imaginatively

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Introduction about Karen M'Closkey and Keith VanDerSys

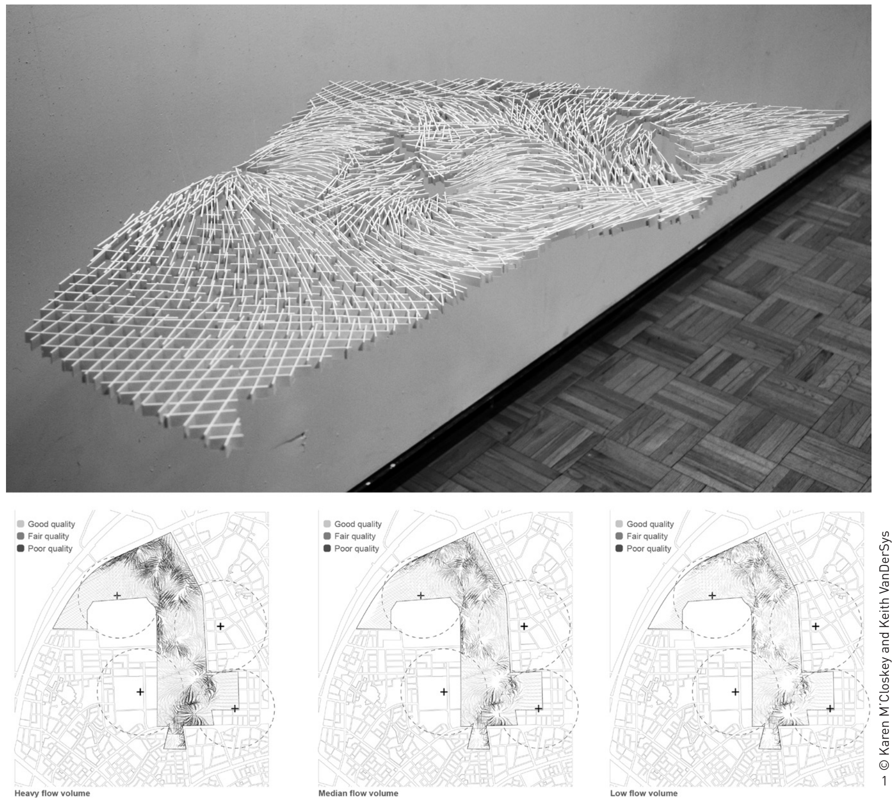
Karen M'Closkey and Keith VanDerSys are faculty in landscape architecture at the University of Pennsylvania's Weitzman School of Design, and co-founders of PEG office of landscape + architecture and Penn's Environmental Modeling Lab (EMLab). Their work focuses on the opportunities and limitations enabled by advancements in digital modeling, and how the assumptions embedded in our methods and tools shape our understanding of landscapes and environments. Their work has been acknowledged through numerous awards, exhibitions, and fellowships, including a Pew Fellowship in the Arts, and their work has appeared in over seventy design publications. They are guest editors of *LA+ GEO* (2020) and *LA+ Simulation* (2016), and authors of *Dynamic Patterns: Visualizing Landscapes in a Digital Age* (2017). Their forthcoming edited volume is titled *Media Matters in Landscape Architecture* (2024).

What do you think is the importance of topography for landscape architects, conceptually and practically?

Karen M'CLOSKEY (M'CLOSKEY hereafter): The term "topography" originates from the Greek words "topos" and "graphia," which mean "place" and "writing." In this way, topography is already understood as a description of a place that is material and representational. As an act of graphic delineation (usually through maps or charts), topography means to "write, record, or describe" natural or human-made features and their relative relationships. The decisions we make as landscape architects about what and how we represent topography set the ground—conceptually and practically—for design. We rely on disciplinary conventions for drawing topography; however, it is easy to forget how these came to be—how inventions became conventions—and how they frame how we see and understand landscapes.

On a practical level, topography—as the ground to shape space and support a variety of conditions and qualities—is foundational for landscape architecture. As a graphic representation on a map, topography is thin, but as the design of ground, it is thick. It is the interface of soil, water, air, and plants, and supports human inhabitation.

Keith VANDERSYS (VANDERSYS hereafter): Representations of topography shape our understanding of site conditions and precede the territories in which we work. Consider the



1. Visualization via hachuring. The drawings (bottom) depict stormwater rates (heavy, medium, and low flow volume, from left to right) and pollution levels: line length represents the slope of the topography; line thickness and darkness depict water quantity and quality, respectively. The physical model (top) is an interpretation of the drawings.

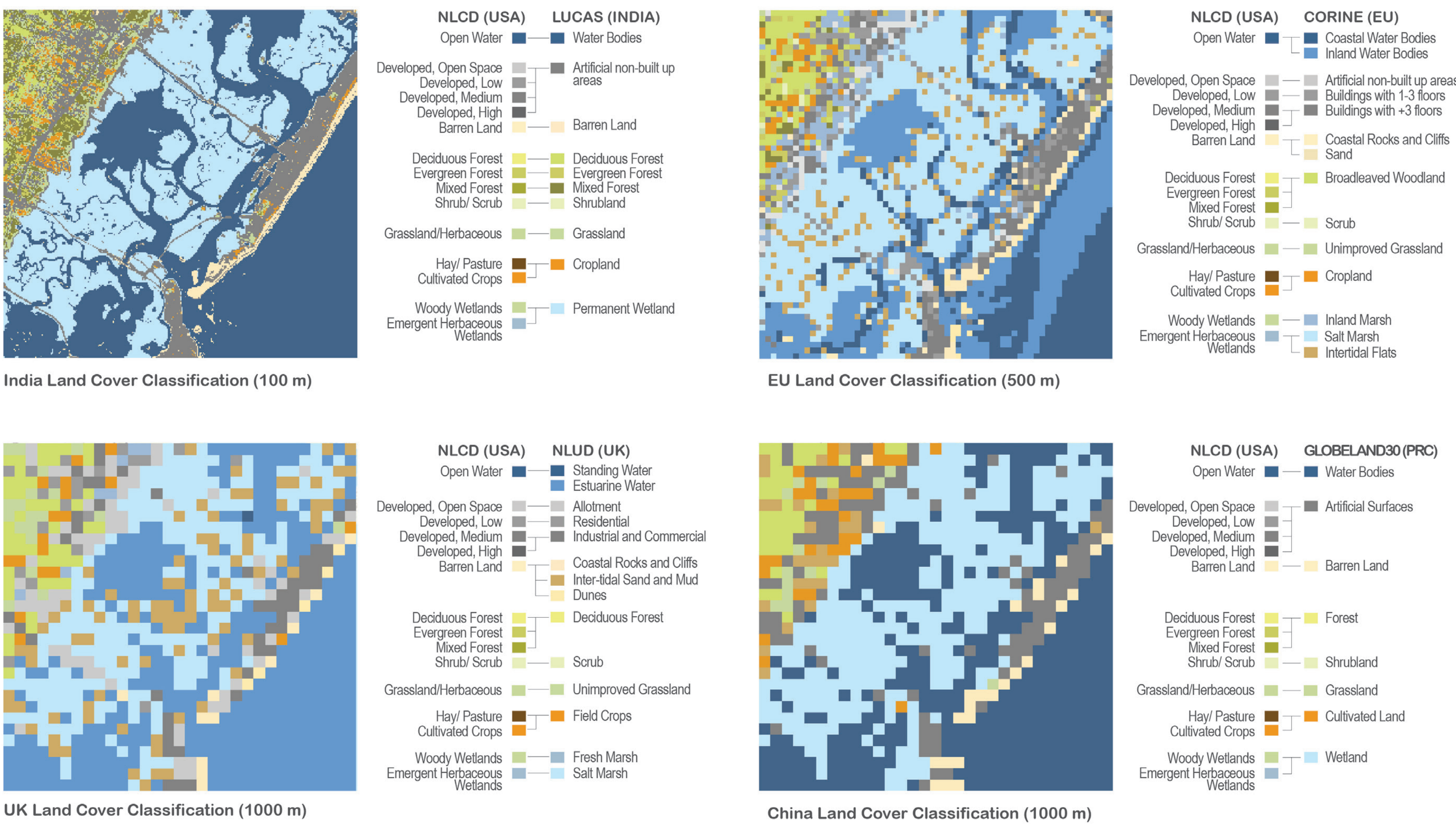
convention of the contour drawing, for instance. We take this as an ontological given. Of course, like all graphical methods, it is an abstract representation—of the ground in this case—illustrating the elevations on the surface of the earth in a measurable and quantifiable way. Hachuring—the repeated, parallel strokes spaced apart at varying distances to depict gentle or steep slopes—was the accepted method for representing terrain prior to the use of contours. Hachuring gives an impression of topography's qualitative aspects—its form, relative steepness, shadow, etc. (Fig. 1), whereas contouring is standardized and quantitative—it depicts elevation numerically using individual, continuous lines of uniform thickness. The advancement of trigonometric surveying provided a repeatable and quantitative representation of the terrain via contour drawing. It revolutionized the way maps were drawn and remains an integral part of the practice of landscape architecture today. However, with the latest technology, which makes it easier to move from survey to model to construction, we may see contours go the way of the hachure in terms of technical drawings.

