

GUEST EDITORIAL PREFACE

Geospatial Technologies and Indigenous Communities Engagement

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INTRODUCTION

The term “Indigenous peoples” has no clear, universally accepted definition. Despite that, it applies, across the world, to approximately 5000 peoples¹ which encompass some 370 million individuals (IWGIA, n.d.). One common way of thinking about Indigenous² groups is that they are descendants of peoples present in particular locations before the arrival of colonizing forces or the formation of an alien state in which the Indigenous groups then found themselves embedded (IWGIA, n.d.). For some Indigenous peoples, this process began centuries ago; for others it began much more recently and in many cases is still ongoing (Coates, 2004). In this special issue, our intent is not to catalog the multitude of disempowerments, displacements, disposessions, and depopulations accompanying that process. Instead, the seven articles in this issue demonstrate in a

number of ways that GIS and other geospatial technologies can support the empowerment of Indigenous communities in today’s world as they grapple with anthropogenic environmental changes, the imposition of external regulatory forces, and other contemporary conditions. The articles cover topics across a range of social, cultural, and environmental issues, in locations from the South American tropics to the North American arctic. Their uses of GIS and other geospatial technologies run the gamut from participatory mapping with web-based applications to GIS for data management and the visualization of pattern to remote sensing and advanced representations of 3D objects. In the remainder of this preface, we provide brief overviews of Indigenous cartographies and of recent scholarly engagement at the intersection of geospatial technologies and Indigenous peoples, before discussing themes represented in this issue.

INDIGENOUS CARTOGRAPHIES

Given the dispersion of Indigenous peoples across the globe, a tremendous diversity of culture is inevitably the case. Therefore statements about “Indigenous culture” are not about absolutes or generalizations. Rather they are about the distinctiveness of Indigenous people in their respective places. Nevertheless some broad observations can be made based on examples from several parts of the world, acknowledging that these generalizations may not be universally applicable.

If we define maps as representational solutions that solve relational, spatial problems (Kitchen & Dodge, 2007, p. 343) (including but not limited to the communication of spatial information to other people; see Harley & Woodward, 1987), humans have been making maps for a very long time and have almost certainly done so within every human group and culture (Turnbull, 1989). That does not mean that every culture’s maps follow the cultural convention of today’s Western maps, however. Each culture creates spatial representations that reflect their understanding of reality using specific socio-cultural lenses (Louis, 2008). European explorers and colonizers often did not recognize as maps the spatial communications of the Indigenous people they encountered, for a number of reasons. For one thing, some spatial representations did not endure but were ephemeral in nature, such as maps sketched on the ground to communicate specific spatial knowledge for an immediate need, out of a repository maintained in an individual’s long-term memory (in contrast to more permanent maps meant for ongoing reference). This practice has been well documented in North America, for instance (Brückner, 2011; Hollis, 2011). Spatial communications among North American and Pacific Island Indigenous groups were also often *performed*, pairing oral presentations with bodily movements and facial gestures. Such spatial communications might be formalized or impromptu, but either way Europeans tended to

miss this information entirely, because they expected spatial information to be communicated graphically (Hollis, 2011; Oliveira, 2014, p. 65). In some instances spatial communications are completely auditory such as Hawaiian chant styles where rhythm, tone, tempo, and vocal origin indicate specific resonance patterns necessary to address spatial problems. (Tangaro & Keali’ikanaka’oleohaililani, Kū e ke olioli Workshop, March 15-16, 2014).

Other Indigenous spatial communications have been stored in 3-dimensional objects, such as wooden carvings of shorelines made by Inuit people, stick and shell charts of islands, tides, and currents made by Marshall Islanders, and lukasa memory boards used in certain African cultures (Turnbull, 1989; Woodward & Lewis, 1998). Petroglyphs often communicate spatial information as well (Lewis, 1998; see also Norder & Carroll, 2011 and Hedquist and colleagues in this volume). Like all maps, these various forms require cultural knowledge for interpretation (Cosgrove, 2007). Some Indigenous cultures, perhaps most notably in Australia, organize this cultural knowledge in highly protected ways, not meant to be available to just anybody, and therefore produce maps that appear to be decorative paintings to the uninitiated but which encode detailed spatial information (Turnbull, 1989, 2003).