How do you understand the importance of mapping in shaping observations and thereby influencing actions by landscape architects?

M'CLOSKEY: Mapping exerts a huge influence on how we understand or convey an idea about a place or site (Fig. 2). It is very important to consider what is being depicted. It has been more than three decades since the rise of critical cartography and its lessons demonstrating the highly selective and political nature of mapping, upending any naive notions that maps represent "actual" conditions objectively. As many scholars have argued, maps are representations of power, politics, and ideology. But as others have demonstrated, there are also far more diverse and complex mapping practices than those of the state or as a delineation of territory. Nevertheless, landscape architects often work with maps and mapping conventions derived from existing sources, such as state or national governments. Such maps are pre-defined and spatially bound, already with a high degree of interpretation of data. As Keith just mentioned, we rely on disciplinary conventions, but as I already said, we easily forget how the inventions became conventions, and how they constrain how and what we see.

For instance, when we talk about existing data sets, the resolution of information is incredibly consequential. We describe this in two recent chapters: "For Whom do we Account in Climate Adaptation?" for the book *A Blueprint for Coastal Adaptation*[1] and "Modeling" in *The Landscape Project*.[2] We write about how the coastal regulations in the United States are based on determinations of how flood plains are delineated, which is related to insurance policies, and there is a lot of inequity in the regulations. But data with different resolutions would change how the flood plain is

2. The application of different international land cover classification standards to the same place (Stone Harbor, New Jersey, USA) clearly demonstrates how the spatial and thematic structure of various classification systems frame our understanding of the landscape. A comparison among the legends shows similarities and differences in how land cover themes (i.e. classifications) are defined. See Ref. [3] for a detailed explanation of multispectral imagery and land cover classification systems.

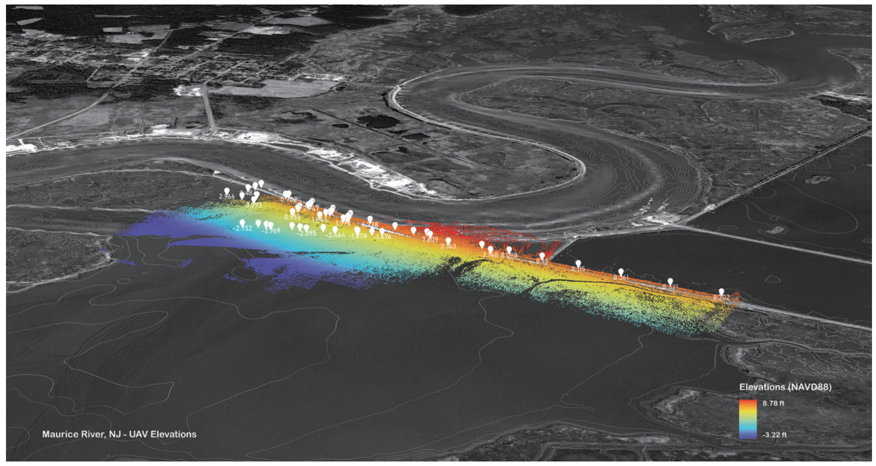


delineated and therefore would alter what can be built and where. The flood zones depicted on maps are not physical realities; they are statistical inventions about certain kinds of storms and floods. The flip side of this example is what gets excluded from flood zone designations. For example, so-called minor flooding can greatly impact people's lives, but these small "events" escape the resolution of current methods of flood modeling and mapping. In other words, the information represented in extant map sources is limited to that which can be captured with current sensing technologies and surveying practices, and those are the standards by which much landscape practice is delimited. This is what we mean when we say it is important to not take for granted the information that we find on maps.

VANDERSYS: If we want to capture higher resolution imagery about a site, which includes elevational information, we can use low altitude sensing technologies, like drones (Fig. 3). Conversely, when gathering imagery at larger scales and longer time frames, a good deal of the information comes by way of satellite sensing. This information gets translated into the maps and models that we (landscape architects) often use as the basis for our designs. We tend to be users, rather than makers, of environmental and spatial data. As users, we may not have a thorough understanding of those data sets. There are a lot of underlying limitations, such as the way land cover is typically classified. The National Land Cover Database (NLCD) in the United States classifies land cover into 11 classes, which can be too broad to be useful for design purposes. This is especially true in dynamic and rapidly changing areas like coastlines. If we are to make proposals for their alteration, it is important to understand the limitations of our standardized tools and representations, and to consider how landscape architects can more expansively engage in shaping environmental visualizations. This means that we should develop practices, protocols, and processing techniques to capture conditions that might be excluded from the conventions.

How do you consider the role of site surveying in landscape design? What have been the impacts of aerial and satellite navigation and sensing technologies on the methods for understanding and designing landscapes?

M'CLOSKEY: Field surveying is, obviously, not recent. Before we had fancy equipment such as Global Positioning Systems (GPS) or drones, landscape architects participated in surveying, and translating surveys into maps. But with satellite technologies and images about the global environment—atmospheric carbon simulations, sea level rise maps, views from outer space, and so on—we have a concept of earth and atmosphere as environmental objects. No matter how local we are working, we all have the idea of global environment in our minds. But for the purpose of proposing physical designs in specific places, as landscape architects do, those kinds of representations are not directly usable—we cannot just zoom in on aerial and satellite images. Although the earth is pervasively sensed, that information is not adequate for local conditions. This is why landscape architects doing their own surveying can provide a different reading and interpretation of the site. As we argued in a recent essay, titled "Behind the Scenes,"[3] landscape architects in general are not too familiar with practices of data collection, delineation, and classification. Without understanding the biases in the given datasets, we lack the ability to change the practices and the resulting maps and models. Practically speaking, site-collected sensing and survey data can be used, for example, to customize land cover maps in order to track changes in the landscape (Fig. 4). The problems of land cover classification notwithstanding (and there are many), we have employed these methods for some of our work in New Jersey at The Wetlands Institute where we are monitoring changes to the high marsh grass through repeated surveying, something that the institute is keen to know since it is trying to protect that particular habitat for nesting birds. The resolution of information and infrequency of collection in standard land cover maps could not be used to do this work.



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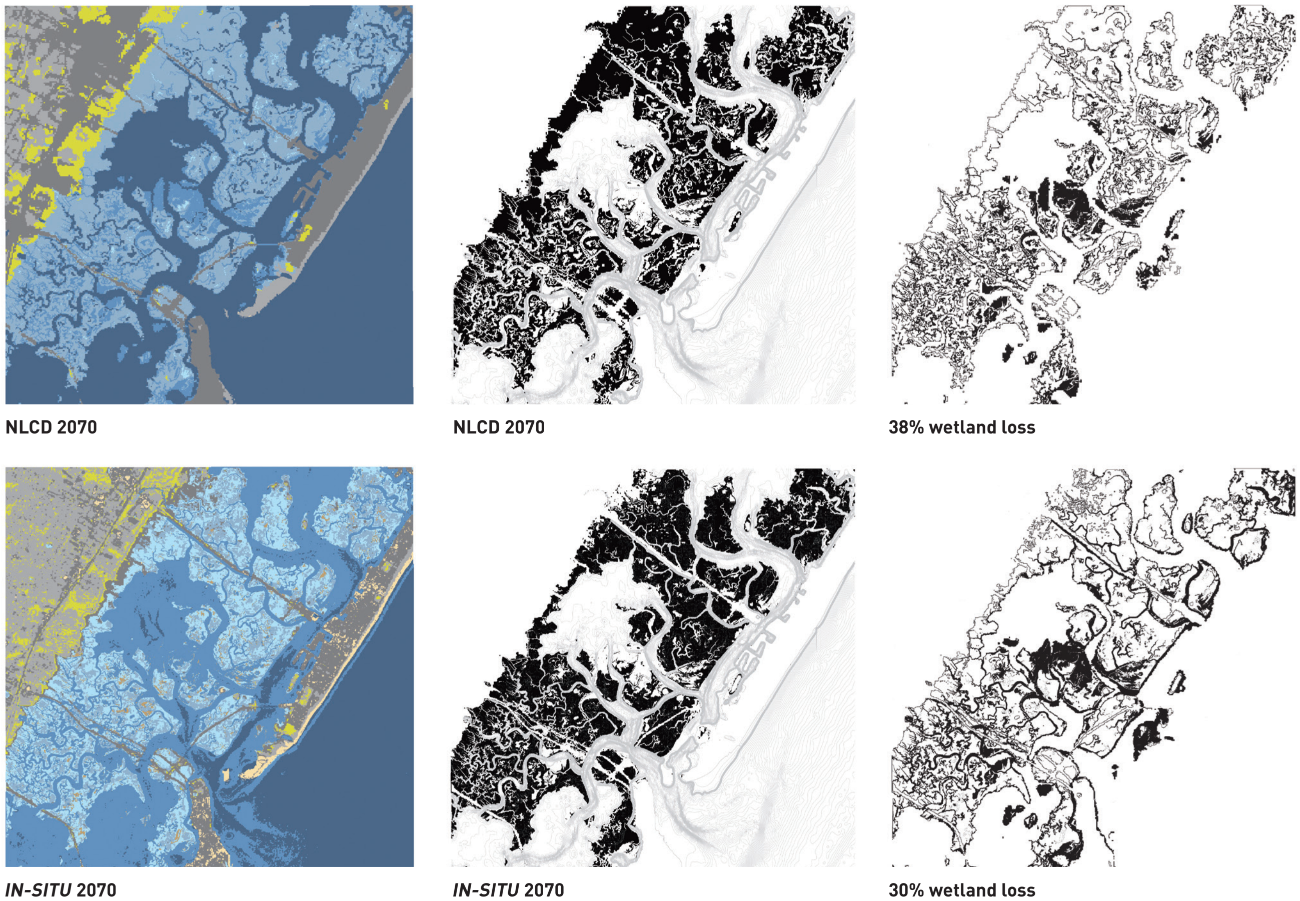
3. UAV (unmanned aerial vehicles) Elevation Composite, as a digital model, simulating existing dike and planned sediment placement areas for Maurice Bay, New Jersey, USA. The existing elevation and vegetation assessments will be important for gauging changes in sediment movement after placement.



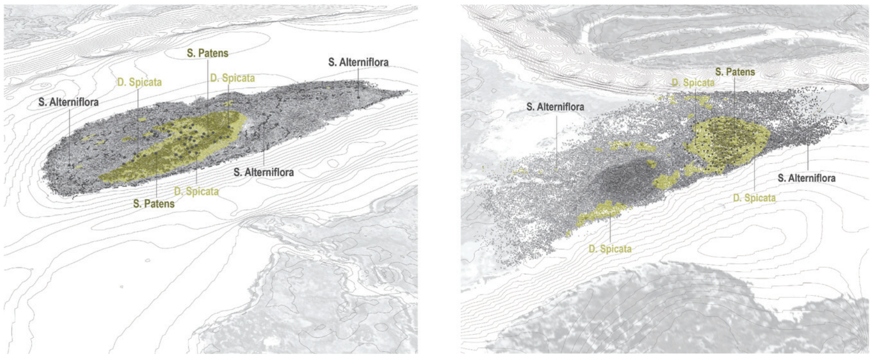
4. A comparison of projected wetland loss using the NLCD (top) and custom land cover created using UAV multispectral imaging (bottom). The center images show the remaining wetland areas in 2070. The images on the right show the amount of wetland loss from 2020 to 2070.

VANDERSYS: Given that the availability of remote sensing and survey technologies has rapidly changed in the last decade—such as unmanned aerial vehicles (UAVs), multispectral and hyperspectral imaging, and high-accuracy survey equipment—landscape architects can more easily make their own data and models. The use of these technologies expands our sensory limits, allowing landscape architects to register and record phenomena beyond what we can see or hear with our own eyes and ears. This alters how and what we understand about particular characteristics of the landscape, such as plant health, which cannot be observed with standard site surveying methods (Fig. 5).

Additionally, the widespread availability of geo-referenced data made possible through GPS has certainly revolutionized how spatial information is derived, and that changes how spatial data are made and used. If the map precedes the territory, as has been often quoted, we must also acknowledge the equally consequential fact that the survey precedes the map, or in the case of today's technologies, the survey precedes the model. As makers of survey data, landscape architects could introduce hybrid or multilayered information about a site that is usually excluded in a traditional engineering survey. For instance, information collected from remote sensing technology can be used to create customized elevation and land cover maps, which are key inputs for simulation models. Unlike static modes of representation, time-based media allow us to engage processes, like water or sediment movement, that shape landscape change (Fig. 6).

As map reading involves personal interpretation that might vary among individuals, how can we increase the legibility and readability of our map representations?

M'CLOSKEY: Maps are drawn for particular reasons and can be interpreted in myriad ways. However, maps are more than spatial repositories that just convey information. As geographers (John Brian Harley, John Pickles, Denis Cosgrove, etc.) amply demonstrated in the 1980s and 1990s, they are instruments of political power, ideology, and governance. This scholarship was instrumental in "deconstructing" and exposing the hegemonic "view from above" favored by the state and military to assert forms of cartographic control through maps. Yet it offered little instruction



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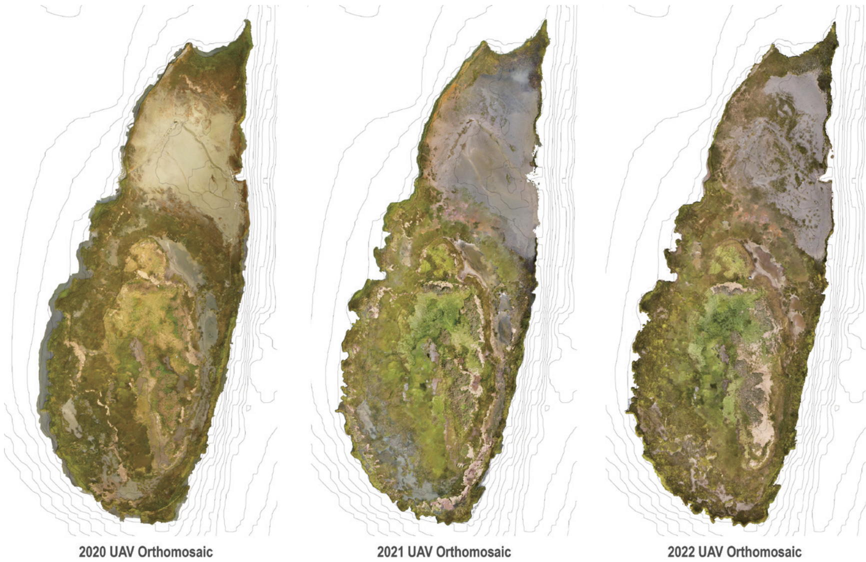