Beyond unfamiliar forms and unfamiliar cultural encodings of spatial information content, a key difference sometimes seen between the Western map convention and those of some Indigenous mappers is one related to conceptual understandings of the world (or ontology) and what is important to communicate. Specifically, in numerous map examples from North America and Australia, what’s important to map is relationships. The streams and rivers in a watershed might be drawn as straight lines, for instance, preserving the relationships of stream junctions (nodes) rather than replicating the twists and turns of the linear features (Lewis, 1998; Turnbull, 1989). Complex political geographies were mapped in several prominent examples from what is now the

southeastern US, with settlements represented as circles graduated by perceived importance and relationships of alliance and enmity between settlements represented by the manner of their linear connections (Lewis, 1998). Some of the latter illustrate such relationships across large sections of North America, demonstrating an extensive grasp of the political landscape. In Australia, a navigational map for example might show relationships between sacred sites as an aid to wayfinding, without concern for replicating distance or direction to scale (Turnbull, 1989). To the GIS user, this emphasis on relationships in Indigenous cartographies has a clear parallel in feature topologies, in which relationships are maintained even when features are distorted, but unlike in GIS use these Indigenous examples focused on relationships almost to the exclusion of the geometric or locational accuracy so prized in the Western mapping convention. One of the very few examples of a comparable form in modern Western culture is the urban transit map (see Ovenden, 2007).

European explorers and cartographers in colonial settings relied heavily on Indigenous geographic knowledge and incorporated such knowledge into the maps they produced. This has been documented extensively in the North American setting, and a consensus has emerged that the mapping of the continent in European style could not have happened at the pace it did without this source of information (for an overview see Hollis, 2011). In many cases, early editions of these maps communicated certain spatial information gleaned from Indigenous informants without true understanding and “translation” on the European cartographer’s part, such that Indigenous ways of framing spatial knowledge were made visible temporarily on European maps of Indigenous peoples’ realms (Galloway, 1998).

Such cultural differences in worldview and ways of structuring and expressing knowledge have continuing relevance in the context of Indigenous peoples and GIS.

GEOSPATIAL TECHNOLOGIES AND INDIGENOUS PEOPLES

Since the 1970s Indigenous applications of geospatial technologies have exploded in number and breadth worldwide, generating numerous conferences, forums, and workshops. Topics at such events range from using these technologies to showcase projects on Indigenous lands, to critically analyzing the technologies’ capabilities to appropriately represent cultural knowledge. Much of the interest in Indigenous community applications of geospatial technologies can be traced to the works of Tobias, Chapin, Fox, and Rambaldi. Each of these men has 40 years of field experience helping Indigenous communities using geospatial technologies. Tobias works with Indigenous communities in Canada and has written two books that outline a series of research principles and data collection methods allowing users to create maps as the basis of legal land claims in Canada (Tobias, 2000, 2013). Chapin works with Indigenous communities in Central and South America, Africa, and New Guinea and advocates collaborative relationships between Indigenous communities and their governments (Chapin & Threlkeld, 2001). Fox works with Southeast Asian communities focusing on land-use and land-cover changes and studying the socio-ethical impact these types of projects have on the region (Fox, Suryanata, & Hershock, 2005). Rambaldi works with Indigenous communities worldwide and in addition to numerous publications he is responsible for launching the Integrated Approaches to Participatory Development (iapad.org) and Public Participation GIS (ppgis.net) websites, and is most noted for his work on developing and promoting Participatory 3D Modeling (P3DM) (Rambaldi & Callosa-Tarr, 2002).

In the last decade, several women including Sieber, Collignon, Elwood, Pearce, and Pyne have contributed directly or indirectly to the development of Indigenous peoples’ engagement with geospatial technologies. Sieber has been at the forefront of Public Participation

GIS (PPGIS) since the inception of the First International PPGIS Conference held by Urban and Regional Information Systems Association (URISA) in 2002 (Aberley & Sieber, 2002). Collignon writes mainly in her native French and assisted the Inuinnaït in Canada map places they deem important while advocating alternative geographic knowledge systems as valid and valued (Collignon, 2006). Elwood's work with grassroots and community organization advanced our understanding of how geospatial technologies can be used for social justice (Elwood, 2002). Pearce's fierce loyalty to the cartographic process shows how existing tools can be reimagined to partially represent Indigenous peoples' perceptions of reality, challenging the next generation to reimagine the tools, techniques, and technologies for a more fully realized representation (Pearce, 2008). Pyne met the challenge using a cybercartographic atlas to enhance and recover different forms of Indigenous knowledge in a living geospatial database (Pyne, 2013).