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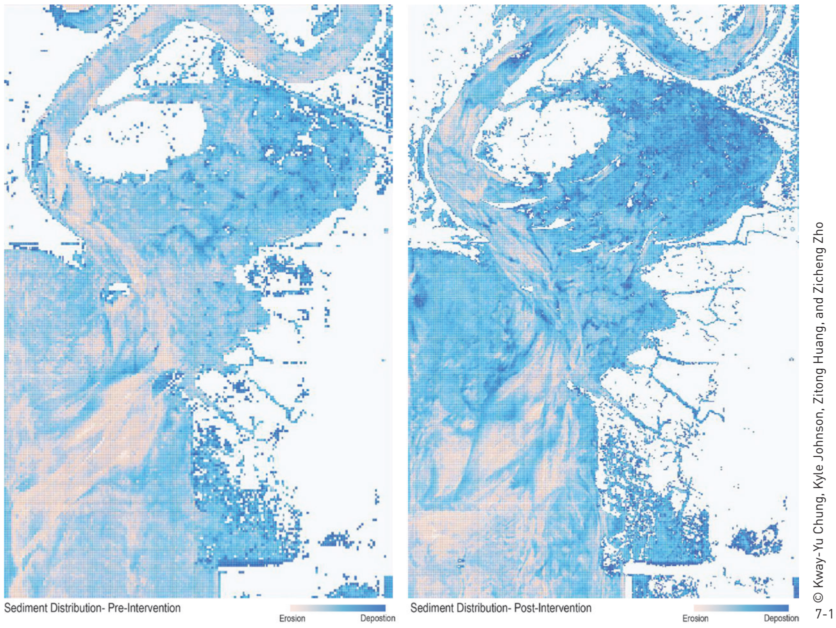
5. Along with survey elevations, UAV multispectral imagery was used to locate zones of high marsh grasses throughout Jenkins Sound Bay, New Jersey, USA. The images depict in detail the locations of the high marsh that remain on Sturgeon Island (left) and Ring Island (right).
6. Multi-year UAV surveying of sediment placement on Sturgeon Island Documenting and measuring changes in vegetation patterns is important for evaluating wetland restoration efforts that use experimental sediment placement strategies.

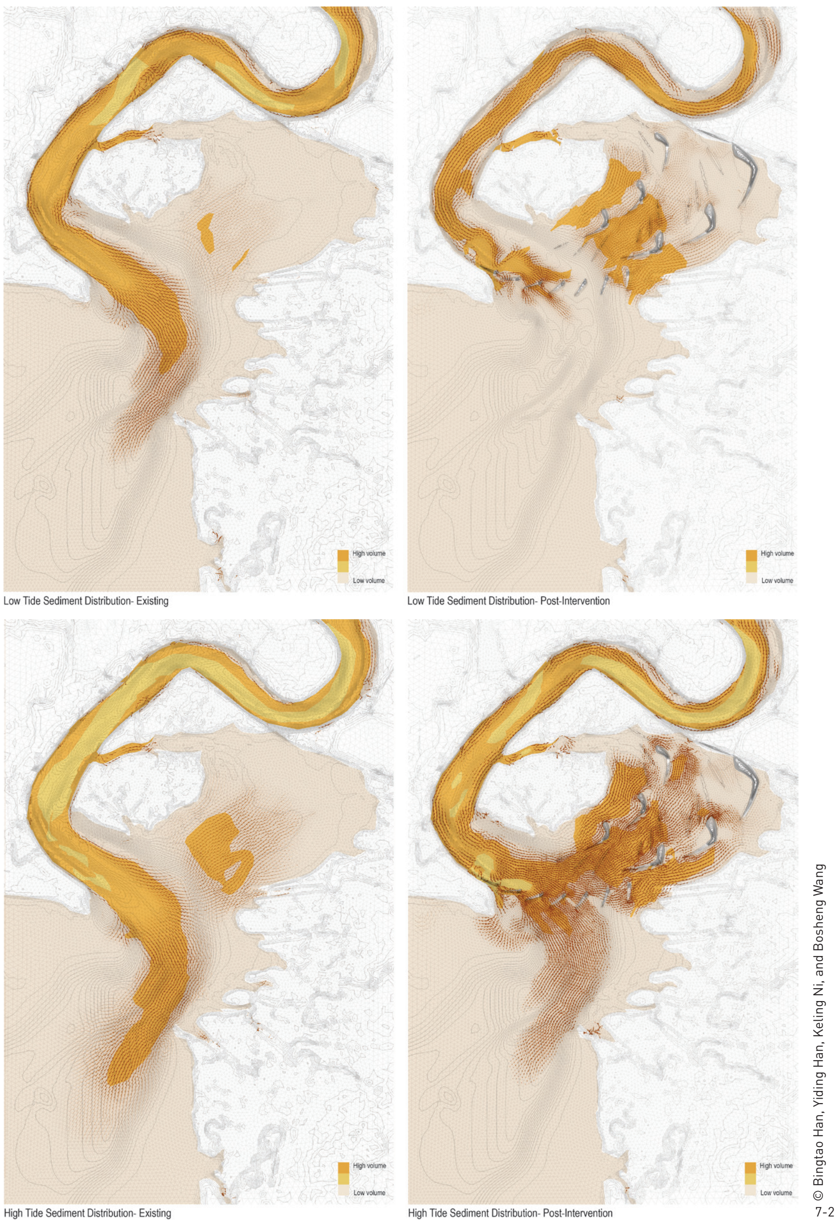
on how to make better or different maps to counteract such dominant forms of cartographic knowledge. Landscape architects like Anuradha Mathur and Dilip da Cunha and, more recently, geographers like William Rankin provide inspiring examples of counter-mapping, albeit in very different ways. There are many examples of maps that stress the social and political dimensions of landscape as a basis to, hopefully, create more equitable spatial representations, or at least use them to reveal inequities. Additionally, wiki-based platforms like OpenStreetMap (OSM) offer a different approach to mapping—one where geographical information is crowd-sourced voluntarily by amateurs, and free to users, rather than a cartographic authority, centrally controlled by experts. OSM contributors add local features that they are familiar with. These are often in remote areas missed by global maps, such as those provided by Google, but that have information that may be more useful locally. So, the short answer to your question is that anyone can make a map and the question of legibility depends on what use or for whom the map is intended.

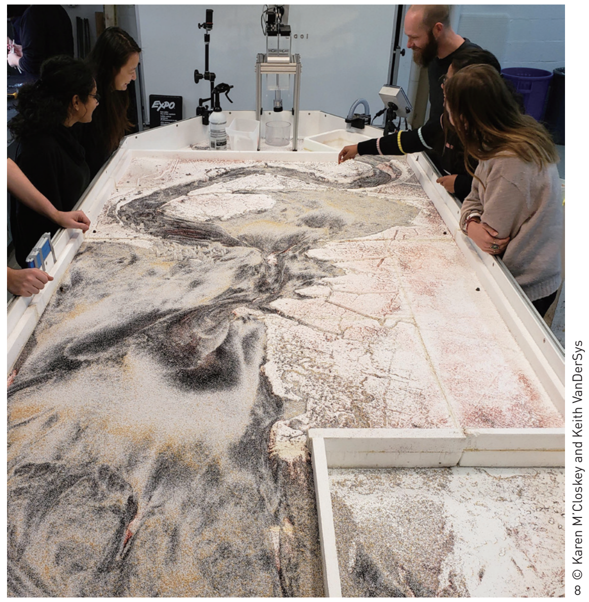
VANDERSYS: We might also ask whether we should map something at all. Mapping something and making it visible and knowable is not always a good idea. Take the example of ocean floor mapping. Less than twenty-five percent has been mapped with high detail. There is both excitement and trepidation about the Seabed 2030 Project to survey the entire ocean floor in the next decade. This could facilitate exploitation by the mining and fossil fuel industries, or it could initiate greater protective regulations of yet unseen underwater topographies and the life it supports.