We would be remiss not to mention the importance of Kemp, Mark and Rundstrom, all of whom have addressed knowledge frameworks in the context of Indigenous peoples and GIS. Kemp's research has focused mainly on developing new methods to improve the integration of environmental models with GIS in Hawaii (Kemp, Keali'ikanaka'oleohaililani, & Hamabata, in press). Mark, in addition to other work, has investigated the cognitive and linguistic foundations of how geospatial knowledge is conceptualized and used by Aboriginal Australians (Mark & Turk, 2003). Rundstrom, in germinal work some 20 years ago (Rundstrom, 1991, 1995) inspired by the likes of Harley (1989), warned us about the homogenizing effect geospatial technologies could have if research projects merely incorporated Indigenous knowledge. This warning has influenced not only the trajectory of Indigenous GIS work but also that of critical cartographic studies, leading scholars such as Wood, Crampton, Krygier, and Pickles (Crampton & Krygier, 2006; Pickles, 1995; Wood, 1992) to consider cartographic practices that link geographic knowledge with

power regimes and Johnson et al. (2006) to encourage the development of critical cartographic literacies in Indigenous communities. Meanwhile Participatory GIS (PGIS) has emerged as a key means to empower Indigenous communities through integrated applications of geospatial technologies, combining expertise from socially differentiated local knowledge and promoting interactive participation of stakeholders in order to facilitate effective long-lasting decision making processes and community advocacy (Ball, 2002; Eisner et al., 2012; Green, 2010; Kyem, 2002; Stewart, Jacobson, & Draper, 2008; Sun, Tsai, Shih, & Lin, 2009; Tripathi & Bhattacharya, 2004; Tsai, Chang, Lin, & Lo, 2013; also see Laituri, 2011).

THEMES IN THIS SPECIAL ISSUE

There is a clear distinction between mapping Indigenous communities, mapping (by/for/with/with consent of) Indigenous communities, and Indigenous cartography. The first is done by an external agency on a specific area to learn more about the interaction of an Indigenous people and their place. The second involves the Indigenous people in some way whether they are initiators, collaborators, or merely approving the mapping as part of their socio-political processes. The third is a set of cultural practices maintained by Indigenous people as their own expressions of their understanding of and relationship with the world. The articles in this special edition fit mainly into the second category, in that they describe largely collaborative projects between academic researchers or other external specialists, on the one hand, and specific Indigenous communities on the other hand. In several cases, Indigenous community members are involved as co-authors of the works. But some of the projects described here also bring in aspects of the third category, for example by incorporating an Indigenous community's way of understanding their cultural/physical environment into the research project or by teaching geotechnology skills to com-

munity members so that they are free to use them within their own ontological framework.

With projects such as these, it is not surprising that a major theme in this collection concerns research ethics and protocol. While in each of the projects the Indigenous community will benefit or has already benefitted directly or indirectly from the work, some of the researchers discuss explicitly their commitment to a high level of research ethics such as that recommended in *AAG Indigenous Peoples Specialty Group Declaration of Key Questions About Research Ethics with Indigenous Communities*. The Declaration encourages collaborative research between Indigenous communities and researchers thereby “making the community and its own ideas and self-determination process central to the project” (IPSG, 2010). In this volume McAnany and her colleagues, for instance, point out that this approach to research puts the needs and desires of the community ahead of those of the academic researchers, even when that has consequences for academic career trajectories.

A second significant theme is that of empowerment. In this context the empowerment of an Indigenous community can be thought of in two ways. One involves the documentation of people’s knowledge and understanding in forms that can be presented as defensible evidence to state agencies or supranational organizations. The other involves the transfer of technical skills and helps build a sense of ability and possibilities. Both types of empowerment are evident in the articles in this volume. Gadamus and Raymond-Yakoubian, for example, demonstrate the former through their participatory research on and documentation of changes in the habitat areas of key prey species for communities in Alaska, providing a defensible basis for protest to state actors. The latter type is seen in a number of the projects described here, including by McAnany and colleagues, Corbett and colleagues, and, in a different sense, Hoerig and colleagues, where students both Indigenous and non-Indigenous are learning GIS skills, research skills, and a sensitivity to Indigenous cultures and the ethics involved in researching with them.

Related to empowerment is a theme about science and the politics of knowledge. As Turnbull (2003, p. 6) expresses it, “Science in the general sense of systematic knowledge, was never uniquely Western, having exemplifications in a wide variety of cultures both ancient and modern, including Islam, India, and China, the Americas, Africa and the Pacific.” Several of the articles in this issue explicitly recognize Indigenous community members as holders of expert-level knowledge about local or regional places, features, environments and ecosystems. In the context of political, economic, and regulatory structures focused on a regime of Western scientific expertise, the incorporation of local expert knowledge reconfigures science as dynamic and culturally relative (even though this reconfiguration is contested and resisted in many instances). This can have tremendous ramifications on multiple levels, as several of these articles demonstrate. Hedquist and colleagues, for example, call forth deep cultural memory in a geotechnical program of heritage preservation; Cummings and colleagues, in a contrasting scenario, parlay the knowledge of Indigenous hunters into new interpretations of remote sensing images. Thornton and Kitka present an intertwined cultural-ecological system by drawing on knowledge from both Western and Indigenous traditions but synthesizing that knowledge in an Indigenous ontological framework founded on interconnectedness in time, space, and the specificity of place.

The importance of place, of land, of people’s interrelationships with land is a foundational theme expressed in a majority of works involving Indigenous peoples, and this volume is no exception. The quotes that begin both the Hedquist et al. and the Hoerig et al. papers express this connectedness and significance well from the perspective of two different American Indian tribes. Other papers in the special issue express similar perspectives, sometimes subtly and sometimes explicitly. In one case (Corbett and colleagues), the importance of place is expressed through attempts to mediate the absence of it.

A final major theme is about change. In every case, the communities involved in these projects are grappling with various forces of change, most of which are not of their own design. These forces of change include, for example, direct climate change effects, indirect climate change effects (shipping patterns; mitigation initiatives such as REDD+), other physical anthropogenic changes (new infrastructure incursions; resource extraction; mismanagement of lands by others), regulatory controls put in place by states, erosion of cultural knowledge due to external educational and societal pressures, and ongoing ramifications of historical (and modern) losses and oppressions. In all of these projects, the uses to which geospatial technologies are put form a part, at some level, of community attempts to address these forces of change.

We have arranged the seven articles roughly along a continuum from humanities-based approaches and an emphasis on the cultural and social, to natural resource management-based methods and more emphasis on environmental conditions—though there is enough breadth in individual articles to make this categorization somewhat fuzzy. There is also considerable overlap in the ways that each project applied geospatial technologies. In order of their appearance in the volume,

- McAnany and colleagues constructed a framework which, though employing fairly simple technologies (GPS units and web-based map applications), allowed participating communities to learn skills and control their own mapping activities. That is, the communities decide through internal social processes what to map, what should not be made public, how to express meaning on maps, and to what use their maps should be put. The authors consider the issues associated with projects of this nature but also celebrate the positive outcomes they have observed, which include tangible social, educational, economic, and environmental benefits and also the beginnings of a digital humanities map-based community history.
- Corbett and colleagues created a community engagement project within the Geoweb—a participatory, interactive, map-based data storage, and management system. Built around open-source document-management software and a web-based mapping application, the project incorporates social networking and the ability to “mash-up” many kinds of documents (archival, photographic) in relation to location. Rather than explore the technology of this system, however, the authors focus on the community context for the project and the barriers of various kinds that have interfered with sustainable implementation of their vision.
- Hedquist and colleagues used both GIS and other geospatial technologies for the preservation and dissemination of place-related knowledge about culturally significant landscape features and broader landscapes. The paper forms an excellent example of how technology, and specifically geospatial technology, can be harnessed in working with cultural heritage and social memory, and explores specific techniques such as visibility analysis, 3D scanning and representation, and deep temporal reconstruction in addition to mapping and attribute storage.
- Hoerig and colleagues used GIS as the technological foundation for a tribally affiliated Research Experience for Undergraduates (REU). Because they combined a program of teaching GIS skills to the student participants (some from the local Indigenous community, some from other Indigenous communities, and some not Indigenous) with engagement with the tribe on a number of levels, students learned how to incorporate GIS in hands-on research and to do so within appropriate ethical guidelines. Students worked on projects that ranged from qualitative to quantitative and from cultural to environmental, pro-

ducing outcomes of benefit to the tribe as well as to the students' own development.