The development of digital media enriches our methods of visualization for landscape design. What sorts of digital tools are demonstrating their potential in landscape architecture?

M'CLOSKEY: Digital media is such a broad, encompassing term. Obviously, the increase in computing power has led to quicker and more efficient photorealistic 3D rendering applications, including software like Blender, Lumion, and V-Ray. Also, recent developments in artificial intelligence (AI) have exploded. The rise of deep learning algorithms for AI-enabled image creation platforms including DALL·E, Midjourney, and Disco Diffusion is now available. With the input of only a couple of words or phrases, these AI engines quickly generate myriad novel and imaginative images. I'm sure you are aware of the equivalent development of ChatGPT and the problems this is causing in terms of authorship, plagiarism, and some of the disturbing content that users have been able to create with it. But given that the focus of this interview is on topography, mapping, and construction, a more pertinent technological transformation has been the pervasive integration of GPS into nearly every facet of life in the past few decades—agriculture, transportation, finance, science—they are all reliant on GPS. In terms of topographic design, parametric software like Rhino and Grasshopper has opened up a lot of opportunities for formal exploration and this has also impacted how physical models are made. All of the fabrication equipment that goes along with digital modeling has seen an upsurge in design offices' use of laser cutters, CNC mills, and 3D printers.







7. Numerical model (SRH-2D + ADCIRC) simulations testing the impacts of nature-based infrastructure interventions in Maurice Bay, New Jersey, USA.
8. Physical sediment table simulations testing the impacts of nature-based infrastructure interventions in Maurice Bay, New Jersey, USA.

① Snøhetta designed a 19 hm^2 park for the outdoor area of Swedish national laboratory MAX IV, providing the landscape solution for ground vibrations mitigation, stormwater management, and meeting the city's sustainability goals. For more details, please see Snøhetta project "Max IV Laboratory Landscape."

VANDERSYS: As I mentioned earlier, the widespread availability of geospatial data is fundamentally changing our methods of work. For instance, one of the things available to us, at least in the United States, is the vast amount of geo-referenced information. Geo-referenced data facilitates greater interoperability among analysis (GIS), modeling (CAD), and simulation (CFD) software which, in turn, allows landscape architects to engage more fully in the consequential processes that shape landscape change, like water, air, and sediment flows. For instance, computational and physical simulation models, like CFD and hydrology tables (Figs. 7, 8), can help us understand sediment deposition and erosion in coastal environments impacted by our changing climate.

While still nascent, GPS-enabled construction equipment will continue to change how we deliver and construct landscape architects' designs. We saw this in recent projects like Snøhetta's Max IV Laboratory① built in 2016. Geo-referenced site survey data enabled the design team to develop and test a series of landform options that were evaluated for acoustic and hydrological performance. The selected terrain configuration was then converted back into a geo-referenced point cloud and used to guide GPS-enabled land moving equipment. Projects like this illustrate the increasing entwinement of virtual and physical environments; a condition with which landscape architects must inevitably contend.

M'CLOSKEY: I would like to add that this is not necessarily a positive development. There are downsides to automation that we should not ignore, particularly as it relates to jobs. These technologies are changing site construction but not always for the better.

Do you think there are any misunderstandings or misuses of such digital technologies and tools by landscape architects?

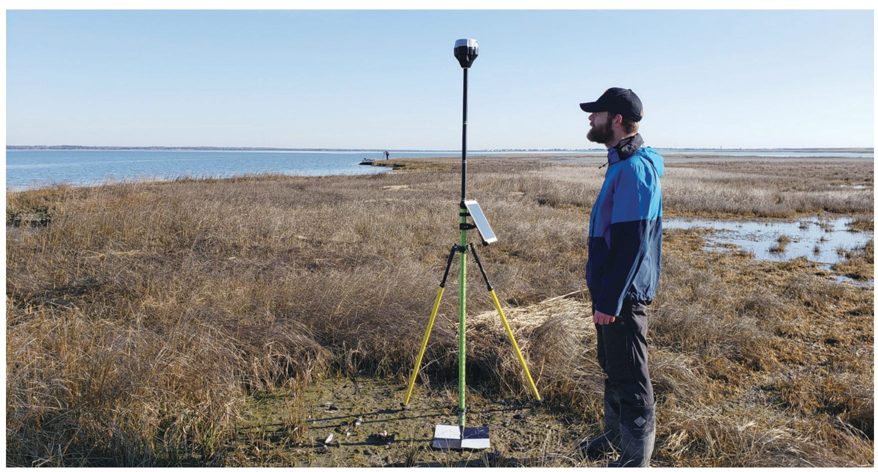
M'CLOSKEY: I do not think that there is such a thing as a misuse of a tool, because a tool can be used for anything other than the job for which it was invented, as people do all the time. But for misunderstanding, I would say yes, regarding those who see digital tools as somehow less tangible or more "distancing" than older tools—younger generations probably have not even heard this critique. I think this view is fading, but such skepticism was really prevalent in the early 2000s when these tools were emerging and the profession was rapidly transitioning to digital tools[4]. Whether something is analog or digital, it, in itself, is irrelevant. What is relevant is that any tool or medium affects how we know, understand, or convey. It is an epistemological question, not a binary distinction.

We are working on a book right now called *Media Matters in Landscape Architecture*, which came out of a symposium titled "Instruments of Change" that we organized as part of the EMLab in 2022. We are very much interested in the scholarship in media studies and science and technology studies. We often reference the work of Jennifer Gabrys because she was originally trained as a landscape architect and her insights are incredibly pertinent for landscape architects to consider how we come to know the environments where we work.[5][6] Anyone who critiques the "digital for being digital" is ignoring the entire history of representation and observation. Any form of media impacts how we know or what we think we know.

VANDERSYS: Familiarity with the data, tools, and practices of working in a digital milieu can only make landscape architects more valuable collaborators. This is especially true in areas, such as coastal environments, that are typically dominated by science and engineering disciplines. As one engages with the data and models used by these disciplines, one becomes aware of the inherent limitations and uncertainties of environmental data—like elevation and land cover (Fig. 9). This leads to more opportunities for framing questions related to coastal infrastructure, flood protection, and conservation policies beyond purely technical terms. In her book *The Will to Improve*,[7] Tania Murray Li argues that the tendency to quantify and simplify a problem makes it amenable to technical prescriptions, what she calls "rendering a problem technical," thereby rendering the issue nonpolitical. Doing so excludes the social, economic, and political factors that created the "problematic" conditions in the first place.

Our work over the last fifteen years has, on the one hand, explored various tools for their creative possibilities but, on the other hand, used them critically to understand how they shape or "discipline" the practice of landscape architecture. And, of course, this includes the media and methods used for mapping. Our particular focus has been on the development of computationally enabled imaging and modeling due to the significant impact that such developments have had on our collective understanding of environment. Computation is pervasive in everything we do now in design, whether taking a picture with your phone, sketching on an iPad, drawing a line in Illustrator, or modeling in Rhino or Grasshopper. Technically speaking, we rarely draw things anymore; we process them instead.

As educators, how do you train students' sensibilities of site surveying and envisioning the potential of land forming and material construction?



9. Sturgeon Island surveying. High contrast ground control points (GCPs) are placed within the area of UAV mapping and the GPS position of each GCP is collected using real-time kinematic surveying equipment to determine its location within a centimeter.

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10. Field collection visit with students to demonstrate salt marsh mapping using a multispectral equipped UAV.

VANDERSYS: At the University of Pennsylvania's Stuart Weitzman School of Design, we have a number of classes and workshops on all aspects of land forming, including two workshop courses on grading and construction. Aspects of land forming are embedded within studio as part of any design proposal and we also have three required media courses as part of the Masters of Landscape Architecture program. In the media classes, much of the course time is dedicated to in-class demonstrations of digital methods related to analysis, design, visualization, and fabrication. While the content is technical in nature, especially as it relates to parametric models, the methods are situated in the theoretical and historical foundations of the media that are being engaged. Teaching the "how" without the "why" leaves students without the capacity to utilize media critically and imaginatively. Hence, our emphasis is on the *principles* rather than the *platforms* of computational media such that students are encouraged to explore both established and emerging techniques of design and visualization.