- Gadamus and Raymond-Yakoubian used GIS as both a data management system for participatory inputs about ecosystem changes and as a means of producing maps to document the evidence of those inputs for community and political uses. The authors focus much of their attention on how they developed their research methodology in a social science context and on how their work fits in with the tenets of participatory GIS. The project leads them to some interesting conclusions about ways PGIS might differ in Indigenous communities as compared to non-Indigenous settings.
- Thornton and Kitka similarly used GIS as a tool for data management, taking advantage of its ability to integrate disparate materials and correlate them based on both space and time. This capability, even though their GIS process is not described in detail, helped the authors to make visible a complex integrated cultural-ecological system of cultivated herring abundance in Southeast Alaska. The article thus serves best as an example of the kinds of insights that can emerge from using GIS in Indigenous community settings rather than an exploration of techniques or of issues involved in community work.
- Cummings and colleagues used the participatory description of vegetation by Indigenous hunters to influence their understanding of remotely sensed vegetation data, in order to produce a detailed raster vegetation map of their study area. The remote sensing processing and formal ground sampling techniques make this the most technical of the papers in the volume, and the one most immersed in Western scientific paradigms, but at the same time the authors succeed in bridging Western science and Indigenous science.

CONCLUSION

The articles in this volume, in common with many other works at the intersection of geospatial technologies and Indigenous peoples, are best considered in light of longstanding Indigenous ontologies, innovative applications of geospatial technologies, and advances in research ethics and participatory GIS protocols toward social justice. These aspects are interwoven in varying permutations in each of these projects but in combination help change the discussion of Indigenous Peoples engagement with geospatial technologies from exploitation of spatial knowledge to expansion of understanding and development of new methods to incorporate information previously overlooked. These articles demonstrate that geospatial technology is more than capable of bridging the gap between different scientific realities, and thereby of helping human societies frame new approaches to systemic problems. If, as Einstein posited, problems cannot be solved using the same kind of thinking or the same level of consciousness that created them, then the informed engagement of Indigenous communities with geospatial technologies has something significant to contribute to the larger human story in our times. The projects described in this volume serve as examples of that principle, in that they help to broaden scientific knowledge to include other systems of knowledge, and thus help us better accommodate the interdependent complexities that lie between the natural environment and human innovation.

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ENDNOTES

¹ We use the term “peoples” to refer to cohesive human groups that have a collective identity and a sense of shared destiny. Peoples in theory have certain rights under the Universal Declaration of the Rights of Peoples, though in practice Indigenous peoples are often denied these collective rights. Also in theory, the much more recent UN Declaration on the Rights of Indigenous Peoples provides specific and general protections of collective rights for the

special circumstances of Indigenous peoples. When the singular “people” is used with the article “a”, it refers to a single such group, but when used without an article it is of course the common term for many individual humans.

² We take the position that the term “Indigenous” when referring to peoples or individual members of such peoples should be capitalized because it refers to a political class of people much like the term “Native American” or “Western.”

G. Rebecca Dobbs received a PhD in geography from University of North Carolina at Chapel Hill in 2007 and currently teaches at Western Carolina University. In addition to a lifelong interest in Indigenous peoples and issues, she is passionate about GIS and the breadth of uses to which it can be put. Her main research involves using archival documents and historical GIS to study the ways that Indigenous cultural landscapes influenced settler choices and infrastructures. Other interests include the American South, Australia, human settlement, historical geographies, and cartography (both making maps and exploring cultures of cartography). She serves as an associate editor of IJAGR and previously guest-edited an issue on historical GIS.

Renee Pualani Louis received her PhD from the University of Hawaii at Mānoa in 2008. She is currently an affiliate researcher at the University of Kansas Institute for Policy and Social Research and a recipient of the 2014 Association of American Geographers Enhancing Diversity Award. She is a Hawaiian woman and an Indigenous cartographer passionate about Hawaiian storied place names, cross cultural ethical research practices, and advocating the integration of Indigenous spatial knowledge systems with Western geosciences. She believes it is time to acknowledge the multiplicity of experiences that contribute to our understanding of the world allowing researchers to move beyond the politics of science and recognize those realities that lie beyond the realm of our senses is not a debate about belief systems, so much as an examination of alternative methodologies.