The open-ended yet mathematically rigorous nature of parametric methods emphasize the relational aspects between form and process, what we have referred to in our book *Dynamic Patterns: Visualizing Landscapes in a Digital Age*[8] as a process of "calculated discovery." Form and process are linked, both implicitly and explicitly, in parametric models. For instance, changes made to the topography in a parametric model affect where water will collect, which can be calculated to measure holding capacities. Conversely, existing flow patterns can be modeled parametrically to determine areas of likely high erosion or deposition. Changes to the topography can then be made to either retard or amplify those extent patterns. As part of elective courses, we also expose students to more advanced computational techniques related to remote sensing and simulation modeling (Fig. 10). These courses focus on the question of how we might understand the magnitude and character of landscape change, especially those aspects that are beyond our immediate apprehension. As part of these electives, students get to participate in field collection trips related to the EMLab's ongoing coastal infrastructure and resiliency grants and projects in southern New Jersey.

M'CLOSKEY: It is also important to note that while the media classes do teach particular drawing methods and software, this is combined with readings and discussion to the extent possible in such a class. I think the criticality of the tools comes from how you approach a project in a comprehensive way. We have been discussing a particular aspect of the design process, which cannot account for the entirety of a project. The use of any convention—or the challenge of it—is always in service of a larger purpose or idea.

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地形学是景观设计的基础
——对话凯伦·麦克洛斯基与基思·范德赛

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摘要

对地形的感知与理解不仅是景观设计师的工作基础，也是景观建造实践中的一个核心问题。在本次访谈中，两位资深学者——来自美国的凯伦·麦克洛斯基与基思·范德赛深入探讨了景观设计学中地形测绘的理论基础与发展历史、图析对景观设计师观察场地与开展设计的影响、新兴导航与传感技术在理解与设计景观中的作用，以及运用先进的数字媒体丰富景观设计呈现形式的方法。最后，他们还分享了如何指导学生进行现场勘察并将之转化为设计的教学经验。

关键词

地形学；
图析；
地形塑造；
地理参照数据；
数字媒体工具；
遥感；
环境媒体

文章亮点

- 景观设计师如何表现地形、表现地形的哪些特征，都对于设计概念生成与实践至关重要
- 图析在很大程度上影响着我们如何理解某一场所或场地，以及如何传达这一想法
- 地图上呈现的洪泛区并不是物理空间意义上的实际范围，而是基于特定雨洪情况的、统计学意义上的计算结果
- 作为环境及空间数据的使用者（而非提供者），景观设计师对相关数据集的理解还不够透彻
- 只教“怎么做”而不教“为什么”会使学生失去批判地、创造性地使用媒介的能力

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凯伦·麦克洛斯基与基思·范德赛简介

凯伦·麦克洛斯基和基思·范德赛是宾夕法尼亚大学韦茨曼设计学院的景观设计专业教师，也是景观+建筑PEG设计工作室和宾大环境建模实验室（EMLab）的联合创始人。他们的工作聚焦数字建模的发展所带来的机遇与局限，探究基于相关方法和工具的设想如何影响我们对景观与环境的理解。他们的作品曾获得众多奖项，多次参展，已被70余种设计出版物所收录，并获得了包括皮尤艺术基金在内的多项基金。麦克洛斯基和范德赛还是《LA + GEO》（2020年）与《LA + Simulation》（2016年）的特邀编辑；二人合著的书籍包括《动态模式：数字时代的景观可视化》（2017年）、《媒介对于景观设计的意义》（2024年）等。

您认为对于景观设计师来说，地形测绘在概念与实践层面具有何种重要意义?

凯伦·麦克洛斯基（以下简称麦克洛斯基）：“地形测绘”（topography）一词来源于希腊语“topos”和“graphia”，即“场所”（place）和“书写”（writing），因而我们可以将“地形测绘”视作对场所中物质与特征的一种描述。作为一种图形表现行为（通常基于地图或图表的形式），地形测绘旨在“书写、记录或描述”自然或人造特征及其相对关系。景观设计师如何表现地形、表现地形的哪些特征，都对于设计概念生成与实践至关重要。我们现在遵循学科惯例进行地形测绘，但却忘记了这些惯例的由来——如何从发明演变为惯例——以及它们如何影响了我们观察与理解景观的方式。

在景观设计实践层面，地形测绘是空间塑造及各种场地条件与品质营建的基础。作为地图上的图形表现，地形测绘的形式似乎很“单薄”；但作为对土地的设计，地形测绘又是丰富厚重的，它涉及土壤、水、空气与植物的接触面，以及栖居其间的人类。

基思·范德赛（以下简称范德赛）：在我们真正接触到设计场地之前，我们对于场地现状的认知往往取决于地形测绘的表现。以我们习以为常的等高线图为例，从本体论的角度来讲——当然，就像所有图形表现方法那样——它抽象地反映了场地的地貌，以可度量的方式展现地表的海拔高度。在等高线之前，晕滃法（hachuring）是人们表现地形的惯用方法。晕滃法是将重复、平行的线条以不同的疏密度排列，从而描绘地势陡缓，这种方法能直观展现出地型、相对陡峭程度、地势高低等质性特征（图1）；而等高线法是用一根根统一的、连续的单线条辅以具体数值的形式描绘高程，这是一种标准化且量化地展现地形特征的方法。再后来发展出了三角高程测量，这是一种基于等高线绘制的可重复、定量表现地形的方法，其为我们绘制地图的方式带来了变革，至今仍然是景观设计实践中不可或缺的一部分。然而，随着新技术不断投入使用，从测量、建模到施工的各环节衔接愈发简单顺畅，我们或将见证等高线法如同晕滃法一般退出专业制图的舞台。

您认为图析对景观设计师观察场地及后续的设计行为会产生怎样的影响?

麦克洛斯基：图析在很大程度上影响着我们如何理解某一场所或场地，以及如何传达这一想法（图2），我们尤其要考虑在图纸上需要描绘哪些内容。批判地图学自兴起至今已三十余年，期间充分展现了图析的高度选择性与政治性本质，改变了认为地图能够客观反映场地“真实”状况的幼稚观念。诚如众多学者所言，地图是权力、政治与意识形态的体现；也有学者指出，图析远比绘制那些行政边界划分的地图更加多样和复杂。不过，景观设计师所接触的地图与制图惯例往往来源于地方（如美国州级）或国家级政府部门等官方机构提供的现有资料，这些地图已被预先定义、受到空间约束，并且配备对数据的详尽说明。诚如基思所言，我们依赖于学科惯例，但我同时认为，我们经常忘记惯例是由人所创造的，而这些创造出来的惯例却似乎成为了一种既定标准，在某种程度上限制了我们自身对场地的观察与理解。

比如，当我们谈及现有数据集时，信息精度非常重要。对此，我们在近期出版的书籍中都有所涉及，详见《沿海适应蓝图》[1]的“在气候适应中我们为谁负责？”，以及《景观项目》[2]的“建模”这两个章节。我们认为，美国沿海地区的法规建立在如何划定洪泛平原的基础上，而洪泛平原的划定又与保险政策相关；同时，法规中的很多条款有失公允。数据精度的不同会对洪泛平原的划定结果产生影响，进而改变可建设的内容与范围。一方面，地图上呈现的洪泛区并不是物理空间意义上的实际范围，而是基于特定雨洪情况的、统计学意义上的计算结果。另一方面，我们也需要注意那些被排除在洪泛区范围之外的地区。例如，即便是在一些“洪泛程度较轻”的地区，人们的生活也会受到较大影响，但由于当前洪水建模与制图方法的精度问题，这些小型“降水事件”通常被忽略了。换句话说，现有地图资源所承载的信息局限于当下传感技术与测绘实践所能捕捉到的信息，而这也是许多景观实践所依据的标准。因此，切忌想当然地采纳地图上的信息。

范德赛：如果我们想要获取某一场地含有高程信息的更高分辨率的影像，可以使用无人机等低空遥感技术（图3）。相对地，如果想要采集尺度更大、时间跨度更长的影像，则可以借助卫星遥感技术来获取大量相关信息。这些信息经转译得到的地图和模型，经常被我们（景观设计师）用作设计的基础。因此，我们更像是这些环境及空间数据的使用者，而非提供者。作为使用者，或许我们对这些数据集的理解还不够透彻，这就会带来许多潜在的局限性，譬如土地覆盖的典型分类方式。美国国家土地覆盖数据库（NLCD）划分的11个土地覆盖类型过于宽泛，对设计而言用处不大，特别是对于诸如海岸线等处于动态、快速变化中的区域。如果要提一些改进建议，我们认为要在理解标准化工具与表现形式的局限性的同时，考虑如何让景观设计师更广泛地参与到环境可视化成果的形成过程中去。这意味着我们应该发展实践、协议与处理技术，以捕捉可能被排除在惯例之外的信息。

您如何看待场地现场勘察在景观设计中的作用？航空、卫星导航与遥感技术对我们理解和设计景观的方法带来了哪些影响?

麦克洛斯基：在地理定位系统（GPS）或无人机等先进设备发明以

前，景观设计师就参与场地现场勘察工作，并将勘察结果转化为地图。卫星技术与记录着全球环境状况的影像资料——大气碳模拟图、海平面上升图、太空视图等——使我们有了将土地和大气作为环境对象的概念。无论设计场地的尺度多小，我们始终都把它们视作全球环境的一部分。但景观设计师在针对特定场所开展实体空间设计时，上述这些形式的资料并不能被直接使用——我们不能简单地在放大后的航空或卫星影像图上进行设计。尽管遥感技术已覆盖全球，但能从中提取到的信息对于了解小范围的场地条件而言还不够。这就是为什么景观设计师能够通过现场勘察提出对场地不同的解读。正如我们近期在刊发的文章《幕后工作》[3]中所提出的，景观设计师大多对数据收集、界定和分类工作不甚了解。如果不理解既定数据集中的偏差，我们就无力对之改进，更不要说应用由此生成的地图和模型。在实操层面上，现场采集的传感与勘测数据可以用来编制土地覆盖类型图以追踪景观中的变化（图4）。鉴于土地覆盖分类存在许多问题，我们在新泽西州湿地研究所的一些工作中就结合了现场勘察的方法：通过多次现场勘察，我们监测了高沼泽草地的动态变化——这是湿地研究人员迫切希望了解的信息，可以为在此筑巢的鸟类制定栖息地保护措施。标准土地覆盖类型图的信息精度和收集频率都无法满足这项工作的要求。

范德赛：遥感与勘测技术（如无人机、多光谱与高光谱成像技术，以及高精度测量设备等）的应用广度在过去的十年间迅速提升，景观设计师得以更便捷地创建自己的数据集与模型。这些技术的使用突破了一些测量的局限，使得景观设计师能够记录超出自己视听范围的事物（如无法通过传统现场勘察方法观测到的植物健康数据），这改变了我们对特定景观特征的理解（图5）。

此外，GPS使得地理参照数据的获取和应用更为普遍，这彻底改变了我们获取空间信息的方式，从而改变了空间数据的创建与使用方式。如果我们认同“地图定义了场地”这种观点，那么也必须同样承认“勘测定义了地图”——或就当今技术的使用情况来看，“勘测定义了场地模型”。作为勘测数据的创建者，景观设计师可以提供的混合或多层场地信息通常为传统工程测量所忽略。例如，通过遥感技术收集的信息可用于生成特定场地的高程与土地覆盖类型图，这些是建模的关键信息。与静态的表现模式不同，记录时间变化的媒介使我们能够参与到景观动态演变的过程中，如水的流动或沉积物的位移（图6）。

人们对于同一幅地图的解读不尽相同，那么怎样增强地图表现的可读取性呢？

麦克洛斯基：地图是基于某种特定目的绘制而成的，但人们的解读方式却可以非常多样。然而，地图不只是反映某些空间信息的数据集。正如地理学家（约翰·布莱恩·哈利、约翰·皮克尔斯、丹尼斯·科斯格洛夫等人）于20世纪八九十年代充分论证的那样，地图是展现政治权力、意识形态与管理体制的工具。相关的学术研究有助于“解构”并揭露出于政治与军事目的、通过地图掌控制图形式的“俯视”霸权主义，但却对如何绘制更好或不同的地图来抵制这种对制图知识的支配鲜有贡献。阿努拉达·马瑟与迪利普·达·库尼亚等景观设计师，以及后来的地理学家威廉·兰金都以各自的方式进行了启发性的“反制图／反图析”（counter-mapping）实践。有许多地图实践强调景观的社会与政治维度，以为创造更公正的空间表现提供依据，或至少可以揭露一些不公平现象。此外，基于维基平台的开放街区地图（OSM）提供了一种与专家集权迥然不同的制图方式：该平台上的地理信息由非专业人士自愿众包，并对用户免费开放；用户可增补他们所熟悉的地方特征，而这些对于设计更加有用的信息是谷歌地图等全球地图所无法体现的。所以，简言之，任何人都可以绘制地图，而地图的可读取性取决于地图的绘制目的或服务对象。

范德赛：也许，这个问题还关乎我们是否应该绘制地图这件事本身。将某地的某些特征记录下来，并将之转化为人们看得见、读得懂的地图形式，有时并不一定是件好事。以海底测绘为例，现在只有不足25%的海底完成了高精度测绘。“海底2030计划”预计在未来十年中完成对地球全部海底的勘测，这既让人激动，又令人不安。因为测绘成果或将加剧海底矿物与化石燃料的开采，也可能会促使政府出台一些保护性政策法规，以保护目前尚不可知的海底地形及生态系统。

数字媒体的发展丰富了景观设计的可视化方法。您认为有哪些数字工具正逐步展现其在景观设计中的应用潜力？

麦克洛斯基：数字媒体的内涵非常广泛，包罗万象。显然，得益于运算能力的提升，Blender、Lumion、V-Ray等支持更快速、更高效地生成逼真3D渲染图的软件不断涌现。近年来，人工智能（AI）领域也取得了爆发式进展，用于AI赋能图像生成平台的深度学习算法正在兴起，并出现了DALL·E、Midjourney、Disco Diffusion等多个平台。只需输入几个单词或短语，这些AI引擎就能迅速生成大量新奇的、颠覆我们想象的图像。相信大家都注意到了同样发展势头正盛的ChatGPT及其衍生出的许多问题，比如版权、剽窃，以及所生成的内容可能会令人感到不适等。回到本次采访的主题，与地形学、图析和地形塑造更相关的技术变革在于GPS在过去几十年间逐渐渗透到我们生活的方方面面，无论是农业、交通，还是金融、科学，都离不开GPS。就地形设计而言，Rhino、Grasshopper等参数化软件已为我们创造了许多探索设计形式的机会，这也影响了实体模型的制作方式。现在，设计师对各种与数字

建模适配的制造设备（如激光切割机、数控铣床与3D打印机）的使用显著增多。

范德赛：就像我之前提到的，地理空间数据的广泛使用正从根本上改变我们的工作方法。至少在美国，我们可以轻易获取海量地理参照信息。这些数据促进了分析（GIS）、建模（CAD）与仿真（CFD）软件的互通性，使景观设计师能够更深入地参与到影响景观变化的重要进程中，比如水、空气与沉积物的流动等。举例来说，像CFD与水文模拟沙盘（图7，8）这些运算与实体模型能帮助我们理解气候变化影响下沿海环境中的沉积物沉积与侵蚀作用。

尽管GPS赋能的建造设备的发展还处于新兴阶段，但它们将持续改变我们交付与建设景观设计的方式。这一点从斯诺赫塔建筑事务所于2016年成立的Max IV实验室①的近期项目中可见一斑。地理参照的场地现场勘测数据使设计团队得以对不同地形设计方案的声学与水文性能进行评估。获选的地形构造又转化为云端的地理参照点，用于引导GPS赋能的陆地移动设备。项目中所展现出的虚拟与现实环境日益扩大的交互作用，正是景观设计师必须予以回应的议题。

麦克洛斯基：我认为这种发展不一定都是积极的。自动化会带来我们不应忽视的消极效应，尤其是在与我们的工作相关的方面。这些技术正在改变场地建设的方式，但并不总是在往好的方向发展。

您认为景观设计师是否对这类数字技术和工具存在认知误区或误用情况？

麦克洛斯基：我认为不存在所谓“误用工具”的情况，因为一个工具可以用于任何情况，我们不应拘泥于它最初的发明用途——我们也一直都是这么做的。但我认为认知误区是存在的，比如那些认为数字工具不如传统工具“看得见、摸得着”，或者认为数字工具更有“距离感”的观点——年轻一代甚至可能没听过这种说法。现在看来，持这种观点的人越来越少，但这种怀疑论调确实盛行于21世纪初期，当时这些工具刚刚出现，整个行业正快速转向数字工具的使用[4]。一个工具或媒介，无论是模拟的还是数字的，都不重要；重要的是这种工具或媒介会如何影响我们认识、理解或表达的方式。这是一个认识论上的问题，而不仅仅是非此即彼的二元区分。

我们正在撰写一本名为《媒介对于景观设计的意义》的书，该书缘自2022年EMLab组织的“变化的工具”专题研讨会。我们对媒介研究与科技研究都非常感兴趣。我们经常参考珍妮弗·嘉布赖斯的著作，她曾是一名景观设计师，而且她的见解非常适合景观设计师去思考如何认识我们的设计场地。[5][6]任何批评“为了数字而数字”的人都忽略了表现与观察的全部发展历史，因为任何形式的媒介都影响着我们认知的方式，以及我们自认为的所知。

范德赛：熟悉数字环境中的数据、工具与操作模式能使景观设计师成为更有价值的合作者，在海岸环境这样由自然科学与工程学科共同主导的领域尤其如此。一旦参与处理这些学科使用的数据与模型，就能意识到环境数据的固有局限性与不确定性——像是高程和土地覆盖情况（图9）。这为我们指明了更多的研究空白，涉及沿海基础设施、防洪措施及保护政策，而不再局限于纯粹的技术术语讨论。在《改善的意愿》[7]一书中，塔尼娅·莫里·李认为，量化与简化问题的趋势往往使人顺从技术解决方案，她称之为“把问题技术化”，即把问题非政治化；如此一来，那些起初造成场地现状“问题”的社会、经济与政治因素就会淡出人们的视野。

在过去的十五年中，我们一方面探索了各种工具的创造性潜能，另一方面试图通过审慎地使用这些工具来理解其影响或“束缚”景观设计实践的方式。当然，这其中就包括用于图析的媒介与方法。我们尤其关注计算赋能的成像与建模技术的发展，因为它们显著影响了我们对环境的集体认知。现如今，计算在我们的设计中无所不在，无论是用手机拍照、在iPad上画草图、在Illustrator中画线，还是在Rhino或Grasshopper中建模。从严格意义上来说，我们的工作已经不再是画图，而是在处理图像了。

作为教师，您怎样培养学生对场地现场勘察、地形塑造及实体建构设想的敏感度？

范德赛：在宾夕法尼亚大学斯图尔特—韦茨曼设计学院，我们开设了大量与地形塑造相关的课程与工作坊，其中两个工作坊专门探讨场地平整与建造。地形塑造的方方面面都会在我们的设计课程中有所渗透，在任何设计方案中也都会有所涉及。此外，我们还为景观设计学硕士研究生设立了三门必修媒介课程，并且在课堂上预留大量时间展示与分析、设计、可视化和加工制作相关的数字方法。虽然这些教学内容本质上是技术的（尤其是涉及参数化模型），但我们会将它们置于其所在的理论与历史背景中来讲授。只教“怎么做”而不教“为什么”会使学生失去批判地、创造性地使用媒体的能力。因此，我们的教学重点是媒介的“原理”是什么，而不是需要掌握的“平台”有哪些；我们还会鼓励学生积极探索已有的及新兴的设计与可视化技术。

① 斯诺赫塔建筑事务所在瑞典国家实验室MAX IV的户外空间设计了一个19hm²的公园，为地面减振、雨水管理及满足城市可持续目标提供了景观解决方案。更多信息详见斯诺赫塔项目“Max IV 实验室景观”。

结果开放而运算严谨的特性使参数化方法可以强调形式与过程之间的关联，我们在《动态模式：数字时代的景观可视化》[8]一书中把这个过程称为“经过计算的发现”。在参数化模型中，形式与过程相互关联，既是内隐的，也是外显的。例如，在模型中改变地形会影响汇水区域，在参数化模型中经计算即可测得相应地形的蓄水能力。相对地，可以对现有的汇水模式进行参数化建模，确定潜在的高侵蚀／沉积区域，进而通过改变地形来缩小／扩大当前的汇水范围。在选修课中，我们还会向学生介绍前沿的遥感和模拟建模计算技术（图10）。在这些课程中，我们探讨如何理解景观变化的幅度与特点，尤其是对于那些我们无法即时理解的问题。作为课程的一部分，我们带领学生们前往新泽西州南部，针对EMLab在当地开展的由沿海基础设施与韧性专项资金资助的项目进行实地调研。

麦克洛斯基：与之同样重要的是，虽然这些媒介课程确实教授特定的绘图方法与软件，但其中也尽可能地融入了阅读与讨论环节。我认为工具的关键作用在于你如何以一种综合的方式解决设计项目的问题。我们一直讨论的是设计过程的某一特定方面，而不是项目的全部。遵循——或挑战——任何惯例都是为更大的目标或理念服务的。

图 1. 用晕滃法进行可视化。下方的图纸分别描绘了高、中、低径流量及相应的雨水污染水平：线条长度代表地形的坡度，线条的粗细与颜色深浅则分别表示水量及水质。上方的实体模型是对下方图纸的具象呈现。

图 2. 对同一场地应用来自多个国家和地区的土地覆盖分类标准，可以直观地看到不同分类系统所呈现的空间与类型结构如何制约了我们对景观的理解。对照各分类系统的图例，可以发现它们对土地覆盖主题（即分类）定义的异同。对于多光谱图像和土地覆盖分类系统的详细信息请参见参考文献 [3]。

图 3. 美国新泽西州莫里斯湾现有堤坝与拟建沉积物堆放区的数字模型，展示了无人机航测高程技术获取的影像。现状高程和植被的评估对于测定堆放后沉积物的位移变化非常重要。

图 4. 使用 NLCD 数据（上图）与借助无人机多光谱成像技术获取的场地土地覆盖数据（下图）的湿地损失预测对比。中间图表示 2070 年的湿地情况；右侧图表示 2020~2070 年间的湿地流失情况。

图 5. 在测量高程数据的同时，无人机多光谱成像技术被用于定位美国新泽西州詹金斯海湾全域的高沼泽草地的工作中。图中显示了鲟鱼岛（左图）和环岛（右图）的高沼泽草地的具体方位信息。

图 6. 借助无人机对鲟鱼岛沉积物堆放进行了多年连续勘测，记录与测量植被覆盖形态变化对通过实验性沉积物堆放策略进行湿地修复措施的成效评价非常重要。

图 7. 运用数值模型（SRH-2D + ADCIRC）对新泽西州莫里斯湾基于自然的基础设施的实施效果进行测试。

图 8. 运用实体沉积物模拟沙盘对新泽西州莫里斯湾基于自然的基础设施的实施效果进行推演。

图 9. 测量鲟鱼岛。将高对比度地面控制点置于无人机测绘范围内，使用实时动态测量设备收集每个地面控制点的 GPS 具体定位，误差不超过 1cm。

图 10. 向参与实地调研的学生展示如何使用配备了多光谱设备的无人机对盐沼进行测绘。